PROJECT MANUAL

FOR

McGUIRE LANDFILL

DUKE POWER COMPANY
McGUIRE NUCLEAR STATION
HIGHWAY 73
HUNTERSVILLE, N.C.

DESIGN ENGINEERING DEPARTMENT
McGUIRE ENGINEERING DIVISION
CHARLOTTE, N.C.

AUGUST 31, 1990

TABLE OF CONTENTS

Cover Sheet	
Invitation to Bidders	INV-1 thru 2
Table of Contents	TC-1 thru 3
Index of Drawings	ID-1
Instructions to Bidders	IB-1 thru 4
Form of Proposal	FP-1 thru 3
Affidavit of Prime Contractor	APC-1
Release and Waiver of Claim	RWC-1
Warranty	W-1

DIVISION 1 - GENERAL REQUIREMENTS

Section 01000-General Conditions	01000-1
01005-Supplementary Conditions	01005-1 thru 9
01010-Summary of Work	01010-1 thru 2
01070-Cutting and Patching	01070-1 thru 3
01300-Submittals	01300-1 thru 4
01310-Substitutions	01310-1 thru 3
01410-Administration and Supervision	01410-1
01450-Progress Schedule and Reports	01450-1 thru 3
01510-Temporary Utility Services	01510-1 thru 3
01700-Project Closeout	01700-1 thru 4

DIVISION 2 - SITE WORK

Section 02100-Site Clearing and Grubbing	02100-1 thru 2
02200-Excavating, Filling and Grading	02200-1 thru 12
02300-Monitoring Well Installation	02300-1
02850-Steel Fence and Gates	02850-1 thru 6

DIVISION 3 - CONCRETE

Section 03100-Concrete Formwork	03100-1 thru 3
03200-Concrete Reinforcement	03200-1 thru 2
03300-Cast-In-Place Concrete	03300-1 thru 3
03310-Concrete//General	03310-1 thru 5

DIVISION 4 - MASONRY

Not Used

DIVISION 5 - METALS

Not Used

DIVISION 6 - WOOD AND PLASTIC

Not Used

TABLE OF CONTENTS (Cont'd)

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

Not Used

DIVISION 8 - DOORS AND WINDOWS

Not Used

DIVISION 9 - FINISHES

Not Used

DIVISION 10 - SPECIALTIES

Section 10050-Dedicated Ground Water Monitoring System 10050-1 thru 3

DIVISION 11 - EQUIPMENT

Not Used

DIVISION 12 - FURNISHINGS

Not Used

DIVISION 13 - SPECIAL CONSTRUCTION

Not Used

DIVISION 14 - CONVEYING SYSTEMS

Not Used

DIVISION 15 - MECHANICAL

For page number specifics, see Table of Contents provided within Division 15.

DIVISION 16 - ELECTRICAL

For page number specifics, see Table of Contents provided within Division 16.

Appendix A HDPE Liner Specification
Appendix B Erosion and Sediment Control Plan
Appendix C Groundwater Monitoring Well Plan
Appendix D Geologic and Hydrogeologic Assessment

INDEX OF DRAWINGS

Civil:

CFD-MG-6433C-C-0010	Landfill Access Road Layout
0020	Landfill Earthwork Excavation Plan
0030	Landfill Sections and Details
0040	Landfill Sections and Details
0050	Landfill Fabrication Details
0060	Landfill Operations
0070	Landfill Erosion Control Plan

Mechanical:

CFD-MG-6433C-P-0010	Piping/Site Plan
0020	Piping/Site Plan/Details
0030	Piping/Site Plan/Details
0040	Hydraulic/Gradient/Details

Electrical:

CFD-MG-6433C-E-0010	Electrical Plan Notes and Details
0020	Electrical Plan

SECTION INV - INVITATION TO BIDDERS

1.0 GENERAL

You are hereby invited to submit proposals for construction of an industrial landfill.

The landfill will have a synthetic liner and a leachate collection system. The site is located south of Highway 73 directly off of Cashion Road.

2.0 PROPOSALS

Each Bidder must submit a proposal on the form herewith provided. The Bidder shall sign his proposal correctly. Proposals may be rejected if they show any omissions, alternations of form, additions not called for or other irregularities of any kind.

Each proposal must be submitted in a sealed envelope so marked to indicate its contents without being opened. This envelope shall be addressed to Duke Power Purchasing Department, 400 South Tryon Street, Wachovia Building, Room 1031, Charlotte, North Carolina.

Proposals must be received not later than 3:00 pm on ____________________ at the office indicated above.

A 100% Performance and Payment Bond will be required.

3.0 AWARD OF CONTRACT

Proposals will be opened privately. The Owner reserves the right to reject any or all proposals. No proposal may be withdrawn for a period of 45 days after the scheduled time for receiving bids.

4.0 DOCUMENTS

Selected Bidders may obtain two (2) sets of bidding documents by contacting the office of Mr. Barry Thom, Duke Power Company, (704) 373-5380.

5.0 ADDENDA

Addenda issued during the time of bidding shall be covered in the bid; and in closing the contract, they will become a part thereof.

Addenda issued covering any negotiated changes to the work between opening of the bids and closing of contracts shall become a part thereof.

Bidder shall state the number of addenda received by them in the appropriate space on the bid form.

6.0 UNIT PRICES

Unit prices are noted on the construction proposals.

7.0 BASE BID AND ALTERNATIVES

Each Bidder shall list in the space provided on the bid form the amount of his base bid which will show the total charge for the project work, including any alternatives.

8.0 QUESTIONS CONCERNING BID DOCUMENTS

Questions regarding work shall be directed to:

C. Barry Thom, P.E.	Phone # (704) 373-5380
Mike R. Robinson, P.E.	Phone # (704) 373-5013

9.0 PRE-BID SITE VISIT

Site visits to be coordinated with D. E. Faulkner at (704) 875-5158.

10.0 SELECTED BIDDER

Contact Mr. Barry Thom, Duke Power Company, P. O. Box 33189, Charlotte, N.C. 28242, (704) 373-5380 for listing of selected bidders.

END OF SECTION INV

INSTRUCTIONS TO BIDDERS

1. PROJECT

McGuire Landfill
McGuire Nuclear Station
N.C. Highway 73
Huntersville, N.C.

2. OWNER

Duke Power Company
Charlotte, N.C.

3. ARCHITECT/ENGINEERS

Duke Power Company
P.O. Box 33189
422 South Church St.
Charlotte, NC. 28242

Civil:	C. B. Thom, P.E. (704) 373-5380
Mechanical:	L. G. Goodman, P.E. (704) 373-8098
Electrical:	E. G. Frampton, P.E. (704) 373-4172

4. CONTRACT DOCUMENTS

The Contract Documents shall consist of the following:

The Owner/Contractor Agreement
The General Conditions
The Supplementary General Conditions
The Specifications
All Addenda, if issued
All Modifications
The Working Drawings, listed in Section ID-1 of this Specification

5. SITE

The site on which the work is to be constructed is the property of the Owner and is available for inspection. The Contractor will visit the site and become familiar with its character and conditions prior to submitting his proposal. Failure to make such inspection will not relieve the Contractor of any responsibility in connection therewith. Site visitations shall be arranged with the Owner prior to arrival at the site. Contact Eddie Faulker, of the Construction Maintenance Dept., Northern Division, (704) 875-5380 for permission to inspect the site.

6. BIDDER'S REPRESENTATION

The submission of a bid will assume that the Contractor has fully examined the site and knows existing conditions and has made every provision for operating under existing conditions, and has included all necessary items, and has read and understands the Bidding Documents.

7. BIDDING PROCEDURES

Three (3) copies of the proposal form shall be furnished to the Owner. The Bidder will execute three (3) copies and return as his bid, retaining a fourth (4th) copy for his file.

A lump sum is required for the work involved in construction. Certain unit prices are listed in the proposal. The Owner reserves the right to make use of unit prices when ordering changes to the work.

Proposals shall be prepared on loose Proposal Form provided with these Specifications. All blank spaces for bids and alternates shall be properly filled in. Failure to do so constitutes an omission or alteration of the form and will make the proposal subject to rejection. Numbers shall be stated both in writing and in figures, and the complete form shall be without any lineation, alterations or erasures:

The Contractor shall fill in the Form of Proposal as follows:

A) If the Documents are executed by a sole Owner, that fact shall be evidenced by the word "Individual" appearing as directed.

B) If the Documents are executed by a partnership, that fact shall be evidenced by the word "Partnership" appearing as directed.

C) If the Documents are executed on the part of a corporation, they shall be executed by either the President or the Vice President and attested by the Secretary in either case, and the title of the office of such persons shall appear after their signatures. The seal of the corporation shall be impressed on the Bid. Evidence the fact by the words "a Corporation" appearing as directed.

D) All signatures shall be properly witnessed and must be in longhand. The Bidder's legal name must be fully stated.

Proposals shall be addressed to the Owner and shall be delivered enclosed in an opaque sealed envelope marked "Proposal" and bearing the title of the work, the legal name of the Bidder, his address and his Bidder's and Contractor's license numbers.

Modifications of bids will be acceptable only if received in writing at the place of the bid opening prior to the time for opening bids.

No Bidder may withdraw, modify or cancel his bid or any part of it for a period of forty-five (45) days after the date of bid opening.

8. BULLETINS AND ADDENDA

Any addenda to the Contract Documents issued during the time of bidding are to be considered covered in the proposal; and in closing a Contract, they will become a part thereof. Receipt of addenda shall be acknowledged by the Bidder on the Proposal Form. No addenda will be issued by the Engineer after seven (7) days prior to the date for receiving bids. Bidders shall direct any questions that may arise to the Engineer in sufficient time for inclusion in the final addendum. Bidders shall acknowledge receipt of addenda in space provided on Proposal Form.

9. EXAMINATION OF BIDDING DOCUMENTS

Should the Bidder find discrepancies in or omission from the Drawings or Documents or should he be in doubt as to their meaning, he shall at once notify the Engineer who will send a written instruction to all Bidders, usually in the form of a bulletin or addendum. The Engineer will not be responsible for any oral instructions. If Plans and Specifications are found to disagree after contract is awarded, the Engineer shall be the judge as to which was intended.

10. REJECTION OF BIDS

The Owner reserves the right to reject any and all bids, to waive informalities and to determine the low Bidder in case of tie bids.

11. POST BID INFORMATION

The successful Bidder shall submit, prior to execution of the Contract, the following:

A) A breakdown of costs for each major item of work in his bid.

B) The designation of work to be performed by the Bidder with his own forces.

C) The proprietary names and the suppliers of principal items or systems proposed for the project.

D) Construction schedule bar chart, CPM, etc. to be furnished and updated monthly.

12. PERFORMANCE AND PAYMENT BOND

The Contractor shall secure a Performance Bond and Labor and Materials Payment Bond in the form issued by American Institute of Architects (AIA Form A311), each in an amount equal to one hundred percent (100%) of the contract sum, to cover all work selected by Owner. Surety shall be a company licensed to do work at the place of work and shall be acceptable to the Owner. The cost of bonds shall become a part of the Contract. Contractor shall state separately on the Bid Form the cost of the Payment Bond and Performance Bond, but this cost shall be included in the Base Bid.

13. COMPLETION DATE

The Bidder is to estimate carefully and realistically his proposed completion date on the basis of the project being complete and ready for occupancy within 270 calendar days.

He shall do all things possible to eliminate unnecessary delays and obstructions to this schedule. Make note that time is of the essence, and that the completion dates will be taken into account in making an award. The term "Beneficial Occupancy" as used herein shall be understood to mean occupancy of the premises for the use intended without interruption and with all utilities, mechanical, and electrical systems in operating conditions. The Contractor shall submit, along with Bid Proposal, a schedule of events for the construction of the proposed project. This may be a bar chart, critical path or other scheduling format.

14. PRODUCT APPROVAL (Substitutions)

Request for product approval by Bidders must be received in the Engineer's office in writing not later than ten (10) days prior to bid opening, and all approvals by the Engineer will be issued in the form of an addenda. After contracts are signed, the Contractor must use one of the products listed in Specifications (base Specifications), or covered in the addendum, and no further substitution will be considered. All requests shall be supported by complete performance data, descriptions, test reports, and the like.

15. LISTED APPROVED PRODUCTS BY ADDENDUM

Subcontractors who intend to furnish products other than those specified in the base Specification shall list such Engineer approved products in their proposal. The listed products must be covered by addenda, indicating ten (10) days prior approval to bid opening.

16. VALUE ENGINEERING PROPOSALS

Bidders may submit "value engineering" proposals (not alternates) if desired. Such proposals shall be submitted by separate attachment on stationary bearing the company name and address. All such proposals shall bear signature of person authorized by company making said proposal.

FORM OF PROPOSAL

Date : ______________________________

Name of Bidder : ______________________________

Business Address : ______________________________

Phone : ______________________________

NC Contractor's License No. : ______________________________

Bidder's License No.: ______________________________

PROJECT : McGuire Landfill
McGuire Nuclear Station
Duke Power Company
N.C. Highway 73
Huntersville, N.C.

TO : Duke Power Company Purchasing Department
400 South Tryon Street, Room 1031
Post Office Box 52306
Charlotte, North Carolina 28232

BID DATE :

ATTENTION : McGuire Landfill Purchasing Agent

Gentlemen:

In compliance with the Instructions to Bidders, the undersigned, having carefully examined the Bidding Documents, Drawings and Specifications, all subsequent Addenda as prepared by Duke Power Company, visited the site and being familiar with all conditions and requirements of the work, hereby agrees to furnish all labor, materials, equipment and services, etc., to complete the work required in accordance with the Contract Documents for the consideration of the following amount/amounts:

LUMP SUM BASE BID (fill in amount in words and figures, words to govern in case of conflict) includes amount shown hereinafter in Performance and Payment Bonds):

______________________________ Dollars ($ __________).

PERFORMANCE AND PAYMENT BONDS: Each Bidder shall enter on the space provided below his cost to provide the performance and payment bond included in the SAMPLE DOCUMENTS Section of these Specifications______________________________

______________________________ Dollars ($ __________).

The undersigned further agrees to sign a Contract for all work in the above amount, if offered within sixty (60) days after receipt of Bids.

UNIT PRICES

Should the undersigned be required to perform work over and above that required by the Contract Documents, or should he be ordered to omit work required by the Contract Documents, he will be paid an extra or shall credit the Owner, as the case may be, on the basis of unit prices stated herein; prices quoted being sum total compensation payable or creditable for such items in place.

WORK	UNIT	PRICE
Additional Clearing	Acre	$________
Additional Grubbing	Acre	$________
Additional Earth Excavation	Cu.Yd.	$________
Additional Backfill (Compacted)	Cu.Yd.	$________
Additional Concrete in Forms	Cu.Yd.	$________
Additional Road Grading	Linear Ft.	$________
Additional Road Gravel	Tons	$________
Additional Drainage Blanket Sand	Tons	$________
Additional Drainage Blanket Gravel	Tons	$________
Additional Permanent Seeding	Acre	$________
Additional Rip Rap and Store	Ton	$________
Additional HDPE Liner	Square Feet	$________
Additional Geotextile Fabric	Square Feet	$________
Additional Sediment Fence	Linear Ft.	$________
Additional Straw w/Net	Square Ft.	$________
Additional 6' Steel Fence	Linear Ft.	$________
Classified Rock Excavation	Cu.Yd.	$________
Monitoring Well Installation	Linear Ft.	$________

Addenda have been received as follows:

Addendum No. ______ Date ______________

Addendum No. ______ Date ______________

Addendum No. ______ Date ______________

The undersigned states that all Federal, State and Local Sales and Use Taxes required by law to be paid for the work are included in this Contract Bid.

The undersigned further attests that he is licensed by the North Carolina Licensing Board and that he has the proper license for the scope of the work for this project.

The undersigned further agrees to begin work promptly after a Notice to Proceed with an adequate force, carry the work forward as rapidly as possible and complete the entire project as specified in Part 13 of Instructions to Bidders.

It is distinctly understood that the Owner reserves the right to reject any and all bids and bidding informalities should he deem it to be in the best interest of the Owner.

Respectively submitted this ________day of ________________ 19___.

Contractor: ____
(Name of firm or corporation making bid)

Address: ______________________________

____

By: ___________________________________
(Signature)

Corporate Seal

By: ___________________________________
(Typed)

Title: ________________________________
(Typed)

N.C. Bidder's License No.: ______________________

N.C. Contractor's License No.: __________________

DATE________________________________

AFFIDAVIT OF PRIME CONTRACTOR
(STATUS OF SUBCONTRACTORS AND MATERIAL SUPPLIERS)

We, ____, certify that to the best of our knowledge and belief no claims or liens exist against any material suppliers or subcontractors who furnished materials or labor on the

Duke Power Company's McGuire Landfill
Name of Project

N.C. Highway 73, Huntersville, N.C.
Location

or if any appear afterwards we as contractor shall save the Owner harmless on account thereof. If any lien remains unsatisfied after all payments are made, the contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging such a lien, including all costs and a reasonable attorney's fee.

Sworn to and subscribed
before me this ________
day of ___________19___.

Contractor:________________________________
(Typed)

Address:________________________________
(Typed)

____

By________________________________
(Signature)

Title________________________________
(Typed Name & Company Title)

Date________________________________

____
Notary Public

RELEASE AND WAIVER OF CLAIM
PRIME CONTRACTOR

______________________________ Personally appeared before me the under-

signed authority in and for said county and state ______________________

______________, ______________ of ______________________________
Name Title Company

who being duly sworn by me, states that all payrolls, material bills, sales tax, privilege tax or license, old age benefits tax, state and federal unemployment insurance and other liabilities have been paid in full, incurred

for use in the performance of ________________ contract for Duke Power
Name of Job
Company's McGuire Landfill
N.C. Highway 73, Huntersville, N.C.

and waives any claims and releases ______________________________

from any rights or claims for debts due and owing by virtue of the furnishing of any material or supplies of any lien thereon.

Sworn to and subscribed
before me this ______
day of __________ 19___.

Contractor: ______________________
(Typed)

Address: ______________________
(Typed)

____

By ______________________
(Signature)

Title ______________________
(Typed Name & Company Title)

Date ______________________

____
Notary Public

DATE________________________________

WARRANTY

____, warrants all materials
Name of Contractor

and workmanship incorporated in the Duke Power Company's McGuire Landfill,
Name of Job

N.C. Highway 73, Huntersville, N.C., against defect due to faulty materials or
Location

faulty workmanship or negligence for a period of twelve (12) months for the general warranty or for such longer periods as may be designated by specific divisions of the specifications.

This warranty is binding where defects occur due to normal usage conditions and does not cover willful or malicious damage, damage caused by acts of God or other casualty.

Sworn to and subscribed
before me this ________
day of ___________19___.

Contractor:________________________________
(Typed)

Address:________________________________
(Typed)

____

By________________________________
(Signature)

Title________________________________
(Typed Name & Company Title)

Date________________________________

____
Notary Public

SECTION 01000 - GENERAL CONDITIONS

STANDARD FORMS: The "General Conditions of the Contract for Construction," AIA Document A201, 1976 Edition together with Supplementary Conditions, are considered an integral part of this specification. Copies may be purchased from the American Institute of Architects, The Octagon, 1735 New York Avenue, Washington, DC or may be examined at the office of the Engineer.

Subcontractors not part of Duke Power Company are contractually bound by the "General Conditions," Supplementary Conditions and Modifications as a part of this Specification.

CONFLICTS: Where any Article or portion of an Article conflicts with the laws of the State of North Carolina, such Article or portion of the Article is hereby stricken.

END OF SECTION 01000

SECTION 01005 - SUPPLEMENTARY CONDITIONS

RELATIONS TO STANDARD FORMS: The Supplementary Conditions contain changes and additions to the AIA Document AIA A201-1987, "General Conditions of the Contract for Construction." When any portion of an Article in AIA Document AIA A201-1987 is modified or voided by the Supplementary Conditions, the unaltered portion of such Article shall remain in effect.

MODIFICATIONS TO STANDARD FORMS: Modify and supplement Articles of AIA Document AIA 201-1987.

ARTICLE 1 - GENERAL PROVISIONS

Subparagraph 1.1.1 - Modify:

Lines 10-12, change "Unless specifically . . . such as" to "The Contract Documents also include the".

Subparagraph 1.1.4 - Add:

Line 4, insert after last sentence: "The Project is the Duke Power Company McGuire Landfarm located at McGuire Nuclear Station.

Subparagraph 1.1.7 - Modify:

Line 1, delete "usually".
Line 2, change "may" to read as "shall".

Subparagraph 1.2.1 - Delete:

Entire subparagraph.

ARTICLE 2 - OWNER

Subparagraph 2.1.1 - Add:

Line 4, insert after last sentence: "The Owner of this Project is Duke Power Company."

Subparagraph 2.2.1 - Delete:

Entire subparagraph.

Subparagraph 2.2.5 - Amend:

"The Contractor will be furnished, free of charge, twelve (12) sets of Drawings and Specifications for the execution of the Work. The Contractor may purchase from the Engineer, extra copies of Drawings and Specifications at the cost of reproduction, postage and handling."

Subparagraph 2.3.1 - Delete:

Line 3, "persistently".

Subparagraph 2.4.1 - Delete:

Lines 6-11, "give the Contractor . . . deficiencies, the Owner may,".

ARTICLE 3 - CONTRACTOR

Subparagraph 3.2.1 - Delete:

Line 14, "an appropriate amount of".

Subparagraph 3.5.1 - Add:

Line 4, insert "of good quality and" after "be".

Line 9, insert after the second sentence: "The Contractor shall promptly notify the Owner and the Engineer when it discovers Work not conforming with the requirements of the Contract Documents."

Paragraph 3.5 - Add:

"3.5.2 This warranty shall be in effect for a period of twelve (12) months following completion of the Work. Where a manufacturer's warranty on equipment or parts thereof exceeds 12 months, the guarantee period on such equipment or parts thereof shall be extended to include the full warranty of the manufacturer. The Contractor shall promptly repair or replace such defective materials, equipment or workmanship to the full satisfaction of the Owner at no cost to the Owner."

Subparagraph 3.7.1 - Delete:

Lines 5-7, "which are customarily . . . negotiations concluded".

Subparagraph 3.10.1 - Modify:

Lines 3-5, change "information a Contractor's . . . at appropriate intervals" to "approval, a Contractor's construction schedule for the Work in such detail as may be required by the Owner. The schedule shall not exceed time limits current under the Contract Documents, may be revised at appropriate intervals with Owner's approval".

Subparagraph 3.18.1 - Delete:

Line 11, "negligent".

ARTICLE 4 - ADMINISTRATIVE OF THE CONTRACT

Subparagraph 4.1.1 - Modify:

Lines 1-3, change "the person lawfully . . . in the Agreement" to "Duke Power Company represented by its employee Engineers".

Subparagraph 4.2.12 - Delete:

Lines 4-8: Delete second sentence.

Subparagraph 4.3.2 - Modify:

Line 6, change "between the Contractor and Owner" to "of the Contractor".

Subparagraph 4.3.3 - Change:

Lines 2 and 3, change "21" to "45".

Subparagraph 4.3.5 - Add:

Add to end:

"The acceptance of final payment by the Contractor shall constitute a waiver of Claims by the Contractor except for those Claims already made which remain unsettled."

Subparagraph 4.3.6 - Modify:

Lines 11 and 22, change "21" to "45".

Subparagraph 4.3.9 - Modify:

Line 7, change "21" to "45".

Subparagraph 4.5.1 - Modify:

"Any dispute, controversy or claim arising out of or relating to the Contract or the breach thereof, shall be resolved by arbitration substantially in accordance with the construction industry arbitration rules of the American Arbitration Association ("AAA"). Arbitration proceedings shall be held in Charlotte, North Carolina, and judgment upon any arbitration award may be entered in any court having jurisdiction thereof, the parties hereby consenting to the jurisdiction of such courts for this purpose. The discovery provisions of the North Carolina State Rules of Civil Procedure in effect at the time of arbitration shall be deemed incorporated herein for the purpose of such arbitration proceedings. If the parties cannot agree upon an Arbitrator, one shall be appointed by the AAA. The Arbitrator's award shall be in writing. The parties shall share the procedural costs of arbitration equally unless the Arbitrator decides otherwise. Each party shall pay its own attorney's fees and other costs incurred by it in connection with the arbitration. Arbitration may be commenced when 45 days have passed after a Claim of the Contractor has been referred to the Engineer as provided in Paragraph 4.3 and at anytime by the Owner.

Subparagraph 4.5.4 - Modify:

Line 2, insert "by the Contracts" after "Claim".

Lines 4-5, change "parties have presented evidence to the Engineer or have" to "Contractor has presented evidence to the Engineer or has".

Subparagraph 4.5.5 - Delete:

Lines 1-7, The first sentence.

Subparagraph 4.5.6 - Delete:

Line 7, "or arbitrators".

Subparagraph 4.5.7 - Delete:

Line 2, "or arbitrators".

ARTICLE 5 - SUBCONTRACTORS

Subparagraph 5.2.1 - Delete:

Lines 9 and 11, delete "reasonable".

Subparagraph 5.2.2 - Delete:

Line 2-3, delete "reasonable and".

Line 5, delete "reasonable".

Subparagraph 5.2.3 - Delete:

Lines 1 and 4, delete "reasonable".

Subparagraph 5.2.4 - Delete:

Line 3, delete "reasonable".

Subparagraph 5.3.1 - Add at End:

"The Owner will not undertake to settle any differences between the Contractor and its Subcontractors, nor between Subcontractors."

ARTICLE 6 - CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

Paragraph 6.1 - Add:

6.1.5 "The Owner reserves the right to provide goods or materials which will be installed by the Contractor."

ARTICLE 7 - CHANGES IN THE WORK

Paragraph 7.1 - Add:

Add "7.1.5 Overhead and profit shall not exceed 15% of the value of labor and material for the Work performed by the Contractor or any Subcontractor. If the Work is performed by a Subcontractor, the Contractor's overhead and profit shall not exceed 7-1/2%."

ARTICLE 8 - TIME

Subparagraph 8.1.2 - Modify:

Line 2, change "the Agreement" to "a written notice to proceed issued by the Owner. No Work shall be performed prior to such date."

ARTICLE 9 - PAYMENTS AND COMPLETION

"9.3.1.3 The Owner may require the Contractor to attach to such application evidence satisfactory to the Owner that all bills for labor, materials, and equipment for the Work hereunder have been paid or to attach waivers and releases of lien from each entity furnishing said labor, materials or equipment."

Subparagraph 9.4.1 - Modify:

Line 1 - change "seven" to "ten".

Subparagraph 9.5.1.7 - Delete:

Line 1, "persistent".

Subparagraph 9.6.1 - Modify:

Lines 2-4, change "in the manner . . . so notify the Engineer" to "within thirty (30) days following the Owner's receipt of a Certificate for Payment from the Engineer, and shall so notify the Engineer. Progress payments will reflect retainage of ten percent (10%) by the Owner".

Subparagraph 9.10.1 - Add at End:

"Final payment shall be made by the Owner within thirty (30) days after receipt by the Owner of the Engineer's final Certificate for Payment."

Subparagraph 9.10 2.6 - Add:

Line 19, insert "and (6) Certificates of Inspection and Occupancy and/or Completion and other data and information such as guarantees, warranties, drawings and operating and maintenance manuals" after "Owner".

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

Subparagraph 10.1.4 - Modify

Lines 15-17, change ", regardless of whether . . . indemnified hereunder" to "; provided, however, this indemnity shall not apply to any party to the extent such claim, damage, loss or expense is caused in part by such party".

Subparagraph 10.2.4 - Add at End:

"No asbestos materials in any form to be allowed on the Project."

ARTICLE 11 - INSURANCE AND BONDS

Subparagraph 11.1.1 - Modify:

"The Contractor shall procure prior to commencement of any Work and shall maintain in full force and effect until all Work has been completed and accepted, insurance of the following kinds and amounts, in such form (including deductibles) and issued by such insurance companies as shall be satisfactory to the Owner:

a. Workers' Compensation Insurance which fully meets the requirements of any Workers' Compensation Law applicable where the Work is to be performed, including the requirements of any Occupational Disease Law, and Employer's Liability Insurance with limits of not less than $1,000,000.

b. Comprehensive General Liability Insurance with a combined single limit of not less than $2,000,000 per occurrence. Such insurance shall include coverage for contractual liability assumed by the Contractor under this Agreement with specific reference made thereto, products/completed operations liability, owner's and contractor's protective, personal injury liability, broad form property damage liability and explosion, collapse and underground hazard coverage. Such insurance shall be primary for all purposes and shall contain standard cross liability provisions.

c. Automobile Liability Insurance with a combined single limit of not less than $2,000,000 per occurrence covering all owned, non-owned and hired vehicles of the Contractor engaged in or about the Work with limits of not less than those in (b) above.

d. The Contractor shall require each Subcontractor to (a) furnish properly executed certificates of insurance to the Owner prior to commencement of Work hereunder, which certificates shall clearly evidence all coverages required above and provide that such insurance shall not be terminated nor expire except on thirty days' prior written notice to the Owner, and (b) maintain such insurance from the time Work first commences until completion of the Work hereunder.

e. The Contractor releases the Owner, to the extent of the Contractor's insurance coverage as set forth herein, from any liability for loss or damage caused by any peril, act or omission included in the coverage of the Contractor's insurance policies even if any loss or damage resulting therefrom should have been brought about or caused by the default or negligence of the Owner or its agents, employees, or other contractors. The Contractor shall require each insurance company writing coverage required hereunder to include such a clause releasing the Owner."

Subparagraph 11.2.1 - Delete:

The first sentence.

Subparagraph 11.3.1 - Modify:

Line 1, change "Owner" to "Contractor".

Subparagraph 11.3.1.2 - Modify:

"If the Owner is damaged by the failure or neglect of the Contractor to purchase or maintain insurance as described above, then the Contractor shall bear all reasonable costs properly attribute thereto."

Subparagraph 11.3.1.3 - Modify:

Line 3, change "Contractor" to "Owner".

Lines 4, 6, 7 and 10, change "Owner" to "Contractor."

Subparagraph 11.3.2 - Modify:

Line 1, change "Owner" to "Contractor".

Subparagraph 11.3.4 - Modify:

Lines 1 and 5, change "Contractor" to "Owner".

Line 3, change "Owner" to "Contractor".

Subparagraph 11.3.6 - Modify:

Line 1, change "Owner" to "Contractor".

Line 2 and Line 8, change "Contractor" to "Owner".

Subparagraph 11.3.8 - Modify:

Line 1, change "Owner's" to "Contractor's".

Subparagraph 11.3.9 - Delete:

Entire subparagraph.

Subparagraph 11.3.10 - Delete:

Lines 2-9, "unless one of the . . . direct such distribution".

Subparagraph 11.4.1 - Modify:

"The Contractor shall, prior to commencement of the Work, obtain payment and performance bonds each being in the penal sum of not less than the Contract Sum and in the form and with a surety acceptable to the Owner. The Contractor shall deliver these bonds to the Owner. Failure of the Contractor to obtain these bonds as specified will be cause to cancel the Contract. If applicable, the Contractor shall also provide a bond acceptable to the South Carolina Tax Commission in accordance with S. C. Code Section 12-9-310(3) and the Owner must receive notice from the South Carolina Tax Commission that the Contractor has complied with this requirement before any payments are made to the Contractor."

ARTICLE 12 - UNCOVERING AND CORRECTION OF WORK

No changes.

ARTICLE 13 - MISCELLANEOUS PROVISIONS

Subparagraph 13.7.1 - Delete:

Entire subparagraph.

ARTICLE 14 - TERMINATION OR SUSPENSION OF THE CONTRACT

Subparagraph 14.1.1.5 - Delete:

Entire subparagraph.

Subparagraph 14.2.1.1 - Delete:

Line 1, "persistently or repeatedly".

Subparagraph 14.2.1.3 - Delete:

Line 1, "persistently".

Subparagraph 14.2.1.4 - Delete:

Line 1, "substantial".

Subparagraph 14.2.2 - Delete:

Lines 1-3, ", upon certification . . . such action,".

Subparagraph 14.3 - Modify:

"14.3 TERMINATION OR SUSPENSION BY THE OWNER FOR CONVENIENCE

The Owner may, without cause, terminate or suspend the Contract in whole or in part. In the event the Owner terminates or suspends the Work for the Owner's convenience, the Contractor shall then take whatever action with respect to performance of the Work as will minimize its claim against the Owner. The Owner will only be liable to the Contractor for the work actually performed prior to the date of termination or suspension plus costs reasonably incurred by the Contractor in terminating or suspending operations. The Contractor shall not be entitled to payments for anticipated profits. The Contractor shall take all reasonable steps to minimize such termination or suspension charges. In the event the Owner terminates this Agreement pursuant to Subparagraph 14.1.1 and it is later determined that such termination was not proper, such termination shall be deemed to be a termination for the Owner's convenience pursuant to Subparagraph 14.3. The Contractor shall resume the Work following a suspension no later than ten (10) days after receiving notice from the Owner to resume working."

END OF SECTION 01005

SECTION 01010 - SUMMARY OF WORK AND DEFINITIONS

1) Definitions:

General: Except as specifically defined otherwise, the following definitions supplement definitions of the Contract, General Conditions, Supplementary Conditions and the other general contract documents, and apply generally to the work.

General Requirements: Provisions of Division 1 sections of these specifications.

Directed, Requested, Approved, Accepted, etc.: In no case releases Contractor from responsibility to fulfill requirements of contract documents.

Furnish: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar requirements.

Provide: Furnish and install, complete and ready for intended use.

Installer: Entity (firm or person) engaged to install work, by Contractor, Subcontractor or Sub-Subcontractor. Installers are required to be skilled in work they are engaged to install.

Overlapping/Conflicting Requirements: Most stringent (generally most costly) applies and will be enforced, unless more detailed language written directly into contract documents clearly indicates that a less stringent requirement is acceptable. Refer uncertainties to Engineer for decision before proceeding.

Minimum Requirements: Indicated requirements are for a specific minimum acceptable level of quality/quantity, as recognized in the industry. Actual work must comply (within specified tolerances), or may exceed minimums within reasonable limits. Refer uncertainties to Engineer before proceeding.

Abbreviations, Plural Words: Abbreviations, where not defined in contract documents, will be interpreted to mean the normal construction industry terminology, determined by recognized grammatical rules, by the Engineer. Plural words will be interpreted as singular and singular words will be interpreted as plural where applicable for context of contract documents.

Description Summary of the Work:

Identification: Refer to the Contract (Owner-Contract Agreement) for name, location, project number and abbreviated identification of the work in the project.

Contract Documents: Requirements of the work are contained in the contract documents, and include cross-references therein to published information, which is not necessarily bound therewith.

Structural Work: Do not cut-and-patch structural work in a manner resulting in a reduction of load-carrying capacity or load/deflection ration. Submit proposal and request, and obtain Engineer's approval before proceeding with cut-and-patch of structural work.

Operational/Safety Limitations: Do not cut-and-patch operational elements and safety components in a manner resulting in decreased performance, shortened useful life, or increased maintenance. Submit proposals and requests and obtain Engineer's approvals before proceeding with cut-and-patches.

Visual/Quality Limitations: Do not cut-and-patch work exposed to view (exterior and interior) in a manner resulting in noticeable reduction in visual qualities and similar qualities, as judged by Engineer.

Limitation on Approvals: Engineer's approval to proceed with cutting and patching does not waive right to later require removal/replacement of work found to be cut-and-patched in an unsatisfactory manner, as judged by Engineer.

2) Verbal Summary:

Install an industrial landfill for the McGuire Nuclear Station. The landfill shall be surrounded by a 6' chain link fence. The landfill will be equipped with a leachate collection system which collects and pumps the leachate to the WC Treatment Facility at the McGuire Nuclear Station. The landfill will be lined with a HDPE liner.

END OF SECTION 01010

SECTION 01070 - CUTTING AND PATCHING

1.0 GENERAL

1.1 DESCRIPTION:

A) Related Work Specified Elsewhere:

1) Summary of work

2) Demolition

3) Excavating and Backfilling

B) Execute cutting (including excavating), filling or patching of work required to:

1) Make several parts fit properly.

2) Uncover work to provide for installation of ill timed work.

3) Remove and replace defective work.

4) Remove and replace work not conforming to requirements of contract documents.

5) Remove samples of installed work as specified for testing.

6) Install specified work in existing construction.

C) In addition to contract requirements upon written instructions of Engineer:

1) Uncover work to provide for Engineer's observation of covered work.

2) Remove samples of installed materials for testing.

3) Remove work to provide for alteration of existing work.

D) Do not endanger any work by cutting or altering work or any part of it.

E) Do not cut or alter work of another contractor without written consent of Engineer.

1.2 SUBMITTALS:

A) Prior to cutting which affects structural safety of project, or work of another contractor, submit written notice to Engineer requesting consent to proceed with cutting, including:

1) Identification of Project.

2) Description of affected work.

3) Necessity for cutting.

4) Affect on other work, on structural integrity of project.

5) Description of proposed work. Designate:

   a) Scope of cutting and patching.

   b) Contractor and trades to execute work.

   c) Products proposed to be used.

   d) Extent of refinishing.

6) Alternatives to cutting and patching.

7) Designation of party responsible for cost of cutting and patching.

B) Prior to cutting and patching done on instruction of Engineer, submit cost estimate.

C) Should conditions of work or schedule indicate change of materials or methods, submit written recommendations to Engineer, including:

   1) Conditions indicating change.

   2) Recommendations for alternative materials or methods.

   3) Submittals as required for substitutions.

D) Submit written notice to Engineer, designating time work will be uncovered to provide for observation.

1.3 PAYMENT FOR COSTS:

A) Costs caused by ill-timed defective work or work not conforming to contract documents, including costs for additional services of Engineer, party responsible for ill-timed, rejected or nonconforming work.

B) Work done on instructions of Engineer other than defective or nonconforming work: Owner.

2.0 PRODUCTS

2.1 MATERIALS:

A) For replacement of work removed: Comply with specifications for type of work to be done.

3.0 EXECUTION

3.1 INSPECTION:

A) Inspect existing conditions of work, including elements subject to movement or damage during:

1) Cutting and patching

2) Excavating and backfilling

B) After uncovering work, inspect conditions affecting installation of new products.

3.2 PREPARATION PRIOR TO CUTTING:

A) Provide shoring, bracing and support as required to maintain structural integrity of project.

B) Provide protection for other portions of project.

C) Provide protection from elements.

3.3 PERFORMANCE:

A) Execute fitting and adjustment to products to provide finished installation to comply with specified tolerances, finishes.

B) Execute cutting and demolition by methods which will prevent damage to other work and will provide proper surfaces to receive installation of repairs and new work.

C) Execute excavating and backfilling as specified in excavating and backfilling.

D) Restore work which has been cut or removed, install new products to provide completed work in accordance with requirements of contract documents.

E) Refinish entire surfaces as necessary to provide an even finish.

1) Continuous Surface: To nearest intersections.

2) Assembly: Entire refinishing.

END OF SECTION 01070

SECTION 01300 - SUBMITTALS

1.0 GENERAL

1.1 DESCRIPTION:

A) Summary

1) Wherever possible throughout the contract documents, the minimum acceptable quality of workmanship and materials has been defined either by manufacturer's name and catalog number or by reference to recognized industry standards.

2) To ensure that the specified products are furnished and installed in accordance with the design intent, procedures have been established for advance submittal of design data and for its review by the Engineer.

B) Related Work Described Elsewhere

1) Contractual requirements for submittals: General Conditions & Supplementary Conditions

2) Individual submittals required: Pertinent Sections of these Specifications

3) Substitutions - Section 01310 of these specifications

2.0 PRODUCTS

2.1 SHOP DRAWINGS:

A) Scale Required

Unless otherwise specifically directed by the Engineer, make all shop drawings accurately to a scale sufficiently large to show all pertinent features of the item and its method of connection to work.

B) Type of Prints Required

Submit blueline or blackline reproductions in number of copies required by technical section of specifications.

2.2 MANUFACTURER'S LITERATURE:

A) General: Where contents of submitted literature from manufacturers includes data not pertinent to the submittal, clearly indicate which portion of the contents is being submitted for the Engineer's review.

B) Number of copies required: Submit the number of copies which are required to be returned, plus two copies which will be retained by the Engineer.

2.3 SAMPLES:

A) Accuracy of Sample: Unless otherwise specifically directed by the Engineer, all samples shall be of the precise article proposed to be furnished.

B) Number of Samples Required: Submit all samples in the quantity which is required to be returned plus one which will be retained by the Engineer.

2.4 PROGRESS SCHEDULE:

The contractor shall prepare a progress schedule for the job and submit it to the Engineer for review within ten (10) days after the contracts are signed. Each of the prime contractors on the job shall plan his work so that it will be coordinated with that of the general contractor and indicate it on the schedule.

2.5 SCHEDULE OF VALUES:

Before the first application for payment, the contractor shall submit to the Engineer a schedule of values allocated to the various portions of the work, prepared in such form and supported by such data to substantiate its accuracy as the Engineer may require. This schedule, unless objected to by the Engineer, shall be used only as a basis for the contractor's application for payment.

2.6 REQUEST FOR PAYMENT:

The contractor's request for payment shall be submitted to the Engineer in quadruplicate on "Application for Payment", AIA form G702 latest edition, each month. The contractor shall show a retainage of 10% on each application for payment.

THE CONTRACTOR'S FIRST APPLICATION FOR PAYMENT SHALL NOT BE HONORED UNTIL PROGRESS SCHEDULE AND SCHEDULE OF VALUES ARE RECEIVED. THE SECOND APPLICATION FOR PAYMENT SHALL NOT BE HONORED UNTIL SHOP DRAWINGS AND SAMPLES ARE RECEIVED.

3.0 EXECUTION

3.1 IDENTIFICATION OF SUBMITTALS:

A) General:

1) Consecutively number all submittals.

2) Accompany each submittal with a letter of transmittal showing the transmittal number, date of transmittal, specification section or drawing number to which the submittal pertains, brief description of the material submitted and the company name of the originator of the submittal.

B) Internal Identification: On at least the first page of each copy of each submittal, indicate the transmittal number corresponding to the letter of transmittal by which the submittal was accompanied.

C) Resubmittals: When material is resubmitted for any reason, transmit under a new letter of transmittal with a new number; indicate by reference to previous submittal that this is a resubmittal.

D) Submittal Log:

1) Maintain an accurate submittal log for the duration of the construction period, showing status of all submittals of all types.

2) Make a log available to the Engineer for review upon request.

3.2 COORDINATION OF SUBMITTALS:

A) General: Prior to submittal for Engineer's review, use all means necessary to fully coordinate all material, including the following procedures:

1) Determine and verify all field dimensions and conditions, catalog numbers and similar data.

2) Coordinate as required with all trades and with all public agencies involved.

3) Secure all necessary approvals from public agencies and others, signify by stamp or other means that all required approvals have been obtained.

4) Clearly indicate all deviations from the contract documents.

B) Grouping of Submittals:

1) Unless otherwise specifically permitted by the Engineer, make all submittals in groups containing all associated items.

2) The Engineer may reject partial submittals as not complying with the provisions of the contract documents.

3.3 TIMING OF SUBMITTALS:

A) General:

1) Make all submittals far enough in advance of scheduled dates for installation to provide all required time for reviews, for securing necessary approvals for possible revision and resubmittals and for placing orders and securing delivery.

2) In scheduling, allow at least ten (10) full working days for the Engineer's review following his receipt of submittal.

3) The contractor shall furnish an itemized list of subcontractors, materials and equipment suppliers to the Engineer before the second request for payment. Request for payment will not be approved until list is received. List shall include names of products to be supplied.

B) Delays: Cost of delays occasioned by tardiness of submittals may be back-charged as necessary and shall not be borne by the Owner.

3.4 DOCUMENTS AND SAMPLES AT THE SITE:

The contractor shall maintain at the site for the Owner one (1) record copy of all drawings, specifications, addenda, change orders and other modifications in good order and marked currently to record all changes made during construction and approved shop drawings, product data and samples. These shall be available to the Engineer and shall be delivered to him for the Owner upon completion of the work.

END OF SECTION 01300

SECTION 01310 - SUBSTITUTIONS

1.0 GENERAL

1.1 RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions and other General Requirements sections, apply to the work specified in this section.

1.2 DESCRIPTION OF REQUIREMENTS:

Definitions and Explanations: The requirements for substitutions do not apply to specified Contractor options on products, materials and construction methods. Revisions to contract documents, where requested by the Owner or Engineer, are "changes" not "substitutions". Requested substitutions during bidding period, which have been accepted prior to the Contract Date, are included in contract document and are not subject to requirements for substitutions as specified herein. Contractor's determination of, and compliance with, governing regulations and lawful orders issued by governing authorities do not constitute "substitutions"; and do not constitute a basis for change orders, except as provided for in contract documents. Otherwise, the Contractor's requests for changes in products, materials and methods of construction request for "substitutions," and are subject to requirements thereof.

"Or Equal": Where named products, materials or methods are accompanied by "or equal" or other language of the same effect, Contractor's request to use unnamed products, materials or methods are considered requests for substitutions, and are subject to requirements thereof.

1.3 LIMITATIONS FOR MAKING SUBSTITUTIONS:

Conditions: Contractor's request for substitution will be received and considered when extensive revisions to contract documents are not required and changes are in keeping with general intent of the contract documents, and when timely, fully documented and properly submitted, and when one or more of the following conditions is satisfied, all as judged by the Engineer; otherwise, requests will be returned without action except to record noncompliance with these requirements:

Where request is directly related to an "or equal" clause or other language of the same effect in the contract documents.

Where required product, material or method cannot be provided within Contract Time, but not as a result of Contractor's failure to pursue the work promptly or coordinate various activities properly.

Where required product, material or method cannot be provided in a manner which is compatible with other materials of the work, or cannot be properly coordinated therewith, or cannot be warranted (guaranteed) as required, or cannot be used without adversely affecting Owner's insurance coverage on completed work, or will encounter other substantial except by making requested substitution, which the Contractor thereby certifies to overcome such noncompatibility, noncoordination, nonwarranty, noninsurability or other noncompliance as claimed.

Where required product, material or method cannot receive required approval by a governing authority, and requested substitution can be so approved.

Where substantial advantage is offered Owner, in terms of cost, time or other valuable considerations, after deducting offsetting responsibilities Owner may be required to bear, including additional compensation to Engineer for redesign and evaluation services, increased cost of other work by Owner or separate contractors, and similar considerations.

Work-Related Submittals: Contractor's submittal of, and Engineer's acceptance of, shop drawings, product data or samples which indicate work not complying with requirements of contract documents, does not constitute an acceptable and valid request for, nor approval of, a substitution.

1.4 SUBMITTALS:

Requests for Substitutions:

Submit 3 copies of requests for substitutions, fully identified for product, materials or method being replaced by substitution, including related specification section and drawing number(s), and fully documented to show compliance with requirements for substitutions. Submit the following:

Complete product data, drawings, and descriptions of materials and methods where applicable of both the proposed substitution and the item originally specified.

Samples where applicable or requested.

Detailed comparison of significant qualities (size, weight, durability, performance and similar characteristics, and including visual effect where applicable) for proposed substitution in comparison with original requirements.

List, with addresses, of 3 projects where proposed substitution has been used previously and successfully in a similar application.

Coordination information, indicating every required change in every other element of the work which is affected by substitution, extended to include work by Owner and separate Contractors.

A complete statement of effect substitution will have upon schedule of the work, including its effect (if any) on Contract Time (in comparison with compliance with requirements without approval of proposed substitution).

Cost information, including a proposal of net change in Contract Sum (if any).

Certification by Contractor to the effect that, in his opinion and after his thorough evaluation, proposed substitution will result in total work which is equal-to or better-than the work originally required by contract documents, in every respect of significance except as specifically stated in certification; and that it will perform adequately in application indicated, regardless of equality and exceptions thereto.

Include in certification, Contractor's waiver of rights to additional payment and time which may subsequently be necessitated, by failure of substitution to perform adequately, and for required work to make corrections thereof.

Change Order Form: Submit requests for substitutions which propose a change in either the Contract Sum or Contract Time, in form and by procedures required for change order proposals.

Action by Engineer:

General: Within two weeks of receipt of Contractor's request for substitution, Engineer will request additional information or documentation as may be needed for his evaluation of request. Within three weeks of receipt of request, or within one week of receipt of requested additional information or documentation (whichever is later), Engineer will notify the Contractor of either acceptance or rejection of proposed substitution.

Rejection will include statement of reasons for rejection (non-compliances with requirements for requested substitutions, or other reasons as detailed).

Acceptance will be in the form of a change order, when required by the contract documents.

2.0 PRODUCTS (not applicable)

3.0 EXECUTION (not applicable)

END OF SECTION 01300

SECTION 01410 - ADMINISTRATION AND SUPERVISION

1.1 PERSONNEL AND RESPONSIBILITIES:

General: In addition to a General Superintendent and whatever other administrative and supervisory personnel may be specified or otherwise required for the performance of the work, provide specific coordinating personnel as specified herein.

1.2 SUBMITTAL OF STAFF NAMES, DUTIES:

Within 15 days of the Current date, submit a listing of Contractor's staff assignments and the consultants, naming the persons and listing their addresses and telephone numbers, for the following assigned responsibilities:

- Project management.
- General superintendence.
- Surveys, lines and levels.
- Mechanical/Electrical coordination.
- Supervision of safety and protection.
- Expediting submittals.
- Expediting work and test procedures.
- Purchasing and awarding subcontracts.
- Preparing/maintaining progress schedule and reports.
- Preparing payment requests.

1.3 REPORTING UNUSUAL EVENTS:

Whenever an event of unusual and significant nature occurs at the site (examples: visit by Government officials plus news media: extraordinary weather phenomenon), prepare and submit a special report to the Owner within one day, listing the chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Whenever such events are known or predictable in advance, advise Owner in advance at the earliest possible date.

END OF SECTION 01410

SECTION 01450 - PROGRESS SCHEDULE AND REPORTS

1.0 GENERAL

1.1 RELATED DOCUMENTS:

The general provisions of the Contract Documents, including General, Supplementary and Special Conditions and other General Requirements sections, apply to the Work specified in this section.

1.2 DESCRIPTION OF REQUIREMENTS:

General: This section specifies the particular administrative and procedural requirements for progress time scheduling and progress reporting for the performance of the Work, as indicated in General Conditions and elsewhere in the Contract Documents. Refer also to the General Conditions, and to the Owner-Contractor Agreement, for definition and specific dates of the Contract Time.

Scheduling Responsibility: Submission of the Contractor's progress schedule to the Owner shall not relieve the Contractor of his total responsibility for scheduling, sequencing and pursuing the work to comply with the requirements of the Contract Documents.

1.3 PRELIMINARY PROGRESS SCHEDULE:

Bar-Chart Schedule: Within 10 days of the date of the Owner-Contractor Agreement, submit a bar-chart type progress schedule indicating a time bar for each major category or unit of work to be performed at the site, properly sequenced and intermeshed, and showing completion of the Work sufficiently in advance of the date established for "substantial completion of the Work" to allow for the Engineer's procedure for issuance of the "certificate of substantial completion." With submittal of bar chart, submit a tabulation (by date) of submittals (of all kinds) required during the first 30 days of Construction Time; as required either directly by date/period relation in the Contract Documents, or necessitated by lead times related to the individual time bars shown on the schedule for the associated Work. At Contractor's option, submittal dates may be shown on the bar-chart schedule, in lieu of being tabulated.

Show the "estimated" total dollar-volume of Work performed at any date during the Contract Time: with a column of cost figures in the left-hand margin, ranging from zero to the Contract Sum.

Distribute preliminary schedule to every entity that needs to know about early scheduled activities, including the Owner.

1.4 FULLY DEVELOPED PROGRESS SCHEDULE:

Bar-Chart Schedule: Utilize the preliminary progress schedule (if any), and whatever updating and feedback may have occurred, in the preparation of the fully developed progress schedule. Within 60 days of the date of the Owner-Contractor Agreement, submit a comprehensive bar-chart type progress schedule indicating (by coded symbols) a time bar for each major category or unit or work to be performed at the site, and including minor units which are, nevertheless, involved in the overall sequencing of the Work. Arrange the schedule to graphically show the major sequences required in the intermeshing of the Work, and to show how substantial completion is scheduled to allow for the Engineer's procedure for certification thereto. Prepare and maintain schedule on sufficiently wide sheet or series of sheets, of stable transparency or other reproducible stock, to show required data clearly for the entire Construction Time, and to permit reproduction for required distribution.

Phasing: Arrange schedule with notations to show how the sequence of the Work is affected by requirements (if any) for phased completion, work by separate contractors, work by the Owner, pre-purchased materials, coordination with existing work, limitations of continued occupancies, non-interruptible services, partial occupancy prior to substantial completion, site restrictions, provisions for future work, seasonal variations, environmental control, and similar provisions of the total project. Refer to the "Summary of Work" sections and other contract documents for such requirements.

Individual Work Stages: By uniform targeted symbols and crosshatched bars, show the significant stages for each category or unit of work including (where applicable), but not necessarily limited to, subcontract letting, submittals, purchases, mockups, fabrication, sample testing, deliveries, installation, testing, adjusting, curing, startup and placement into final use and operation. Within long bars showing fabrication or installation of major units of work (3 months and longer), show estimated percentage-of-completion markers at 10 percent increments. As each unit of work progresses, mark each long bar with a contrasting mark (at 10 percent increments) to show actual percentage-of-completion.

Cost Correlation: Immediately below the date line at the heading of the chart, provide a double-line cost correlation line ("precalculated" and "actual") to show the dollar-volume of work performed as of the same dates used for the preparation of payment requests. Use those same dates as the primary vertical lines of the schedule. Insofar as it is practical to do so, use the same units of work in the progress schedule as indicated in the "schedule of values" required by General Conditions.

Superimpose an S-curve on the schedule (only first sheet for multiple-sheet schedule) to show the "precalculated" dollar-volume against time at any point during the Contract Time; with a double column of figures in the left-hand margin ranging from zero dollars to the Contract Sum, an from zero percent to 100. As work progresses (on each date used in payment requests), plot a second S-curve showing "actual" dollar-volume of work performed.

Distribution: Following initial submittal to and response by the Engineer, print and distribute the progress schedule to the Engineer, (3 copies), separate contractors (if any), principal subcontractors and suppliers or fabricators, and others with a need-to-know schedule compliance requirement. Post copies in project meeting rooms and field (temporary) offices. Distribute and post subsequent updated issues to the same entities, whenever revisions are made; except delete entities from distribution which have completed assigned work and are no longer involved in performance of scheduled work.

END OF SECTION 01450

SECTION 01510 - TEMPORARY UTILITY SERVICES

1.0 GENERAL

1.1 RELATED DOCUMENTS:

The general provisions of the Contract Documents, including General, Supplementary and Special Conditions and other General Requirements sections, apply to the Work specified in this section.

1.2 DESCRIPTION OF REQUIREMENTS:

General: This section of the General Requirements specifies the minimum requirements for temporary utilities to be brought to the site in order to enable the construction of the Project to progress adequately. The providing of adequate utility capacity at every stage of performing the Work is the Contractor's sole responsibility, and is not limited by the requirements hereof. Except as otherwise indicated, the Contractor may, at his option, provide stand-alone utility plants to provide needed services, in lieu of connected services from available public utilities, provided such stand-alone plant facilities comply with governing regulations. Prior to availability of temporary utility services, provide trucked-in/trucked-out containerized or unitized services for startup of construction operations at the site.

Except as otherwise indicated, the costs of providing and using temporary utility services are included in the Contract Sum.

The types of utility services required for general temporary use at the Project site include the following (other specific services may be required for specific construction methods or operations):

Water service (potable for certain uses).

Open drainage/run-off control facilities.

Electric power service.

Telephone service.

1.3 QUALITY ASSURANCE:

Regulations: Comply with governing regulations and utility company regulations and recommendations for the construction of temporary utility services; including (but not necessarily limited to) code compliances, permits, inspections, testing and health and safety compliances.

Comply with pollution and environmental protection regulations for the use of water and other services, and for the discharge of wastes and storm water drainage from the project site.

Standards: Comply with the "Manual of Accident Prevention in Construction" by AGC. Comply with NFPA Code 241 "Building Construction and Demolition Operations".

1.4 SUBMITTALS:

Reports and Permits, Temporary Utilities:

Submit copies of inspections, tests, meter readings and similar data, and copies of permits, easements and similar documentation concerning the installation and use of temporary utility services, if any are required.

1.5 JOB CONDITIONS:

Scheduled Uses: In conjunction with establishment of the job progress schedule, establish a schedule for the implementation and termination of service for each temporary utility or facility. At the earliest feasible time, and when acceptable to the Owner and Engineer, change over from the use of temporary utility service to permanent service in each instance, so as to enable the removal of the temporary utility and eliminate its possible interference with the completion of the Work.

Conditions of Use: Operate, maintain and protect temporary utilities in a manner which will prevent overloading, freezing of water-filled piping, contamination of sources, flooding, unsanitary conditions, hazardous exposures, and similar deleterious effects.

2.0 PRODUCTS - not required

3.0 EXECUTION

3.1 INSTALLATION OF TEMPORARY UTILITY SERVICES:

General: Wherever feasible, engage the utility company to install the temporary service to the Project, or as a minimum, to make the connection to the existing utility service. Use qualified tradesmen for the installation of each service. Locate services where they will not interfere with the total Project construction Work, including the installation of permanent utility services. Maintain temporary services as installed for the required period of use; and relocate, modify or extend as necessary from time to time during that period as required to accommodate total Project construction Work.

Arrange with utility companies and existing users of utility services for an acceptable time when their services can be interrupted for the purpose of making the connection of temporary utility services.

3.3 ELECTRIC POWER SERVICE:

General: Install weatherproof, grounded electric power service of the size, capacity and power characteristics required for temporary uses, including construction machinery, tools and equipment, lighting, heating (to the extent indicated, if any), alarms, communication devices, and the initial operation and testing of Work which requires power and must be test operated or placed in service ahead of the time permanent power service is available. Install service and grounding in compliance with the National Electrical Code (NFPA 70). Include meters, transformers, overload protected disconnect and main distribution switch gear.

Install overhead service, except to the extent underground service must be used to avoid construction conflicts or comply with governing regulations.

Connect service to local power company main as directed by company official.

3.4 TELEPHONE SERVICE:

General: Arrange for the local telephone company to install temporary telephone service to the Project site, of the capacity and type required for the indicated telephone requirements.

OPERATIONS AND TERMINATIONS:

Inspections: Prior to placing temporary utility services into use, inspect and test each service and arrange for governing authorities' required inspection and tests, and obtain required certifications and permits for use thereof.

Supervision: Enforce strict discipline in the use of utility services. Limit availability to essential uses, so as to minimize wastes. Do not allow the installations to be abused or endangered.

Protection: Prevent water-filled piping from freezing, by ground cover or insulation or by keeping drained, or by temporary heating. Maintain distinct markers for underground lines, and protect from damage during excavating operations.

Termination and Removal: At the time the need for a temporary utility service or a substantial portion thereof has ended, or when its service has been replaced by use of permanent services, or not later than the time of substantial completion, promptly remove the installation unless requested by the Engineer to retain it for a longer period. Complete and restore Work which may have been delayed or affected by the installation and use of the temporary utility, including repairs to construction and grades and restoration and cleaning of exposed surfaces. Replace Work damaged beyond acceptable restoration.

END OF SECTION 01510

SECTION 01700 - PROJECT CLOSEOUT

1.0 GENERAL

1.1 RELATED DOCUMENTS:

The general provisions of the Contract Documents, including General, Supplementary and Special Conditions and other General Requirements sections, apply to the Work specified in this section.

1.2 DESCRIPTION OF REQUIREMENTS:

Definitions: Closeout is hereby defined to include general requirements near the end of Contract Time, in preparation for final acceptance, final payment, normal termination of Contract, occupancy by Owner and similar actions evidencing completion of the Work. Time of closeout is directly related to "Substantial Completion," and therefore may be either a single time period for entire Work or a series of time periods for individual parts of the Work which have been certified as substantially complete at different dates. That time variation (if any) shall be applicable to other provisions of this section, regardless of whether resulting from "phased completion" originally specified by the Contract Documents or subsequently agreed upon by Owner and Contractor.

1.3 PREREQUISITES TO SUBSTANTIAL COMPLETION:

General: Prior to requesting Engineer's inspection for certification of substantial completion, as required by General Conditions (for either the entire Work or portions thereof), complete the following and list known exceptions in request:

In progress payment request coincident with or first following date claimed, show either 100% completion for portion of Work claimed as "substantially complete," or list incomplete items, value of incompletion, and reasons for being incomplete.

Submit statement showing accounting of changes to the Contract Sum.

Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications and similar documents.

Obtain and submit releases enabling Owner's full and unrestricted use of the Work and access to services and utilities, including (where required) occupancy permits, operating certificates, and similar releases.

Deliver tools, spare parts, extra stocks of materials, and similar physical items to Owner.

Make final changeover of locks and transmit keys to Owner, and advise Owner's personnel to changeover in security provisions.

Complete start-up testing of systems, and instructions of Owner's operating/maintenance personnel. Discontinue (or change over) and remove from project site temporary facilities and services, along with construction tools and facilities, mock-ups, and similar elements.

Complete final cleaning up requirements.

Touch-up and otherwise repair and restore marred exposed finishes.

Review Procedures: Upon receipt of Contractor's request, Engineer will either proceed with review or advise Contractor of prerequisites not fulfilled. Following initial review, Engineer will either prepare certificate of substantial completion, or advise Contractor of Work which must be performed prior to issuance of certificate; and repeat review when requested and assured that Work has been substantially completed. Results of completed review will form initial "punch-list" for final acceptance.

1.4 PREREQUISITES TO FINAL ACCEPTANCE:

General: Prior to requesting Engineer's final inspection for certification of final acceptance and final payment, as required by General Conditions, complete the following and list known exceptions (if any) in request:

Submit final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

Submit Contractor's affidavit of release of liens.

Submit updated final statement, accounting for additional (final) changes to the Contract Sum.

Submit certified copy of Engineer's final punch-list of itemized work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, endorsed and dated by Engineer.

Submit final meter readings for utilities, and similar data as of time of substantial completion or when Owner took possession of and responsibility for corresponding elements of the Work.

Submit record drawings, maintenance manuals, damage or settlement survey, and similar final record information.

Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications and similar documents.

Complete final cleaning up requirements, including touch-up of marred surfaces.

Submit consent of surety.

Revise and submit evidence of final (continuing) insurance coverage complying with insurance requirements.

Reinspection Procedure: Upon receipt of Contractor's notice that work has been completed, including punch-list items resulting from earlier reviews, and excepting incomplete items delayed because of acceptable circumstances, Engineer will re-review work. Upon completion of re-review, Engineer will either prepare certificate of final acceptance or advise Contractor of Work not completed or obligations not fulfilled as required for final acceptance. If necessary, procedure will be repeated.

1.5 RECORD DOCUMENT SUBMITTALS:

General: Specific requirements for record documents are indicated in individual sections of these specifications. Other requirements are indicated in General Conditions, with additional provisions indicated in 15000 and 16000 Series sections for mechanical and electrical work, respectively. General submittal requirements are indicated in the 01000 Series sections. Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for Engineer's reference during normal working hours.

Record Drawings: Maintain a white-print set (blue-line or black-line) of contract drawings and ship drawings in clean, undamaged conditions, with mark-up of actual installations which vary substantially from the Work as originally shown. Mark whichever drawing is most capable of showing "field" condition fully and accurately; however, where shop drawings are used for mark-up, record a cross-reference at corresponding location on Contract drawings. Mark with red erasable pencil and, where feasible, use other colors to distinguish between variations in separate categories of Work. Mark-up new information which is recognized to be of importance to Owner, but was for some reason not shown on either contract drawings or shop drawings. Give particular attention to concealed Work, which would be difficult to measure and record at a later date. Note related change order numbers where applicable. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on cover of each set.

Maintenance Manuals: Organize maintenance-and-operating manual information into suitable sets of manageable size, and bind into individual binders properly identified and indexed (thumb-tabbed). Include emergency instructions, spare parts listing, warranties, wiring diagrams, recommends "turn-around" cycles, inspection procedures, shop drawings, product data, and similar applicable information. Bind each manual of each set in a heavy-duty 2", 3-ring vinyl-covered binder, and include pocket folders for folded sheet information. Mark identification on both front and spine of each binder.

2.0 PRODUCTS (not applicable)

3.0 EXECUTION

3.1 CLOSEOUT PROCEDURES:

General Operating/Maintenance Instructions: Arrange for each installer of Work requiring continuing maintenance (by Owner) or operation, to meet with Owner's personnel, at project site, to provide basic instructions needed for proper operation and maintenance of entire Work. Include instructions by manufacturer's representatives where installers are not expert in the required procedures. Review maintenance manuals, record documentation, tools, spare parts and materials, lubricants, identification system, control sequences, hazards, cleaning and similar procedures and facilities. For operational equipment, demonstrate startup shutdown, emergency operations, noise and vibration adjustments, safety, economy/efficiency adjustments, and similar operations. Review maintenance and operations in relation with applicable warranties, agreements to maintain, bonds, and similar continuing commitments.

Listing of Instructions: Specifically, but not necessarily by way of limitations, provide instruction to Owner's personnel on the following categories of Work:

Refer to 15000 to 16000 Series sections for mechanical and electrical equipment instructions.

3.2 FINAL CLEANING:

Clean Project site (yard and grounds), including landscape, development areas, of litter and foreign substances.

Removal of Protection: Except as otherwise indicated or requested by Engineer, remove temporary protection devices and facilities which were installed during course of the Work to protect previously completed work during remainder of construction period.

Compliances: Comply with safety standards and governing regulations for leaning operations. Do not burn waste materials at site, or bury debris or excess materials on Owner's property, or discharge volatile or other harmful or dangerous materials into drainage systems; remove waste materials from site and dispose of in a lawful manner.

Where extra materials of value remaining after completion of associated work have become Owner's property, dispose of these to Owners' best advantage as directed.

3.3 CONTINUING INSPECTIONS:

General: Except as otherwise required by specific warranties, agreements to maintain, workmanship/maintenance bonds, and similar continuing commitments, comply with Owner's requests to participate in inspections at end of each time period of such continuing commitments. Participate in general inspection of the Work approximately one year beyond date(s) of substantial completion.

END OF SECTION 01700

SECTION 02100 - SITE CLEARING & GRUBBING

1.0 GENERAL

1.1 RELATED DOCUMENTS:

The general provisions of the Contract, including General Conditions and General Requirements (if any), apply to the work specified in this section.

1.2 DESCRIPTION OF WORK:

The extent of site clearing and grubbing is shown on the drawings.

Site clearing operations include, but are not limited to the following:

Demolition and removal of all existing structures.
Clear and grub road and pipe path.
Clear and grub area for landfill, spoil, leachate pond, ditches and erosion control ponds.
Protection of the buried TRANSCO Gas Co. pipe.
Protection of adjacent property owner.

Related Work Specified Elsewhere:

Excavation, Filling and Grading: Section 02200.

2.0 PRODUCTS - NOT APPLICABLE

3.0 EXECUTION OF CLEARING

3.1 SITE CLEARING, GENERAL:

Clear trees in spoil area. Remove existing structures and debris from the site. Clear trees that lie in the path of the erosion control ditches and sediment ponds. Install erosion control protection as detailed on drawings and as specified in Appendix B. Clear remaining trees on site. Clear trees that are located in the path of the access road.

3.2 SPECIFICATION FOR CLEARING:

Salable timber and pulpwood, if any, shall be cut and stockpiled as directed by the Engineer and will remain the property of the Owner. Any other trees or underbrush may be cleared by means of bulldozers or other equipment and any such materials shall be burned or piled as directed by the Engineer.

3.3 MEASUREMENT AND PAYMENT FOR ADDITIONAL CLEARING:

The quantity of clearing will be determined by measuring horizontally areas in which clearing is actually done.

Payment for clearing will be made at the unit contract price per acre for clearing. No payment will be made for clearing in areas other than those previously indicated. Any land cleared by the contractor not specifically designated on the contract drawings or by the Engineer shall receive the proper slope protection as specified in Appendix B within 30 days of clearing at the expense of the Contractor.

There will be no separate payment for clearing in areas where small scattered trees are to be removed. This exclusion will apply when trees 4" to 10" in diameter (5 ft. above ground) are 20 ft. or more apart and/or trees larger than 10" in diameter are 50 ft. or more apart. There will be no payment for removal of trees and brush less than 4" in diameter (5 ft. above ground) unless such trees and brush are removed from areas which otherwise qualify for clearing payment.

4.0 EXECUTION OF GRUBBING

4.1 SITE GRUBBING, GENERAL:

Grubbing shall be done as required in all areas cleared and any other area specified by the Engineer.

4.2 SPECIFICATION FOR CLEARING:

The Contractor shall remove all logs, stumps, roots, and similar materials, and all stones of more than 12" in maximum dimension and as directed by the Engineer.

All logs, stumps and other material shall be burned or piled as directed by Engineer. The Engineer will direct disposition of material that cannot be burned.

4.3 MEASUREMENT AND PAYMENT FOR ADDITIONAL GRUBBING:

The quantity of grubbing will be determined by measuring horizontally areas in which grubbing is actually done. Grubbing of areas cleared by the Contractor will be measured separately from grubbing of areas cleared by the Owner.

Payment for the two types of grubbing will be made at the contract price per acre for grubbing (clearing by Contractor) and grubbing (clearing by Owner) respectively.

END OF SECTION 02100

SECTION 02200 - EXCAVATING, FILLING AND GRADING & MATERIAL PLACEMENT

1.0 GENERAL

1.1 RELATED DOCUMENTS:

The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this section.

All referenced specifications and standards shall be the latest issue unless specified otherwise.

1.2 DESCRIPTION OF WORK:

The work shall include excavation, filling and grading required for the Landfill as indicated on the contract drawings and in these specifications.

Excavation, filling, and grading and material placement include, but are not limited to the following:

(1) Road grading.
(2) Leachate pond excavation, filling and grading.
(3) Landfill trench excavation, filling and grading.
(4) Erosion control ditch excavation.
(5) Erosion control sediment pond.
(6) Pipe trench and manhole excavation and backfilling.
(7) Placement of rip-rap, gravel, sand, operational soil.
(8) Disposal of unsuitable material.
(9) Installation of HDPE liner.
(10) Installation of filter fabric.

1.3 REFERENCES:

All standards and specification mentioned in this section shall be considered as part of the specification to the extent referenced.

1.4 JOB CONDITIONS:

Existing Utilities: Contractor is responsible for knowing where the TRANSCO gas pipes are located and for ensuring that all equipment cross the pipe corridor at the approved areas only. Location maps are available and can be requested through the Engineer.

Should uncharted or incorrectly charted piping or other utilities be encountered during construction, consult the Engineer immediately for directions as to procedure. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility Owner.

Do not interrupt existing utilities serving facilities occupied by the Owner or others, except when permitted in writing by the Engineer and then only after temporary utility services have been provided.

Use of Explosives: Do not bring explosives onto the site or use in work without prior written permission from the Engineer. Contractor is solely responsible for handling, storing, and using explosive materials when their use is permitted.

Protection of Persons and Property: Barricade open excavations and post with warning lights for safety of persons. Operate warning lights during hours from dusk to dawn each day.

Protect structures, utilities, sidewalks, pavements and other facilities immediately adjacent to excavations, from damage caused by settlement, lateral movement, undermining, washout or other hazards.

Take precautions and provide necessary bracing and shoring to guard against movement or settlement of existing improvements or new construction. The Contractor is entirely responsible for the strength and adequacy of bracing and shoring and for the safety and support of construction from damage or injury caused by the lack thereof or by movement or settlement.

2.0 PRODUCTS

2.1 SUBSTITUTION:

Materials and methods specified are for establishing the design, performance and quality required. Materials and methods that produce equal design, performance and quality will be considered provided the request for substitution is submitted in accordance with DIVISION 1 - GENERAL REQUIREMENTS.

2.2 EARTH:

Earth shall be defined as a combination of soil and rock.

2.3 SOIL:

Soil shall be defined as any material other than rock. In general, shall be free of debris, roots, wood, scrap material, vegetable matter, refuse, deleterious frozen soil and other objectionable matter.

2.4 ROCK:

Rock shall be defined as follows:

(A) GENERAL SITE EXCAVATION: This paragraph shall not be construed as a geological definition of any material or substance but as a definition of a material or substance for removal purposes. Rock is defined as sound soil masses, layers or ledges of hard material in EXCESS of 1 cubic yard in size which CANNOT be effectively loosened or broken down by ripping in a single pass with a late model tractor-mounted hydraulic ripper equipped with 1 digging point of standard manufacturer's design adequately sized for use which is propelled by a crawler-type tractor rated between 210 and 240 net flywheel horsepower, operating in low gear, EXCEPT AFTER FIRST being broken up by the use of hand tool wedging or rock drills. Should the material or substance be 1 cubic yard or less in size or should it be removable by the ripper as described above WITHOUT FIRST the use of hand tool wedging or rock drills, then for the removal purposes of this Project, this material or substance shall be defined as earth and not rock.

(B) TRENCH EXCAVATION: This paragraph shall not be construed as a geological definition of any material or substance but as a definition of a material or substance for removal purposes. Rock is defined as a material 1 cubic yard or larger in size which CANNOT be removed by a late model 1 cubic yard diesel hydraulic backhoe WITHOUT FIRST the use of hand tool wedging or rock drills. Should the material or substance be 1 cubic yard or less in size or should it be removable by the 1 cubic yard capacity backhoe as described above WITHOUT FIRST the use of hand tool wedging or rock drills, then for the removal purposes of this Project, this material or substance shall be defined as earth and not rock. For rock excavation, a trench shall be defined as linear excavation that is 5" or less in width and 2" or greater in depth. All other rock excavation shall be considered general site excavation.

2.5 FILL:

All of the fill material shall comply to the general requirement for soil above. On site there are two types of soil and are to be stored, piled in separate locations:

(1) Red brown micaceous fine sandy clayey silt.

(2) Yellowish brown to multicolored micaceous fine sandy silt.

The red-brown soil shall be stockpiled in the spoil area to be used later for construction of the clay berms shown on the drawing and to be used in the final cover after each cell is full. (Minimum 20,000 cubic yds).

The yellowish brown soil shall be used to build the backfilled slopes of the landfill. The remaining yellowish brown soil shall be stockpiled to be used later during the operation of the landfill (approx. 32,000 cubic yds).

The soils used to build the slopes of the landfill may be a combination of the two soils provided that the red-brown soil minimum of 20,000 cubic yds has been stockpiled.

2.6 BACKFILL:

All backfill shall comply to the general requirements for soil above.

2.7 RIP-RAP, CRUSHED STONE, AND SAND:

All rip rap, crushed stone, and sand designations, used are defined in the North Carolina Department of Transportation Standard Specifications for Roads and Structures.

Material Type	Location of Use	Size
Washed clean crushed stone	Erosion Control	#5 or #57
Rip Rap	Erosion Control	Class B
Washed clean sand	Drainage Blanket on Slope of Landfill	#2S
Washed clean crushed stone	Drainage Blanket on on bottom of Landfill	#67
Road gravel	Access Road	Type A Aggregate (Ref. 520-6)

2.8 GEOTEXTILE FABRIC:

Geotextile fabric shall be a continuous filament needle punched nonwoven fabric made from polypropylene. The required fabric properties and location of use are as follows:

Location	Grab Tensile (ASTM D4632)	Grab Elongation (ASTM D4632)	Puncture Resistance (ASTM D4833)	Trapezoidal Tear (ASTM D4533)	Mullen Burst (ASTM D3786)
Directly on Liner	320 lbs.	80%	140 lbs.	120 lbs.	450 psi
On top of #67 Stone & on Slope on top of Sand	170 lbs.	50%	85 lbs.	75 lbs.	260 psi

2.9 HDPE SYNTHETIC LINER:

The liner shall be manufactured in accordance with Section 2 of Appendix A. All references to the Gundle Lining Systems Inc. and Gundle Lining Construction Corp. shall be considered generic. (i.e., Any reference to Gundle Lining Systems Inc. shall be understood to be synonymous with the HDPE Liner Manufacturer and any reference to Gundle Lining Construction Corp. shall be understood to be synonymous with the HDPE Liner and geosynthetic Contractor.)

2.10 SEDIMENT FENCE AND POSTS:

The sediment fence shall be a filter fabric made of nylon, polyester, propylene or ethylene yarn with extra strength - 50 lb./linear inch (minimum) and with a flow rate of 0.3 gal/ft^2/min. Fabric should contain ultraviolet ray inhibitor and stabilizer.

Posts shall be 4" diameter pine with a minimum length of 4'.

2.11 STRAW WITH NET:

Straw with Net material chosen for use by the contractor shall be approved by the Engineer.

revised
submitted 4/11/91

TABLE 905-1
AGGREGATE GRADATION
COARSE AGGREGATE

STD. SIZE #	PERCENTAGE OF TOTAL BY WEIGHT PASSING																REMARKS
	2"	1½"	1"	¾"	½"	⅜"	#4	#8	#10	#16	#30	#40	#50	#80	#100	#200	
467	100	95-100		35-70		10-30	0-5									0-* 0.6	Bit. Conc. Base Course
5		100	90-100	20-55	0-10	0-5										0-* 0.6	BST Mat Coat
57		100	95-100		25-60		0-10	0-5								0-* 0.6	Str. Conc.
57M		100	95-100		25-45		0-10	0-5								0-* 0.6	P.C. Conc. Pavement
6			100	90-100	20-55	0-15	0-5									*	BST, Bit. Retreatment
67			100	90-100		20-55	0-10	0-5								0-* 0.6	Str. Conc., Bit. Plant Mix Pavement
78 M				100	95-100	75-100	20-45	0-15								0-* 0.6	Bit. Plant Mix Pvmt., BST, Weep Hole Drains
14						100	50-75	5-20		0-5						*	Bit. Retreatment
15				100	95-100		30-60		10-35							0-* 4	Bit. Plant Mix
16						100	88-98	35-50	25-35	15-25	0-10		0-5			0-* 2	Cold Mix Resurfacing
17	100	75-90	60-80		40-60		20-40		0-25							0-* 10	Maintenance Stabilization
SA	100	98-100	60-100		36-84		21-61		10-50			0-34				0-* 13	Stabilizer Aggregate
ABC		100	75-97		55-79		35-55		25-45			14-30				4-* 12 **	Aggregate Base Course, Bit. Plant Mix
ABC(M)		100	75-100		45-79		20-40		0-25							0-12	Maintenance Stabilization

* When these sizes of aggregate are used for portland cement concrete, bituminous surface treatment and retreatment, and bituminous plant mix, the requirements pertaining to material passing the No. 200 sieve shall be as follows:

A. FOR COARSE AGGREGATE USED IN PORTLAND CEMENT CONCRETE, AND BITUMINOUS SURFACE TREATMENT AND RETREATMENT:

1. When tested during production, the amount of material passing the No. 200 sieve shall be not greater than 0.6% by weight.
2. When tested at the job site prior to use, the amount of material passing the No. 200 sieve shall be not greater than 1.5% by weight and shall consist essentially of rock dust produced through normal handling of the aggregate.
3. For portland cement concrete only, if a stockpile at the job site is found to contain in excess of 1.5% passing the No. 200 sieve prior to use, the Engineer may approve its use provided the total percentage by weight passing the No. 200 sieve in the combined coarse and fine aggregate in the mix does not exceed 2.0%, and provided no increase in water-cement ratio is required by the use of this coarse aggregate.

B. FOR COARSE AGGREGATE USED IN BITUMINOUS PLANT MIX OTHER THAN SIZE ABC:

1. When tested during production, the amount of material passing the No. 200 sieve shall be not greater than 0.6% by weight.
2. When tested at the job site prior to use, the amount of material passing the No. 200 sieve shall be not greater than 2.0% by weight and shall consist essentially of rock dust produced through normal handling of the aggregate.
3. If a stockpile at the job site is found to contain in excess of 2.0% passing the No. 200 sieve prior to use, the Engineer may approve its use provided the total percentage by weight of minus 200 material in the plant mix being produced, as determined by the extraction test, can be maintained within the limits allowed by the job mix formula.

C. FOR SIZE ABC COARSE AGGREGATE USED IN BITUMINOUS PLANT MIX:

1. When tested during production or at the job site prior to use, the amount of material passing the No. 200 sieve shall be from 0.0% to 12.0% by weight. The gradation requirements for material passing the No. 10 sieve (soil mortar) which are shown in Section 910 for aggregate base course shall not apply.

** For ABC Coarse Aggregate:

A. The gradation requirements for material passing the No. 10 sieve (soil mortar) are 40-84% passing the No. 40 sieve and 11-35% passing the No. 200 sieve.

B. In addition to the gradation requirements the material passing the No. 40 sieve shall not have a liquid limit in excess of 30 nor a plasticity index in excess of 6.

All standard sizes of fine aggregate shall meet the gradation and any other requirements of Table 905-2. Standard sizes of fine aggregate are identified by number followed by the suffix "S" or "MS".

905-4 TESTING.

(A) General:

Aggregates shall be tested in accordance with the requirements of this article except where other test procedures are required by other articles covering a particular aggregate or its use for a particular application.

(B) Gradation:

Aggregates will be tested for gradation in accordance with AASHTO T27, except that aggregate to be used in a base course or as a stabilizer aggregate will be tested for gradation in accordance with AASHTO T88 as modified by the Department. Copies of the modified test procedures are available upon request from the Materials and Tests Unit.

(C) Liquid Limit:

Aggregates will be tested for liquid limit in accordance with AASHTO T89 as modified by the Department. Copies of the modified test procedures are available upon request from the Materials and Tests Unit.

(D) Plasticity Index:

Aggregates will be tested for plasticity index in accordance with AASHTO T90.

(E) Resistance to Abrasion (Percentage of Wear):

Aggregates will be tested for percentage of wear in accordance with AASHTO T96.

(F) Soundness:

Aggregates will be tested for soundness in accordance with AASHTO T104 using sodium sulfate.

TABLE 905-2
AGGREGATE GRADATION
FINE AGGREGATE

STD.	PERCENTAGE OF TOTAL BY WEIGHT PASSING												REMARKS
SIZE #	½"	⅜"	#4	#8	#10	#16	#30	#40	#50	#80	#100	#200	
1S		100	90-100			40-85			0-20			0-3	Blotting Sand., Bit. Retreatment
2S		100	95-100	80-100		45-95	25-75		8-30		0.5-10	0-3	Concrete, Subsurface Drainage
2MS		100	95-100	84-100		45-95	25-75		8-35		0.5-20	0-* 8	Concrete
4S			100	95-100					15-45		0-10	0-5	Mortar

*** FOR MANUFACTURED FINE AGGREGATE USED IN PORTLAND CEMENT CONCRETE:**

When tested during production the amount of material passing the No. 200 sieve shall not be greater than 8%. When tested at the job site prior to use, the amount of material passing the No. 200 sieve shall not be greater than 10%, shall consist of the dust of fracture, and shall be essentially free from clay or shale.

3.0 EXECUTION:

3.1 LAYOUT AND SITING OF WORK:

The work shall be located as shown on the Site Plan.

3.2 SUBSURFACE INVESTIGATION:

A copy of the soil boring test records is included in this Appendix D. These records on indicated subsurface conditions are not intended as representations or warranties of the continuity of such conditions. It is expressly understood that the Owner will not be responsible for interpretations or conclusions drawn therefrom by the Contractor.

The Contractor may make an additional investigation at his expense.

3.3 CLASSIFICATION OF EXCAVATION:

Earth excavation consists of removal of materials of any classification indicated in data on subsurface conditions, and other materials encountered that are not classified as rock excavation or unauthorized excavation. Site investigation indicates no rock present in the anticipated areas of excavation. Should rock be encountered and after the actual quantity of rock removed is determined, the Contract will be adjusted up, by Change Order using the unit prices shown on the Bid Form. Rock and method of measurement shall be as herein defined. An accurate log shall be kept for all rock removed indicating the method of removal. Before rock is removed, the Contractor shall notify the Engineer for his review of the excavation. Rock removal shall not begin until the Contractor has been notified by the Engineer. When the final rock is removed, the Contractor shall again notify the Engineer for his review.

3.4 UTILIZATION OF EXCAVATED MATERIALS:

All unsatisfactory material removed from excavations shall be disposed of as directed by the Engineer. Satisfactory material removed from excavations shall be reused, insofar as practical, in the construction of fills, subgrades, backfill and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Satisfactory material authorized to be wasted shall be disposed of in designated areas or as herein specified. The removal and disposed costs of all excavated materials shall be included in the base bid and in the corresponding unit prices. All soil shall be spoiled in the area shown on contract drawings. No excavated material shall be disposed on the Project site in such a manner as to obstruct the flow of any stream, endanger a partly finished structure, or be detrimental to the completed work in any way.

3.5 UNAUTHORIZED EXCAVATION:

Unauthorized excavation consists of removal of material beyond indicated subgrade elevations or dimensions without specific direction from the Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be at the Contractor's expense.

Fill unauthorized excavations as specified for authorized excavations of the same classification, unless otherwise directed by the Engineer.

3.6 EXCAVATION IN ROCK:

Any rock excavation that is required inside the landfill and in the pipe trenches shall be excavated to a minimum overdepth of 6" below the indicated depth on the drawings. Backfill of overdepth in rock excavation in the landfill shall be with the yellowish brown to multicolored micaceous fine sandy silt thoroughly tamped. Backfill of overdepth in the rock excavation in the pipe trench shall be with sand.

3.7 BASIS OF PAYMENT FOR ROCK EXCAVATION:

The quantity of rock excavation will be the volume between a) the surface determined by surveys made prior to commencing rock excavation and b) the surface determined by the liner and grade shown on the drawing. Adequate surveys will be made by the Owner to determine that a sufficient volume was excavated. No payment will be made for additional earth excavation required as a result of overbreak.

Payment will be made at the contract price per cubic yard for rock excavation listed on the bid form. The price will cover the excavation, removal, haulage and the ultimate disposal of the rock in the spoil area designated by the Engineer.

3.8 BLASTING:

Blasting shall not be permitted without written authorization of the Engineer. Blasting shall be accomplished only by persons skilled in this work and who are licensed by governing authorization to perform such work. Handle and store explosives and blasting agents in accordance with NFPA No. 495 and Section 9 Explosives of the Manual of Accident Prevention in Construction by the Associated General Constructors of America, Inc. Take precaution to insure safety of persons and property. Avoid shattering or removing rock beyond authorized grades and lines. If blasting is necessary, adjacent property owners are to be notified prior to the time of blasting.

3.9 DRAINAGE/DEWATERING:

Drainage in the excavated areas shall be provided by the Contractor as directed by the Engineer. The Contractor shall install, operate, and maintain pumping facilities of adequate size to remove water from the excavations. If it becomes necessary, and as directed by the Engineer, the Contractor shall furnish, operate and maintain wellpoint systems of adequate capacity. After these systems have completed their work, so far as the Contractor's excavation is concerned, the Contractor shall continue to operate and maintain all or part of the pumping, drainage, and wellpoint system until Owner's work is complete, or as directed by the Engineer. The Owner will assume the operating and wellpoint rental costs during this period, but the Contractor shall remove the systems after their usefulness to the Owner is finished. The cost of temporary drainage and pumping during excavation shall be included in the bid unit price for earth excavation and no extra payment shall be made for those items. If a wellpoint system is required, the Contractor shall be prepared to negotiate basis for payment with the Engineer.

Stormwater runoff shall be diverted away from the area of excavation toward the erosion control ditches.

3.10 PIPE TRENCH EXCAVATION AND BACKFILL:

DISPOSITION OF UTILITIES: Execute all work under this heading in conformity with the rules and regulations governing the utility involved. Protect all encountered active utilities not indicated in accordance with written instructions. Contract Sum will be adjusted for any additional work not called for in the Contract Documents.

TRENCH EXCAVATION: No more trench shall be opened in advance of the pipe laying than is necessary to expedite the work. Ground conditions and/or location requirements shall govern the amount of trench open at any one time.

TRENCH WIDTH: Trench shall be equal to the outside diameter of the pipe plus 18". Trench width shall be measured between faces of cut at an elevation 12" above the top of pipe. If the Contractor varies from this requirement without prior approval of the Engineer, he shall, at his own expense, provide additional deeper bedding and compacted granular backfill.

TRENCH DEPTH: The Trench Excavation depth shall be 6" below the outside diameter of the utility, to elevations, grades and lines indicated.

BRACING AND SHORING:

All excavations shall be properly protected by the necessary bracing and timber to prevent any cave-ins or injury to adjacent improvements. The sides of the trenches shall be securely held by bracing or sheathing. This bracing or sheathing shall not be removed until the level of the backfill has reached the point where such removal can be safely carried out. The thickness of the sheathing and the dimensions of the cross-braces, shoes, etc., to be used by the Contractor shall be satisfactory to properly protect the sides of the trench, and to prevent injurious cave-ins or erosions.

Should latent earth conditions necessitate special supports for piping and appurtenances, including the removing of unsuitable material and refilling with gravel or other material, such work shall be performed and the Contract Sum will be adjusted by Change Order.

When underground lines cross, the trench of the lower pipe shall be backfilled with sharp sand, well tamped to provide a bed for higher pipe. Lines which run parallel and at different levels shall be adequately separated to furnish a firm bedding for the lines.

Under no circumstances lay pipe or install appurtenances in water. Keep trenches free from water until pipe joint material has hardened. The presence of groundwater in the earth or the necessity of sheathing or bracing trenches shall not constitute a condition for which any increase may be made in the Contract Sum.

PIPE BEDDING: Utilities shall be bedded in sand to a depth of one-half the pipe height.

TRENCH BACKFILL:

(A) Trenches and all excavations shall not be backfilled until all required piping pressure tests have been performed and until all the piping conforms to the location requirements specified or indicated.

(B) The excavation shall be backfilled as rapidly as possible upon completion of the test and acceptance. Where damage may result from withdrawing sheathing, the sheathing shall be left in. The backfilling shall be made in 6" layers rammed and air tamped. Only specified materials shall be used for backfill. All backfill shall be tamped to degree of compaction specified under COMPACTION. In case of settlement, Contractor shall provide additional fill to cover depression within guarantee period. Where excavation occurs under buildings, footings, etc., Contractor shall provide backfill so as not to endanger structure. All backfill shall be subject to FIELD TESTING AND VERIFICATION.

3.11 BASIS OF PAYMENT FOR ADDITIONAL PIPE TRENCH EXCAVATION AND BACKFILL:

Additional excavation of earth shall be measured by measurement of the volume between (a) the original ground surface as determined by surveys made before any excavation and (b) the final excavated surface to either rock or grade as determined by surveys made after completion of earth excavation.

Payment will be made in accordance with the unit cost listed on the bid form. The unit price shall cover the excavation, removal and disposal or placement of specified materials, whether to spoilage, stockpile or compacted fill.

3.12 LANDFILL EXCAVATION:

The landfill excavation shall conform to the elevations shown on the drawings within $\pm$ 0.1 feet. Any overexcavation must be backfilled in accordance with the authorized requirements for fill material specified in Section 3.14 and 3.16.

The surface area of the excavation shall be smooth and free of all rocks, stones, sticks, roots, sharp objects, or debris of any kind.

3.13 BASIS OF PAYMENT FOR ADDITIONAL EARTH EXCAVATION:

Additional excavation of earth shall be measured by measurement of the volume between (a) the original ground surface as determined by surveys made before any excavation and (b) the final excavated surface to either rock or grade as determined by surveys made after completion of earth excavation.

Payment will be made in accordance with the unit cost listed on bid form. The unit price shall cover the excavation, removal and disposal or placement of specified materials, whether to spoilage, stockpiles or compacted fill.

3.14 FILLING AND BACKFILLING:

Backfill consists of placing acceptable soil material in layers in excavations to required subgrade elevation.

Fill consists of placement of acceptable soil materials, in layers, over ground surface to required elevation.

Backfill and Fill Materials: Provide acceptable soil materials for backfill and fill, free from clay, rock or gravel larger than 2" in any dimension, debris, waste, frozen materials, vegetable matter, and other deleterious matter. No stones permitted within 12" of finished grade.

In excavations, use excavated or borrow material that has been tested and approved.

Preparation of Ground Surface to Receive Fill: Remove vegetation, debris, unsatisfactory soil materials, obstructions and deleterious materials from ground surface prior to placement to fill. Plow, strip or breakup sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

Placement and Compaction: Place backfill and fill material in maximum 8 inch loose lifts (6" when using hand compaction equipment). Before compaction, moisten or aerate each layer, as necessary, to provide the optimum moisture content. Compact each layer to the required percentage of maximum density. Do not place backfill or fill material on surfaces that are muddy, frozen or contain frost or ice.

3.15 BASIS FOR PAYMENT FOR ADDITIONAL FILLING OR BACKFILLING:

Same as in Section 3.13.

3.16 COMPACTION REQUIREMENTS:

Compaction, when tested in accordance with Standard Proctor Density Test ASTM D698 shall be as follows:

(1) Fill of landfill embankments and undisturbed interior landfill subgrade, 90%

(2) Backfill for underground pipe, 95%

(3) Fill of leachate pond embankment, 95%

(4) Fill for divider berms within landfill, 95%

(5) Operational cover on slopes, 95%

All fill shall be compacted at $\pm 2\%$ of the optimum moisture content.

When completed areas are disturbed by subsequent construction operations or adverse weather, the surface shall be scarified and recompacted to the required density prior to further construction.

revised
submitted 4/11/91

Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.

Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

3.17 FINISH OPERATIONS:

FINAL GRADING: Upon completion of excavating, trenching, filling, backfilling, and all other work, the site shall be fine graded to the elevations indicated.. All final grades shall be within 0.2" of that indicated.

Finish grades not otherwise indicated shall be uniform levels or slopes between points where levels are given or between such points and existing finish grades. Abrupt changes in slopes shall be rounded. Should figures for finish elevations conflict with finish contours shown, the figures shall govern. No ruts, depressions, and low spots shall be permitted in any final graded areas.

3.18 FIELD TESTING AND VERIFICATION:

All testing and observations under this Section, except as noted otherwise, shall be by an independent soil consultant as specified in this Section. The independent soil consultant shall be employed and paid directly by the Contractor.

The Contractor shall notify and schedule the soil inspector for the times and dates the soil inspector will be required under this Section.

UNSUITABLE MATERIAL: Shall be as herein specified and determined by the inspector.

ENGINEERED CONTROLLED FILL: No fill shall be placed until the earth has been tested by the soil inspector and reviewed by the Engineer. All fill shall be formed of suitable material tested and approved by the soil inspector. The soil inspector shall perform one field density test for each 2 feet of accumulated fill for each 2500 square feet of fill for the landfill interior and exterior slopes.

3.19 TESTING BY SOIL INSPECTOR:

The Contractor's inspector will monitor the quality of work performed with a program of inspection, sampling and testing which shall consist of but not be limited to the following:

(A) Soil Classification (Site and Borrow)

(B) Determination of Suitability of Soil Materials (Site and Borrow)

(C) Compaction Tests (Moisture-Density Curves)

(D) In-Place Field Density Tests

3.20 ROAD GRADING AND GRAVEL PLACEMENT:

Grading and gravel placement for the road shall be done in accordance with the contract drawings. Before placing gravel, remove existing vegetation. Clearing and grubbing shall be done in accordance with Section 02100, Subsection 3.0 and 4.0.

3.21 BASIS OF PAYMENT FOR ADDITIONAL GRADING AND ROAD GRAVEL:

The quantity of additional road grading shall be measured in linear feet and the gravel shall be measured by weight (tons). Payment will be at the contract unit price for Additional Grading and Road Gravel.

The unit price for the Road Gravel shall be considered full compensation for the furnishing and installing of the Road Gravel.

3.22 LANDFILL DRAINAGE BLANKET:

Install sand and gravel on the interior of the landfill as shown on the contract drawings. Equipment used to place the sand and gravel shall comply with Section 3.7 of Appendix A.

3.23 BASIS OF PAYMENT FOR ADDITIONAL PLACEMENT OF SAND OR GRAVEL:

The quantity of the additional sand or gravel used for the drainage blanket shall be measured by weight (tons). Payment will be at the Contract unit price for Additional Placement of Drainage Blanket Sand and Gravel.

The unit price shall be considered full compensation for the furnishing and installing of the sand and gravel.

3.24 PERMANENT SEEDING:

Seeding shall be done in accordance with the requirements in Appendix B.

3.25 BASIS OF PAYMENT FOR ADDITIONAL SEEDING:

Additional permanent seeding shall be measured along the surface of the ground. Payment for additional seeding will be paid for at the Contract unit price per acre for "Permanent Seeding".

Seeded areas which have failed to establish a satisfactory stand of grass or legume, or areas which have failed due to carelessness or neglect on the part of the Contractor shall be repaired at no cost to the Owner.

Where earthwork and permanent seeding has been adequately constructed, completely drained and properly maintained, and damage occurs due to natural causes, the Contractor will be paid at the Contract unit price for the excavated material required for repairs to the damaged earthwork as provided for in Section 02200, Subsection 3.13 and at the Contract unit price for "Additional Permanent Seeding" for correcting the damaged seeded area.

3.26 EROSION CONTROL, RIP RAP AND STONE:

Erosion control, rip rap and stone shall be done in accordance with the contract drawings and with the requirements detailed in Appendix B.

3.27 BASIS OF PAYMENT FOR ADDITIONAL EROSION CONTROL, RIP RAP AND STONE:

The quantity of the additional rip rap and stone shall be measured by weight (tons). Payment will be at the Contract unit price for Erosion Control, Rip Rap and Stone.

The unit price shall be considered full compensation for the furnishing and installing of the rip rap and stone.

3.28 HDPE LINER AND GEOTEXTILE FABRIC:

The HDPE liner and geotextile fabric shall be installed in accordance with the contract drawings and with the requirements detailed in Appendix A.

3.29 BASIS OF PAYMENT FOR ADDITIONAL HDPE LINER AND GEOTEXTILE FABRIC:

The quantity of additional HDPE liner and geotextile fabric to be paid for shall be measured by square feet. Payment for additional seeding will be paid at the Contract unit price for Additional HDPE Liner and the Geotextile Fabrics.

The unit price shall be considered full compensation for the furnishing and installing of the HDPE Liner and the Geotextile Fabric.

3.30 SEDIMENT FENCE:

The sediment fence shall be installed in accordance with the contract drawings and with the requirements detailed in Appendix B.

3.31 BASIS OF PAYMENT FOR ADDITIONAL SEDIMENT FENCE:

The quantity of additional silt fence to be paid for will be the number of linear feet measured at the bottom of the installed fence. Payment will be at the Contract unit price for Additional Silt Fence.

3.32 STRAW WITH NET:

Straw with net shall be installed in accordance with manufacturer's recommendations.

3.33 BASIS OF PAYMENT FOR ADDITIONAL STRAW WITH NET:

The quantity of additional straw with net shall be measured in square feet. Payment will be at the Contract unit price for Additional Straw with Net.

The unit price for the Straw with Net shall be considered full compensation for the furnishing and installing of the Straw with Net.

END OF SECTION 02200

SECTION 02300 - MONITORING WELL INSTALLATION

1.0 GENERAL

1.1 RELATED DOCUMENTS:

The general provisions of the Contract, including General Conditions and General Requirements (if any), apply to the work specified in this section.

1.2 DESCRIPTION OF WORK:

Install the ground water monitoring wells in the locations shown on the drawing.

Related Work Specified Elsewhere:

Dedicated Ground Water Monitoring System (Bladder Pumps):

Section 10050

2.0 PRODUCTS - NOT APPLICABLE

3.0 EXECUTION

3.1 MONITORING WELL INSTALLATION, GENERAL:

Monitoring wells shall not be installed until all clearing and earthwork is complete.

3.2 SPECIFICATION FOR MONITORING WELL INSTALLATION:

See Appendix C p. 2 for Monitoring Well Installation.

3.3 BASIS OF PAYMENT:

The monitoring well installation shall be payed in accordance with the contract unit price.

END OF SECTION 02300

SECTION 02850 - STEEL FENCE AND GATES

1.0 GENERAL

1.1 RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK:

The extent of steel fencing and gates is shown on the drawings. The types of steel fences and gates include the following:

Galvanized steel systems.

Swing gates.

1.3 QUALITY ASSURANCE:

Standards of Manufacture: Comply with the standards of the Chain Link Fence Manufacturer's Institute for "Galvanized Steel Chain Link Fence Fabric" and as herein specified.

Provide each type of steel fence and gates as a complete unit provided by a single manufacturer, including necessary erection accessories, fittings, and fastening.

1.4 SUBMITTALS:

For information only, submit 2 copies of manufacturer's technical data and installation instructions for steel fence and gates. Transmit a copy of each instruction to the Installer.

Submit shop drawings for steel fences and gates including plan layout and details illustrating fence height, location and sizes of posts, rails, braces, gates and footings, hardware list and erection procedures.

2.0 PRODUCTS

2.1 GENERAL:

Pipe sizes indicated are commercial pipe sizes. Roll-formed section sizes are the nominal outside dimensions. Tube sizes indicated are nominal outside dimensions.

Finish for Framework and Appurtenances: Furnish the following finishes for steel framework and appurtenances.

Galvanized finish with not less than minimum weight of zinc per sq. ft., complying with the following:

Pipe: ASTM A120 (1.8 oz. zinc PSF)

Square Tubing: ASTM A123 (2.0 oz. zinc PSF)

H-Sections: ASTM A123 (2.0 oz. zinc PSF)

Hardware and Accessories: ASTM A153 (zinc weight per Table I).

2.2 FABRIC:

Furnish chain link fabric as follows:

One-piece fabric width, No. 9 gauge wires with a 2 inch mesh. Top and bottom selvages to be twisted and barbed.

Galvanized finish with not less than 1.2 oz. zinc per sq. ft., complying with ASTM Z392, Class I.

2.3 POSTS, RAILS AND BRACES:

End, Corner and Pull Posts: Furnish end, corner and pull posts of the minimum sizes and weights as follows:

2.875 inch OD pipe weighting 5.79 lbs. per lin. ft.

2.50 inch square tubing weighting 5.79 lbs. per lin. ft.

3-1/2 inch x 3-1/2 inch roll-formed section weighing 5.14 lbs. per lin. ft.

Line Posts: Furnish line posts of the minimum sizes and weights as follows: Space posts 10 ft. o.c. maximum.

2.375 inch OD pipe weighing 3.65 lbs. per lin. ft.

2.25 inch x 1.70 inch roll-formed section weighing 4.10 lbs. per lin. ft.

Gate Posts: Furnish gate posts for supporting single gate leaf, or one leaf of a double gate installation for nominal gate widths as follows:

Up to 6 ft. wide:

2.875 inch OD weighing 5.79 lbs. per lin. ft.

2-1/2 inch square tubing weighing 5.70 lbs. per lin. ft.

3-1/2 inch x 3-1/2 inch roll formed section weighing 5.14 lbs. per lin. ft.

Over 6 ft. 50 13 ft. wide:

4 inch OD weighing 9.10 lbs. per lin. ft.

3 inch square tubing weighing 9.10 lbs. per lin. ft.

Over 13 ft. to 18 ft. wide:

6.625 inch OD pipe weighing 18.97 lbs. per lin. ft.

Over 18 ft. wide:

8.625 inch OD pipe weighing 24.70 lbs. per lin. ft.

Top Rail: Furnish top rails, unless otherwise indicated, of the following:

1.660 inch OD pipe weighing 1.80 lbs. per lin. ft.

1.625 inch x 1.25 inch roll-formed sections weighing 1.35 lbs. per lin. ft.

Furnish in manufacturer's longest lengths (18 ft. minimum), with expansion type couplings, approximately 6 inches long, for each joint. Provide means for attaching the top rail securely to each gate, corner, pull and end post.

Post Brace Assembly: Furnish bracing assemblies at end and gate posts and at both sides of corner and pull posts, with the horizontal brace located at mid-height of the fabric.

Use 1.660 inch OD pipe weighing 1.80 lbs. per lin. ft. for horizontal brace and 3/8 inch diameter rod with turnbuckle for diagonal truss.

Tension Wire: Furnish tension wire consisting of galvanized 7 gauge coiled spring wire. Zinc coating shall be a minimum coating of .80 oz. per sq. ft. of surface area.

Locate at bottom of fabric only.

Barbed Wire Supporting Arms: Furnish pressed steel, wrought iron, or malleable iron barbed wire supporting arms, complete with provision for anchorage to posts and attaching 3 rows of barbed wire to each arm. Supporting arms may be either attached to posts or integral with post top weather cap. Provide the following type:

Single 45 degree arm, one for each post.

Barbed Wire: 2 strand, 12-1/2 gauge wire with 14 gauge, 4-point barbs spaced 5 inches O.C. All wire shall be zinc coated with a minimum coating of .80 oz. per sq. ft. of surface area.

Post Tops: Pressed steel, wrought iron, or malleable iron, designed as a weathertight closure cap. Furnish one cap for each post unless equal protection is afforded by combination post top cap and barbed wire supporting arm. Furnish caps with openings to permit through passage of the top rail.

Stretcher Bars: One piece lengths equal to full height of fabric, with a minimum cross section of 3/16 inch x 3/4 inch. Provide one stretcher bar for each gate and end post, and 2 for each corner and pull post.

Stretcher Bar Bands: Steel, wrought iron or malleable iron, spaced not over 15 inches O.C. to secure stretcher bars to end, corner, pull and gate posts.

2.4 GATES:

Fabricate gate perimeter frames of tubular members. Provide additional horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware and accessories. Space so that frame members are not more than 8 feet apart. Fabricate as follows:

Up to 6 feet high, or leaf width 8 feet or less:

1.660 inch OD pipe weighing 1.80 lbs. per lin. ft.

1-1/2 inch square tubing weighing 1.90 lbs. per lin. ft.

Over 6 feet high, or leaf width exceeding 8 feet

1.90 OD pipe weighing 2.72 lbs. per lin. ft.

2 inch square tubing weighing 2.60 lbs. per lin. ft.

Assemble gate frames by welding or with special malleable or pressed steel fittings and rivets for rigid connections. Use same fabric as for fence. Install fabric with stretcher bars at vertical edges. Bars may also be used at top and bottom edges. Attach stretchers to gate frame at nor more than 15 inches O.C. Attach hardware with rivets or by other means which will provide security against removal or breakage.

Install diagonal cross-bracing consisting of 3/8 inch diameter adjustable length truss rods on gates where necessary to ensure frame rigidity without sag or twist.

Extend the end members of gate frames 1'-0" above the top member and prepare to receive 3 strands of barbed wire. Provide necessary clips for securing wire to extensions.

Gate Hardware: Furnish the following hardware and accessories for each gate.

Hinges: Pressed or forged steel or malleable iron to suite gate size, non-lift-off type, offset to permit 180 degrees gate opening. Provide 1-1/2 pair of hinges for each leaf over 6 feet nominal height.

Latch: Forced type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.

Keeper: Provide keeper for all vehicle gates, which automatically engages the date leaf and holds it in the open position until manually released.

2.5 MISCELLANEOUS MATERIALS AND ACCESSORIES:

Wire Ties: For tying fabric to line posts, use 9 gauge wire ties spaced 12 inches O.C. For tying fabric to rails and braces, use 9 gauge wire ties spaced 24 inches O.C. For tying fabric to tension wire, use 11 gauge hog rings spaced 24 inches O.C. Finish of ties to match fabric finish.

Concrete: Provide concrete consisting of portland cement complying with ASTM C150, aggregates complying with ASTM C33, and clean water. Mix materials to obtain concrete with a minimum 28-day compressive strength of 2500 PSI.

3.0 EXECUTION

3.1 INSPECTION:

Installer must examine the conditions under which the fence and gates are to be installed and notify the Contractor in writing on conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.2 INSTALLATION:

Excavation: Drill holes of diameters and spacings shown on the shop drawings for post footings.

If not shown on the shop drawings, excavate hole depths approximately 3 inches lower than the post bottom, with bottom of posts set not less than 35 inches below grade.

Spread soil from excavations uniformly adjacent to the fence line, or on adjacent areas of the site, as directed.

When solid rock is encountered near the surface, drill into rock at least 12 inches for line posts and at least 18 inches for end, pull, corner and gate posts. Drill hole at least 1 inch greater diameter than the diameter of the post being placed.

Setting Posts: Remove loose and foreign materials from sides and bottoms of holes and moisten soil prior to placing concrete.

Center and align posts in holes 3 inches above bottom of excavation.

Place concrete around posts in a continuous pour, vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.

Trowel finish tops of footings and slope or dome to direct water away from posts. Extend footings for gate posts to the underside of bottom hinge. Set keeps, stops, sleeves and other accessories into concrete as required.

Keep exposed concrete surfaces moist for at least 7 days after placement, or cure with membrane curing materials.

Grout in posts set in rock excavations with nonshrink portland cement grout or other acceptable grouting materials.

Concrete Strength: Allow concrete to attain at least 75% of its minimum 28-day compressive strength, but in no case sooner than 7 days after placement, before rails, tension wires, barbed wire, or fabric is installed. Do not stretch and tension fabric and wires, and do not hang gates until the concrete has attained its full design strength.

Top Rails: Run rails continuously through post caps or extension arms, bending to radius for curved runs. Provide expansion couplings as recommended by fencing manufacturer.

Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.

Tension Wire: Install tension wires by weaving through the fabric and tying to each post with not less than 6 gauge galvanized wire, or by securing the wire to the fabric.

Fabric: Leave approximately 2 inches between finish grade and bottom selvage. Pull fabric taut and tie to posts, rails and tension wires. Install fabric on security side of fence and anchor to framework so that fabric remains in tension after pulling force is released.

Repair damaged conditions in the shop or during field erection by recoating with manufacturer's recommended repair compound, applied per manufacturer's directions.

Stretcher Bars: Thread through or clamp to fabric 4 inches O.C. and secure to posts with metal bands spaced 15 inches O.C.

Barbed Wire: Install 3 parallel wires on each extension arm on security side of fence. Pull wire taut and fasten securely to each extension arm.

Gates: Install gates plumb, level and secure for full opening without interference. Install ground-set items in concrete for anchorage, as recommended by the fence manufacturer. Adjust hardware for smooth operation and lubricate where necessary.

Tire Wires: Use U-shaped wire conforming to diameter of pipe, clasping the fabric firmly to the pipe with ends twisted at least two full turns. Bend ends of wire to minimize hazard to persons or clothing.

Fasteners: Install nuts for tension band and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.3 BASIS OF PAYMENT FOR ADDITIONAL 6' STEEL FENCE:

The quantity of the additional Steel Fence shall be measured in liner feet. Payment will be made at the Contract unit price for Additional 6' Steel Fence.

The unit price shall be considered full compensation for the furnishing and installing of the fence.

END OF SECTION 02850

SECTION 03100 - CONCRETE FORMWORK

1.0 GENERAL

1.1 RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any), apply to the work specified in this section.

1.2 DESCRIPTION OF WORK:

The extent of formwork is indicated by the concrete structures shown on the drawings.

The work includes providing formwork and shoring for cast-in-place concrete, and installation into formwork of items furnished by others, such as anchor bolts, setting plates, bearing plates, anchorages, inserts, frames, nosings and other items to be embedded in concrete.

1.3 QUALITY ASSURANCE:

Codes and Standards: Design, construct, erect, maintain and remove forms for cast-in-place concrete work in compliance with Chapter 4 of ACI 301-84 "Specifications for Structural Concrete for Buildings" and as specified herein.

2.0 PRODUCTS

2.1 FORM MATERIALS:

Forms for Exposed Finish Concrete: Unless otherwise shown or specified, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood-faced or other panel type materials acceptable to Engineer, to provide continuous, straight, smooth exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

Use plywood complying with American Plywood Association B-B Plyform, Class I.

Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in the finished structure with plywood, metal or other acceptable material.

2.2 FORM TIES:

Spreaders or wire ties shall not be used. Snap ties will be permitted except on exposed exterior surfaces where pull ties shall be used. Where snap ties are permitted they shall be of such type as to leave no metal closer than 1-1/2" to the surface. They shall not be fitted with lugs, cones, washers or other devices to act as a spreader within the forms or for any other purpose which will leave a hole or depression larger than 7/8" in diameter or a depression in excess of 1/8" back of the exposed surface.

2.3 FORM COATINGS:

Provide commercial formulation form coating compounds that will not bond with, stain, nor adversely affect concrete surfaces and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting surfaces to be cured with water or curing compounds.

3.0 EXECUTION

3.1 INSPECTION:

The Installer must examine the substrate and the conditions under which concrete formwork is to be performed, and notify the Contractor in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.2 FORM CONSTRUCTION:

Construct forms to shapes, lines and dimensions shown; to maintain plumb, straight and sufficiently tight to prevent leakage; to securely brace, shore and safely support construction loads; and to prevent displacement.

Provide access openings for cleaning and inspecting wall forms and reinforcing prior to depositing concrete. Suitable openings shall be provided in wall forms for pouring so as to deposit concrete as nearly as practical to its final position to avoid segregation. Where soil conditions will permit excavation to accurate sizes without bracing or shoring, side forms for footings may be omitted.

Snap ties shall be removed immediately after the forms are stripped and have their holes or depressions filled with non-shrink grout.

3.3 COATING OF FORMS:

All forms for concrete shall be coated with a chemical form release agent. Prior to each pour and before placing reinforcing steel, all forms shall be thoroughly cleaned and then coated with the release agent in accordance with the manufacturer's instructions. In no case shall the reinforcing steel and inserts be coated with this product.

3.4 INSTALLATION:

Provide openings in concrete formwork to accommodate work of other trades. Size and location of openings, recesses and chases are the responsibility of the trade requiring such items. Accurately place and securely support items to be built into forms and protect until the concrete pouring is completed.

Structural Formwork Tolerances: Unless designated otherwise, formwork shall be constructed so that the concrete surfaces will conform to the tolerance limits listed in Table 4.3.1 of ACI 301.

3.5 REMOVAL OF FORMS:

Forms shall be removed without damage to concrete and in a manner to insure complete safety to the structure. Leave shoring in place until concrete members will safely support its own weight plus any live load that may be placed upon it or until the concrete has obtained at least 75 percent of design strength. Should the forms for walls and other formed members be removed sooner than seven (7) days after pouring, the resulting exposed surfaces shall be sprayed with the curing compound specified in Section 03300.

3.6 FINISHES:

All permanent exposed-to-view surfaces shall receive a rubbed form finish per Section 10.3.1 of ACI 301.

Surfaces not permanently exposed to view shall receive a rough form finish per Section 10.2.1 of ACI 301.

END OF SECTION 03100

SECTION 03200 - CONCRETE REINFORCEMENT

1.0 GENERAL

1.1 RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any), apply to the work specified in this Section.

All referenced specifications and standards shall be the latest issue unless specified otherwise.

1.2 DESCRIPTION OF WORK:

The extent of concrete reinforcement is shown on the drawings.

The work includes fabrication and placement of reinforcement for cast-in-place concrete, including bars, welded wire fabric, ties and supports.

1.3 QUALITY ASSURANCE:

Codes and Standards: Comply with requirements of the following codes and standards, except as herein modified:

Concrete Reinforcing Steel Institute, "Placing Reinforcing Bars." Concrete Reinforcing Steel Institute, "Manual of Standard Practice."
American Concrete Institute, ACI 301-84 "Specifications for Structural Concrete for Buildings," including the 1985 revisions.

1.5 DELIVERY, HANDLING AND STORAGE:

Deliver reinforcement to the project site bundled, tagged and marked. Use tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.

Store reinforcement materials at the site to prevent damage and accumulation of dirt or excessive rust.

2.0 PRODUCTS

2.1 MATERIALS:

Welded Wire Fabric: ASTM A185, smooth wire fabric.

Reinforcing Bars: ASTM A615, Grade 60, Deformed bars.

3.0 EXECUTION

3.1 INSTALLATION:

The Installer must examine the substrate and the conditions under which concrete reinforcement is to be installed, and notify the Contractor in writing of unsatisfactory conditions. Do not proceed with the work until satisfactory conditions have been corrected in a manner acceptable to the Installer.

Clean reinforcement to remove rust and mill scale, earth, ice and other materials which reduce or destroy bond with concrete.

Accurately place reinforcement in accordance with the placement drawings and adequately secure in position with metal chairs, spacers, ties, and other devices for proper support and fastening, in accordance with the CRSI "Placing Reinforcing Bars," before placing concrete. Placement tolerances within formed structural members shall be in accordance with ACI 301.

Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one pitch plus 2 inches and tie with 16 gauge wire. Offset end laps in adjacent widths to prevent continuous laps.

END OF SECTION 03200

SECTION 03300 - CAST-IN-PLACE CONCRETE

1.0 GENERAL

1.1 RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any), apply to the work of this Section.

All referenced specifications and standards shall be the latest issue unless specified otherwise.

The requirements of Section 03310 "Concrete, General" apply to the work of this Section.

Related Work Specified Elsewhere:

Concrete Reinforcement: Section 03200
Concrete Formwork: Section 03100
Concrete, General: Section 03310

1.2 DESCRIPTION OF WORK:

The extent of cast-in-place concrete work is shown on the drawings.

The work includes providing cast-in-place concrete consisting of Portland cement, fine and coarse aggregate, water, and selected admixtures; combined, mixed, transported, placed, finished and cured as herein specified.

1.3 SUBMITTALS:

Coordinate the work of this section with requirements for submittals specified in Section 03310.

Delivery Tickets: Furnish copies of delivery tickets for each load of concrete delivered to the site. Provide items of information as specified in Section 03310.

1.4 QUALITY ASSURANCE:

All cast-in-place concrete work shall be performed in accordance with ACI 301-89 "Specifications for Structural Concrete for Buildings" and as specified herein. A copy of ACI Field Reference Manual SP-15 (88) shall be kept at the jobsite at all times.

2.0 PRODUCTS

2.1 CONCRETE:

For concrete materials, see Section 03310.

3.0 EXECUTION

3.1 CONCRETE PLACEMENT:

General: Concrete placement shall comply with Chapter 8 of ACI 301 "Specifications for Structural Concrete for Buildings" and as herein specified.

Do not use concrete which becomes non-plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials. Do not use retempered concrete. Remove rejected concrete from the project site and dispose of in an acceptable location.

Pre-Placement Inspection: Before placing concrete, complete and inspect the formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts involved in ample time to permit the installation of their work; cooperate with other trades in setting such work, as required.

Soil at bottom of foundation systems are subject to testing for soil bearing value by the testing laboratory, as directed by the Engineer. Place concrete immediately after approval of foundation excavations.

Placing Concrete into Forms: Remove temporary spreaders in forms when concrete placing has reached an elevation rendering their service unnecessary.

Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Vibration of forms and reinforcing will not be permitted.

Cold Weather Placing: Do not place concrete on frozen subgrade or on subgrade containing frozen material. Forms, reinforcing steel and adjacent concrete surfaces must be completely free of frost, snow and ice before placing concrete.

Do not use calcium chloride, salt, and other material containing anti-freeze agents or chemical accelerators, without written approval from the Architect.

3.2 JOINTS:

Contraction Joints: Contraction joints in slabs-on grade shall be located and detailed as indicated on the drawings.

Isolation Joints: Isolation joints shall be located and detailed as indicated on the drawings.

3.3 CONCRETE FINISHES:

Formed Surface Finishes: Formed surfaces shall be finished as specified in Section 03100 of these Specifications.

See Section 02560 "Portland Cement Concrete Paving" for finishing exterior paving.

3.4 CONCRETE CURING AND PROTECTION:

Concrete curing and protection shall be in accordance with Chapter 12 of ACI 301-84 and as specified herein.

3.5 REPAIR OF SURFACE DEFECTS:

Unless otherwise instructed by the Engineer, all surface defects shall be repaired in accordance with Section 9.2 of ACI 301-84.

END OF SECTION 03300

SECTION 03310 - CONCRETE, GENERAL

1.0 GENERAL:

1.1 RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any), apply to the work specified in this section.

All referenced specifications and standards shall be the latest issue unless specified otherwise.

The requirements of this section apply to the work specified in the following Section:

03300 Cast-In-Place Concrete

1.2 DESCRIPTION OF WORK:

This section establishes general criteria for materials, mixes and evaluations of concrete as required for other related sections of these specifications.

1.3 QUALITY ASSURANCE:

Codes and Standards: Comply with the provision of the following codes, specifications and standards, except as otherwise shown or specified:

ACI 301-89 "Specifications for Structural Concrete for Buildings."

Where provisions of the above codes and standards are in conflict with the building code in force for this project, the building code shall govern.

Concrete Testing Service: The Contractor shall employ at his own expense a testing laboratory acceptable to the Engineer and experienced in design and testing of concrete materials and mixes to perform material evaluation tests and proportion concrete mixes. Testing agency shall meet the requirements of ASTM C1077.

Selection of a testing laboratory is subject to the Engineer's acceptance. Submit a written description of the proposed concrete testing laboratory giving qualifications of personnel, laboratory facilities and equipment, and other information as may be requested by the Engineer.

Quality Control Testing During Construction: The Contractor shall provide at his own expense a testing laboratory acceptable to the Engineer to perform quality control testing during construction and to submit test reports to the Engineer and the Contractor. The testing laboratory shall be responsible for conducting and interpreting the tests, and shall state in each report whether or not the test specimens comply with the specified requirements, and shall indicate any deviations therefrom. The Contractor must supply any of the concrete ingredients to the testing laboratory at the request of the Engineer.

The testing laboratory shall meet the requirements of ASTM C1077.

Materials and installed work may require testing and retesting, as directed by the Engineer, at anytime during the progress of the work. Allow free access to material stockpiles and facilities at all times. Retesting of rejected materials and installed work shall be done at the Contractor's expense.

The testing laboratory shall sample and test for quality control during the placement of concrete, as follows:

Sampling Fresh Concrete: ASTM C172.

Slump: ASTM C143; one test for each set of compressive strength test specimens, or when the consistency of concrete appears to vary. Sampling shall be at the point of placement.

Air Content: ASTM C231, pressure method; one for every set of compressive strength test specimens, sampling shall be at the point of placement.

Compression Test Specimens: ASTM C31; one set of 6 standard cylinders for each compressive strength test. Mold and store cylinders for laboratory cured test specimens and field cured test specimens as specified in ASTM C31.

Concrete Temperature: ASTM C1064; test hourly when air temperature is 40°F and below, and 80°F and above; and each time a set of compression test specimens are made.

Compressive Strength Tests: ASTM C39; one set for each 100 cu. yds. or fraction thereof, of each mix design placed in any one day or for each 5,000 sq. ft., of surface areas placed; 2 specimen tested at 7 days, 2 specimens tested at 28 days, and two specimens retained in reserve for later testing if required.

Test results shall be reported in writing to the Engineer and the Contractor on the same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of contractor, name of concrete supplier and truck number, name of concrete testing service, concrete type and class, location of concrete batch in the structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.

1.4 SUBMITTALS:

The following documentation shall be submitted to the Engineer for review and approval prior to use of concrete: Do not begin concrete production until mixes have been reviewed and approved by the Engineer.

Certified Mill Test Reports from the cement supplier documenting that the cement used in the project conforms with this specification.

Certification based on the most recent test documentation that the aggregates used meet the applicable specification.

Certification based on test reports from the manufacturer that the admixtures used meet the applicable specification.

Mix proportions for each proposed mix design including compressive strength tests at 7 and 28 days from not less than 3 test cylinders for each age. Cylinders shall be molded in accordance with ASTM C31 and tested in accordance with ASTM C192.

If field experience method is used to determine mix proportions, submit sufficient documentation to show that the proposed mix design meets the strength requirements of this specification.

If the trial mixture method is used to determine mix proportions, submit for each proposed mix design a curve showing the relationship between compressive strength and water-cement ratio.

2.0 PRODUCTS

2.1 CONCRETE MATERIALS:

Portland Cement: Comply with ASTM C150, Type 1 or Type II.

Aggregates, Normal Weight Concrete: Comply with ASTM C33.

Water: Clean, fresh, drinkable.

Concrete Admixtures: Provide admixtures produced by acceptable manufacturers and use in compliance with the manufacturer's printed directions. Do not use admixtures which have not been incorporated and tested in the accepted mixes, unless otherwise authorized in writing by the Engineer.

Use Air-Entraining Admixtures complying with ASTM C260.

Use Water-Reducing Admixtures complying with ASTM C494, Type A, free of set accelerating or set-retarding compounds, chlorides, fluorides, or nitrates.

Fly Ash: Comply with ASTM C618, Class F, expect the maximum value of loss on ignition is to be 6%.

Calcium Chloride: Do not use calcium chloride in concrete, unless otherwise authorized in writing by the Engineer. Do not use admixtures containing calcium chloride where concrete is placed against galvanized steel.

2.2 MIX PROPORTIONS:

Concrete mixes shall be proportioned to meet the quality level required by this specification and shall possess the necessary workability to enable placement without excessive segregation. Mix proportions shall be developed by either trail mixture or field experience methods in accordance with Section 3.9 of ACI 301. Materials used in determining proportions shall be the same as those proposed for use in the work.

2.3 CONCRETE STRENGTHS:

Design mixes to provide normal weight concrete with the following properties and as indicated on drawings and schedules:

2.4 SLUMP LIMITS:

Mixes shall be proportioned to result in concrete at the point of placement having a maximum slump of 4 inches.

2.5 AIR ENTRAINING ADMIXTURES:

Use Air-Entraining admixture in all concrete, unless otherwise indicated. Add air-entraining admixture to result in concrete at the point of placement having air content as follows:

Nom. Max. Size Coarse Agg. (in)	Total Air Content Percent
3/8	8
3/4	6
1	5
1 1/2	4.5

The total air content at the point of placement for the building slab-on-grade shall not exceed 3 percent.

3.0 EXECUTION

3.1 PRODUCTION AND DELIVERY OF CONCRETE:

The production and delivery of concrete, including the measuring of materials, the batching, mixing and transporting of concrete and the batch ticket information shall conform to ASTM C94-84, unless otherwise required by this specification or modified herein.

The temperature of plastic concrete, as placed, shall not exceed 90°F. During cold weather the temperature of the plastic concrete, as placed, shall not be less than 50°F.

Delivery tickets with each batch shall comply with Section 16 of ASTM C94 including the additional information listed in Section 16.2.

Water may be added at the point of placement in accordance with Section 11.7 of ASTM C94 when approved by the Architect but in no case shall the total amount of water added at the jobsite and batch plant exceed the quantity specified by the mix design.

3.2 CONCRETE ACCEPTANCE OR REJECTION:

Acceptance of concrete will be based upon results of test for slump, air content, temperature and strength taken at the site. Tests for acceptance or rejection of concrete will be performed on samples taken no later than 30 minutes after the concrete arrives at the site in accordance with the requirements of "Method of Sampling Fresh Concrete," ASTM C172.

The strength level of the concrete will be considered satisfactory so long as the average of all sets of three consecutive strength test results equal or exceed the specified compressive strength and no individual strength test result falls below the specified compressive strength by more than 500 psi.

The maximum specified slump applies at the sampling point. Unless otherwise allowed by the Engineer, the sampling point shall be at the truck mixer/agitator discharge if the last piece of conveying equipment is a chute, bucket, conveyor or similar equipment and at the pump line discharge if the concrete is pumped. A tolerance of up to 1 inch above the maximum slump will be allowed for one in five consecutive batches tested.

The specified air content applies at the sampling point. Concrete will be acceptable as long as the air content is within +2% to -4% of the total air content given in Section 2.5.

3.3 ACCEPTANCE OF STRUCTURE:

Acceptance of structure shall be in accordance with Chapter 18 of ACI 301. If core testing is required, it shall be performed in accordance with Section 17.3.2 of ACI 301 except the minimum core size shall be in accordance with ASTM C42-84a "Obtaining and Testing Drilled Cores and Sawed Beams of Concrete."

Results of core testing shall be submitted to the Engineer in writing on the same day the tests are made. Report shall be in accordance with Section 6.8 of ASTM C42-84a.

END OF SECTION 03310

SECTION 10050 - DEDICATED GROUND WATER MONITORING SYSTEM

1.0 GENERAL

1.1 DESCRIPTION:

Furnish a complete dedicated groundwater monitoring system for the collection of samples from the eight groundwater monitoring wells.

1.2 SYSTEM DESCRIPTION:

The system shall include:

1. A dedicated positive gas-displacement bladder pump (one per well) constructed of 316 Stainless Steel and Teflon body and fittings/Teflon bladder equipped with 316 Stainless Steel screen, with the following physical characteristics and operating features:

   a. Pump fills from bottom inlet, with water entering interior of bladder, and drive air on outside of bladder.

   b. Does not allow drive air to contact water sample.

   c. Constructed only of virgin grade materials.

   d. Will withstand 125 psi continuous operating pressure with no modifications.

   e. Will pump from 300 ft. with no modifications; up to 1000 ft. maximum.

   f. Will fit into well casings of 1.90 inches (inside diameter) and larger.

   g. Will pump continuously at 50 gpm from 100 ft. depth (3.0 SCFM drive air at 100 psi at sea level, with 25 ft. submergence).

   h. Will pump dry without damage.

   i. Teflon bladder warranted for one (1) year against failure due to cracking or splitting.

   j. All Stainless Steel will be electro-polished type 316.

   k. Incorporates the use of a pump inlet screen, having a screen opening size not to exceed 0.012 inches.

   l. Self cleaning ball checks to be provided with hard seats, no elastromeric compound in seat of ball check.

   The pump(s) shall be washed in a laboratory-grade detergent solution, rinsed in a high quality lab-grade water, and sealed in clean polyethylene packaging prior to shipment. The effectiveness of the cleaning shall be verified by soaking the pumps in lab-grade water for a minimum of 18 hours and analyzing the soak water for the absence of EPA 601, 02, acid extractable, and base neutral parameters. The analysis shall be performed by an independent laboratory, and copies of the analytical results must be provided upon request. Certification that this procedure has been performed shall be provided in writing with each pump, and shall be coded to the individual production serial numbers imprinted on each pump and test batch numbers.

2. (Lockable protected) well caps with quick-connect fitting for pump air supply and suitable fittings and adapters for attachment to the down well pumping device. Caps must have provision for dedicated pneumatic static (standing) water level. Teflon elbow provided on each well cap.

3. The system shall be available with tubing cut to exact length (to nearest foot) as specified by customer, preassembled to pump and well cap and factory tested for leakage. The tubing shall be virgin grade Teflon for sample discharge and air supply.

   The sample discharge tube shall provide a separate sample flow path without exposure to pump drive air or purge water, and be fully and continuously visible and accessible for inspection, replacement or coupling with standard compression fittings. The air supply tube and sample delivery tube shall be continuously bonded to each other (no adhesives or mechanical fasteners) for ease of handling, yet be manually separable and sealable via standard compression fittings.

4. All wells to be adaptable to existing controller and existing water level indicator.

   a. Operates the pumping device automatically.

   b. Is mounted in a fully-enclosed high impact resistant case, with all connecting fittings inside case.

   c. Does not contact the sample in any way.

   d. Can withstand 125 psi continuous operating pressure, and has a pressure indication gauge.

   e. Uses an all-pneumatic design which requires no batteries or electronics to operate.

   f. Allows optimization of pumping rate at any depth.

   g. Allows adjustments of discharge velocity and pressure at any depth to achieve 100 ml./min. maximum sample flow rate.

   h. Can be fully wetted without damage.

   i. Can be operated from any compressed air source.

   j. Uses quick-connect fittings at all air connections.

k. Includes all necessary air hoses of industrial-grade rubber with quick-connect fittings.

5. All wells to be adaptable to existing controller (Well Wizard Model #3013) and existing water level controller (Well Wizard Model #6111). All components to be supplied by one vendor and all parts to be interchangeable with same parts in existing dedicated bladder pump system that is currently installed at the McGuire Landfill.

1.3 QUALITY ASSURANCE:

(A) The supplying manufacturer shall have a minimum of five (5) years experience producing and servicing dedicated positive displacement-type bladder pump systems.

(B) The manufacturer shall provide a list of at least 5 customer references.

(C) The installation contractor shall be approved by the manufacturer, use manufacturer approved service personnel, and have a history of 5 years of experience.

1.4 SUBMITTALS:

(A) Submit manufacturer literature in accordance with Section 01300.

(B) Submit supplying manufacturer experience record.

(C) Submit a manufacturer reference list with a minimum of 20 customer references.

1.5 DELIVERY:

Materials shall be delivered in original, unopened packages, clearly labeled with the manufacturer's name and item description.

1.6 PROJECT CONDITIONS:

The General Contractor shall be responsible for ensuring/providing compatibility between bladder pumps and well enclosures.

1.7 INSPECTION:

The Engineer shall verify the acceptability of the installed product.

END OF SECTION 10050

DUKE POWER COMPANY
MCGUIRE NUCLEAR STATION
SOLID WASTE LANDFILL
LEACHATE SYSTEM

SECTION 15400

Prepared By: R L Smith Date: 8-29-90

Check By: Valerie Underwood Date: 8.30.90

Approved By: [signature] Date: 8/30/90

REVISION LOG

1. ________

2. ________

3. ________

4. ________

5. ________

6. ________

7. ________

8. ________

9. ________

10. ________

NORTH CAROLINA
PROFESSIONAL
SEAL
10166
ENGINEER
LINUS G. GOODMAN, III

8/30/90

EMCE41

TABLE OF CONTENTS

		Page No.
PART 1 - GENERAL		
1.01	Definitions	15400-1
1.02	Qualification	1
1.03	Bid Proposal Instructions	1
1.04	Related Documents	1
1.05	Discrepancies and Interpretations	2
1.06	Scope	2
1.07	System Descriptions	2
1.08	Codes and Standards	3
1.09	Submittals	3
1.10	Storage and Protection	4
1.11	Warranty	4
1.12	Calculations	4
PART 2 - PRODUCTS		
2.01	Contractor Furnished Items	15400-8
2.02	General	8
2.03	Piping Systems Material	9
2.04	Manholes	11
2.05	Pump Station	11
2.06	Controls	12
2.07	Valves	13
2.08	Insulations	13
2.09	Hangers	14
PART 3 - EXECUTION		
3.01	Piping Drawings	15400-15
3.02	Clearing of Site	15
3.03	Excavation	15
3.04	Underground Pipe	16
3.05	Grading	16
3.06	Concealing	16
3.07	Hangers	16
3.08	Valves	16
3.09	Insulation	16
3.10	Painting and Tagging	17
3.11	Piping Systems	17
3.12	Flushing, Cleaning, Testing and Disinfecting	17
3.13	Permits and Inspections, Laws and Ordinances	18
3.14	Cooperation	18
3.15	Alternates/Alternatives/Substitutions	19

SECTION 15400 - MCGUIRE LANDFILL LEACHATE SYSTEM

PART 1 GENERAL

1.01 DEFINITIONS:

A. Owner

Duke Power Company
P.O. Box 33189
Charlotte, NC 28242

B. Engineer

Mr. L.G. Goodman, III
Duke Power Company
P.O. Box 33189
Charlotte, NC 28242
(704) 373-8098

For Questions, Contact

Mr. R. L. Smith
Duke Power Company
P. O. Box 33189
Charlotte, NC 28242
(704) 373-4516

C. Bidder

A company or firm qualified to become the Contractor for the Work described herein.

D. Contractor

The licensed utility company or firm awarded the order to supply, construct, start-up, and test the piping systems described herein.

1.02 QUALIFICATION:

A licensed Utility Piping Contractor shall perform all work specified in this Section and shown on the reference drawings. The Contractor shall be experienced in the installation of polyethylene, stainless steel, and polyvinylchloride pipe and shall employ experienced craftspersons and mechanics to perform high quality work as specified herein.

1.03 BID PROPOSAL INSTRUCTIONS:

See Section 01300 and Instructions to Bidders IB-1 Thru 4.

Bidders shall visit the installation site and acquaint themselves with conditions which affect the work specified herein prior to submitting proposals.

1.04 RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

In addition, the following drawings shall be a part of these specifications:

DRAWING NUMBER	TITLE
CFD-MG-6433C-C-0010	Landfill Access Road Layout
CFD-MG-6433C-C-0020	Landfill Earthwork Excavation Plan
CFD-MG-6433C-C-0030	Landfill Sections and Details
CFD-MG-6433C-C-0040	Landfill Sections and Details
CFD-MG-6433C-C-0050	Landfill Fabrication Details
CFD-MG-6433C-C-0060	Landfill Operations
CFD-MG-6433C-C-0070	Landfill Erosion Control Plan
CFD-MG-6433C-P-0010	Landfill Leachate System Piping/Site Plan
CFD-MG-6433C-P-0020	Landfill Leachate System Piping/Site Plan/Details
CFD-MG-6433C-P-0030	Landfill Leachate System Piping/Site Plan
CFD-MG-6433C-P-0040	Landfill Leachate System Hydraulic Gradient/Details
CFD-MG-6433C-E-0010	Landfill Electrical Site Plan
CFD-MG-6433C-E-0020	Landfill Electrical Site Plan

1.05 DISCREPANCIES AND INTERPRETATIONS:

Should a Bidder or Contractor find discrepancies in, or omissions from the drawings or specifications, or be in doubt as to their meaning, notification shall be made to the Engineer, who will issue an interpretation.

1.06 SCOPE:

This Division covers the furnishing and installation of the complete landfill leachate collection and wastewater effluent system for the McGuire Nuclear Station.

The systems shall be as specified herein and as shown on the reference drawings. All equipment, materials and services required for a complete, satisfactory, finished, operable system in the judgment of the Engineer shall be provided by the Contractor.

The work involves the installation, inspection and testing of the following major components:

A. The landfill leachate collection system.

B. The wastewater effluent system.

C. The stormwater system.

D. The pump seal water system.

1.07 SYSTEM DESCRIPTIONS:

A. Leachate Collection System: This system shall consist of all piping and equipment to convey subsurface rainwater absorbed in the landfill to the wastewater effluent system.

B. Wastewater Effluent System: This system receives wastewater from the leachate collection system and conveys the effluent through a forced main to the McGuire Nuclear Station's Conventional Wastewater Treatment System Initial Holdup Pond where it is subsequently treated prior to discharging into the Catawba River.

C. Storm Water System: This system receives clean storm water run off and conveys the storm water to an erosion control sediment basin.

D. Pump Seal Water System: This system receives clean water from the McGuire Nuclear Station Transformer Switchyard Drinking Water System and provides seal water to Pumps A & B. A backflow preventor shall be installed at the connection to the drinking water system and a hose hydrant shall be supplied for washdown and maintenance at the pump station.

Note: Reference Civil and Mechanical drawings for clarification of piping systems. Leachate piping will vary depending on development stage of landfill.

1.08 CODES AND STANDARDS:

The following codes and standards of the latest issue and all addenda thereto in effect at the date of invitation for bids shall form a part of this specification the same as if bound herein:

Ten States Standard, "Recommended Standard for Sewage Works," 1987

North Carolina Plumbing Code, 1980, Rev. 4

Any other authorities having jurisdiction.

1.09 SUBMITTALS:

A. Shop Drawings:

1. See Section 01300.

2. The Contractor shall submit, in addition to requirements given in other sections, as a minimum, the following drawings and information to the Engineer for approval:

   - Catalog cuts on all valves and gasket packs.
   - Catalog cuts, dimensional drawings showing connections, pump curves and wiring diagrams on pump station and controls.
   - Catalog cuts on all plumbing fixtures, manholes, equipment, etc.
   - Piping material Certificate of Compliance.
   - Hydrotest Certificate of Compliance.
   - Disinfection Certificate of Compliance.

B. As-Built Drawings:

The Contractor, upon completion of this installation, shall submit to the Engineer marked-up prints indicating any changes necessitating revision to the drawings in order to make a complete record of the final installation for the Owner's use in maintenance work, etc. Final payment will not be issued until drawings have been received by the Engineer.

1.10 STORAGE AND PROTECTION:

Storage: The Contractor shall provide its own storage space for materials and equipment.

Protection from injury: All pipe, valves, pumps, and equipment of the leachate system and associated piping systems shall be protected against damage by weather, abuse, etc. during receiving, storage, and construction.

1.11 WARRANTY:

A. The Contractor shall guarantee all materials, equipment and workmanship, against any defects of any description for a period of twelve (12) months from the date of final completion and acceptance of the work, except as noted in the General Conditions.

B. All piping and equipment furnished and installed by the Contractor shall operate without objectionable noise or vibration, as determined by the Engineer and the Owner.

1.12 CALCULATIONS:

The following calculations are for the McGuire Nuclear Station Solid Waste Landfill Leachate Wastewater Effluent System using the "Recommended Standards for Sewage Works," 1987 Edition.

A. Equations.

1. Manning Formula: $d = (2.16\ Qn \div \sqrt{s})^{3/8}$

   d = minimum diameter of circular sewer, in feet
   Q = peak capacity for sewer in cubic feet per second, flowing full
   n = coefficient of roughness for PE = 0.009
   s = slope of sewer ¼" per foot = 0.0208

2. Williams and Hazen Formula: $f = 0.2083\ (100Q/c)^{1.85} \times 1/d^{4.8655}$

   f = friction head, feet of liquid/100 feet of pipe
   d = inside diameter of pipe
   c = constant roughness of pipe = 130
   Q = flow in gallons per minute = 300 gpm

3. Total Friction Head: $f_t = fLs + 15\%$ safety factor

   f_t = total friction head loss, feet
   L = length of pipe + 15% for fittings in feet
   s = specific gravity = 1

4. Volume of pumped liquid per cycle: $V = Qt$

   V = volume of pumped liquid per cycle in gallons
   Q = flow in gallons per minute = 300 gpm
   t = run time of pump per cycle = 3 minutes

5. Flow Velocity: $V = Q/A$

   V = flow velocity of liquid in 6" pipe in feet per second, fps
   Q = flow in gallon per minute = 300 gpm
   A = area of pipe in square feet = 0.16 ft^2

B. Determine the size and capacity of the gravity wastewater effluent system.

1. The gravity wastewater effluent will convey the leachate wastewater from the holdup pond to the pump station.

2. Maximum design flow will be based upon <u>300 gallons per minute</u>.

3. From Eq. 1.12.A.1,

   $d = (2.16\ Qn \div \sqrt{s})^{3/8}$

   where:

   Q = 0.67 cubic feet per second
   n = 0.009
   s = 0.0208
   $d = (2.16 \times 0.67\ ft^3/sec \times 0.009 \div \sqrt{0.0208})^{3/8}$
   d = 0.405 ft. or 6" (To meet ½ flow conditions, pipe shall be 8")

C. Determine the pump capacity in gallons per minute (gpm) and size of the force main.

1. From 1.12.B.2, it was determined that the peak flow to the pump station is 300 gpm. The minimum pump capacity should be capable of handling greater than or equal to 300 gpm.

   To maintain a minimum flow velocity ≥ 3.5 fps, the minimum flow rate must be <u>300 gpm</u>. The minimum pipe size is 6".

2. Determine the total dynamic head (TDH).

   a. Calculate Static Head.

      The maximum vertical distance for the minimum water level in the proposed pump station basin (pump stop Elevation 706'+0") to the highest point in the discharge piping (Elevation 756'+0") is 50 feet.

   b. Calculate Friction Head.

      From Eq. 1.12.A.2,

$f = 0.0283\ (100\ Q/C)^{1.85} \times 1/d^{4.8655}$
$\quad = 0.0283\ (100 \times 300\ \text{gpm}/130)^{1.85} \times 1/5.421^{4.8655}$
$f = 1.32\ \text{ft}/100\ \text{ft}$

c. Calculate Total Friction Head.

From Eq. 1.12.A.3,

$f_t = fLs$
$\quad = 1.32\ \text{ft}/100\ \text{ft} \times 9.924\ \text{ft} \times 1.15 \times 1$
$f_t = 150.65$ ft. Say 151 ft.

d. The Total Dynamic Head is the total of the static head and total friction head, (50 + 151) = 201 feet + 10% safety factor = 221.1 feet. Say 222 feet.

e. Calculate Flow Velocity.

From Eq. 1.12.A.5,

$V = Q/A$
$\quad = 300\ \text{gpm}/0.16\ \text{ft}^2$
$V = 4.2$ fps

D. Determine the pump station basin size.

1. The pump station shall be constructed of polyethylene and concrete, 4 feet minimum diameter. See reference drawings.

2. The depth of the pump station shall be determined by the pump operating characteristics and the distance between the grade elevation and the invert elevation of the gravity influent pipe. Based upon the selection of 300 gpm pump at 222 TDH, with an operating differential between low level and high level of 5'-0", the bottom of the basin shall be 9" below the invert elevation of the gravity influent pipe. The bottom elevation is 14'-4" below the top of the basin of 718'+0". See reference drawings.

3. Determine minimum volume of stored liquid to be pumped.

From Eq. 1.12.A.4,

$V = Qt$
$\quad = 300\ \text{gpm} \times 3\ \text{min}$
$V = 900$ gallons

4. Determine stored capacity of pump basin between pump start and pump stop.

Diameter = 4'-0"
High = 5'-0"
Volume = 467.9 gal x 2 pump basins = 935.7 gal.

E. Determine storage of liquid due to power loss.

The pump stations are supplied with two (2) separate electrical circuits. If one power source is disrupted, the second electrical power source automatically supplies power to the pumps. If both power supplies are disrupted, the high level alarm will alert personnel at the McGuire Nuclear Station that a problem exists. There is adequate volume in the holdup pond to store an additional rate of rainfall (assuming maximum rainfall) of approximately 1½ hours. This time will allow personnel to investigate the problem. If the pumps cannot be started, the isolation valve between the landfill and the holdup pond will be closed and the landfill will be used to hold the rainfall until repairs can be made.

END OF PART 1

PART 2 PRODUCTS

2.01 CONTRACTOR FURNISHED ITEMS:

Contractor shall furnish all equipment, fixtures, piping, valves, hangers, fittings, and incidentals necessary for the complete installation of the McGuire Landfill Leachate Collection System.

2.02 GENERAL:

All materials, fixtures, piping, valves, pump station and equipment shall be provided from manufacturers as listed on the drawings/specifications. Equipment and materials are specified by a manufacturer's name and catalog, model or type number and/or by description which shall fix a standard of quality, material, finish, design, performance, configuration, etc. The phrase "as approved" shall be construed to mean that equal substitute material may be used only **if properly submitted and approved only by the Engineer, in writing at least ten (10) days prior to awarding a contract**.

Any substitute materials, installed, that **have not been approved** by the Engineer in writing, will be done at the Contractor's own risk and will be subject to removal from the system at any stage of construction and shall be replaced with that specified, and any damage done to other trades shall be made good to the satisfaction of the Engineer.

Unless otherwise specified, all materials and equipment specified in this section shall be new, of high quality and as listed in printed catalogs of the manufacturer. Each article of its kind shall be the standard product of a single manufacturer.

Whenever the words "or equal," "equivalent equipment," "acceptable," or other words of similar intent or meanings are used, implying that judgment is to be exercised, it is understood that it is referring to the judgment of the Engineer **only**.

All manufactured materials shall be delivered and stored in their original containers.

References to standards are intended to be the latest revision of the standard specified.

Manufacturer's Recommendations. Equipment installed under this section shall be installed according to manufacturer's recommendations, unless otherwise shown on the drawings or herein specified.

Equipment and materials shall be protected against damage during construction, and shall be thoroughly cleaned and any necessary adjustments shall be made before the final inspection.

2.03 PIPING SYSTEMS MATERIAL:

Piping materials are denoted on the drawings and specified below.

A. Generic Material: Stainless Steel - SS

Pipe - Seamless or EFW, ANSI B36.10, ASTM A-312, Gr TP 304

Fittings - ≤ 2" Socket Weld, Forged, ANSI B16.11, ASTM A-182, Gr F 304, 3,000 lbs.
> 2" Butt Weld, Seamless or EFW, ANSI B16.9, ASTM A-403, Gr WP 304

Flanges - ≤ 2" Socket Weld, ANSI B16.5, ASTM A-182, Gr F 304, Cl 150 Flat Face
> 2" Weld Neck, ANSI B16.5, ASTM A-182, Gr F 304, Cl 150 Flat Face

B. Generic Material: Polyethylene - PE

Maximum Design Conditions:

	SDR 17	SDR 11
Temperature (°F)	75	75
Pressure (Psig)	65	160

Material:

Pipe and fittings shall be made of Hostalen GM 5010T2 polyethylene pipe raw material pipe compound that meets the requirements for Type III, Grade P34, Category 5, Class C, polyethylene material as defined in ASTM D-1248 and ASTM F-714, NSF Approved, and shall be 100% virgin material (no regrind) with the following minimum physical properties:

Physical Property	Minimum Value	ASTM Std.
Density, g/cm³	0.955 g/cm³	D-1505
Melt Index - E	0.14 grams/10 min.	D-1238
Elongation	800% (2 in. min.)	D-638
Tensile Strength, Yield	3500 PSI (2 in. min.)	D-638
Tensile Strength, Ultimate	5000 PSI (2 in. min.)	D-638
Environmental Stress Crack Resistance (ESCR) - Condition C	5000 PSI, F_{20} > 3500 hrs.	D-1693

Pipe:

Pipe shall conform to ASTM F-714, NSF Approved, with a rating of PE 3408 as described under material and shall have a SDR of 17 for gravity piping and SDR of 11 for pressure piping.

Perforated leachate piping shall be supplied with three (3) - 3/4" diameter holes drilled at 0°, 15° and 345° and shall be spaced 5" on centers. The perforations shall begin and stop approximately 5" from the ends and shall be supplied in 60 foot lengths. Non-perforated pipe shall be supplied in 60 foot lengths except the Service Water Pipe shall be supplied in 250 feet to 1000 feet rolls. Length of rolls shall be determined by the Contractor.

The three (3) - 8" perforated strainers in the holdup pond effluent shall be perforated by the Contractor. The perforations shall be 1" diameter holes drilled at 0°, 90°, 180°, 270° for the first row and 45°, 135°, 225°, 315° for the second row. Alternate hole patterns for a total of nine rows for each strainer. Rows shall be equally spaced and shall start 5" from each end.

Fittings:

Fittings shall conform to ASTM D-3261 and ASTM F-714, NSF Approved, with a PPI rating of PE 3408 as described under material and shall have a SDR of 17 for gravity piping, SDR of 11 for pressure pipe, and shall have full pressure rating equal to that of the pipe.

Joints:

Joints ≤ 1 1/2" NPS shall be socket fusion per ASTM per D-1693.

Joints ≥ 2" NPS shall be butt fusion per ASTM D-638

Material shall be supplied with applicable ASTM and NSF markings on pipe.

Polyethylene pipe and fittings shall be supplied as manufactured by PLEXCO, Phillips 8600, or prior approved equal.

A certificate of compliance shall be supplied by the manufacturer.

C. Gaskets, Bolts, Nuts (Gasket Packs):

Gaskets packs shall be APPCO "GASKET PAC" or approved equal as follows:

1. Gaskets - Solid Teflon, PTFE, 1/8 inch thick, full face, ANSI B16.21.
2. Bolts - Studs conforming to ANSI B1.1 from ASTM B-473, type UNS 8020 material, Class 2A.
3. Nuts - Conforming to ANSI B18.2.2 from ASTM B-473, type UNS 8020 material, Class 2B, Heavy Hex.

2.04 MANHOLES:

Manholes shall be PLEXCO, EHMWPE 3408 Polyethylene or prior approved equal and shall be fabricated as shown on reference drawings. Top of manholes shall be flanged with 12-1⅛" diameter bolt holds drilled symmetrically.

Manhole covers shall be reinforced to accept 1500 lb. load. Diameter of covers shall match the flange diameter of the manholes. Manholes with extensions shall be flanged with 20-1⅛ diameter bolt holes drilled symmetrically.

Manholes shall be bolted together (gaskets not required) with bolts as specified under 2.03.C.

Manholes shall be manufactured and installed as specified on the drawings.

2.05 PUMP STATION

A. The pump station shall be supplied with two (2) Allis-Chalmers or prior approved CSO-V Vertical Wet Pit Process Pumps. Each pump shall be suitable for exterior applications and equipped as follows:

ITEM: 1 QTY: 2

OPERATING CONDITIONS

Service:	Sump Pump	Flow gpm:	300
Liquid:	Water	Head TDH:	222'
S.G.:	1	NPSHa:	Flooded
Temp:	75°F		

SELECTION

PUMP DATA		DRIVE	
Model:	ITT/AC Pump	HP:	30
Type:	CSO-V	RPM:	3600
Curve:	A-8506-1	Type:	TEFC
Size:	3x2x8.5 x 6 Ft.	Frame:	286 VP
Connections:	150# FF Flange	Volt:	460/3/60
Impeller Dia:	7.75" (machined to meet curve demand)	S.F.:	1.15
All Mat'ls Const:	316 SS		
Stuff Box Arngmt:	N/A		
Base Plate Type:	Steel Sole Plate with 4" Flg Vent Connection		
CPLG Type:	Solid Adjustable		
Flow Indicator:	G.F. Teflon		
Rotation:	CW		
Pump Eff:	63%		
BHPd:	26.80		
BHPm:	34.34		
RPM:	3500		

2.06 CONTROLS:

Furnish and install one automatic pump control center in NEMA 4X (Fiberglass) enclosure for 460 volts, 3 phase, 60 hertz 4 wire power supply. For each pump motor, there shall be included:

A combination circuit breaker/overload unit providing overload protection, short-circuit protection, reset and disconnect for all phases; across-the-line magnetic contactor; hand/off/automatic pump operations selector switch; 120 volt control panel pilot circuitry. A 24 volt control circuit transformer with disconnect circuit breaker and overload protection, for external pilot circuitry shall be included with an automatic electric alternator for two pump stations (providing alternating operation of pumps under **ALL** conditions. **Pumps shall not be designed to run simultaneously**).

The following shall be supplied with the panel:

- High Level Alarm (local)
- Condensation heater
- Running time meters
- Pump run, pump stop lights
- Lightning arrester
- Mounting bracket (to mount on electrical support)
- Power Monitor
- Square D pressure switches set at 9 psig.
- External contacts for the following:

  a. Power On - Pump A & B
  b. Power Off - Pump A & B
  c. Run On - Pump A & B
  d. Run Off - Pump A & B
  e. High Level Alarm

Liquid level sensors shall be a non-floating, displacement type and shall be rated for operation at milliwatt levels. Floats or restrained floats shall not be considered as equal.

Operation of Pump Station - Pump level control switches and alarms shall be set to operate at the dimensions shown on design drawings.

The pressure switch installed in the bearing seal water supply shall cut off the power supply to the pump that it is serving in the event the supply pressure drops to 9 psig. A signal will be sent to the C.T. Lab alarming personnel of the power failure.

A terminal panel with dry contacts shall be supplied by the Contractor and installed in the Switchyard Relay House. Duke Power Company will connect to terminal panel and install the remaining Control System to the C.T. Lab.

The control cable from the control panel to the terminal panel shall be ANIXTER or prior approved equal. Model 7TD-1412, Teck 90 minus 40°C, 14 AWG, C1 B stranded copper, CSA approved insulation per CSA C22.2, No. 131, uninsulated C1 B ground. Flame spread rating IEEE 383 or better, and suitable for direct bury. The Contractor shall supply and install per the reference drawing.

The Contractor shall be responsible for mounting control panel. Location is to be coordinated with the Electrical Contractor. Interconnecting wiring between control panel and pump station shall also be furnished and installed. Local power disconnects shall be provided at the pump station. Power supply to the control panel and receptacle shall be furnished and installed by the Electrical Contractor. The power receptacle (115V, 1Ø) shall be installed in waterproof box on a ground-fault breaker. Reference Electrical Drawings CFD-MG-6433C-E-0010 and CFD-MG-6433C-E-0020.

2.07 VALVES:

Pressure Reducing: No. U5BLP, ½" Union Connection and Stainless Steel Strainer. Pressure shall be set at 12 psig min. to 15 psig max.

Knife Gate: DeZURIK, Series C, Stainless Steel, Model 0200, 825, WB, RS16, LHG and 0800, 825, WB, RS16, LHG.

Check Valve: Mission, Swing Check, Stainless Steel, Positive Seat, Flanged.

Double Check Backflow: Watts, Model 709, 1" Brass, with Strainer.

Ball Valves: Apollo, All Sizes, Brass, Full Port.

Hose Hydrant: Jay R. Smith, Figure 5911, 1" Inlet and Hose Connection, Non-Freeze, 3'-0" Bury.

2.08 INSULATION:

Insulation shall be 1" thick one-piece insulation molded from fine glass fibers and have a density of 3-1/2 lbs. per cubic foot, and have a factory applied flame retardant jacket (FRJ) permanent type, and flame spread shall not exceed a 25 rating as approved by NFPA (National Fire Protection Association). Adjoining sections shall be butted firmly together and the longitudinal seam of the vapor barrier lap adhesive. Ends of pipe insulation shall be sealed off with fire resistant mastic at all flanges, valves and fittings and at intervals not more than 21 feet on continuous runs of pipe. Staples are not to be used on the vapor barriers jacket. Insulation shall be Manville Micro-Lock or approved equal.

All flanges, valves and fittings shall be insulated with premolded insulation of a thickness equal to that of the insulation of the adjoining pipe, securely fastened in place, vapor sealed with a fire-resistant positive vapor barrier lapped onto the adjoining insulation, reinforced with flame retardant jacket and finished with a second coat of mastic.

In addition, insulation material for exterior exposed piping shall be compatible with heat tape and the heat tape shall be compatible with plastic pipe where applicable. Exterior exposed piping shall be covered with an aluminum sheath, in addition to insulation and canvas jacket. Aluminum shall be securely held in place by stainless steel bands. All covering shall be weathertight.

2.09 HANGERS:

Provide all miscellaneous steel, etc., for hanging pipe as shown or as required. See Part 3, Article 3.07.

All miscellaneous steel hangers shall be coated in accordance with Part 3, Article 3.10.

END OF PART 2

PART 3 EXECUTION

3.01 PIPING DRAWINGS:

The work specified herein shall be done in accordance with the piping drawings. The drawings are diagrammatic, but shall be followed as closely as actual construction and the work of other trades will permit. The location of piping, equipment and fixtures are shown approximately in their desired locations; however, the Contractor shall verify all locations and measurements before installation to insure the best quality installation possible.

In executing minor changes to the work, not covered on drawings or by this specification, the Contractor shall be guided by common and accepted practices. Should job conditions arise wherein the Contractor feels that certain changes will be advisable, the Contractor will communicate with the Engineer and secure approval before proceeding to execute the work, except in emergency endangering life or property.

Although the reference drawings are to scale where indicated, dimensions shall be determined by actual field measurements, from manufacturer's certified prints, and from coordination with other trades whenever possible.

3.02 CLEARING OF SITE:

The Contractor shall keep the premises free from accumulation of rubbish and all unsightly material caused by their work and shall remove all such accumulated waste from the building.

3.03 EXCAVATION:

The Contractor shall do all excavation required in the piping work. Excavated material not required for fill or backfill shall be removed by the Contractor to a site as directed by the Engineer. Excavation shall not be carried below required level. Excess excavation below required level shall be backfilled at the Contractor's expense, using earth, sand, gravel, or concrete as directed by the Engineer, and thoroughly tamped. Ground adjacent to all excavation work shall be graded to prevent water running in.

Banks of trenches shall be OSHA approved. Width of the trench shall be 6 inches minimum and 8 inches maximum on each side of the pipe. Where plastic pipe is used, the bottom of the trench shall be covered with 4 inches of rock free soil or sand. In rock, excavation shall be carried 8 inches below bottom of pipe. Loose earth or sand shall be used for backfill and tamped thoroughly.

After pipes have been tested and approved, backfilling shall be done with approved material free from larger clods or stones. Backfill material shall be placed evenly and carefully around and over pipe in 6 inch maximum layers. Each layer shall be thoroughly and carefully tamped until 1 foot of cover exists over pipe. The remainder of the backfill material shall be placed, moistened, and compacted (rolling may be used in areas that are not subjected to traffic). The Contractor shall refill for settlement all backfill areas.

All piping, manholes, etc that is to be installed per the Civil drawings and piping around the pump station shall be backfilled in accordance with the Civil Specification.

Earth backfill under roads, walks, parking lots or equipment pads shall be compacted to 100 percent maximum compaction at optimum moisture content (±3%). Compaction shall be accomplished by compacting with a motorized hand-tamper as each 6" thick layer is added. This work shall meet with the Engineer's approval.

3.04 UNDERGROUND PIPE:

Underground pipe shall be at a depth to avoid damage from freezing, three (3) feet minimum, or as directed by the Engineer, and shall be at sufficient depth under roads, parking lots, etc., so as not to be damaged, or shall be protected by some other means, subject to Engineer's approval.

3.05 GRADING:

Grading of all pipes shall be in accordance with the standards prescribed by the Code, avoiding unengineered traps and low spots in horizontal runs of piping.

3.06 CONCEALING:

Concealment of piping shall not be done until after proper tests and inspections have been made unless approved prior to concealment in writing by the Engineer.

3.07 HANGERS:

Hangers, insets and supports shall be provided for all above ground horizontal and vertical piping, and shall be of a design which will permit removal and replacement of the band and hanger without taking down the pipe and must also permit vertical adjustment of the pipes. Grinnell figure numbers are given as a guide, but similar hangers by Fee and Mason, Ellen or Modern will be acceptable provided they are submitted to the Engineer for approval before installation.

Metallic piping shall be supported every 10 feet maximum, on straight runs of pipe. No end section of pipe longer than 36 inches shall be left unsupported. Vertical pipes shall be properly secured with clamps at sufficiently close intervals to keep the piping alignment and carry the weight of the pipe and contents.

3.08 VALVES:

All valves for each particular service shall be of one manufacturer.

Valves shall be installed per the drawings and at any other locations or services deemed necessary.

3.09 INSULATION:

The Contractor shall insulate all exposed piping. Exterior piping shall be heat traced and insulated. Heat tracing shall be sized a 4 watts per foot and installed by the Electrical Contractor. The Piping Contractor shall install the insulation after heat tracing has been installed in accordance with manufacturer's recommendations and as herein specified. See Part 2, Article 2.02.

Piping surfaces to be insulated shall be clean and dry and shall be tested before the insulation is applied.

At hangers on all pipe where the support is on the insulation, a 16 gauge metal saddle, three times the nominal pipe diameter and a minimum length of 10" shall be provided between hanger and insulation. Use spacer block insulation at metal hangers. No unions of any kind shall be covered.

3.10 PAINTING AND TAGGING:

Painting: All exposed bare piping, hanger rods and steel framing supports or other metal, other than galvanized or non-ferrous metal shall be painted with 1 coat of primer and 2 coats of high quality industrial enamel. All equipment furnished and installed by Contractor shall be painted.

Tagging: The Contractor shall provide all valves with brass or aluminum tags attached with "S" hooks and chains. Tag is to be marked "LW" for leachate wastewater and "SW" for service water with valve numbers on each valve.

3.11 PIPING SYSTEMS:

Leachate and Associated Piping Systems: The Contractor shall furnish and install the complete leachate and associated piping systems, all as shown on the piping and civil plans and schematic diagrams and herein specified.

Minimum fall of all horizontal piping shall comply with the code stated in Part 1, Article 1.07.

The Contractor shall be responsible for determining the number of fittings and additional flanges required to install the piping systems.

All metallic pipe, flanges, or other metallic objects underground shall be coated with a polysensitive tape and shall be wrapped watertight.

All piping shall have a minimum horizontal distance of 10'-0" from any potable water system.

3.12 FLUSHING, CLEANING, TESTING, AND DISINFECTING:

A. Flushing and Cleaning:

All piping shall be thoroughly flushed under pressure and cleaned of foreign matter, scale, pipe dope, gravel, etc., before systems are put into operation.

After cleaning the systems, all connections shall be made and the entire piping and apparatus shall be tested for leaks at operating pressure.

B. Testing:

General: All parts of the systems shall be tested before covering or concealment of piping and adjusted for proper operation. Fixtures shall be tested for soundness and proper support. Any other tests required by

Code or requested by the Engineer shall be performed by the Contractor at his expense. Any defects disclosed by the test shall be repaired promptly by the Contractor without cost to the Owner.

Atmospheric Piping: All atmospheric non-perforated piping shall be tested by filling system with water and observing for leaks. These tests shall be conducted as the work progresses, in order to maintain a minimum head of 15 feet. Allowable leakage rate = 0.

Pressurized Piping: Piping shall be hydrostatically tested at 175 psi for a minimum of 2 hours. Allowable leakage rate = 0.

C. Disinfecting: All piping, fittings and valves shall be disinfected from the switchyard drinking water tie-in through the backflow preventer in accordance to State and Local requirements.

All tests shall be observed and approved by State and Local Inspectors as required by governing codes and standards.

3.13 PERMITS AND INSPECTIONS, LAWS AND ORDINANCES:

Unless directed otherwise, the Contractor shall obtain all permits required, give all legal notices, and have all work inspected. Fees for permits and inspection shall be paid by the Contractor, unless directed otherwise.

All State Laws, Codes, and regulations of NFPA governing or related to any portion of this work are incorporated into and made a part of these specifications. Anything contained in these specifications or shown on the drawings shall not be construed to conflict with any of the above rules or regulations or the requirements of same.

3.14 COOPERATION:

The Contractor shall cooperate with other Contractors, Subcontractors and the Owner. The Contractor shall install its work so as not to delay the construction of any portion of the landfill project or the completion of same.

The Contractor shall coordinate its work with that of other Contractors, and pipes shall be run so as not to cause interference with mechanical piping, electrical etc.

The Contractor shall verify the proposed locations of piping and underground services of other trades to the effect that there is no interference or conflict in the installation of this work, and shall coordinate its work with work by other trades.

3.15 ALTERNATES/ALTERNATIVES/SUBSTITUTIONS:

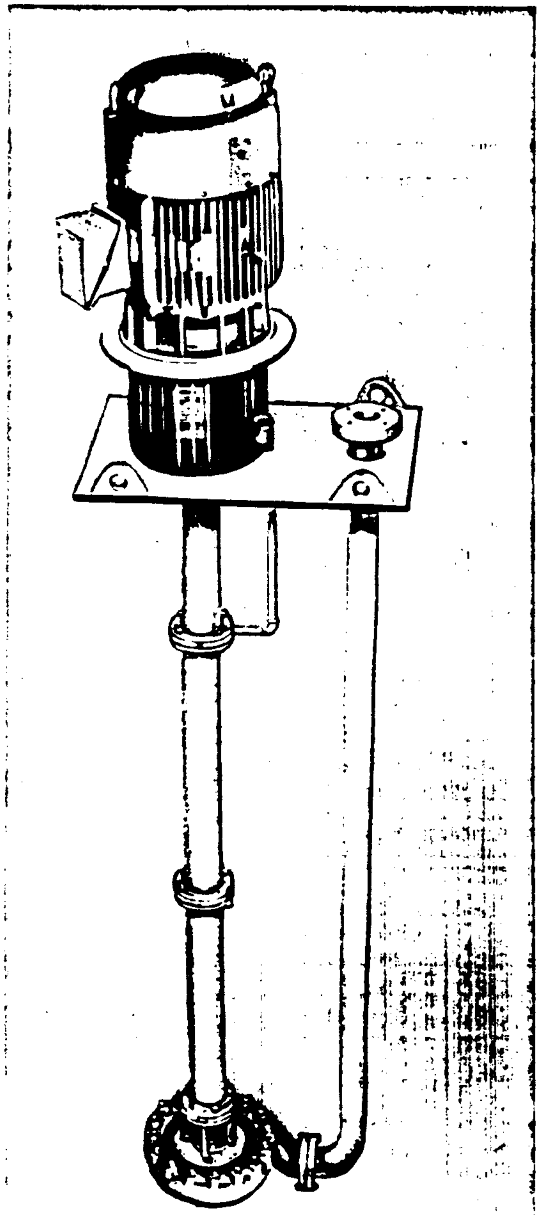
Reference Part 2, Article 2.02 of this Section and Section 01310.

END OF SECTION 15400

process pumps CSO-V

Vertical wet pit design— MODEL 500
Single stage—open impeller

ALLIS-CHALMERS



Allis-Chalmers "CSO-V" pumps are designed for severe pumping problems of corrosion, abrasion and temperature extremes in the chemical, petrochemical, pulp and paper, brewing, food and other process industries.

The "CSO-V" vertical wet pit pump offers outstanding design features.

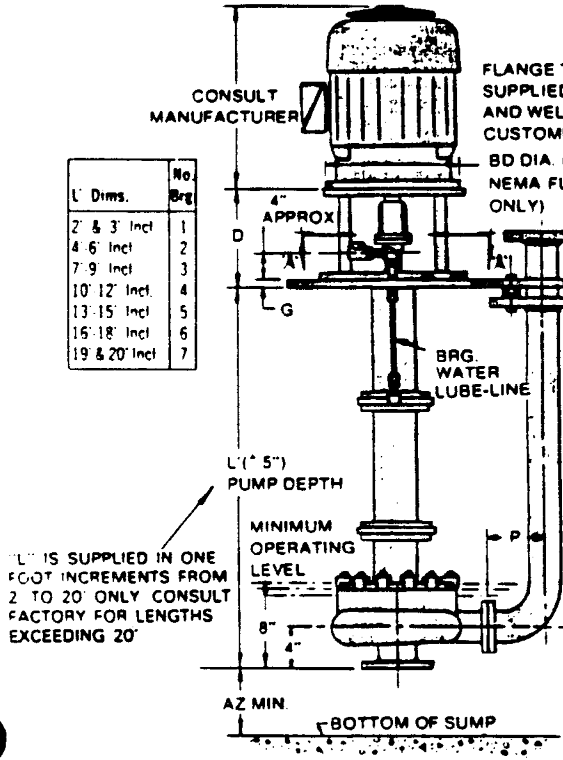
- Utilizes ANSI B73.1 (AVS) STANDARD Hydraulic Pump Parts.
- Sealed Bearing Column – The pressurized column design is standard on all units. Fluted Cutless rubber or Teflon bearings are available. A clean source of external liquid is introduced into the top bearing at a pressure 10-15 psi. A lip seal type arrangement affords the method of pressurizing the column and prevents the entrance of the pump liquid into the column assembly.
- Metallurgy – Pump ends are available from stock parts in DURON metal, 316 stainless steel, 20 stainless steel and CD-4MCu. Column assemblies are available in carbon steel and 316 stainless steel.
- Discharge Pipe Discharge pipe and flange is supplied on all units as a standard. Discharge piping is available in carbon steel and 316 stainless steel.
- Impeller Adjustment – The axial impeller running clearance can be set and easily maintained throughout the life of the pump by simple adjustment on the Allis-Chalmers solid adjustable coupling furnished as standard.
- Eliminate Thrust and Clogging Problems – Impeller design provides higher efficiencies with lower NPSH requirements. Fully open contoured vane impellers balance hydraulic thrust loads. Pressure balance vanes on the rear of the impeller keep solids from collecting behind the impeller.

  A cast hex head on the impeller of all "CSO-V" pumps allows you to remove the impeller with any standard wrench, when normal maintenance is needed . . . no chance to damage impeller with unnecessary pounding or force.
- Standard Vertical Motor Drive – All units are manufactured to accept the new NEMA VP-HP standard design for vertical solid shaft, normal thrust, "P" flange motors.

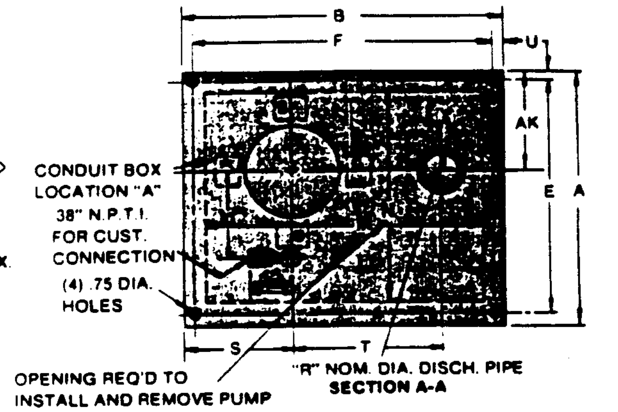
ATTACHMENT 1

January, 1981

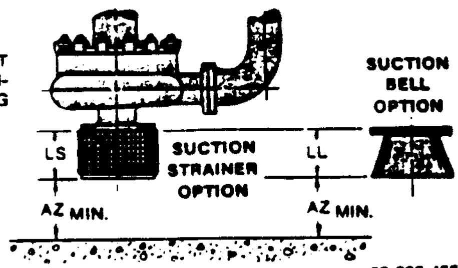
Supersedes all previous issues



'L' Dims.	No. Brg.
2' & 3' Incl	1
4'-6' Incl	2
7'-9' Incl	3
10'-12' Incl.	4
13'-15' Incl	5
16'-18' Incl	6
19' & 20' Incl	7



CUSTOMER MUST SUPPORT DISCHARGE PIPING INDEPENDENT OF DISCHARGE PIPING SUPPLIED BY A-C.



52-325-455

MOTOR FRAMES	BD	D	G
143-145 VP, 182-184 VP, 213-215 VP, 254-256 VP, 284-286 VP	10 or 12	12.5	.75
324-326 VP, 364-365 VP, 404-405 VP, 444-445 VP	16.5 or 20	14.5	.75

Key No.	Pump Size	Suct.	** Disc.	A	B	E	F	M	N	** P	** R	S	T	U	LL	LS	AZ	AK
1	1¼ x 1 x 6	1.5	1*	26.5	26	25	24.5	22	22.5	3.0	1.5	8.25	9.5	.75	6	3.25	1	9.00
2	3 x 1¼ x 6	3	1.5	26.5	26	25	24.5	22	22.5	3.0	1.5	8.25	9.5	.75	8	4.50	1.5	9.00
3	3 x 2 x 6	3	2	26.5	26	25	24.5	22	22.5	3.75	2.0	8.25	10.25	.75	8	4.50	1.5	9.00
4	1¼ x 1 x 8	1.5	1*	26.5	26	25	24.5	22	22.5	3.0	1.5	8.25	9.5	.75	6	3.25	1	9.00
5	3 x 1¼ x 8	3	1.5	26.5	26	25	24.5	22	22.5	3.0	1.5	8.25	9.5	.75	8	4.50	1.5	9.00
6	2 x 1 x 10	2	1*	25.25	28.75	23.75	27.25	24.75	21.25	3.0	1.5	11.25	11.5	.75	6	3.50	1	9.75
7	3 x 1¼ x 8¼	3	1.5	25.25	28.75	23.75	27.25	24.75	21.25	3.0	1.5	11.25	11.5	.75	8	4.50	1.5	9.75
8	3 x 2 x 8¼	3	2	27.5	33.75	26	32.25	29.75	23.5	3.75	2.0	13	13.25	.75	8	4.50	1.5	11.50
9	4 x 3 x 8¼	4	3	28.62	37.25	27.12	35.75	33.25	24.62	5.5	3.0	13	16.5	.75	8	4.62	2	11.88
10	3 x 1¼ x 11	3	1.5	27.5	33.75	26	32.25	29.75	23.5	3.0	1.5	13	13.5	.75	8	4.50	1.5	11.50
11	3 x 2 x 11	3	2	28.62	37.25	27.12	35.75	33.25	24.62	3.75	2.0	13	15.25	.75	8	4.50	1.5	11.88
12	4 x 3 x 11	4	3	32	43.75	30.5	42.25	39.75	28	5.5	3.0	13	18	.75	8	4.62	2	13.50
13	3 x 1¼ x 13	3	1.5	27.5	33.75	26	32.25	29.75	23.5	3.0	1.5	13	13.5	.75	8	4.50	1.5	11.50
14	3 x 2 x 13	3	2	28.62	37.25	27.12	35.75	33.25	24.62	3.75	2.0	13	15.25	.75	8	4.50	1.5	11.88
15	4 x 3 x 13	4	3	32	43.75	30.5	42.25	39.75	28	5.5	3.0	13	18	.75	8	4.62	2	13.50
16	6 x 4 x 13	6	4	32	43.75	30.5	42.25	39.75	28	7.0	4.0	13	20.5	.75	8	5.62	3	13.50

* Riser Pipe for 1" Disch. is 1.5" Standard (See "R" Dim.)
**Riser Pipe Sizes Common to Disch. Dia. (Standard) other Sizes Available. Consult Factory.

NOT FOR CONSTRUCTION, INSTALLATION OR APPLICATION PURPOSES UNLESS CERTIFIED

Certified For:

CO # ID # SO #

	Size & Type	Model	Curve No.		GPM		Head	Rotation	Flanges
PUMP DATA								CW	
	HP	RPM	Phase		Hertz		Volts	Frame Size	Enclosure
MOTOR DATA			1	3	50	60			

Sign: Date ____/____/____

Page 301 available as 52D4881-03

DIMENSIONS

DUKE POWER COMPANY

VERIFICATION OF SPECIFICATION

Company: Duke Power Co.

Title of Specification: McGuire Nuclear Station BRC Construction Landfill

Specification Number:

Revision: 0

In accordance with established procedures, the quality of this specification has been assured. Signatures certify that the above specification was originated, checked, and approved as noted below:

Prepared By: [signature] Date: 8/7/90

Checked By: [signature] Date: 8/8/90

Approved By: E. G. Frampton Date: 8/13/90

CAROLINA PROFESSIONAL SEAL 6025 ENGINEER E. G. FRAMPTON

Signature: Eugene G. Frampton

Name: EUGENE G. FRAMPTON

Professional Engineer

No. & State: 6025 N.C.

16000 - ELECTRICAL SPECIFICATION

TABLE OF CONTENTS

SECTION	DESCRIPTION
16050	GENERAL REQUIREMENTS
16110	RACEWAYS
16120	WIRES, CABLES AND CONNECTORS
16143	WIRING DEVICES
16450	GROUNDING
16460	TRANSFORMERS
16470	PANELBOARDS

DIVISION 16000 - ELECTRICAL WORK

SECTION 16050 - GENERAL REQUIREMENTS

16050.01 GENERAL:

16050.01.01 INTRODUCTION:

The work covered by this section of the specification consists of furnishing all labor, equipment, supplies and materials and performing all operations, including trenching, backfilling, cutting, channeling, chasing and patching necessary for the installation of the complete electrical system, in strict accordance with this section of the specification. The work is further described in the body of the specifications and on the electrical drawings.

16050.01.02 APPLICABLE SPECIFICATIONS AND STANDARDS:

The applicable provisions of the following specifications and standards shall form a part of these specifications:

A) Underwriters Laboratories Incorporated

B) National Fire Protection Association

C) National Electrical Manufacturers Association

D) National Electrical Code

16050.01.03 BASIC ELECTRICAL MATERIALS AND METHODS:

The installation shall comply with the applicable rules of the National Electrical Code and rules and regulations of local authorities having jurisdiction. In no case shall the materials and workmanship fail to meet the minimum requirements of the National Electrical Code. Certificates of approval shall be issued by those departments having jurisdiction before work will be approved for final payment. The contract drawings indicate the extent and general arrangement of the electrical work. The drawings and specifications shall be considered supplementary, one to the other, so that materials and workmanship indicated, called for or implied by the one and not by the other shall be supplied and installed as though specifically called for by both. All labor and material required to perform all work in conjunction therewith whether or not indicated or specified shall be furnished and installed as part of this work. The Contractor shall do all cutting necessary for the proper installation of his work, and shall repair any damage done by himself or his workmen or other workers under his supervision.

16050.02 MATERIALS:

All materials used in this work shall be new and approved by Underwriters Laboratories in every case where they have established a standard for the particular type of material to be installed. All lighting fixtures shall bear the label of Underwriters Laboratories. Reference in the specifications to any article, device, product, material, fixture, form, or type of construction by name, make, or catalog number shall be interpreted as establishing a standard for quality and shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, form, or type of construction which in the judgment of the Project Engineer, expressed in writing, is equal to that specified.

16050.03 SUPERVISION:

The Contractor shall have in charge of the work at all times during construction a thoroughly competent foreman with extensive experience in the work to be performed under this contract. Anyone deemed not capable by the Engineer shall be replaced immediately upon request, and after a satisfactory foreman has been assigned, he shall not be withdrawn without the written consent of the Engineer.

16050.04 DOCUMENTATION:

16050.04.01 The Contractor, upon completion of this project, shall furnish two (2) clearly marked sets of as-built drawings to the architect. Any variations from the original drawings/specifications shall be noted in detail.

16050.04.02 The Contractor upon completion of this project, shall provide the Owner with copies of warranties, operating manuals, specifications and service agreements for all equipment supplied and installed as part of the electrical portion of this project.

16050.04.03 Shop drawings, required in other sections of this specification, shall be submitted in a timely manner prior to delivery of the equipment by the manufacturer/supplier for Design Engineering approval.

16050.05 LABELING:

All electrical equipment shall be labeled with engraved Phenolic plates with white letters 0.375" high on a black background. Labels shall be mounted as follows:

- Panelboards; to the front of the panelboard cover above the door, centered between the two side edges and read as shown on the panelboard schedule.

- Transformers; to the front of the transformer enclosure centered between the two side edges and read as shown on the riser diagram.

- Disconnect Switches; to the front of the switch enclosure, centered between the two side edges and shall indicate voltage, number of phases, amperage and load identification.

- Manual Starters; to the front of the starter enclosure, centered between the two side edges and read as indicate voltage, number of phases and load identification.

- Special Receptacles; to the top to the cover plate, centered between the two side edges and shall indicate voltage, number of phases and amperage as shown on the drawings.

- Lighting Contactors; to the front of the contactor enclosure, centered between the two side edges and shall indicate voltage, amperage and power source.

- Telephone Cabinets; to the front of the enclosure, centered between the two sides and shall read as shown on the drawings.

- Transfer Switches; to the front of the switch enclosure, centered between the two side edges and shall indicate voltage, amperage, number of phases, power sources, and load identification.

- Attachment to enclosures shall be made with an epoxy type adhesive compound to provide a permanent resilient bond.

16110.00 RACEWAYS

16110.01 GENERAL:

16110.01.01 This section of the specifications details the requirements for electrical raceways including conduit, electrical metallic tubing, and wireways, which are used for electrical power and signal distribution.

16110.01.02 All raceways used for power or signal distribution shall comply with the applicable requirements of the NEC, NEMA and be UL listed.

16110.02 METAL CONDUIT AND TUBING:

16110.02.01 Unless otherwise specified, conduit shall be Electrical Metallic Tubing (EMT) with appropriate compression type fittings for the type of installation indicated on the drawings.

16110.02.02 Unless otherwise specified, flexible conduit shall be formed from continuous length of spirally wound, interlocked zinc-coated strip steel with appropriate fittings specifically designed to be used with flexible metal conduit and approved for grounding purposes.

16110.02.03 All conduit and fittings shall be of like materials. Where dissimilar metals are used together, suitable provisions shall be made to prevent galvanic action.

16110.03 NONMETALLIC CONDUIT:

16110.03.01 Unless otherwise specified, nonmetallic conduit shall be Electrical Plastic Conduit (PVC), schedule 40, 90°C, UL rated for direct burial, or normal above ground use.

16110.04 TELEPHONE/POWER POLES:

16110.04.01 Telephone/power poles shall be used with telephone, data and power systems installed above suspended ceilings. The poles should have provisions for telephone cables, coaxial cables and power circuits in the sizes, ratings and quantities as indicated on the drawings.

16110.05 INSTALLATION:

16110.05.01 Install raceways as indicated on the drawings and in compliance with NEC, and NECA's "Standards of Installation".

16110.05.02 Exposed conduits shall be installed parallel with or perpendicular to structural members, and shall follow the approximate routing shown on the drawings, except as required to avoid interferences.

16110.05.03 Mechanically fasten together metal conduits, enclosures, and any type of raceways to form continuous electrical conductors. Connect to electrical boxes, fittings and cabinets to provide electrical continuity and firm mechanical assembly.

16110.05.04 All junction boxes, cabinets, switches, light fixtures and other electrical equipment shall be solidly mounted prior to the installation of conduit, and shall not depend upon the conduit for support. Conduit systems shall be installed complete between pull points before pulling wire.

16110.05.05 Install expansion fittings in raceways every 200 feet of linear run or wherever structural expansion joints are crossed.

16110.05.06 The ends of all conduit runs shall be closed immediately after installation to prevent the accumulation of water, dirt and other foreign material.

16110.05.07 Bends may be either factory or field made. The radius of field bends shall be not less than those established by the NEC, and bends shall be made such that the effective cross-sectional area of the conduit is not reduced. Heating for bending shall be done by UL approved methods and shall be approved by the Engineer.

16110.05.08 Conduit connections to junction boxes and other equipment having unthreaded openings shall be made using lock nuts and insulating bushings in a manner that ensures electrical continuity for grounding purposes.

16110.05.09 Fittings may be used for 90° turns at circuit voltages of 600 volts and below, except that conductors 4/0 AWG and larger may require pull boxes in order to allow sufficient cable bending radius.

16110.05.10 All exposed conduit (or above drop ceilings) shall be rigidly supported between couplings, on either side of bends, at terminations and fittings, and in general on not greater than 10 ft. centers for 1" and larger conduit, and 8 ft. centers for 1/2" and 3/4" sizes. Conduits in damp location or outdoors shall be exposed to the air on all sides, and shall not be installed tight against walls, ceilings, and structural members, etc. Use clamp backs and/or offsets as necessary to maintain uniform clearances.

16110.05.11 Field cut conduit ends shall be square and reamed of inside burrs and sharp edges. Field threads shall have the same dimensions and taper as factory cut threads.

16110.05.12 If threads are exposed on galvanized conduit after threads are made up, the exposed threads shall be coated with cold galvanizing compound.

16110.05.13 Flexible conduit shall be used for final connection to all motors, recessed lighting fixtures, and other devices subject to movement or vibration.

16110.05.14 All electrical installations requiring flexible connections in outdoor or wet locations shall be provided with seal-tight flexible conduit and suitable connectors.

16120.00 WIRES, CABLES AND CONNECTORS

16120.01 GENERAL:

16120.01.01 This section specifies the minimum requirements for wire, cables and wiring connectors used to distribute electric power.

16120.01.02 All wire, cable and wiring devices shall comply with the applicable NEC, ICEA and IEEE codes and/or standards, and shall be UL listed and labeled.

16120.01.03 Wires and cables shall be manufactured by Anaconda, General Electric, Okonite, Phelps-Dodge, Rome, Simplex Triangle, or approved equal.

16120.02 WIRES:

16120.02.01 All wires to be furnished for this project shall be copper of the size and ampacity indicated on the drawings and shall be type THHN or THWN, unless otherwise indicated.

16120.02.02 Branch circuit conductors shall be no smaller than No. 12 AWG, except that conductors for branch circuits whose length from panel to center of load exceeds 300 feet shall be no smaller than No. 10 AWG to the first outlet.

16120.03 CABLES:

16120.03.01 All cables to be furnished for this project shall be of the size, ampacity rating, voltage rating and jacketing/sheathing indicated on the drawings.

16120.03.02 Direct buried cable shall be UL listed, of the size and ampacity indicated on the drawings and shall be approved for direct burial. Conductors shall be copper with THWN Type insulation.

16120.04 CONNECTORS:

16120.04.01 Provide UL-listed factory-fabricated, metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Where not indicated, provide proper selection as determined by Installer to comply with project's installation requirements, NEC and NEMA standards.

16120.05 INSTALLATION:

16120.05.01 Wiring installations in conduit shall be made so that no undue stress is placed on the insulation. Slack wire shall be left in junction boxes and pull boxes so that the wires are not drawn tight against bushings; insulation is not squeezed at corners; or undue stress is not placed on terminal studs. Insulating bushings shall be used at the ends of all conduits.

16120.05.02 Conductors shall be continuous from pull box to pull box, outlet to outlet, junction box or conduit fitting. Splices will not be permitted in wireway, troughs, cable trays or conduit fittings unless approved for splicing service. Wire size of #1/0 or larger shall not be spliced unless approved by the engineer.

16120.05.03 Where splices are required, wire connectors of insulating material or properly taped solderless pressure connectors, shall be utilized for all splices in wiring.

16120.05.04 All conductors run, but not used or connected, shall be tagged as spare at each end. Spare conductors run with instrumentation/ control circuits to be grounded at one end only and taped at the other end. Ground power circuits at both ends.

16120.05.05 Compression type connectors size # 1/0 AWG and above shall be crimped with a hydraulic tool with the die size as recommended by the connector manufacturer.

16120.05.06 For installation of cables and wires in conduit systems, wire pulling compounds approved by cable manufacturers, such as Burndy "Slikon" or equal, may be employed. Mixtures containing soap or detergent shall not be used.

16120.05.07 Bending radius for cables shall be as per NEC Sections 330-13, 333-8, 334-11 and 336-14 or any other applicable section.

16120.05.08 All conductors, feeders and branch circuits shall be color coded by phases (Phase A, Black; Phase B, Red; Phase C, Blue; Grounded Neutral, White; Equipment Ground, Green) and plainly marked in accordance with Sections 200-6, 210-5 and 310-12 of the NEC, and shall be clearly legible after installation. Scotch tape of proper color shall be used, whenever required, to identify the phase conductors of the larger feeders. Painting or taping will not be acceptable on conductors No. 6 AWG or smaller.

16120.05.09 All feeders, subfeeds to panels, meters, etc., shall be completely phased-out as to sequence and rotation. Phase sequence shall be A-B-C from front to back, top to bottom, or left to right when facing equipment.

16120.05.10 Energize circuitry and perform operational tests to verify proper operation. Where necessary, correct any malfunction and retest. If a circuit breakers trips, a circuit test shall be performed to determine the cause of trip and the problem resolved prior to resetting the breaker to energize the circuit.

16143.00 WIRING DEVICES

16143.01 GENERAL:

16143.01.01 This section of the specification covers the minimum requirements for electrical devices such as receptacles, switches, wallplates, etc., which are defined as units of electrical distribution systems which are intended to carry but not utilize electric energy.

16143.01.02 All wiring devices shall be SPECIFICATION GRADE and comply with the applicable requirements of the NEC, NEMA, IEEE and be UL listed and labeled.

16143.01.03 All wiring devices shall be manufactured by Crouse-Hinds Co., General Electric Co., Harvey Hubbell Inc., Thomas and Betts Corp., Square D, Westinghouse, Wiremold Co., or approved equal.

16143.02 RECEPTACLES:

16143.02.01 Duplex receptacles for general use shall be 2 pole, 3-wire, grounding type with green hexagonal ground screw, ground terminals and poles internally connected to mounting yoke, 15 amperes, 125 volts; designed for side and back wiring with spring loaded, screw activated pressure plate, and NEMA configuration 5-15R unless otherwise indicated. Exception: Where only 1 receptacle is provided on a circuit, the receptacle shall have a rating not less than the circuit breaker.

16143.02.02 Single receptacles for clocks shall be 2 pole, 3-wire, grounding, 15 ampere, 125 volts, side wiring with NEMA configuration 5-15R, with recess for male plug which permits clock to be mounted flush with wall and cover outlet. Provide with stainless steel plate with metal hook for supporting clock.

16143.02.03 Floor service receptacle outlets and fittings shall be of die cast aluminum, satin finish with 15 amperes, 125 volts, back to back duplex receptacles, NEMA configuration 5-15R. Furnish with 1" NPT, 1" long, locking nipple for installation. <<TELEPHONE CABLE OUTLET, IF REQUIRED>>.

16143.02.04 Special-purpose receptacles shall be specified on the drawings.

16143.02.05 Ground fault circuit interrupter receptacles (GFCI) shall be capable of being installed in a 2 3/4" deep outlet box without adapter, grounding type, UL rated, rated 20 amperes 120 volts, 60 Hz; with solid-state ground fault sensing and signaling, with NEMA 5-15R configuration and 5 milliamps ground fault trip.

16143.03 SWITCHES:

16143.03.01 Single phase disconnect switches shall be 2 pole non-fusible heavy duty in a NEMA 1 enclosure for indoor use or a NEMA 3R enclosure for outdoor use. Voltage and ampere rating shall be as indicated on the drawings.

16143.03.02 Three phase disconnect switches shall be 3 pole non-fusible heavy duty in a NEMA 1 enclosure for indoor or a NEMA 3R enclosure for outdoor use. Voltage and ampere rating shall be as indicated on the drawings.

16143.03.03 Flush mounted toggle switches for general use shall be 20 amperes, 120-277 volts AC, with mounting yoke insulated from mechanism, equipped with plaster ears, switch handles, and side-wired screw terminals.

16143.03.04 Combination switch/receptacle devices for general use shall be 20 amperes, 120-277 volts AC, with toggle switch handle, and 3-wire grounding receptacle, 20-amperes, 120 volts, equip with plaster ears, and with break-off tabs which allow separate or common feed wiring, with NEMA 5-20R configuration.

16143.03.05 Special-purpose switches shall be specified on the drawing.

16143.04 DIMMERS:

16143.04.01 Incandescent lamp dimmers shall be solid-state AC control, wattage as indicated on the drawings, 120 volts, 60 Hz with continuously adjustable rotary dimmer, satin finish stainless steel face plate, single pole, with ON-OFF switch. Equip with electromagnetic filters to eliminate noise, RF and TV interference, and with 5-inch wire connecting leads.

16143.04.02 Fluorescent lamp dimmers shall be single-pole, full-wave semiconductor modular type AC dimmer, with wattage and voltage as indicated on the drawings, with electromagnetic filters to reduce noise, RF and TV interference to a minimum, and with continuously adjustable trim potentiometer for lighting level adjustment of 40 to 100% unless otherwsie indicated on the drawings. Provide 5-inch wire connecting leads. Fixtures used with dimmers shall be provided with dimming ballasts.

16143.04 WALLPLATES:

16143.04.01 Wallplates for single and combination wiring devices shall be 0.04" thick satin finished stainless steel, of size, types and with cutouts as indicated. Screws for securing plates to devices shall be of metal with heads to match finish of plates.

16143.05 INSTALLATION:

16143.05.01 All wiring devices shall be installed in accordance with manufacturer's instructions, applicable requirements of NEC, and as indicated on the drawings.

16143.05.02 Wiring devices shall be installed only after wiring work is completed and electrical boxes are free from building materials, dirt and debris.

16143.05.03 Wallplates shall be installed only after painting work is completed and boxes are made plumb and flush fitting with wall surface.

16143.05.04 Prior to energizing the completed installation, thoroughly inspect and test wiring for continuity and short circuits. Ensure proper polarity, phasing of all connections and presence of all required neutral and ground connections.

16143.05.05 Unless otherwise specified on the drawings, the mounting height above the finished floor (AFF) to the top of the outlet box shall be as follows for the devices indicated:

Device	Height (AFF)
*Receptacles	18" (48" in shop areas)
*Telephone/Data Outlets	18"
*Computer Outlets	18"
*Light Switches	48"
Wall Telephone	48"
Water Cooler	Coordinate with Plumbing Contractor
Clock Outlets	96"
Battery Pack Outlets	96"
Vending Machine Outlets	48"

*Devices located where counter tops are to be installed shall be mounted 6 inches above the counter top unless otherwise indicated on the drawings.

16143.05.06 The Electrical Contractor shall be responsible to insure that all light switches are located on the strike side of the door.

16450.00 GROUNDING

16450.01 GENERAL:

This section of the specification covers the installation of ground electrodes, grid systems, loop systems and ground connections for equipment grounds, power system grounds, service entrance grounds, separately derived systems and lightning grounds.

Electrical systems shall be completely and effectively grounded as required by "The National Electrical Code"; however, the impedance to ground shall be 5 ohms or less.

16450.02 GROUNDING ELECTRODE:

The grounding electrode shall be the main metallic water pipe where it enters the building, or be a copper welded steel rod 5/8" diameter by 10' long, or multiple copper welded steel rods 5/8" diameter by 10' long interconnected by a BARE copper conductor as indicated on the drawings.

16450.03 GROUNDING ELECTRODE CONDUCTOR:

The grounding electrode conductor shall be copper of the size indicated on the drawings. The grounding electrode conductor shall connect the equipment grounding conductors, the service equipment enclosure, and the system grounded conductor to the grounding electrode.

16450.04 BUILDING STRUCTURE AND PIPING SYSTEMS:

The following systems shall be bonded to the equipment grounding bus:

A) All interior metallic cold water piping

B) Metallic electrical service conduit

C) Steel building structure.

16450.05 GROUNDING CONDUCTORS:

A green insulated copper conductor shall be run with every feeder or branch circuit and size in accordance with Table 250-95 of the NEC, unless specified otherwise on the drawings.

16450.06 GROUND FAULT PROTECTION:

When required by the NEC or when specified on the drawings, a ground fault protection system shall be included as part of the electrical installation. It shall consist of: a) current sensor enclosing all phases and neutral conductors of the circuit to be monitored, b) appropriate relaying equipment to provide the desired ground fault current sensitivity and time-current response characteristic, and c) a visual indication of ground fault interruption.

16450.06.01 CURRENT SENSOR:

A sensitive current sensor shall be provided of sufficient size to encircle the phase conductors and the neutral conductor of the circuit to be monitored. Current sensor output shall be coordinated with the required input to the relay.

The frame of the current sensor shall be so constructed that one leg can be opened to allow removal or installation around cable or bus without disturbing the cable or requiring drop-links in the bus.

16450.06.02 GROUND FAULT RELAY:

The relay shall be solid state construction for maximum reliability, except that a coil operated output relay may be provided to operate a fusible bolted switch trip mechanism. The ground fault relay shall require no external source of power for tripping the associated molded case circuit breaker. Adjustable pickup current sensitivity for ground fault currents with a current range as indicated on the drawings shall be provided for mains and feeders. A calibrated dial shall be provided for setting the current pickup point in the field. Settings for individual relays shall be as shown on the drawings. Time delay provided by the relay circuitry shall be minimally 0.1 seconds, 0.3 seconds, or 0.5 seconds or shall be permanently calibrated to preclude tampering with the time delay after installation.

SECTION 16460.00 - TRANSFORMERS

16460.01 GENERAL:

This section of the specification details the requirements for single-phase and three-phase dry-type transformers in ratings between 1 KVA and 1000 KVA. All transformers shall be designed for 60 Hz operation, and manufactured by square D. Westinghouse, ITE, General Electric, or approved equal.

16460.02 STANDARDS:

Transformers shall be designed, built and tested in accordance with all applicable NEMA, ANSI and IEEE Standards. Noise levels shall not exceed maximum sound level ratings as determined in accordance with ANSI/NEMA Standards (NEMA ST-20).

16460.03 INSULATION:

All transformers shall be 115°C rise above 40°C ambient temperature unless otherwise indicated on the drawings. All insulating materials used shall be in accordance with NEMA ST-20 Standards for a 185°C insulation system. The basic impulse levels (BIL) shall be a minimum of 20 KV for the 2.5 KV class.

16460.04 WINDINGS AND TAPS:

Transformer primary windings shall be provided with full capacity taps, with a minimum of 2-2½% above and 2-2½% below rated voltage.

16460.05 ENCLOSURE:

Transformers 15 KVA and larger shall be in a heavy gauge, sheet steel, ventilated enclosure. The ventilating openings shall be designed to prevent accidental access to live parts in accordance with UL, NEMA and NEC Standards for ventilated enclosures. Transformers 2 KVA and smaller may be of exposed core construction and shall be designed with leads brought into an adequately sized wiring compartment for connection of incoming primary and secondary conductors. Transformers larger than 2 KVA and smaller than 15 KVA shall be in a non-ventilated weatherproof enclosure.

All transformers shall be designed to limit terminal compartment temperature to 75°C when transformer is operating continuously at rated load with ambient temperature of 40°C. The maximum temperature of the top of the enclosure shall not exceed 50°C rise above 40°C ambient. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible metal grounding strap.

Transformers for outdoor use shall be provided with weather shields.

16460.06 RATINGS:

The KVA and voltage rating of transformers shall be as specified on the drawings.

16460.07 NAMEPLATE:

Each transformer shall be provided with a durable nameplate permanently attached to the front of the transformer housing or case. The nameplate shall include a transformer connection diagram, transformer impedance, KVA rating, temperature rise, and primary/secondary voltages.

16460.08 INSTALLATION:

16460.08.01 Transformers shall be installed at the location indicated on the drawings; any necessary changes shall be approved by the Owner.

16460.08.02 Coordinate transformer installation work with electrical raceway and wire/cable work, as necessary for proper interface.

16460.08.03 Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with torque values specified in UL Std. 486A and B.

16460.08.04 Prior to energizing, the transformer windings shall be checked for continuity and correctness of connections.

16460.08.05 Prior to energizing the distribution system, transformers rated 150KVA and larger shall be tested as follows:

- Megger the primary windings with the primary power supply cables connected and the breaker open.
- The secondary windings shall be meggered with the secondary leads connected and the secondary breaker open.

Test results shall be within the limits below:

Winding	Megger Test Voltage	Minimum Megohms Reading
480V	1000	45
240/120V or 208/120V	500	30

16470.00 PANELBOARDS

16470.01 GENERAL:

16470.01.01 This section of the specification covers the minimum requirements for AC power, lighting, receptacle and service entrance panelboards.

16470.01.02 Each panelboard shall be provided with main lugs or a main circuit breaker and single, double or triple pole thermal magnetic type branch circuit breakers, as indicated on the drawings. The position of the toggle handles shall clearly indicate breaker position and when tripped.

16470.01.03 Panelboards shall be factory assembled and rated for the voltage, ampacity and short circuit current indicated on the drawings.

16470.01.04 Manufacturer's/shop drawings shall be submitted for engineering approval prior to shipment of equipment.

16470.01.05 Equip panelboard with unit devices, of types, ratings and characteristics indicated on the drawings. Construct with rectangular shaped bus bars of solid copper, with conductivity not less than 98%, which are securely mounted and braced.

16470.01.06 Panelboards shall be manufactured by Square D, Westinghouse, ITE, General Electric or approved equal.

16470.02 ENCLOSURE:

16470.02.01 Panelboards shall have a minimum width of 20 inches and shall be provided with wiring gutters no less than 4-inch as at the sides, and 6-inchs top and bottom. These dimensions are minimum requirement and do not forfeit NEC requirements for cable bending radius and/or clearances for live parts.

16470.02.02 Flush enclosures shall be provided with trims having adjustable trim clamps. Trims shall be fitted with hinged doors having combination lock and latch and shall be keyed the same.

16470.02.03 Enclosures are to be fabricated by the same manufacturer as panelboards and shall mate properly with panelboards. Enclosures shall be NEMA 1 for indoor use and NEMA 3R for outdoor use, unless otherwise indicated on the drawings.

16470.02.04 One or more directory holders with glass or clear plastic plate and metal frame as required for rendering entire directory visible shall be furnished with each enclosure. Directories are to be typed with complete information for all circuits assigned (description, location and rating) and circuits designated as spares.

16470.03 SERVICE ENTRANCE PANELBOARDS:

Panelboards shall be dead-front, safety constructed factory-assembled service-entrance type circuit-breaker panelboards in sizes and ratings as indicated on drawings. Provide panelboard with bolt-in type heavy duty, quick-make, quick-break main circuit breaker suitable for service on a 480 volt, 3-phase, 4-wire system or as otherwise specified on the drawings. Panelboard shall be provided with UL markings indicating "SUITABLE FOR USE AS SERVICE-ENTRANCE EQUIPMENT".

16470.04 POWER PANELBOARDS:

Equip with copper bus bars and with full-size neutral bus; provide suitable lugs on neutral bus for outgoing feeders requiring neutral connections. Where multi-pole breakers are indicated, provide with common trip so overload on one pole will trip all poles simultaneously. Provide panelboards with bare uninsulated grounding bars suitable for bolting to enclosures.

16470.05 LIGHTING AND RECEPTACLE PANELBOARDS:

Provide dead-front safety type lighting and appliance panelboards as indicated on the drawings; with antiburn solderless pressure type lug connectors approved for copper conductors; equip with copper bus bars, and full-sized neutral bar. Provide suitable lugs on neutral bus for each outgoing feeder required; provide bare uninsulated grounding bars suitable for bolting to enclosures.

16470.06 INSTALLATION:

16470.06.01 The Electrical Contractor shall mount the panelboards in their assigned locations, as indicated on the drawings, install any interior component, complete the external connections, and install the exterior trim.

16470.06.02 Panelboards shall be installed level, plumb and parallel to building lines.

16470.06.03 Provisions shall be made and furnished by the Electrical Contractor to protect the panelboards from mechanical injury during construction.

16470.06.04 Panelboards shall not be defaced with marking pens, etc. For construction identification, marked tags may be affixed to the panels, provided they can be readily removed after installation. If the panelboards are in any way defaced; it shall be the Electrical Contractor's responsibility to restore the surface to the original condition and finish or replace the equipment.

APPENDIX A

GUNDLE LINING SYSTEMS, INC.

GUNDLE LINING CONSTRUCTION CORP

QUALITY ASSURANCE MANUAL FOR THE INSTALLATION OF HDPE LINING SYSTEMS

OCTOBER, 1989

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Terms of Reference

1.1.1 Purpose
1.1.2 Quality Assurance and Quality Control
1.1.3 Lining Materials
1.1.4 Scope of Quality Assurance
1.1.5 Units
1.1.6 References

1.2 Parties

1.2.1 Designer
1.2.2 Earthwork Contractor
1.2.3 Resin Supplier
1.2.4 Geomembrane Manufacturer
1.2.5 Installer
1.2.6 Transporter
1.2.7 Soils Quality Assurance Consultant
1.2.8 Geosynthetic Quality Assurance Laboratory
1.2.9 Owner
1.2.10 Project Manager

1.3 Meetings and Visits

1.3.1 Resolution Meeting
1.3.2 Pre-Construction Meeting
1.3.3 Progress Meetings
1.3.4 Manufacturing Plant Visits

2. GEOMEMBRANE MANUFACTURING AND DELIVERY

2.1 Manufacturing

2.1.1 Raw Materials
2.1.2 Geomembrane Manufacturing
2.1.3 Rolls

2.2 Delivery

2.2.1 Transportation and Handling
2.2.2 Storage

3. GEOMEMBRANE INSTALLATION

3.1 Crest Anchorage System

3.2 Geomembrane Placement

3.2.1 Field Panel Identification
3.2.2 Field Panel Placement

3.2.2.1 Location
3.2.2.2 Installation Schedule
3.2.2.3 Weather Conditions
3.2.2.4 Method of Placement
3.2.2.5 Damage

3.3 Field Seaming

3.3.1 Seam Layout
3.3.2 Seaming Equipment and Products
3.3.3 Seam Preparation
3.3.4 Weather Conditions for Seaming
3.3.5 Trial Seams
3.3.6 General Seaming Procedure
3.3.7 Nondestructive Seam Continuity Testing

3.3.7.1 Concept
3.3.7.2 Vacuum Testing

3.3.8 Destructive Testing

3.3.8.1 Concept
3.3.8.2 Location and Frequency
3.3.8.3 Sampling Procedure
3.3.8.4 Size of Samples
3.3.8.5 Field Testing
3.3.8.6 Laboratory Testing
3.3.8.7 Procedures for Destructive Test Failure

3.4 Defects and Repairs

3.4.1 Identification
3.4.2 Evaluation
3.4.3 Repair Procedures
3.4.4 Verification of Repairs

3.5 Backfilling of Anchor Trench

3.6 Lining System Acceptance

3.7 Soils in Contact with the Geomembrane

4. GEOTEXTILES AND GEONETS

4.1 Manufacturing and Testing

4.2 Shipment and Storage

4.3 Installation

4.4 Repairs

4.5 Placement of Cover Material

APPENDIX A Cold Temperature Seaming: Destructive Test Results

APPENDIX B Effect of Cooling Rates on Seam Integrity

EXHIBITS

1. INTRODUCTION

1.1 Terms of Reference

1.1.1 Purpose

This manual addresses the quality assurance and quality control of the installation of flexible membrane liners, and other geosynthetic products used by [redacted] in hazardous waste disposal landfills, surface impoundments or other installations as specified by the owner and/or engineer. This manual therefore delineates the quality procedures and standards for production and installation.

This manual reflects the requirements of the Hazardous and Solid Waste Amendments of 1984 to the Resource Conservation and Recovery Act (RCRA), and "Construction Quality Assurance for Hazardous Waste Land Disposal Facilities, Public Comment Draft", Document EPA/530-SW-85-021, October 1985.

1.1.2 Quality Assurance and Quality Control

In the context of this manual, quality assurance and quality control are defined as follows:

Quality Assurance - A planned and systematic pattern of all means and actions designed to provide adequate confidence that items or services meet contractual and regulatory requirements and will perform satisfactorily in service.

Quality Control - Those actions which provide a means to measure and regulate the characteristics of an item or service to contractual and regulatory requirements.

In the context of liner production and installation:

Quality assurance refers to means and actions employed by [redacted] and [redacted] to assure conformity of the lining system production and installation with the Quality Assurance Plan, drawings and specifications.

Quality control refers to those actions taken by the Manufacturer, Fabricator and Installer to ensure that the materials and the workmanship meet the requirements of the plans and specifications.

1.1.3 Lining Materials

The materials comprising the lining system include geosynthetics; geomembranes, geotextiles, and geonets manufactured from synthetic polymers.

For purposes of this document, the term "geomembrane" is applied to flexible membrane liners. More specifically "geomembrane" refers to polyethylene geomembranes made from resins with a specific gravity greater than 0.935 which includes those polymers known as high density polyethylene (HDPE).

The geomembranes are utilized either alone or in conjunction with low permeability soils as composite liners. Geomembranes are the key components of the lining system, and, therefore, none of the geomembrane requirements contained herein should be compromised in any way. Geotextiles, geonets and granular soils are utilized in combination for leachate collection systems.

The quality assurance of a geosynthetic liner system is addressed herein in its entirety, including all stages from manufacture to installation. The quality assurance of soils is only discussed relative to their interaction with the geosynthetics.

1.1.4 Scope of Quality Assurance and Quality Control

The scope of this manual includes the quality assurance applicable to manufacturing, shipment, handling, and installation of all geosynthetics. In particular, full time quality assurance of the installation of geomembranes and the installation of other geosynthetics is essential.

This manual does not address design guidelines, installation specifications, or selection of geomembranes and other geosynthetics (which includes compatibility between geosynthetic and contained material).

This manual does not address the quality assurance of soils, except in cases where soil placement may have an influence on the geosynthetics.

1.1.5 Units

In this manual, all properties and dimensions are expressed in U.S. units, with "equivalent" SI units in parentheses. It should be noted that the conversion is typically only accurate within ten percent. In cases of conflict or clarification, the U.S. units shall be deemed to govern.

1.1.6 References

The manual includes references to test procedures of the American Society for Testing and Materials (ASTM), the Federal Test Method Standards (FTMS) and the "Standards for Flexible Membrane Liners" of the National Sanitation Foundation (NSF). Recognizing the changing nature of the above standards and the geosynthetic industry at large, this manual is subject to periodic revision.

1.2 Parties (See Organization Chart - Next Page)

The completion of a particular lined system is dependent on the interaction of many parties. The parties discussed below are those associated with the ownership, design, specification, manufacture, fabrication, transportation, installation, quality assurance of the liner system. The qualifications of the Installer and Geosynthetic Quality Assurance Consultant are particularly critical to the successful completion of the lining systems, and must be emphasized in the Quality Assurance Plans.

1.2.1 Designer

The Designer is responsible for the design, drawings, plans, and specifications of the lining system.

1.2.2 Earthwork Contractor

The Earthwork Contractor is responsible for the preparation of the supporting soil on which the lining system is to be installed, and may also be the party responsible for placing earth and granular materials (if any) over the installed lining system.

1.2.3 Resin Supplier

The Resin Supplier produces and delivers the resin to the Manufacturer.

1.2.4 Geomembrane Manufacturer [redacted]

The Geomembrane Manufacturer is responsible for the production of geomembrane rolls from resin.

1.2.5 Installer [redacted]

The Installer is responsible for field handling, placing, seaming, loading (against wind), and other aspects of the geosynthetics installation.

1.2.6 Transporter

The Transporter transports the rolls of geomembrane between the Manufacturer and the site.

1.2.7 Soils Quality Assurance Consultant

The Soils Quality Assurance Consultant is normally a party, independent from the Owner, Manufacturer, Fabricator and Installer that is responsible for observing, testing, and documenting activities related to the quality assurance of the earthwork at the site. He is also responsible for issuing a certification report sealed by a Registered Professional Engineer.

1.2.8 Geosynthetic Quality Assurance Laboratory

The Geosynthetic Quality Assurance Laboratory is a party responsible for conducting tests on samples of geosynthetics.

1.2.9 Owner

The Owner owns, and/or is responsible for, the lined facility. In this manual the term "Owner" shall apply equally to "Operator"; i.e., the party responsible for operating the lined facility.

1.2.10 Project Manager

The Project Manager is the official representative of the owner. In this manual the term "Project Manager" shall apply equally to

"Construction Coordinator"; i.e., the individual in charge of coordinating field activities.

1.3 Meetings and Visits

To guarantee a high degree of quality during installation, open channels of communication are essential. To that end, meetings are critical.

1.3.1 Resolution Meeting

Following the completion of the design, plans, and specifications for the project, a Resolution Meeting may be held. This meeting shall include all parties involved, including [redacted] the Soil Quality Assurance Consultant, the Design Engineer, and the Project Manager.

The purpose of this meeting is to begin planning for coordination of tasks, anticipate any problems which might cause difficulties and delays in construction, and above all, present the Geosynthetic Quality Assurance Plan to all the parties involved. It is very important that the rules regarding testing, repair, etc., be known and accepted by all.

The first part of the Resolution Meeting may be devoted to a review of the design drawings and specifications for completeness and clarity.

This meeting should include (but not be limited to) all of the following activities:

Communicate to all parties any relevant documents;

Review critical design details of the project;

Review the panel layout drawing provided by [redacted]

Review the Geosynthetic Quality Assurance Manual and make any appropriate modifications;

Make any appropriate modifications to the Geosynthetic Quality Assurance Manual to ensure that it specifies all quality assurance activities that are necessary;

Ensure that a site specific addendum is developed;

Make any appropriate modifications to the design criteria, plans, and specifications so that the fulfillment of all design specifications or performance standards can be determined through the implementation of the site specific addendum;

Reach a consensus on the quality control procedures, especially on methods of determining acceptability of the lining system;

Assign responsibilities of each party; depending on the number of seaming crews and on the type of seaming equipment;

Establish lines of authority and communication;

Prepare a time schedule for all operations (see Section 3.2.2.2); and

Any other site specific items pertinent to the lining installation.

The meeting shall be documented by a person designated at the beginning of the meeting, and minutes shall be transmitted to all parties. In certain instances, the Resolution Meeting and Pre-Construction Meeting may be combined, provided that all provisions of 1.3.1 and 1.3.2 are addressed.

1.3.2 Pre-Construction Meeting

A Pre-Construction Meeting shall be held at the site. As a minimum, the meeting shall be attended by [redacted] the Earthwork Contractor, the Soils Quality Assurance Engineer, and the Project Manager.

Specific topics considered for this meeting include:

Develop a site specific addendum;

Review the responsibilities of each party;

Review lines of authority and communication;

Review methods for documenting and reporting and for distributing documents and reports;

Establish rules for writing on the geomembrane; i.e., who is authorized to write, what can be written and in which color;

Outline procedures for packing and storing archive samples;

Review the time schedule for all operations;

Conduct a site walk-around to verify that earthwork construction is proceeding on schedule and to review material storage locations;

Review panel layout and numbering systems for panels and seams;

Finalize field cutout sample sizes;

Review seam testing procedures;

Review repair procedures; and

Review precautions to be taken against clay cracking (surface desiccation).

The meeting shall be documented by a person designated at the beginning of the meeting, and minutes shall be transmitted to all parties. In certain instances, the Resolution Meeting and Pre-Construction Meeting may be combined, provided that all provisions of 1.3.1 and 1.3.2 are addressed.

1.3.3 Progress Meetings

A daily progress meeting shall be held between the Earthwork Manager, [redacted] the Project Manager, and any other concerned parties. This meeting shall discuss current progress. Any matter requiring action which is raised in this meeting shall be reported to the appropriate parties.

1.3.4 Manufacturing Plant Visits

A geomembrane manufacturing plant visit may be carried out by a representative of the Owner or his designated alternate if he so chooses.

2. GEOMEMBRANE MANUFACTURING AND DELIVERY

2.1 Manufacturing

2.1.1 Raw Material

The raw material shall be first quality polyethylene resin containing no more than 2% clean recycled polymer by weight, and meeting the following specifications:

Specific Gravity (ASTM D792 Method A or ASTM D1505): $\geq$ .935

Melt Index (ASTM D1238 Condition 190/2.16):0.05 - 0.3 g/10 min

Quality control testing shall be carried out by [redacted] to demonstrate that the product meets this specification.

Prior to project completion, [redacted] shall provide the Project Manager with the following information:

The origin (resin supplier's name, resin production plant), identification (brand name, number) and production date of the resin;

A copy of the quality control certificates issued by the resin supplier noting results of density and melt index (see Figures 1 and 2 for examples of certificates)

Reports on the tests conducted by GLS to verify the quality of the resin used to manufacture the geomembrane rolls assigned to the considered facility [these tests should include specific gravity (ASTM D792 Method A or ASTM D1505) and melt index (ASTM D1238 Condition 190/2.16)];

Reports on the tests conducted by [redacted] to verify the quality of the sheet.

2.1.2 Geomembrane Manufacturing

[redacted] shall provide the Project Manager/Owner with the following:

A properties sheet including, at a minimum, all specified properties, measured using test methods indicated in the specifications, or equivalent; (Please see example of material spec. sheet in Figure 3.);

A list of the descriptions of the base polymers which comprise the geomembrane,

The sampling procedure and results of testing; and

A certification that property values given in the properties sheet are guaranteed by the Geomembrane Manufacturer.

The Owner or Owner's Representative shall verify that:

The property values certified by the Geomembrane Manufacturer meet all of the specifications; and

The measurements of properties by the Geomembrane Manufacturer are properly documented, and that the test methods used are acceptable.

2.1.3 Rolls

After receipt of material, [redacted] shall provide the Project Manager with one quality control certificate for every two rolls of geomembrane provided. The quality control certificate shall be signed by a responsible party. The quality control certificate shall include:

Roll numbers and identification; and

Results of quality control tests. As a minimum, results shall be given for thickness, tensile strength, and tear resistance, evaluated in accordance with ASTM test the methods approved by the Designer. (A standard quality control certificate is included in Figure 4).

2.2 Delivery

2.2.1 Transportation and Handling

Transportation of the geomembrane will be performed by [redacted], [redacted] or other party as agreed upon. If geomembrane arrives on site prior to [redacted] project personnel, customer is responsible for off-loading rolls. Material, when off-loaded, should be placed on a smooth surface free of rocks or any other protrusions which may damage the material. No special covering is necessary.

The following should be verified prior to off-loading the geomembrane:

Handling equipment used on the site is adequate and does not pose any risk of damage to the geomembrane; and

Personnel will handle the geomembrane with care.

Upon arrival at the site, [redacted] shall conduct a surface observation of all rolls for defects and for damage. This inspection shall be conducted without unrolling rolls unless defects or damages are found or suspected. [redacted] shall indicate to the Project Manager:

Rolls or factory panels which include minor repairable flaws.

2.2.2 Storage

The Project Manager shall provide storage space in a location (or several locations) such that on-site transportation and handling are minimized. Storage space should be protected from theft, vandalism, passage of vehicles, and be adjacent to the area to be lined.

3. GEOMEMBRANE INSTALLATION

3.1 Crest Anchorage System

The anchor trench shall be excavated by the Earthwork Contractor (unless otherwise specified) to the lines and widths shown on the design drawings, prior to geomembrane placement.

If the anchor trench is excavated in a clay liner susceptible to desiccation, no more than the amount of trench required for the geomembrane to be anchored in one day shall be excavated (unless otherwise specified) to minimize desiccation potential of the anchor trench clay soils.

Slightly rounded corners shall be provided in the trench where the geomembrane adjoins the trench so as to avoid sharp bends in the geomembrane. No loose soil shall be allowed to underlie the geomembrane in the anchor trench.

Backfilling of the anchor trench shall be conducted in accordance with Section 3.5.

3.2 Geomembrane Placement

Immediately prior to installation of the designed geomembrane liner, the surface shall be observed by [redacted] and the owner or the owner's representative. The decision to repair cracks, if any, shall be made only by the Project Manager. The subgrade shall be walked by [redacted] and the Project Manager for joint approval. [redacted] will sign acceptance of the surface condition of the subgrade. The integrity of the underlying soil is the responsibility of the owner/earth work contractor. (Please note Figure 5 for example of Pre-start Site Inspection Certificate of Acceptance).

Subgrade Preparation Recommendations

No liner shall be placed on surfaces not previously found acceptable by the [redacted] project manager or his agent.

Surfaces to be lined shall be flat within ± 0.2 feet in any 100 square feet. All intersections between planes shall be made along straight lines. No sharp stones or other hard objects that will not pass through a 3/8 inch screen shall be present in the top 1 inch of the surfaces to be covered.

Surfaces to be lined shall be smooth and free of all rocks, sharp stones, sticks, roots, sharp objects, or debris of any kind. The surface should provide a firm, unyielding foundation for the membrane with no sudden, sharp or abrupt changes or break in grade.

3.2.1 Field Panel Identification

A field panel is the unit area of geomembrane which is to be seamed in the field; i.e., a field panel is a roll or a portion of roll cut in the field.

At the time of installation, the [redacted] Field Supervisor shall give each field panel an "identification code" (number or letter-number) consistent with the layout plan. This identification code shall be agreed upon by the Project Manager. This field panel identification code shall be as simple and logical as possible.

3.2.2 Field Panel Placement

3.2.2.1 Location

Field panels are installed at the location indicated in the layout plan, or as modified by the [redacted] Field Supervisor based upon existing site conditions.

3.2.2.2 Installation Schedule

Field panels may be installed using any one of the following schedules:

All field panels are placed prior to field seaming (in order to protect the subgrade from erosion by rain or wind);

Field panels are placed one at a time, and each field panel is seamed immediately after its placement (in order to minimize the number of unseamed field panels); and

Any combination of the above.

[redacted] shall record the identification code, location, and date of installation of each field panel (see Figure 6, example of Daily Progress Report). Daily Progress Report to be submitted to Project Manager for forwarding to Engineer (Owner) also on a daily basis.

3.2.2.3 Weather Conditions

Welding shall not take place during any precipitation, in the presence of excessive moisture (e.g., fog, dew), in an area of ponded water, or in the presence of excessive winds (unless wind barriers are provided).

3.2.2.4 Method of Placement

[redacted] shall verify the following:

Any equipment used does not damage the geomembrane by handling, trafficking, excessive heat, leakage of hydrocarbons, or other means;

The prepared surface underlying the geomembrane has not deteriorated since previous acceptance and is still acceptable immediately prior to geomembrane placement;

Any geosynthetic elements immediately underlying the geomembrane are clean and free of debris;

All personnel working on the geomembrane do not smoke, wear damaging shoes, or engage in other activities which could damage the geomembrane;

The method used to unroll the panels does not cause scratches or crimps in the geomembrane and does not damage the supporting soil;

The method used to place the panels minimizes wrinkles (especially differential wrinkles between adjacent panels);

Adequate temporary loading and/or anchoring (e.g., sand bags, tires), not likely to damage the geomembrane, has been placed to prevent uplift by wind (in case of high winds, continuous loading, e.g., by adjacent sand bags, or soil is recommended along edges of panels to minimize risk of wind flow under the panels);

Direct contact with the geomembrane is minimized; i.e., the geomembrane is protected by geotextiles, extra geomembrane, or other suitable materials in areas where excessive traffic may be expected.

[redacted] shall inform the Project Manager if the above conditions are not fulfilled.

3.2.2.5 Damage

[redacted] shall inspect each panel after placement and prior to seaming for damage. [redacted] shall advise the Project Manager which panels or portions of panels should be repaired or accepted. Damaged panels or portions of damaged panels which have been rejected shall be marked and their removal from the work area recorded by [redacted]. Repairs shall be made according to procedures described in Section 3.4.

3.3 Field Seaming

3.3.1 Seam Layout

Upon commencement of the installation, GLCC shall provide the Project Manager with a proposed panel layout drawing; i.e., a drawing of the facility to be lined based upon submitted engineering drawings. The proposed panel layout drawing is tentative and may be modified by [redacted] Field Supervisor with Project Manager approval.

In general, seams should be oriented parallel to the line of maximum slope; i.e., oriented along, not across, the slope. In corners and odd-shaped geometric locations, the number of seams should be minimized. No horizontal seam should be less than 5 feet (1.5 m) from the toe of the slope or areas of potential stress concentrations unless otherwise authorized.

A seam numbering system compatible with a panel numbering system shall be agreed upon at the Resolution and/or Pre-Construction Meeting.

3.3.1.1 Field joints shall be made by overlapping adjacent sheets a minimum of 3.5 inches (unless approved by the engineer).

3.3.1.2 HDPE pipe sleeves shall be used at pipe sleeves penetrating through waterproofing. The pipe shall be sealed as shown. The HDPE waterproofing sheet shall be extrusion welded to the HDPE pipe sleeve.

3.3.2 Seaming Equipment and Products

The approved processes for field seaming are extrusion welding and fusion (hot wedge) welding. Proposed alternate processes shall be documented and submitted to the Owner or his representative for his approval.

The extrusion welding apparatus shall be equipped with gauges giving the temperature of the apparatus at the nozzle.

The fusion-welding apparatus must be an automated vehicular-mounted device which produces a double seam with an enclosed space.

The fusion welding apparatus shall be equipped with gauges giving the applicable temperatures.

[redacted] shall log apparatus temperatures, extrudate temperatures, ambient temperatures, and geomembrane surface temperatures at appropriate intervals.

[redacted] shall verify that:

Equipment used for seaming is not likely to damage geomembrane;

The extrusion welder is purged prior to beginning a seam until all heat-degraded extrudate has been removed from the barrel;

The electric generator is placed on a smooth base such that no damage occurs to the geomembrane;

Buffing shall be completed no more than one (1) hour prior to extrusion welding;

A smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage; and

The geomembrane is protected from damage in heavily trafficked areas.

3.3.3 Seam Preparation

[redacted] shall verify that:

Prior to seaming, the seam area is clean and free of moisture, dust, dirt, debris of any kind, and foreign material;

Seams are aligned with the fewest possible number of wrinkles and "fishmouths".

3.3.4 Weather Conditions for Seaming

The normally required weather conditions for seaming are as follows:

The high temperature limit for extrusion welding is 110 degrees Fahrenheit

Unless authorized in writing by the Project Manager, no seaming shall be attempted at ambient temperatures below 5 degrees Fahrenheit

The colder the weather, the slower the welding speeds possible for effective welding. Further detail for cold weather welding follows in this section.

In all cases, the geomembrane shall be dry and protected from wind.

[redacted] shall verify that these weather conditions are fulfilled and will advise the Project Manager if they are not. The Project Manager shall then decide if the installation shall be stopped or postponed.

Cold Weather Seaming of HDPE Liners

Cold weather welding restrictions exist because problems associated with hot air seaming techniques have been mistakenly applied to the [redacted] extrusion welds. The [redacted] extrusion weld, however, has been successfully employed in cold weather on several dozen job sites. With the assistance of preheating the sheet, the [redacted] weld has been applied as low as -5 degrees Fahrenheit. Both the [redacted] extrusion weld and hot wedge weld are able to overcome cold weather welding restrictions because of their unique designs.

[redacted] extrusion weld is not solely temperature dependent. It combines pressure, extrudate, and mixing action in addition to temperature, to bond the liner together. The mixing action means that convective heat transfer takes place in addition to conductive heat transfer. Overall heat transfer is thus improved and sensitivity to ambient temperature is dramatically reduced.

The [redacted] extrusion welder is capable of continuously monitoring and controlling the temperatures of the extrudate and the zone of contact for independence of environmental conditions. To control the molten bead temperature accurately and to ensure no fluctuation out of the predetermined range the machine has:

a. An over capacity heater band on the extruder.

b. An extra over capacity heater band on the nozzle.

c. A separate proportional temperature controller for each heater band.

d. The nozzle thermocouple positioned approximately 1/8 inch from the end of the nozzle which rides on sheet.

The [redacted] hot wedge welder comes equipped with a hot air blower attached to the welder which automatically preheats the sheet in the path of the hot wedge. Temperature controls can be adjusted to guarantee fully integrated welding as demonstrated by peel testing.

Destructive testing results are included in Appendix "A" from two cold weather installments where the welding temperatures were known not to exceed 10 degrees F (Wamsutter, WY, 2/14/85 and Midland, Michigan, 1/13/86). The failure rates compare quite favorably with summertime work and indicate that the cold weather conditions did not imply bad welds for the Gundle welds.

Also enclosed in Appendix "B" is a study determining the effect of accelerated cooling upon seam integrity. As the report concludes, there is no difference between quick weld cooling and slow weld cooling in either seam integrity (destructive testing) or internal percent crystallinity of the polymer. Accelerated cooling due to cold weather welding is not detrimental to the seam.

But to guarantee quality welding in cold weather, the following procedures are recommended for Gundle welds:

1. The sheet should be preheated before welding any time ice crystals are present in the weld path.

2. When strong winds are present, a shield of some sort should be set in place to prevent large convection heat losses from the welding gun during seaming. (Tunnels over the seams were used for such a purpose at the Midland, Michigan project.)

3. Test welds should always be prepared and tested before seaming in order to gauge appropriate welding conditions. (Example: Gun temperatures should be set higher and welding rates slowed down.)

3.3.5 <u>Trial Seams</u>

Trial seams shall be made on fragment pieces of geomembrane liner to verify that seaming conditions are adequate. Such trial seams shall be made at the beginning of each seaming period (start of day, mid-day, and anytime equipment is shut down) for each seaming apparatus used. Trial seams shall be made under the same conditions as actual seams (see Fig. 7, example of Pre-Weld Qualification form).

The trial seam sample shall be at least 3 feet (1.0 m) long by 1 feet (0.3 m) wide (after seaming) with the seam centered lengthwise. Seam overlap shall be nominally 4 inches; 3 inches minimum.

Two adjoining specimens each 1 inch (25 mm) wide, shall be cut from the trial seam sample by the installer. The specimens shall be tested respectively in shear and peel using a field tensometer, and they should not fail in the seam. If the additional specimen fails, the entire operation shall be repeated. If the additional specimen fails, the seaming apparatus and seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive successful full trial welds are achieved.

3.3.6 <u>General Seaming Procedure</u>

Unless otherwise specified, the general seaming procedure used by [redacted] shall be as follows:

The rolls of membrane shall be overlapped by a minimum of four (4) inches (100 mm) for fusion welding and three (3) inches (75 mm) for extrusion welding.

"Fishmouths" or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle in order to achieve a flat overlap. The cut "fishmouths" or wrinkles shall be seamed and any portion where the overlap is inadequate shall then be patched with an oval or round patch of the same geomembrane extending a minimum of 6 inches beyond the cut in all directions.

Seaming shall extend up the panels, 6 inches past the crest of the anchor trench.

All cross seams are to be extrusion welded where they intersect.

For fusion welding, a movable protective layer of plastic may be required to be placed directly below the overlapped membranes being seamed. This is to prevent any moisture buildup between the sheets to be welded.

3.3.7 Nondestructive Seam Continuity Testing

3.3.7.1 Concept

[redacted] shall nondestructively test all field seams over their full length using a vacuum test unit, air pressure testing, or other approved method. (Vacuum testing is described in Section 3.3.7.2 and air pressure testing is described in Section 3.3.7.3). The purpose of nondestructive tests is to check the continuity of seams. It does not provide information on seam strength. Continuity testing shall be carried out as the seaming work progresses, not at the completion of all field seaming.

3.3.7.2 Vacuum Testing

The equipment shall be comprised of the following:

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 gauge to indicate chamber vacuum;

A steel vacuum tank and pump assembly equipped with a pressure controller and pipe connections;

A rubber pressure/vacuum hose with fittings and connections;

A bucket and wide brush or spray assembly;

A soapy solution;

The following procedures shall be followed:

Energize the vacuum pump and reduce the tank pressure to approximately 5 psi (10 inches. of Hg.) gauge;

Wet a strip of geomembrane approximately 12 inches by 48 inches (0.3 m by 1.2 m) with the soapy solution;

Place the box over the wetted area;

Close the bleed valve and open the vacuum valve;

Ensure that a leak tight seal is created;

For a period of approximately 5 to 10 seconds, examine the geomembrane through the viewing window for the presence of soap bubbles;

If no bubble appears after 10 to 15 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3 inches (75 mm) overlap, and repeat the process;

All areas where soap bubbles appear shall be marked and repaired in accordance with Section 3.4;

Vacuum tested seams are recorded on Daily Progress Reports (Figure 6).

3.3.7.3 Air Pressure Testing (For Double Fusion Seam Only)

The equipment shall be comprised of the following:

an air pump (manual or motor driven) equipped with pressure gauge capable of generating and sustaining a pressure between 25 and 30 psi (160 and 200 kPa);

a rubber hose with fittings and connections;

a sharp hollow needle, or other approved pressure feed device.

The following procedures shall be followed:

seal both ends of the seam to be tested;

insert needle or other approved pressure feed device into the tunnel created by the fusion weld;

energize the air pump to a pressure between 25 and 30 psi (160 and 200* kPa), close valve, and sustain pressure for approximately five minutes;

if loss of pressure exceeds 2 psi (15 kPa), or does not stabilize, locate faulty area and repair in accordance with Section 3.4;

remove needle or other approved pressure feed device and seal.

3.3.8 Destructive Testing

3.3.8.1 Concept

Destructive seam tests shall be performed at preselected locations. The purpose of these tests is to check that welds are fully integrated with each other and to evaluate seam strength. Seam strength testing shall be done as the seaming work progresses, not at the completion of all field seaming.

3.3.8.2 Location and Frequency

The owner and/or owner's representative shall select locations where seam samples will be cut. These locations shall be established as follows:

A minimum frequency of two samples per day when welding. This minimum frequency is to be taken throughout the entire facility.

A maximum frequency shall be agreed upon by [redacted] and the Project Manager at the Resolution and/or Pre-Construction Meeting.

The seaming technician shall not be informed in advance of the locations where the seam samples will be taken.

3.3.8.3 Sampling Procedure

Samples shall be cut by [redacted] as the seaming progresses in order to have laboratory test results before the geomembrane is covered by another material. [redacted] shall:

Cut samples;

Assign a number to each sample which is to be based upon seam and sample number and mark it accordingly (see Figure 8, example of sample sticker);

Record sample location on layout drawing; and

All holes in the geomembrane resulting from destructive seam sampling shall be immediately repaired in accordance with repair procedures described in Section 3.4. The continuity of the new seams in the repaired area shall be tested according to Section 3.3.7.

3.3.8.4 <u>Size of Samples</u>

At a given sampling location, two types of samples shall be taken by the Installer.

First, two samples for field testing should be taken. Each of these samples shall be 1 inch (0.25 mm) wide by 12 inches (0.3 m) long with the seam centered parallel to the length. The distance between these two samples shall be 38 inches (.97 m).

If both samples pass the field test described in Section 3.3.8.5, a sample shall be cut into three parts and distributed as follows:

One portion to the Installer [redacted] for laboratory testing [redacted] 12 inches X 12 inches (0.3 m x 0.3 m);

One portion for Geosynthetic Quality Assurance Laboratory testing if applicable, 12 inches x 12 inches (0.3 m x 0.3 m); and

One portion to the Owner for archive storage, 12 inches x 12 inches (0.3 m x 0.3 m).

Final determination of the sample sizes shall be made at the Pre-Construction Meeting.

3.3.8.5 <u>Field Testing</u>

The two 1 inch (25 mm) wide strips, mentioned in Section 3.3.8.4 shall be tested in the field for peel and shear and shall not fail in the seam. If any field test sample fails to pass, then the procedures outlined in 3.3.8.7 shall be followed.

3.3.8.6 <u>Laboratory Testing</u>

Destructive test samples shall be packaged and shipped via express mail to [redacted]s laboratory.

GLS Laboratory shall provide verbal test results no more than 24 hours after they receive the samples. Written results will follow within one week. (See Figure 9, example of destructive seam test report form.)

Hand tensometer testing in the field is also carried out. The following procedure is followed: If the test passes, the sample qualifies for testing in the laboratory. If it fails, the seam should be repaired in accordance with Section 3.4.

Destructive Testing of Seams

Destructive testing of seams is very important because it provides the only direct evaluation of seam strength and bonding efficiency which indicates seam durability.

Destructive testing involves two techniques: 1) shear testing, and 2) peel testing. Shear testing applies a tensile stress from the top sheet through the weld and into the bottom sheet. Peel testing, on the other hand, peels the top sheet back against the overlapped edge of the bottom sheet in order to observe how separation occurs. The peel test indicates whether or not the sheets are continuously and homogeneously connected through the seam.

Pass/Fail Criteria

Test	Type of Separation Req'd to Pass	Minimum Recorded Stress Necessary To Pass (lbs. per inch width) (mil): 20	30	40	60	80	100
Shear (ASTM D3083)	FTB[1]	45*	63*	86*	126*	171*	216*
Peel (ASTM D413)	FTB[1]	25*	35*	48*	70*	95*	115*

FTB[1] = Film Tearing Bond. Polymer material tears, indicating a fully integrated connection between top and bottom sheets. (FTB separations are pictorially defined in Figure 10.)

* stresses only apply for FTB separations in weld. When tearing occurs in the sheet, minimum stresses are not necessary; FTB becomes only criteria.

Reasons for Pass/Fail Criteria

The FTB requirement is very important. With a fully integrated, continuous connection through the seam, no weld bead/sheet or sheet/sheet interface exists. Such an interface might be separated by absorbed chemicals, causing failure of the seam.

In addition to the FTB criterion a minimum stress level is specified. This is important in order to protect against legitimate tearing of a thin portion of polymer in the weld (as might occur if the weld is off center).

The minimum stress levels are necessarily lower than tensile yield strengths because of the different configuration of the test specimens during destructive testing. Bending moments come into play along with straight tensile stresses especially as the sheets are bent back in peel. These bending moments depend on the shape of the welds which vary even within the same welding technique. The minimum stress values are based on the average performance of hundreds of good weld specimens tested in the laboratory.

3.3.8.7 Procedures for Destructive Test Failure

The following procedures shall apply whenever a sample fails a destructive test. [redacted] has two options:

1) Reconstruct the seam between any two passed test locations,

2) Trace the welding path to an intermediate locations [10 feet maximum from the point of the failed test in each direction] and take a small sample for an additional field test at each location. If these additional samples pass the field test, then full laboratory samples are taken. If these laboratory samples pass the tests, then the seam is reconstructed between these locations. If either sample fails, then the process is repeated to establish the zone in which the seam should be reconstructed.

All acceptable seams must be bounded by two locations from which samples passing laboratory destructive tests have been taken.

[redacted] shall document all actions taken in conjunction with destructive test failures; e.g., capping of failed seam area.

3.4 Defects and Repairs

3.4.1 Identification

All seams and non-seam areas of the geomembrane shall be examined by [redacted] for identification of defects, holes, blisters, undispersed raw materials and any sign of contamination by foreign matter.

3.4.1.1 Defective/damaged materials shall be identified via a deficiency report, either separately or on the Daily Report. Actions taken to resolve or correct the problem will also be recorded on the similar form.

3.4.1.2 Defects, holes, blisters, undispersed raw materials, signs of contamination by foreign matter, unacceptable welds and other unsatisfactory conditions will be identified on the Daily

Report form. The repair/corrective action to "fix" the problem will also be recorded on a similar form.

3.4.2 Evaluation

Each suspect location both in seam and non-seam areas shall be non-destructively tested using the methods described in Section 3.3.7 as appropriate. Each location which fails the non-destructive testing shall be marked by GLCC and repaired. Work shall not proceed with any materials which will cover locations which have been repaired until laboratory test results with passing values are available.

3.4.3 Repair Procedures

Any portion of the geomembrane exhibiting a flaw or failing a destructive or nondestructive test shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be agreed upon between the Project Manager and [redacted] The procedures available include:

Patching--used to repair large holes, tears, and contamination by foreign matter;

Buffing and re-welding--used to repair small sections of extruded seams;

Spot welding or seaming--used to repair small tears, pinholes, or other minor localized flaws;

Capping--used to repair large lengths of failed seams;

Topping--used to repair areas of inadequate seams which have an exposed edge;

In addition, the following provisions shall be satisfied:

Surfaces of the geomembrane which are to be repaired shall be abraded no more than one hour prior to the repair;

All surfaces must be clean and dry at the time of the repair;

All seaming equipment used in repairing procedures must be approved;

The repair procedures, materials, and techniques shall be approved in advance of the specific repair by the Project Manager and [redacted]

Patches or caps shall extend at least 6 in. beyond the edge of the defect, and all corners of patches shall be rounded with a radius of at least 3 inches.

3.4.4 Verification of Repairs

Each major repair requiring a patch or cap shall be identified on the as-built drawing. Each repair shall be non-destructively tested using the methods described in Section 3.3.7 as appropriate. Repairs which pass the non-destructive test shall be taken as an indication of an adequate repair. Failed tests indicate that the repair shall be re-done and re-tested until a passing test results.

3.5 Backfilling of Anchor Trench

The anchor trench, if any, shall be adequately drained to prevent ponding or otherwise softening of the adjacent soils while the trench is open. The anchor trench shall be backfilled by the Earthwork Contractor or as outlined in the specifications and bid documents.

Since backfilling the anchor trench can affect material bridging at toe of slope, consideration should be given to backfill the liner at its most contracted state; preferably during the cool of the morning or extended period of over-cast skies. Care shall be taken when backfilling the trenches to prevent any damage to the geosynthetics.

3.6 Lining System Acceptance

The geosynthetic lining system shall be accepted when:

The installation or portion for backfilling is finished;

Verification of the adequacy of all seams and repairs including associated testing is complete;

All documentation for installation is completed, and submitted to the engineer.

3.7 Soils in Contact with the Geomembrane

Important points for quality assurance of soils in contact with geomembranes include:

A geotextile or other cushion approved by the designer may be installed between angular aggregate and the geomembrane.

Equipment used for placing soil shall not be driven directly on the geomembrane.

A minimum thickness of 1 foot (0.3 m) of soil is recommended between a light dozer (such as a CAT D-3 or wide track caterpillar D-6 or lighter) and the geomembrane.

In heavily trafficked areas such as access ramps, soil thickness should be at least 2 to 3 feet (0.6-0.9m).

Soil/Earth Cover on top of Geomembrane

Placement of soils, sand or other types of earth cover on top of the liner shall not be performed until all destructive and non-destructive testing has been performed and accepted.

Placement should be performed to minimize wrinkles. Equipment operations should be briefed on method of placement and affects to thermal expansion and contraction of the liner.

Material placed on top of the liner should be stock piled and displaced off the stockpile to create a cascading effect of the cover material on top the liner.

If a wrinkle forms, every effort should be made to walk the wrinkle out.

Minor folding over of wrinkles is acceptable providing an even transition occurs at the tail of the wrinkle. If excessive stress points are created at the tail of the wrinkle, the wrinkle should be cut out and repaired per Section 3.4.

These points shall be observed by GLCC.

4. GEOTEXTILE AND GEONET

4.1 Manufacturing and Testing

4.1.1 GLS will provide a list of guaranteed minimum average roll value properties for the specified geotextile to be installed.

4.1.2 GLS will provide a list of guaranteed minimum physical properties for the specified geonet to be installed.

4.1.3 Each roll of geotextile and geonet shall bear a label which identifies the following:

Manufacturer
Product identification
Unique roll or lot number
Roll dimension

4.2 Shipment and Storage

4.2.1 Geotextile

During shipment and storage, the geotextile shall be protected from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions. To that effect, geotextile rolls shall be shipped and stored in relatively opaque and watertight wrappings.

Geotextiles shall not be exposed to precipitation prior to being installed. Geotextile shall not be exposed to sunlight for more than 15 days unless otherwise specified and guaranteed by the geotextile manufacturer.

4.2.2 Geonet

Geonets shall be shipped and stored in such a manner that the material is protected from mud, dirt, and damage.

4.3 Installation

4.3.1 Geotextile and geonets shall be handled in such a manner as to ensure they are not damaged in any way.

4.3.1.1 On slopes, geotextiles and geonets shall be anchored in the anchor trench; then rolled down the slope in such a manner as to continually keep the material in tension.

4.3.1.2 In the presence of wind, the materials shall be weighted with sandbags until final covers are installed.

4.3.1.3 Care shall be taken to assure that any underlying layers are not damaged during placement of geo-textiles and geogrid.

4.3.1.4 Care shall be taken to assure that stones, mud, and dirt are not entrapped in the geotextile and geonet during placement and seaming operations.

4.3.2 Geotextiles may be installed by overlapping one foot and thermally bonding on a spot or continuous basis, or by sewing as specifications dictate.

If sewing is required, thread shall be a polymeric material with chemical resistance similar to the geotextile.

4.3.3 Geonets may be butt joined or lapped. Nylon cable ties shall be applied to the net edge at 5 foot intervals along the edge.

End splices shall be made as follows: On slopes, the ends shall overlap 2 feet and two rows of cable ties applied.

On bottoms, the ends shall overlap a minimum of 2 inches and one row of three cable ties applied.

4.4 Repairs

4.4.1 Any holes or tears in geotextiles shall be repaired by patching with the same geotextile. The patch shall be a minimum of 12 inches larger in all directions than the area to be repaired and shall be spot bonded thermally.

4.4.2 Any holes or tears in geonets shall be repaired by patching with the same geonet. The patch shall be a minimum of 12" larger in all directions than the area to be repaired. The patch shall be tied in place using a minimum of four nylon cable ties.

4.5 Placement of Cover Material

Any cover material such as soil or geomembrane liners which is placed over geotextiles or geonets shall be placed in such a manner as to assure that the geotextile and geonet are not damaged.

Care shall be taken to minimize any slippage of the geotextile and geonet and to assure that no tensile stress is induced in the materials.

APPENDIX A

COLD TEMPERATURE SEAMING:

DESTRUCTIVE TEST RESULTS

Gundle

AMBIENT TEMP. 5°F

LABORATORY REPORT # 661

DATE: 2/14/85

SUBJECT:

Quality control testing of site welds from WAMSUTTER, WYOMING
GUNDLINE HD 30 MIL. (extrusion weld)

TEST METHOD:

ASTM D638 Type IV dumb-bells were used for peel and shear testing of the welds.

TEST RESULTS: (FTB = Film Tearing Bond)

Seam/Sample	Thickness	Peel		Shear
		Failure Type	Failure Stress, ppi	Yield, ppi
3901/3901	28	FTB	72	92
3887/3887	28	FTB	72	88
3893/3893	28	FTB	68	88
3903/3903	29	FTB	60	96
3962/3900	28	FTB	60	96
4676/4877	28	FTB	76	92
4677/4877	28	FTB	72	96
4678/4678	29	FTB	72	92

Total number of samples tested in peel: 16
Total number of samples tested in shear: 8

SHEAR

Average yield strength of weld: 93

Minimum yield strength of sheet: 70

$\frac{\text{Weld Yield Strength}}{\text{Sheet Yield Strength}} =$ 100%

PEEL

Average break strength of passing weld: 69

$\frac{\text{Weld Break Strength}}{\text{Sheet Yield Strength}} =$ 100%

Rev.1
9/88

Gundle

Laboratory Report # 661

Page 2

Percent of Samples Peeled: 0%

CONCLUSION:

ALL WELD SAMPLES PASSED.

Sengthong Phouangsavanh
Senior Lab Technician

Rev.1
9/88

Gundle

AMBIENT TEMP. 10°F

LABORATORY REPORT #1203

DATE: 1/13/86

SUBJECT:

Quality control testing of site welds from MIDLAND, MICHIGAN
GUNDLINE HD 100 MIL (extrusion weld) 02/166

TEST METHOD:

ASTM D638 Type IV dumb-bells were used for peel and shear testing of the welds.

TEST RESULTS: (FTB = Film Tearing Bond)

Seam/Sample	Thickness	Peel Failure Type	Peel Failure Stress, ppi	Shear Yield, ppi
14A	100	FTB	180	288
15	106	FTB	128	244
15A	103	FTB	164	248
16	106	FTB	158	288
17	100	2 PEEL	140	256
18	109	FTB	152	288
19	110	FTB	164	280

Total number of samples tested in peel: 14
Total number of samples tested in shear: 7

SHEAR

Average yield strength of weld: 270

Minimum yield strength of sheet: 240

$\frac{\text{Weld Yield Strength}}{\text{Sheet Yield Strength}} =$ 100%

PEEL

Average break strength of passing weld: 155

$\frac{\text{Weld Break Strength}}{\text{Sheet Yield Strength}} =$ 65%

Rev.1
9/88

Gundle

Laboratory Report # 1203

Page 2

Percent of Samples Peeled: 14%

CONCLUSION:

ALL WELD SAMPLES PASSED EXCEPT SAMPLE 17.

Sengthong Anouangsavanh
Senior Lab Technician

Gundle

AMBIENT TEMP. 10°F

LABORATORY REPORT #1204

DATE: 1/13/86

SUBJECT:

Quality control testing of site welds from GUNDLINE HD 100 MIL (extrusion weld) — MIDLAND, MICHIGAN 02/166

TEST METHOD:

ASTM D638 Type IV dumb-bells were used for peel and shear testing of the welds.

TEST RESULTS: (FTB = Film Tearing Bond)

Seam/Sample	Thickness	Peel Failure Type	Peel Failure Stress, ppi	Shear Yield, ppi
B-6	99	FTB	176	256
E-10	104	FTB	124	272
N-23	103	FTB	144	264
26	105	FTB	90	288
25-E-48	107	FTB	188	248
14-E-48	106	FTB	188	280
W-48	103	FTB	162	248
W-54	100	FTB	128	272
N-57	102	2 PEEL	96	280
N-59	107	FTB	156	280

Total number of samples tested in peel: 20
Total number of samples tested in shear: 10

SHEAR

Average yield strength of weld: 269

Minimum yield strength of sheet: 240

$\frac{\text{Weld Yield Strength}}{\text{Sheet Yield Strength}}$ = 100%

PEEL

Average break strength of passing weld: 145

$\frac{\text{Weld Break Strength}}{\text{Sheet Yield Strength}}$ = 60%

Rev.1
9/88

Gundle

Percent of Samples Peeled: 10%

CONCLUSION:

ALL WELD SAMPLES PASSED EXCEPT SAMPLE N-57.

Sengthong Phouangsavath
Senior Lab Technician

APPENDIX B

EFFECT OF COOLING RATE ON SEAM INTEGRITY

LABORATORY REPORT # 1117

NOVEMBER 22, 1985

THE EFFECT OF ACCELERATED COOLING ON SEAM INTEGRITY

SUBJECT:

Because accelerated cooling of seams during installation prevents the formation of "fishmouths" and improves the efficiency of welding, this study was initiated to determine if "water-cooled" extrusion welds were equivalent to normal "air-cooled" extrusion welds.

EXPERIMENTAL:

Standard welding practices for a 60 mil Gundline HD sheet were followed. These practices included preliminary beveling, leistering, and grinding of the polyethylene sheet.

In order to confine the independent variables of welding to cooling style, a continuous 6 foot seam was prepared. The first 2 feet and the last 2 feet were allowed to cool naturally (in the open air). The middle 2 feet of seam was cooled with a towel soaked with water. Immediately after the weld was laid in the middle section, it was cooled until it neared air temperature. Both initial water temperature and air temperature were ca. 65^{o}F.

Samples from each two foot section was tested in peel and shear modes. In addition the percentage crystallinity of the weld beads was monitored for one week following seam construction. A DuPont Model 910 pressurized differential scanning calorimeter was used for the crystallinity determinations. Results of the testing are displayed below.

RESULTS:

Peel Testing

Sample	Failure Type	Failure Stress
1st Two Feet (A.C.)	FTB	130
Middle Two Feet (W.C.)	FTB	138
Last Two Feet (A.C.)	FTB	132

Shear Testing

Sample	Failure Type	Failure Stress
1st Two Feet (A.C.)	FTB	164
Middle Two Feet (W.C.)	FTB	160

Last Two Feet (A.C.)	FTB	160

Percent Crystallinity

	1 Day Later	1 Week Later
Air Cooled Welds	56%	54%
Water Cooled Welds	53%	56%

* A.C. - Air Cooled Weld
W.C. - Water Cooled Weld

DISCUSSION AND CONCLUSION:

Results indicated there was no significant difference between the seams allowed to cool in the open air and those cooled with a water-soaked towel. Destructive seam testing results were good in both cases. Concentrations of crystallinity were very typical of the hexene copolymer pipe-grade resin used for Gundline HD. The minor variation in percent crystallinity is equivalent to a density difference of ± 0.001 g/cm^3.

CERTIFIED BY:

Darlene Phouangsavanh
Darlene Phouangsavanh
Lab Supervisor

Mark Cadwallader
Mark Cadwallader
Director of Research &
Technical Development

EXHIBITS

Chevron

Chevron Chemical Company
Orange, TX 77630 • Phone (409) 886-7491

Orange Plant

February 3, 1988

Mark Cadwallader
Bill Collier
Ray McCurdy
Gundle Lining Systems
Houston, TX 77073

Dear Sirs:

The following are the requested information on resin shipment sent to Gundle.

Package	GOCX58186
Product	LS0340
Lot Number	V121088
Melt Index	.17
Density	.9452
ESCR	in progress
Ship Date	12-17-87
Production Date	2-1-88
Weight	148,000

Sincerely,

J. D. Dunn
Manager
Quality Control

dh

Rev.1
9/88

FIGURE 2

(EXAMPLE)

?537

DDD 1302 CDT 04/21/88

NDLE HOU

APR 21 1988 1505
SUNDLE HOU

170675 PHILXPA
1-JHV-3314-88

BUNDLE LINING SYSTEMS INC.
BUNDLE ROAD
1340 EAST RICHEY ROAD
HOUSTON TEXAS 77073

TWX-462-0281

ATTN: MR. RAY MCCURDY

CC: Q A FILE
E. E. FOGLE-PAD

THIS WILL CERTIFY THAT MARLEX RESIN SUPPLIED BY PHILLIPS 66 COMPANY CONFORMS TO THE MANUFACTURING SPECIFICATION.

TA ON A RECENT SHIPMENT IS LISTED BELOW.

E	HHM TR-400
LOT NUMBER	0381928
P. O. NUMBER	17516
DATE SHIPPED	4/19/88
PACKAGE	PLCX 46379
QUANTITY	186.500
DENSITY	.937
MELT INDEX	.16
ESCR F50. COND. B	.GT.1000

VERY TRULY YOURS

J. H. VADEN
QUALITY ASSURANCE MANAGER
PHILLIPS 66 COMPANY
PASADENA TX
4-21-88

PLEASE RESPOND VIA TRT NUMBER 170675
170675 PHILXPA

SUNDLE HOU

508 04/21
REPLY VIA WORLDCOM

Gundle Lining Systems Inc

Gundle®

Gundline® HD

GUNDLINE® HD is a high quality formulation of High Density Polyethylene containing approximately 97.5% polymer and 2.5% of carbon black, anti-oxidants and heat stabilizers. The product was designed specifically for exposed conditions. It contains no additives or fillers which can leach out and cause embrittlement over time.

GUNDLINE® HD SPECIFICATIONS

TYPICAL PROPERTIES*	TEST METHOD	GAUGE (NOMINAL)							
		30 mil (0.75 mm)	40 mil (1.0 mm)	50 mil (1.25 mm)	60 mil (1.5 mm)	80 mil (2.0 mm)	100 mil (2.5 mm)	120 mil (3.0 mm)	140 mil (3.5 mm)
Density. g/cc. (Min.)	ASTM D1505	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Melt Flow Index. g/10 min. (Max.)	ASTM D1238 Condition E (190°C, 2.16 kg.)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Tensile Properties (Typical)	ASTM D 638 Type IV Dumb-bell at 2 ipm.								
1. Tensile Strength at Break (Pounds/inch width)		120	160	200	240	320	400	480	560
2. Tensile Strength at Yield (Pounds/inch width)		70	95	115	140	190	240	290	340
3. Elongation at Break (Percent)		700	700	700	700	700	700	700	700
4. Elongation at Yield (Percent)		13	13	13	13	13	13	13	13
5. Modulus of Elasticity (Pounds per square inch × 10^5)	ASTM D882	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Tear Resistance Initiation. lbs. (Typical)	ASTM D1004 Die C	22	30	37	45	55	65	80	95
Low Temperature Brittleness. °F (Typical)	ASTM D746 Procedure B	−112	−112	−112	−112	−112	−112	−112	−112
Dimensional Stability. % Change Each direction. (Max.)	ASTM D1204 212°F 1 hr.	±2	±2	±2	±2	±2	±2	±2	±2
Resistance to Soil Burial. Percent change in original value. (Typical)	ASTM D3083 using ASTM D638 Type IV Dumb-bell at 2 ipm.								
Tensile Strength at Break and Yield	% Change	±10	±10	±10	±10	±10	±10	±10	±10
Elongation at Break and Yield	% Change	±10	±10	±10	±10	±10	±10	±10	±10
Environmental Stress Crack. Hours. (Min.)	ASTM D1693 (10% Igepal, 50°C)	1500	1500	1500	1500	1500	1500	1500	1500
Puncture Resistance. Pounds. (Typical)	FTMS 101 Method 2065	30	52	65	80	105	130	150	169
Coefficient of Linear Thermal Expansion. $\times 10^{-4} \frac{cm}{cm\ °C}$ (Typical)	ASTM D696	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Thermal Stability Oxidative Induction Time (OIT). Minutes. (Min.)	ASTM D3895 130°C, 800 psi O_2	2000	2000	2000	2000	2000	2000	2000	2000

**Note: All values except when specified as minimum or maximum are typical test results.*

PRODUCT DESCRIPTION

JOINING SYSTEMS

Critical to the success of any flexible membrane liner is the joining system. Gundle's Hot-Wedge Welding System and patented Extrusion Welding System are used to join individual panels of GUNDLINE HD. Request your copy of the Gundle Joining Systems Bulletin for complete details.

CHEMICAL RESISTANCE

GUNDLINE HD is resistant to a wide range of chemicals including acids, alkalis, salts, alcohols, amines, oils, and other hydrocarbons. Since combinations of chemicals of different concentrations and temperatures have different characteristics, consult Gundle for specific application details. Write for Gundle's chemical compatibility information.

SUPPLY SPECIFICATIONS

The following describes typical roll dimensions for GUNDLINE HD.

THICKNESS		WIDTH		LENGTH		AREA		ROLL WEIGHT	
mil	mm	ft	m	ft	m	ft²	m²	lb	kg
30	0.75	22.5	6.86	840	256	18,900	1756	2800	1272
40	1.0	22.5	6.86	650	198	14,625	1359	2800	1272
50	1.25	22.5	6.86	500	152	11,250	1043	2800	1272
60	1.5	22.5	6.86	420	128	9,450	878	2800	1272
80	2.0	22.5	6.86	320	98	7,200	670	2800	1272
100	2.5	22.5	6.86	250	76	5,625	522	2800	1272
120	3.0	22.5	6.86	210	64	4,725	439	2800	1272
140	3.5	22.5	6.86	180	55	4,050	377	2800	1272

GUNDLINE HD is rolled on 6" I.D. hollow cores.
Each roll is provided with 2 slings to aid handling on site.
Dimensions and weights are approximate. Custom lengths available on request.

Gundle Lining Systems Inc

Gundle®

Gundle Lining Systems Inc
19103 Gundle Road
Houston, Texas 77073
U.S.A.

Phone: (713) 443-8564
Toll Free: (800) 435-2008
Telex: 4620281 Gundle Hou
Fax: (713) 875-6010

Gundle

QUALITY CONTROL CERTIFICATE

GUNDLINE HD

MATERIAL ______________________ DATE ______________________

BATCH # ______________________ PROJECT ______________________

ROLL # ______________________ ______________________

TEST PARAMETER	REQUIRED SPECIFICATIONS	TEST RESULTS	ASTM TEST METHOD
Thickness, mils	± 10%		D 1593
Density, gm/cm^3	.94		D 1505
Melt Flow Index, g/10 min.	0.3 max		D 1238 E
Tensile Strength			D 638 Type IV 2 ipm
Yield (psi)	2333		
Break (psi)	4000		
% Elongation			D 638
Yield	13		
Break	700		
Carbon Black (%)	2.0		D 1603

CERTIFIED BY:

Darlene Phouangsavanh
Lab Supervisor

Rev.1
9/88

Gundle®

FIGURE 5

PROJECT: ____________

LOCATION: ____________

DATE ________ P.F.# ________

PRE-START SITE INSPECTION

INSPECTED BY:

NAME	REPRESENTING	POSITION

2. DESCRIPTION OF INSPECTED AREA

____

____

____

PHOTOS ENCLOSED ☐ TO FOLLOW ☐

3. REMEDIAL WORK REQUIRED:

____

____

____

4. DATE & CONDITIONS OF GUNDLE START–UP:

____

____

____

5 FURTHER INSPECTION REQUIRED: YES ☐ NO ☐ DATE: ____________

6. BILLING FOR ADDITIONAL INSPECTION/WORK (Must be accompanied by Change Order)

____

____

GUNDLE REPRESENTATIVE	OWNER/CONTRACTOR	INSPECTOR
(WHITE)	(YELLOW)	(PINK)

Rev.1
9/88

Form No. 05128
Southwest Data Corp. 713-880-3308

GUNDLE REPRESENTATIVE

Gundle

PROJECT: ______

LOCATION: ______

DATE: ______ P.F.# ______

DAILY PROGRESS REPORT

'EATHER: Temp. Max ______ °F Min ______ °F Precip. ______ in. Wind: Vel ______ mph Dir. N S E W

LABOR:	No.	Manhours
›pervisors		
›echnicians		
›aborers		
›perators		
Other		

DEPLOYED:

Type	Panel	Roll#	Length	Type	Panel	Roll#	Length

'ELDED

Gun#	Tech.	Seam#	(Linear Feet) Seam Weld	Repairs	Total Lin. Ft.	Sample No.'s

VACUUM TESTED

Tech.	Seam	(Linear Feet) Seam Weld	Repairs	Total Lin. Ft.

OTHER PROGRESS: ______

FIELD MEMOS/CHANGE ORDERS ISSUED: ______

SITE MEETINGS/VISITS: ______

SIGNED:

Gundle Representative (WHITE) | Owner/Contractor (YELLOW) | Inspector (PINK)

Rev.1
9/88

FIGURE 7

PROJECT: ____________________

LOCATION: ____________________

DATE: ____________ P.F.# ____________

MATERIAL: ____________________

PRE-WELD QUALIFICATION

Welder# ____________________

Welded by: ____________________

Time: ____________________

Welder# ____________________

Welded by: ____________________

Time: ____________________

Welder# ____________________

Welded by: ____________________

Time: ____________________

Welder# ____________________

Welded by: ____________________

Time: ____________________

Welder# ____________________

Welded by: ____________________

Time: ____________________

Welder# ____________________

Welded by: ____________________

Time: ____________________

Welder# ____________________

Welded by: ____________________

Time: ____________________

Welder# ____________________

Welded by: ____________________

Time: ____________________

Welder# ____________________

Welded by: ____________________

Time: ____________________

Welder# ____________________

Welded by: ____________________

Time: ____________________

____
Gundle Representative

____
Inspector

FIGURE 8

Gundle Lining Construction Corp Weld Sample

Gundle

Project ____________________ Seam ________________________

Field Test Results

Date ____________________ Peel ____________________ P/F

Welded by ____________________ Shear ____________________ P/F

Gundle®

FIGURE 9

LABORATORY REPORT #

DATE:

SUBJECT:

Quality control testing of site welds from

TEST METHOD:

ASTM D638 Type IV dumb-bells were used for peel and shear testing of the welds.

TEST RESULTS: (FTB = Film Tearing Bond)

Seam/Sample	Mils Thickness	Peel (ASTM D413)		Shear (ASTM D3083)
		Failure Type	Failure Stress, ppi	Yield, ppi

Total number of samples tested in peel:
Total number of samples tested in shear:

CONCLUSION:

ngthong Phouangsavanh
Senior Lab Technician

Rev.1
/88

FIGURE 10

VARIETIES OF SEPARATION RESULTS DURING DESTRUCTIVE TESTING

UNTESTED SPECIMEN

TYPES OF BREAKS


SEPARATION IN ADHESION - FAILURE


SEPARATION IN ADHESION - FAILURE


FTB SEPARATION IN WELD - PASS, IF RECORDED STRESS MEETS SPEC.


FTB SEPARATION IUN WELD - PASS, IF RECORDED STRESS MEETS SPEC.


FTB SEPARATION IN BOTTOM SHEET AT OUTSIDE SEAM EDGE. - PASS


FTB SEPARATION IN BOTTOM SHEET AT INSIDE SEAM EDGE. - PASS


FTB SEPARATION IN BOTTOM SHEET. - PASS


FTB SEPARATION IN TOP SHEET - PASS


FTB SEPARATION IN TOP SHEET AT SEAM EDGE - PASS


FTB SEPARATION IN BOTTOM SHEET AFTER SOME DELAMINATION. - PASS

APPENDIX B

Appendix B

McGuire Nuclear Station Landfill

Erosion and Sedimentation Control Plan

Huntersville, N.C.

August 31, 1990

Table of Contents

Page

Narrative.......... B-1
Construction Schedule.......... B-4
Maintenance Plan.......... B-5
Vicinity Map.......... B-6
Specification for Practices Specified.......... B-7
Vegetation Plan.......... B-11
Supporting Calculation.......... B-12
Financial Responsibility/Ownership Form.......... B-23
Checklist.......... B-24
Drawings.......... B-25

Narrative

Project Description

The purpose of the project is to build an Industrial Landfill that will serve McGuire Nuclear Station. Approximately 10 acres will be disturbed during this construction period. The site is located in Mecklenburg County south of McGuire Nuclear Station.

Site Description

The site has rolling topography which slopes off to each side of the Landfill trench. The majority of the site is currently cleared of trees; however, tree clearing will be required to make room for the exterior slopes of the landfill and to provide a path for the gravel access road. There is a large cluster of trees on the southern most boundary of the Landfill trench, a portion of which shall be left to block/minimize view from the road.

Adjacent Property

Land use in the vicinity is mixed. The area to the west of the site has some private dwellings; however, to the east of the site all the way to the Catawba River, Duke Power owns 628 acres which is covered with high voltage transmission lines. The storm water runoff from the McGuire Landfill will not leave Duke Property until it reaches the Catawba River which is approximately 2/3 of a mile away.

Soils

See Appendix D.

Planned Erosion and Sedimentation Control Practices

1. Surface Roughening -- Practice 6.03

   The exterior slopes of the landfill shall be "tracked" by movement of a cleated dozer up and down the slope to impede surface runoff.

2. Tree Preservation and Protection -- Practice 6.05

   A minimum of 2.0 feet high protective fence will be erected around the remaining cluster of trees located outside the proposed fence line on the south end of the landfill trench.

3. Permanent Seeding -- Practice 6.11

   The interior and exterior slopes of the landfill trench, the soil storage piles, and all other disturbed areas shall be seeded to reduce erosion and stabilize these areas.

4. Grass Lined Channel -- Practice 6.30

   Two excavated channels shall be installed down each side of the landfill trench to divert the sediment laden water to the sediment traps. The grass lined channels convert to riprap lined channels further downstream.

5. Riprap Lined Channel -- Practice 6.31

   The two previously mentioned channels will have riprap located when descending down the steeper slope.

6. Outlet Stabilization Structure -- Practice 6.41

   A riprap apron will be located at the outlet of the road culvert and at the outlet for the sediment basins to prevent scour.

7. Sediment Basins -- Practice 6.61

   Two sediment traps will be constructed on either side of the landfill trench. The water from the disturbed area will be directed to each basin. The northeast basin will also function as a sediment basin for the stormwater generated from within the landfill trench. The stormwater coming from within the landfill shall have little to no sediment due to the filter fabrics used.

8. Sediment Fence -- Practice 6.62

   A sediment fence will be constructed around the soil stockpile and near the road culvert or shown on drawings.

9. <u>Dust Control</u> -- <u>Practice 6.84</u>

Dust will be controlled on all areas affected by the construction operations where dust may create a potential or actual unsafe condition, public nuisance, or condition endangering the value, utility or appearance of any property.

Construction Schedule

1. Notify Mecklenburg County Engineering/State that construction is to commence.
2. Clear areas sufficient to construct gravel and riprap filter basins.
3. Install Basins 1 & 2, diversion ditches and silt fence.
4. Complete all clearing, install the erosion control measures and complete all rough grading.
5. Stabilize all cut and fill slopes with permanent grassing within 30 days of completion of the rough grading.
6. State/County inspection.
7. Fine grade all areas and place stone on designated road areas.
8. Establish permanent grassing on all graded areas within 30 days of completion of fine grading.
9. Remove temporary control devices, fine grade these areas and permanent grassing of all areas.
10. Final Inspection.

Maintenance Plan

1. Inspect ditches at regular intervals as well as after major rains, and make repairs promptly. Give special attention to the outlet and inlet sections and other points where concentrated flow enters.

2. Check stability at road crossings and look for indications of piping, scour holes or bank failures. Make repairs immediately.

3. Maintain all vegetation adjacent to the channel in a healthy, vigorous condition to protect the area from erosion and scour during out-of-bank flow.

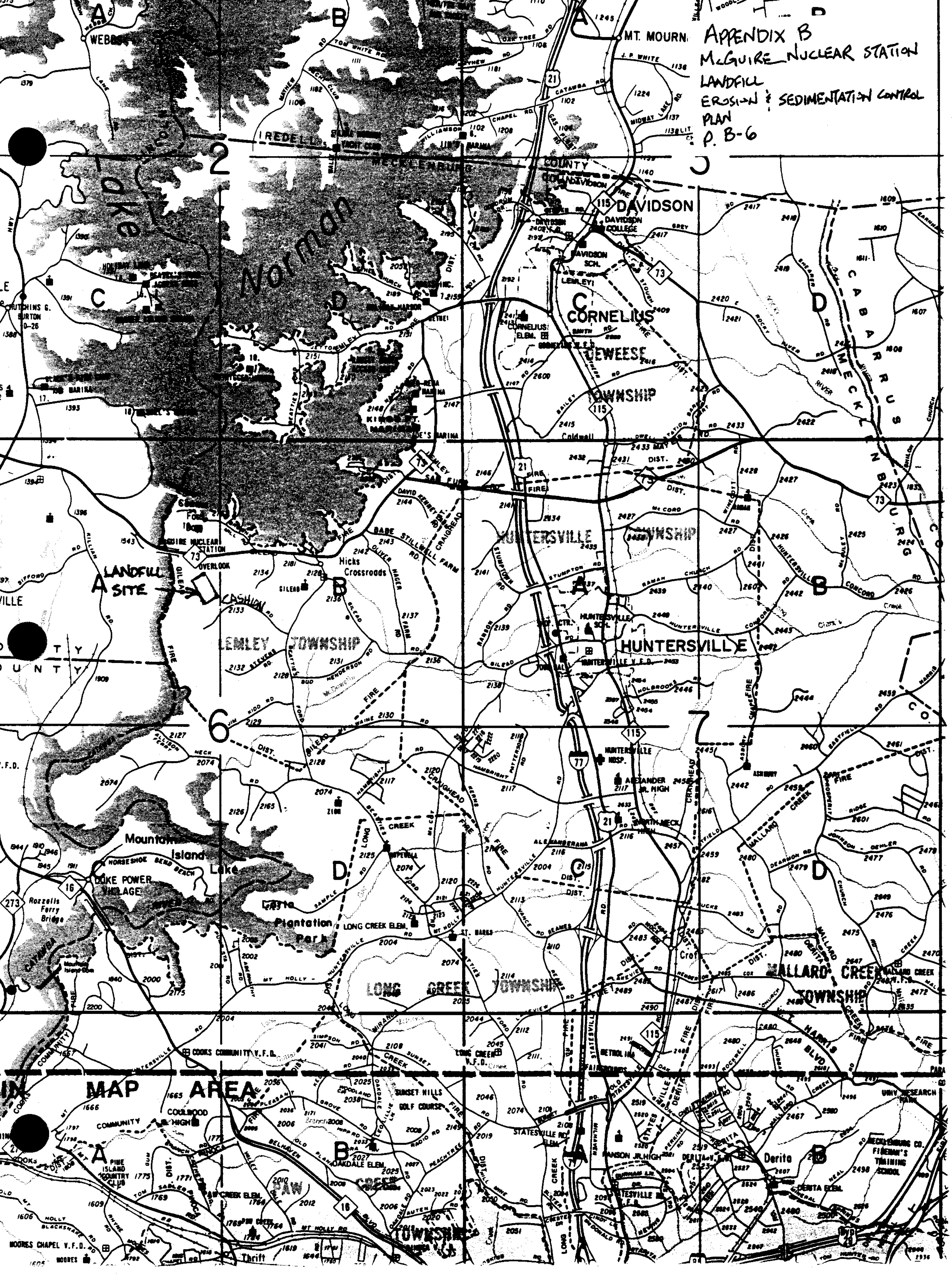
4. Inspect riprap for scour or dislodged stones. Control of weed and brush growth may be needed in some locations.

5. Sediment will be removed from the sediment trap when storage capacity has been approximately 50% filled. Gravel will be cleaned or replaced when the sediment pool no longer drains properly.

6. Sediment will be removed from behind the sediment fence when it becomes about 0.5 feet deep at the fence. The sediment fence will be repaired as necessary to maintain a barrier.

7. All seeded areas will be fertilized, reseeded as necessary, and mulched according to specification in the vegetative plan to maintain a vigorous, dense vegetative cover.

APPENDIX B
McGUIRE NUCLEAR STATION
LANDFILL
EROSION & SEDIMENTATION CONTROL
PLAN
P. B-6



Specifications

1. Grass Lined Diversion Ditches

Construction Specifications:

1. Remove all trees, brush and stumps.

2. Excavate the ditch and shape it to an even cross-section as shown on Erosion Control Plan Drawing. When staking indicate a .2' overcut around the channel perimeter for silting and bulking.

3. Grade soil away from ditch so that surface water may enter freely.

4. Apply lime, fertilizer and seed to the channel and adjoining areas in accordance with the vegetation plan.

5. Place and secure either straw with net, excelsior matting or other approved matting in accordance with manufacturer's recommendations.

2. <u>Riprap Lined Diversion Ditches</u>

Construction Specifications:

1. Clear the foundation of all trees, stumps and roots.

2. Excavate the bottom and sides of the channel 28" below grade at all points to allow for placement of riprap as shown in the typical cross-section.

3. Uniformly place the gravel filter blanket 6" thick immediately after the ground foundation is prepared.

4. Placement of riprap should follow immediately after placement of the filter. Place riprap so that it forms a dense well-graded mass of stone with a minimum of voids. The desired distribution of stones throughout the mass may be obtained by selective loading at the quarry and controlled dumping during final placement. Place riprap to its full thickness in one operation. Do not place riprap by dumping through chutes or other methods that cause segregation of stone sizes. Take care not to dislodge the underlying loose or filter when placing the stones. The finished slope should be free of pockets of small stones or clusters of large stones. The finished grade of the riprap should blend with the surrounding areas. No overfall or protrusion of riprap should be apparent.

5. Vegetate all disturbed areas in accordance with the vegetation plan.

3. Sediment Basin

Construction Specification:

1. Install two 7200 ft^3. sediment basins in accordance with the notes and details shown on the Erosion Control Plan Drawing and CMLDS Drawing # 30.02 (See P. B-26).

2. Ensure that the top of the dam at all points is 0.5' above the natural surrounding ground.

3. Stabilize the embankment and all disturbed area above the sediment pool as shown in the vegetation plan.

4. <u>Sediment Fence</u>

Construction Specification:

1. Install the sediment fence in accordance with the notes and details shown on the Erosion Control Plan Drawing and CMLDS Drawing # 30.06 (See P. B-26).

2. Locate posts downslope of fabric to help support fencing.

3. When joints are necessary, securely fasten the fabric at a support post with overlap to the next post.

VEGETATIVE PLAN

FALL PERMANENT SEEDING	AUG. 20 - OCT. 25
LIME	90 LBS/1000 S.F.
10-10-10 FERTILIZER	20 LBS/ 600 S.F.
TURF TYPE ARID FESCUE	6 LBS/1000 S.F.
RYE GRAIN	1.5 LBS/1000 S.F.
STRAW MULCH	90 LBS/1000 S.F.

SPRING PERMANENT SEEDING	FEB. 1 - APRIL 15
LIME	90 LBS/1000 S.F.
10-10-10 FERTILIZER	20 LBS/1000 S.F.
TURF TYPE ARID FESCUE	8 LBS/1000 S.F.
STRAW MULCH	90 LBS/1000 S.F.

WINTER TEMPORARY COVER	OCT. 25 - JAN. 31
LIME	90 LBS/1000 S.F.
10-10-10 FERTILIZER	12 LBS/1000 S.F.
RYE GRAIN	6 LBS/1000 S.F.
STRAW MULCH	90 LBS/1000 S.F.

SUMMER TEMPORARY COVER	APRIL 15 - AUG. 20
LIME	90 LBS/1000 S.F.
10-10-10 FERTILIZER	12 LBS/1000 S.F.
BROWNTOP MILLET	6 LBS/1000 S.F.
STRAW MULCH	90 LBS/1000 S.F.

FOR SLOPES 3:1 OR GREATER

(SEED WITHIN 30 DAYS OF COMPLETION OF GRADING)

PERMANENT SEEDING	
LIME	90 LBS/1000 S.F.
10-10-10 FERTILIZER	20 LBS/1000 S.F.
SCARIFIED SERICEA LESPEDEZA (SPRING & SUMMER)	6.5 LBS/1000 S.F.
UN-SCARIFIED SERICEA LESPEDEZA (FALL & WINTER)	6 LBS/1000 S.F.
BROWNTOP MILLET (SUMMER)	1.5 LBS/1000 SL.F.
RYE GRAIN (WINTER)	3 LBS/1000 S.F.
STRAW MULCH	90 LBS/1000 S.F.

SEEDINGS.MWS(3A)/csc

Station ______ Unit ______ Rev. ______ File No. ______ Sheet B-12 Of ______

Subject: Gravel AND Rip Rap Filter Basin (Temporary Sediment Trap)

By HW Smith Date 5-15-90

Prob No. ______ Checked By CBhan Date 6-1-90

Data

Total Watershed Area = 6 AC.
Disturbed Area = 4 AC.
Expected Time of Exposure = 6 MO. (Infor. Only)

Design Requirements

Design Storm: 10-Year Frequency
: 25-Year Storm Safety Spillway

$Q = CIA$

Estimate t_c = 5 min. From Figure 8.03a
I_{10} = 7.0 " " 8.03g
I_{25} = 8.0 " " 8.03g
C = 0.6 Avg.

$Q_{in.\,(10\,Yr.)} = CIA = 0.6(7.0)(4) = 16.8$ cu. ft/sec.

Required Storage

$Q_s = 1800$ cu. ft/AC. $(4\ AC) = 7{,}200$ CU. FT.

Try Basin 60'x30': d = Depth of Filter Basin: $\frac{7200\ C.F.}{60' \times 30'} = 4.0'$ Min. ∴ OK

Storage at Peak - Required Storage + Flood Safety Zone

Total Depth = 4.0' + 1.0' = 5.0'; Use 4.0' Conser. (Min. Depth)

Storage Volume = $\underline{\underline{60' \times 30' \times 4'}}$ = $\underline{\underline{7{,}200}}$ CU. Ft.

$Q_{25} = 0.6(8.0)(6\ AC.) = 28.8$ cu. ft/sec.

Form 00184 (R4-88)

DUKE POWER COMPANY

Station ____ Unit ____ Rev. ____ File No. ____ Sheet B-13 Of ____

Subject Gravel and Rip Rap Filter Basin (Temporary Sediment Trap)

By HWSmith Date 5-15-90

Prob No. ____ Checked By CB Thom Date 6-1-90

$$Q_o = Q_i - Q_s = 28.8 - \frac{7{,}200 \text{ Cu. Ft.}}{(5 \text{ Min.})(60 \text{ Sec}/\text{Min})} = 4.80 \text{ Cu. Ft.}/\text{sec.}$$

Spillway Dimension: 25 Yr.; $Q = 1.9 L H^{3/2}$

$L = 10'$ Min. & $H = 1'$ Min.

Length Weir Req'd.: $L = \frac{Q}{1.9 H^{3/2}}$

$$L = \frac{4.80}{1.9(1)^{3/2}} = 2.53' \text{ use } 10' \text{ Min}$$

Form 00184 (R4-88)

DUKE POWER COMPANY

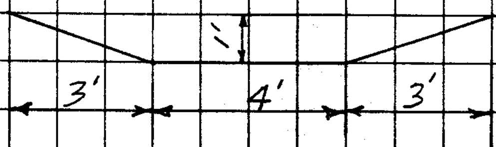
Station *McGUIRE LANDFILL* Unit_____ Rev._____ File No.__________ Sheet *B-14* Of_____

Subject *DIVERSION CHANNEL*

LINE "A" BASIN #1 By *HWSmith* Date *5-15-90*

Prob No. *0+0 TO 4+0* Checked By *CB [signature]* Date *6-1-90*

TEMPORARY LINER: STRAW WITH NET ($S = 0.01$ FT/FT)



TYPICAL CHANNEL SIZE

BASIN #1

Disturbed Area = 4 AC

$\frac{1}{2}$ D.A. $= \frac{4}{2}$ AC $= 2$ AC.

$Q_{10} = CIA = 0.6(7.0)(2) = 8.4$ CU.FT./SEC.

$A = 4(1) + 3(1)^2 = 7\,\square'$

$P = 4 + 2(1)\sqrt{(3)^2+1} = 10.325'$

$R = \frac{A}{P} = \frac{7}{10.325} = 0.678'$

$Q_{10} = 8.4$ CU. FT./SEC.
$S = 0.01$ FT./FT.
$b = 4'$
$Z = 3'$
$A = 7\,\square'$

Table 8.05e, $n = 0.065$, $d < 0.5$ Ft. Flow Depth for ½ Dist. Area

$Q = VA$

NOTE: Table 8.05b, $n = 0.02$ (EARTH)
$V = 5.75$ FT./SEC > 2.0 FT./SEC. (ALLOW.)
∴ USE Table 8.05e for Temporary Liner

$V = \frac{1.49}{n} R^{2/3} S^{1/2}$;

$V = \frac{1.49}{.065}(0.678)^{2/3}(.01)^{\frac{1}{2}} = 1.77$ FT./SEC.

$Q = VA = 1.77(7) = 12.4$ CFS

$Q > Q_{10}$ ∴ OK

Page 8.05.12

Shear Stress $= T = \gamma d S = (62.4\ \#/FT^3)(0.5')(0.01) = 0.31\ \#/FT^2$

Table 8.05g: Permissible Unit Shear Stress, $T_d = 1.45\ \#/FT^2 > 0.31\ \#/FT^2$

∴ OK

Form 00184 (R4-88)

DUKE POWER COMPANY

Station ______ Unit ______ Rev. ______ File No. ______ Sheet B-15 Of ______

Subject DIVERSION CHANNEL
LINE "A" BASIN #1 By HWSmith Date 5-15-90

Prob No. 4+0 TO 8+0 Checked By CB [signature] Date 6-1-90

CHANNEL WITH RIPRAP LINING

$Q_{10} = 16.8$ CFS

$S = 0.12\%$

$b = 4'$

$Z = 3'$

$A = 7^{\circ}$

Find: Flow depth and mean riprap size.

(1) Figure 8.05K ; $d = 0.55$ ft, $d_{50} = 0.52$ ft.

(2) Shear Stress $= T = \gamma d S = (62.4 \text{ \#/ft}^3)(0.55)(0.12) = 4.12 \text{ \#/ft}^2$

Table 8.05g Use $d_{50} = 10''$
Page 8.05.17

(1) $d_{max} = 1.5(10'') = 15''$

(2) Riprap Thickness $= 1.5(15'') = 22.5''$

Form 00184 (R4-88)

DUKE POWER COMPANY

Station ______ Unit ______ Rev. ______ File No. ______ Sheet B-16 Of ______

Subject DIVERSION CHANNEL
LINE "B" BASIN #1 By HWSmith Date 5-15-90

Prob No. STA. 0+0 TO 2+0 Checked By CB Thom Date 6-1-90

CHANNEL WITH RIPRAP LINING

APPROX. 0.7 AC. (INCLUDED IN TOTAL DISTURBED AREA)

Q_{10} = 3 CU. FT/SEC.

S = 0.15%
b = 4'
Z = 3'
A = 7 P'

Find: Flow depth and mean riprap size.

(1) Figure 8.05K, d = 0.22, d_{50} = 0.25

(2) Shear Stress = $T = \gamma d s = (62.4\ \#/ft^3)(0.22)(.15) = 2.06\ \#/ft^2$

Table 8.05 Use d_{50} = 6"

(1) d_{max} = 9"

(2) Riprap Thickness = 13.5"

Form 00184 (R4-88)

DUKE POWER COMPANY

Station ______ Unit ______ Rev. ______ File No. ______ Sheet B-17 Of ______

Subject DIVERSION CHANNEL

LINE "A" BASIN #2 By HWSmith Date 5-15-90

Prob No. STA. 0+0 TO 2+30 Checked By CB [illegible] Date 6-1-90

TEMPORARY LINER: STRAW WITH NET ($S = 0.05$ FT/FT)

$Q_{10} = 5.5$ CFS

1/3 Disturbed Area = $\frac{4}{3}$ AC. = 1.3 AC

$S = 0.05$ FT/FT

$Q_{10} = CIA = 0.6(7.0)(1.3) = 5.5$ CU. FT/SEC.

$b = 4'$

$Z = 3'$

$A = 7^{\square'}$

Table 8.05e, $n = 0.065$, $d = 0 - 0.5$ ft.

$Q_n = (5.5)(0.065) = 0.36$;

Figure 8.05d; $\frac{d}{b} = 0.11$; $d = 0.11(4) = 0.44$ ft.

Shear Stress $= T = \gamma d S = (62.4\ \#/FT^3)(0.44)(0.05) = 1.37\ \#/FT^2$

Table 8.05g: Permissible Unit Shear Stress, $T_d = 1.45\ \#/FT^2 > 1.37\ \#/FT^2$

∴ OK

$V = \frac{1.49}{0.065}(0.678)^{2/3}(.05)^{1/2} = 3.96$ FT/SEC < 4.5 FT/SEC (Tall fescue, Table 8.05a)

$Q = VA = 3.96(7) = 27.7$ CFS $> Q_{10}$ ∴ OK

Form 00184 (R4-88)

DUKE POWER COMPANY

Station ______ Unit ______ Rev. ______ File No. ______ Sheet B-18 Of ______

Subject DIVERSION CHANNEL

LINE "A" BASIN #2 By HWSmith Date 5-15-90

Prob No. STA. 2+30 TO 6+00 Checked By CB [illegible] Date 6-1-90

CHANNEL WITH RIPRAP LINING

$Q_{10} = 16.8$ CFS

$S = 0.05$ Ft/Ft

$b = 4'$

$Z = 3'$

$A = 7\square'$

NOTE:
Due to the increase in Flow the shear stress would be too high for a grass channel ∴ Riprap will be used

(1) Try $d_{50} = 6''$

Table 8.05f: $n = 0.054$; $d < 1$

Table 8.05g: Permissible Unit shear stress $= 2.50$ #/Ft^2

(2) $Q_n = (16.8)(0.054) = 0.91$;

Figure 8.05d; $\frac{d}{b} = 0.17$; $d = 0.17(4) = 0.68'$

(3) Shear Stress $= T = \gamma d S = (62.4$ #/Ft.$^3)(0.68')(0.05'/') = 2.12$ #/Ft.$^2 < 2.50$ #/Ft.^{2}

∴ Use $d_{50} = 6''$

Determine Maximum stone size and riprap thickness

(1) $d_{max} = 1.5 \times d_{50} = (1.5)(6'') = 9''$

(2) Thickness of riprap (installed below finished grade)

$= 1.5 \times d_{max} = (1.5)(9'') = 13.5''$

Station ______ Unit ______ Rev. ______ File No. ______ Sheet B-19 Of ______

Subject DIVERSION CHANNEL
LINE "B" BASIN #2 By HWSmith Date 5-15-90

Prob No. STA. 0+0 TO 2+0 Checked By CB [illegible] Date 6-1-90

CHANNEL WITH RIPRAP LINING

Approx. 0.7 AC. (INCLUDED IN TOTAL DISTURBED AREA)

$Q_{10} = CIA = 0.6(7.0)(0.7) = 2.94$ CU.FT./SEC.

$Q_{10} = 3$ CU.FT./SEC
$S = 0.10$ FT/FT.
$b = 4'$
$z = 3'$
$A = 7^{\square'}$

(1) Try $d_{50} = 6''$

Table 8.05f: $n = 0.054$

Table 8.05g: Permissible Unit Shear stress $= 2.50\ \#/FT^2$

(2) $Q_n = (3)(0.054) = 0.16$;

Figure 8.05d; $\frac{d}{b} = 0.05$; $d = .05(4) = 0.20$

(3) Shear Stress $= T = \gamma dS = (62.4\ \#/FT.^3)(0.20)(0.10) = 1.25\ \#/FT^2 < 2.50\ \#/FT^2$

$\therefore$ Use $d_{50} = 6''$

(1) $d_{max} = 9''$

(2) Riprap Thickness $= 13.5''$

Form 00184 (R4-88)

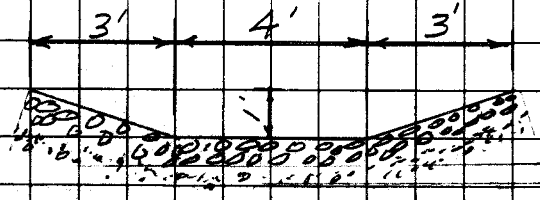
DUKE POWER COMPANY

Station McGUIRE Unit ____ Rev. ____ File No. ____ Sheet B-20 Of ____

Subject LANDFILL ESTIMATED QUANTITIES

By HWSmith Date 5-15-90

Prob No. ____ Checked By CB Thom Date 6-1-90



TYPICAL CHANNEL SIZE

P = 10.3'

A = 7 □'

I. Matting

Basin #1 Line "A" Diversion Ditch Sta. 0+0 To 4+0

Basin #2 " " " " " 0+0 To 2+30

overlap

1. 630' [10.3' + 2(6")] = 7,119 □' / 9 □'/YD = 791 Sq. Yds. use 1000 Sq. Yds

II. Riprap

Basin #1 Line "A" Diversion Ditch Sta. 4+0 to 8+00 = 400'

" " "B" " " " 0+0 " 3+50 = 350'

Basin #2 " A " " " 2+30 " 5+80 = 350'

" " B " " 0+0 " 2+00 = 200

Total = 1300'

Avg width

2. 900' (11') (1.2') = 11,880 Cu. Ft — Depth = 22" For 400'

3. 400' (11') (1.83') = 8,052 " — " = 14" " 900'

19,932 " 100#/Cu.Ft = 1,993,200# / 2000#/Ton = 997 Ton + 3 " Pieces

Use 1000 Tons

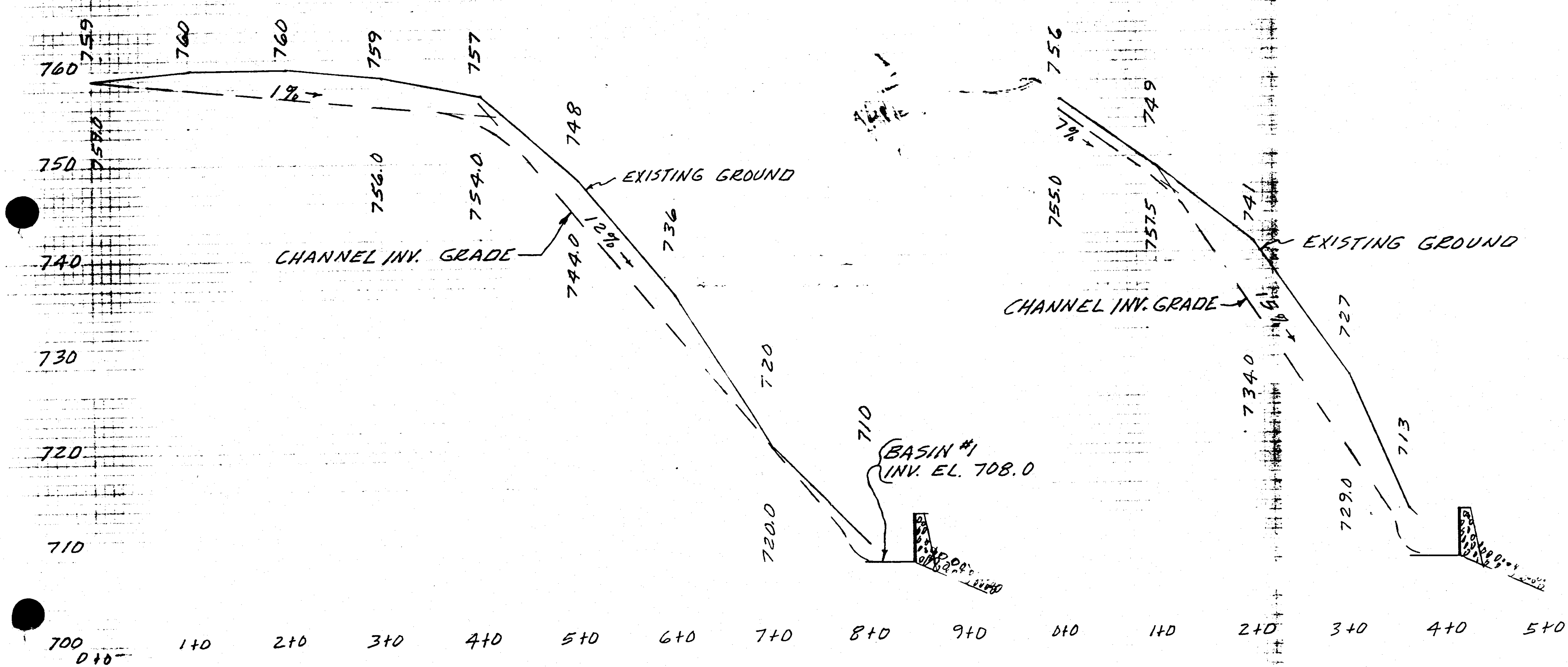
III. No. 5 Filter Stone

4. 1300' (11') (0.5') = 7,150 Cu.Ft (145#/Cu.Ft) / 2000#/TON = 518 Ton

Use 525 Tons

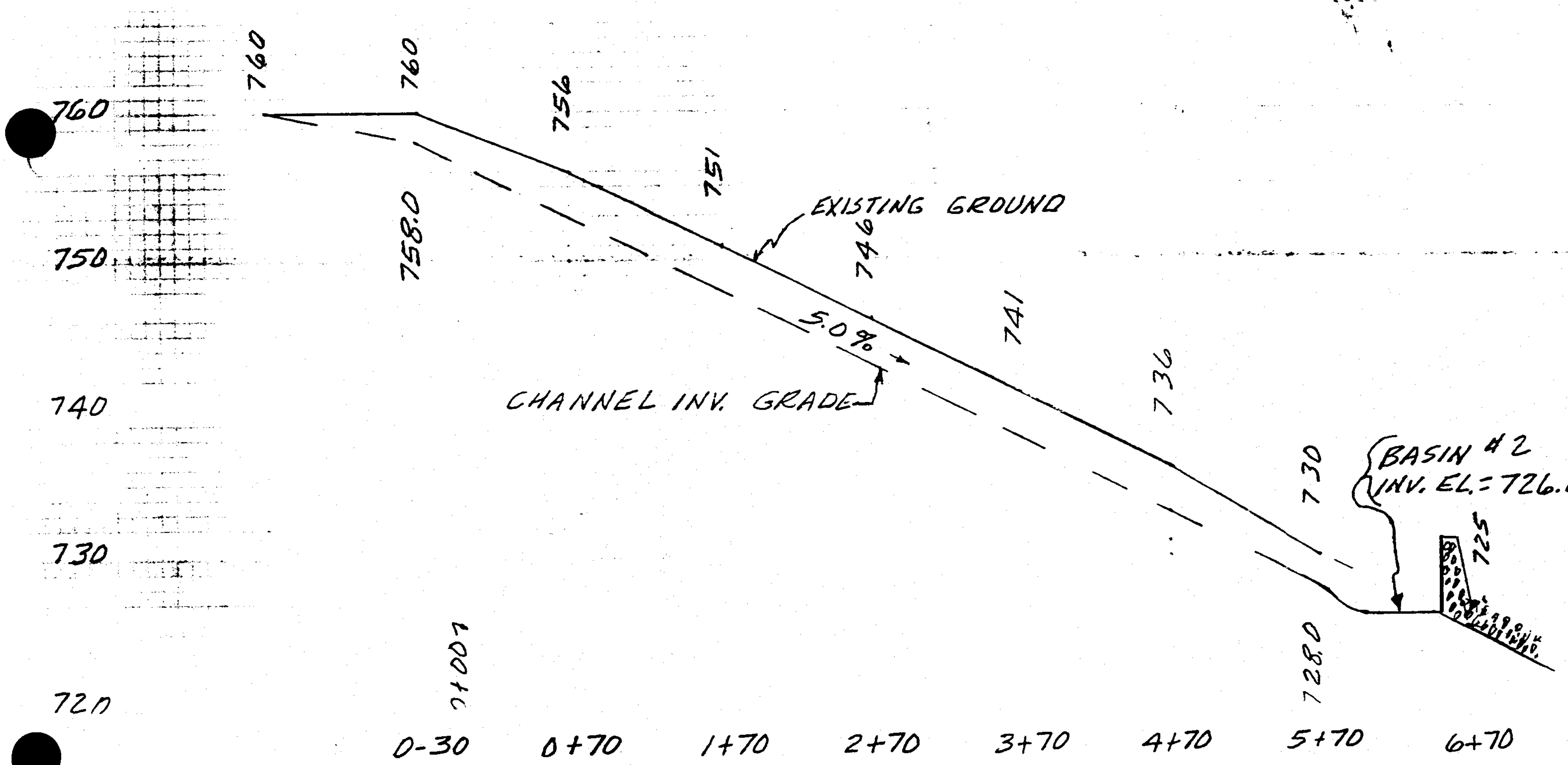
Avg. Width Avg. Depth

IV. Ditch Excavation 1930' (11') (5') / 27 C.Ft/C.Yds = 3,932 C.Y. Use 4,000 C.YDS.

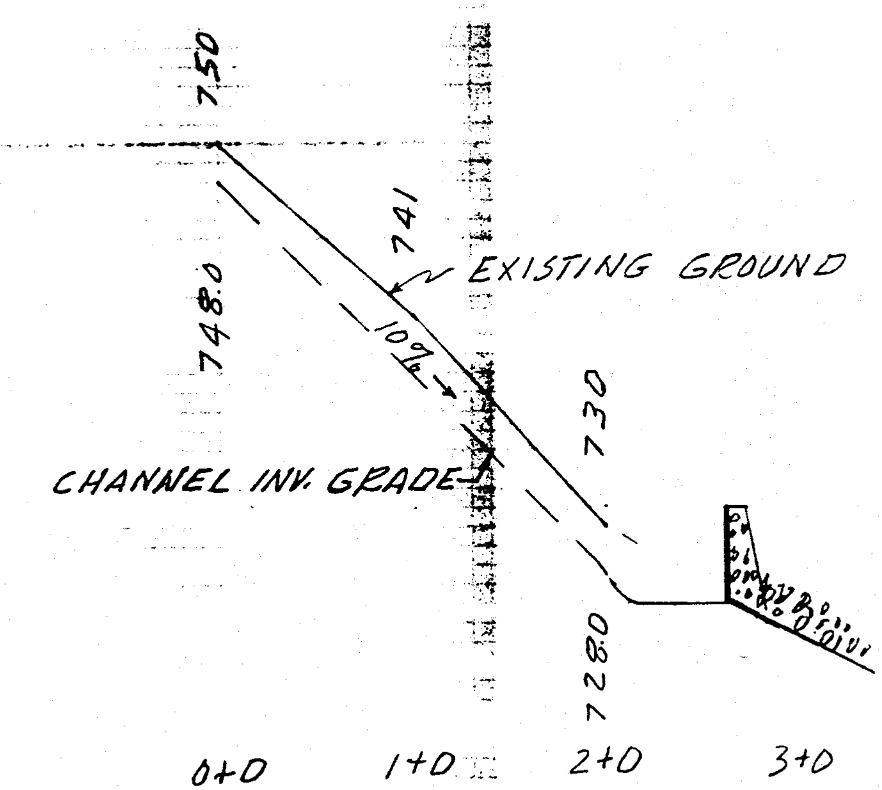


LINE "A" BASIN #1

LINE "B" BASIN #1



LINE "A" BASIN #2



LINE "B" BASIN #2

FINANCIAL RESPONSIBILITY/OWNERSHIP FORM
SEDIMENTATION POLLUTION CONTROL ACT

No person may initiate any land-disturbing activity on one or more contiguous acres as covered by the Act before this form and an acceptable erosion and sedimentation control plan have been completed and approved by the Land Quality Section, N.C. Department of Natural Resources and Community Development. (Please type or print and, if question is not applicable, place N/A in the blank.)

Part A.

1. Project Name McGuire Landfill
2. Location of land-disturbing activity: County Mecklenburg, City or Township Cornelius, and Highway / Street Hager Ferry Road
3. Approximate date land-disturbing activity will be commenced: May 1991
4. Purpose of development (residential, commercial, industrial, etc.) : Industrial
5. Approximate acreage of land to be disturbed or uncovered : 8
6. Has an erosion and sedimentation control plan been filed ?Yes X No ____
7. Person to contact should sediment control issues arise during land-disturbing activity.

   Name Tamara Carpenter Telephone (704)373-7016
8. Landowner (s) of Record (Use blank page to list additional owners.):

   Duke Power Company
   Name (s)

   P. O. Box 33189
   Current Mailing Address

   Charlotte, NC 28242
   City State Zip

   500 South Churst Street
   Current Street Address

   Charlotte, NC 28242
   City State Zip
9. Recorded in Deed Book No. 312 Page No. 250

Part B.

1. Person (s) or firms (s) who are financially responsible for this land-disturbing activity (Use the blank page to list additional persons or firms):

   Duke Power Company
   Name of Person (s)or Firm (s)

   P. O. Box 33189
   Mailing Address

   Charlotte, NC 28242
   City State Zip

   Telephone (704)373-7016

   500 South Street
   Street Address

   Charlotte, NC 28242
   City State Zip

   Telephone ____

2. (a) If the Financially Responsible Party is a Corporation give name and street address of the Registered Agent.

Duke Power Company

Name

P. O. Box 33189	
Mailing Address	Street Address
Charlotte, NC 28242	
City State Zip	City State Zip
(704)373-7016	
Telephone	Telephone

(b) If the Financially Responsible Party is a Partnership give the name and street address of each General Partner (Use blank page to list additional partners.):

Duke Power Company

Name

P. O. Box 33189	
Mailing Address	Street Address
Charlotte, NC 28242	
City State Zip	City State Zip
(704)373-7016	
Telephone	Telephone

The above information is true and correct to the best of my knowledge and belief and was provided by me under oath. (This form must be signed by the financially responsible person if an individual or his attorney-in-fact or if not an individual by an officer, director, partner, or registered agent with authority to execute instruments for the finanacially responsible person). I agree to provide corrected information should there be any change in the information provided herein.

T. C. McMeekin	Vice President, Design Engineering
Type or print name	Title or Authority
TC McMeekin	9/24/90
Signature	Date

I, Kathy S. Moraleda, a Notary Public of the County of Mecklenburg State of North Carolina, hereby certify that T. C. McMeekin appeared personally before me this day and being duly sworn acknowledged that the above form was executed by him.

Witness my hand and notarial seal, this 24th day of September, 19 90.

Seal

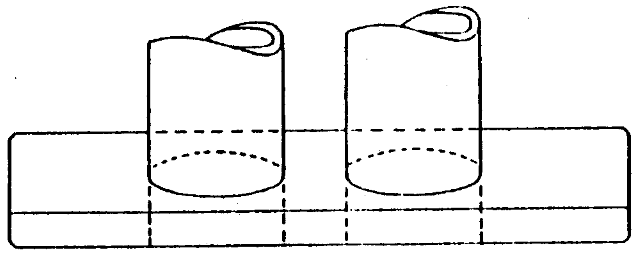
Kathy S. Moraleda
Notary

My commission expires December 13, 1993

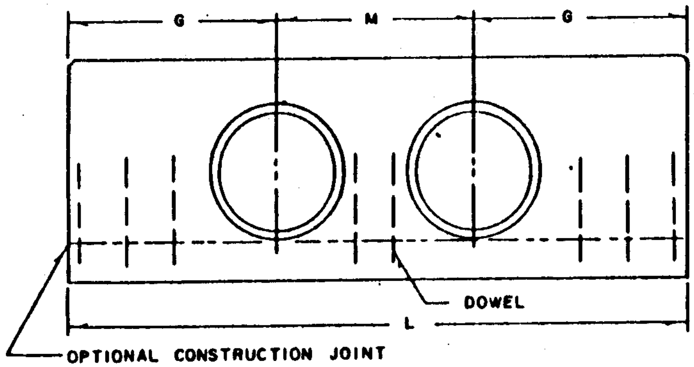
LIST OF (CMLD) STANDARD DRAWINGS

TABLE OF CONTENTS

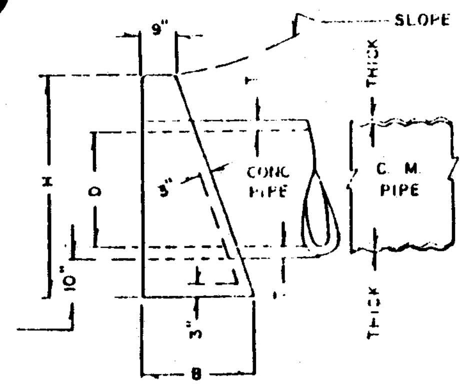
STD. NO.	REV.	TITLE
20.16	0	Concrete End Wall (pipe culverts)
20.23	1	Riprap Apron
30.02	0	Gravel and Riprap Filter Basin (2 sheets)
30.06	2	Temporary Silt Fence (2 sheets)
30.10	1	Temporary Rock Check Dam



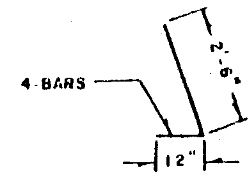
PLAN



ELEVATION



END ELEVATION



DOWEL BAR "X"

DOWELS IN ENDWALL WITH REINFORCED CONCRETE PIPE

LOC.	PIPE DIA	SINGLE PIPE 15"	18"	24"	30"	36"	42"	42"	48"	48"	DOUBLE PIPE 15"	18"	24"	30"	36"	42"	42"	48"	48"
	BARS	"X"	"X"	"X"	"X"	"X"	"X"	Y*	"X"	Y*	"X"	"X"	"X"	"X"	"X"	"X"	Y*	"X"	Y*
G	QTY	2	2	3	3	4	4		5		2	2	3	3	4	4		5	
M	QTY	—	—	—	—	—	—	2	—	2	1	1	2	2	2	2	2	3	2
G	QTY	2	2	3	3	4	4		5		2	2	3	3	4	4		5	
TOT. LBS.		9	9	14	14	19	55		65		12	12	19	19	23	77		92	

* SEE NOTES

DOWELS IN ENDWALL WITH CORRUGATED METAL PIPE

LOC.	PIPE DIA	SINGLE PIPE 15"	18"	24"	30"	36"	42"	42"	48"	48"	DOUBLE PIPE 15"	18"	24"	30"	36"	42"	42"	48"	48"
	BARS	"X"	"X"	"X"	"X"	"X"	"X"	Y*	"X"	Y*	"X"	"X"	"X"	"X"	"X"	"X"	Y*	"X"	Y*
G	QTY.	2	2	3	3	4	4		5		2	2	3	3	4	4		5	
M	QTY.	—	—	—	—	—	—	2	—	2	1	1	1	2	2	2	2	2	2
G	QTY	2	2	3	3	4	4		5		2	2	3	3	4	4		5	
TOT. LBS.		9	9	14	14	19	53		52		12	12	16	19	23	73		85	

* SEE NOTES

DIMENSIONS AND CONCRETE QUANTITIES

	USING CONCRETE PIPE									USING CORRUGATED METAL PIPE							
	COMMON DIMS				SINGLE PIPE		DOUBLE PIPE			COMMON			SINGLE PIPE		DOUBLE PIPE		
D	H	B	G	T	L	CU YD	M	L	CU YD	H	B	G	L	CU. YD	M	L	CU. YD
15"	3'-4"	1'-8"	2'-9"	1 7/8"	5'-6"	0.734	2'-2"	7'-8"	0.970	3'-0"	1'-6"	2'-6"	5'-0"	0.573	1'-11"	6'-11"	0.760
18"	3'-7"	1'-10"	3'-2"	2"	6'-4"	0.958	2'-7"	8'-11"	1.274	3'-3"	1'-8"	2'-11"	5'-10"	0.767	2'-3"	8'-1"	1.014
24"	4'-2"	2'-1"	4'-0"	2 1/2"	8'-0"	1.506	3'-5"	11'-5"	2.010	3'-9"	1'-11"	3'-8"	7'-4"	1.200	3'-0"	10'-4"	1.597
30"	4'-9"	2'-5"	4'-7"	2 3/4"	9'-2"	2.145	4'-3"	13'-5"	2.920	4'-3"	2'-2"	4'-5"	8'-10"	1.757	3'-9"	12'-7"	2.348
36"	5'-3"	2'-8"	5'-6"	3"	11'-0"	3.040	5'-0"	16'-0"	4.086	4'-9"	2'-5"	5'-2"	10'-4"	2.456	4'-6"	14'-10"	3.288
42"	5'-10"	2'-11"	6'-4"	3 1/2"	12'-8"	4.120	5'-10"	18'-6"	5.534	5'-3"	2'-8"	5'-11"	11'-10"	3.310	5'-3"	17'-1"	4.434
48"	6'-5"	3'-3"	7'-2"	4"	14'-4"	5.535	6'-8"	21'-0"	7.427	5'-9"	2'-11"	6'-8"	13'-4"	4.337	6'-0"	19'-4"	5.812

APPROVED DATE 7-1-84

REVISIONS

NO.	DATE	DESCRIPTION

CHARLOTTE - MECKLENBURG LAND DEVELOPMENT STANDARDS

CONCRETE ENDWALL FOR SINGLE AND DOUBLE PIPE CULVERTS 15" THRU 48" PIPE - 90° SKEW

SHEET 1 OF 2

STD. NO.	REV.
20.16	

GENERAL NOTES :

ALL CORNERS TO BE CHAMFERED 1".

THE CONTRACTOR WILL BE REQUIRED TO PLACE 2 - #6 BARS "Y" IN THE TOP OF ALL ENDWALLS FOR PIPE CULVERTS 42" AND OVER WITH A MINIMUM OF 3" COVER AND A LENGTH OF 6" LESS THAN ENDWALL.

FORMS ARE TO BE USED FOR THE CONSTRUCTION OF THE BOTTOM SLAB.

WALL THICKNESS (T) SHOWN IS NOT TO BE INTERPRETED TO MEAN THE THICKNESS ACCEPTABLE, BUT ARE USED ONLY IN COMPUTING ENDWALL QUANTITIES.

IF CONTRACTOR ELECTS TO USE CONSTRUCTION JOINT AT BOTTOM OF PIPE, BAR X (DOWELS) SHALL BE PLACED IN THE BASE AS SHOWN ON PLANS. SPACING OF BARS TO BE APPROXIMATELY 12" CENTERS UNLESS ENGINEER DIRECTS OTHERWISE.

WHEN CONTRACTOR ELECTS TO USE CONSTRUCTION JOINT AT BOTTOM OF PIPE AND POURS BASE SEPARATELY, THE TOP OF BASE SHALL BE LEFT ROUGH.

WHEN SKEW ANGLE OF PIPE IS OVER 45° USE G-1 DIMENSION FOR 45° PLUS 6" FOR EACH 5° OVER 45°. G2 DIMENSION WILL BE THE NEW G-1 DIMENSION DIVIDED BY THE COSINE OF THE ANGLE OF PIPE SKEW.

ALL CONCRETE TO BE 3600 P.S.I.

REVISIONS

NO	DATE	DESCRIPTION

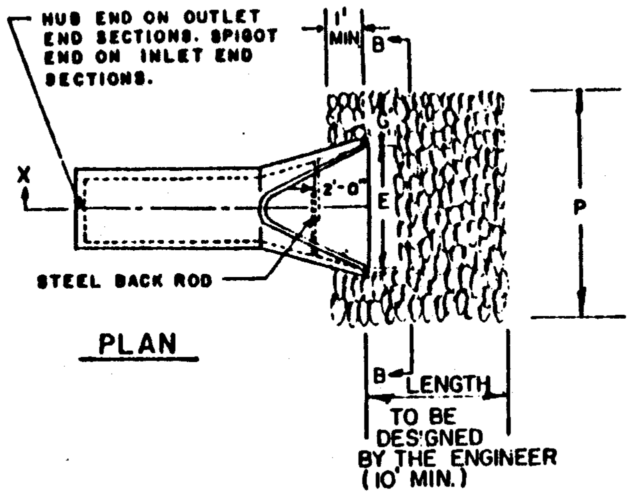
APPROVED DATE 7-1-84

CHARLOTTE - MECKLENBURG LAND DEVELOPMENT STANDARDS

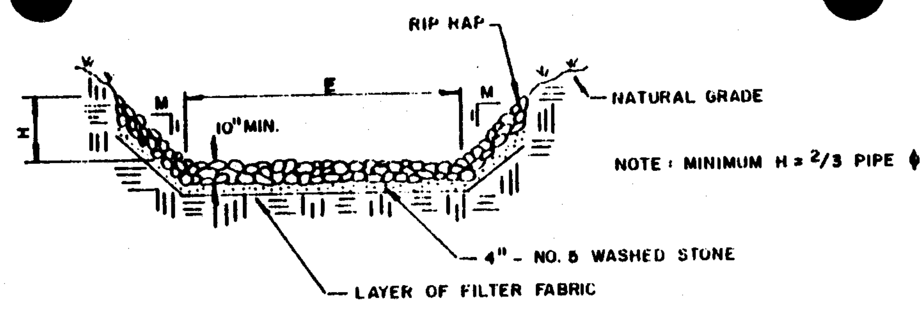
CONCRETE ENDWALL FOR SINGLE AND DOUBLE PIPE CULVERTS 15" THRU 48" PIPE - 90° SKEW

SHEET 2 OF 2

STD. NO. 20.16 REV.



PLAN



SECTION B-B

CLASS OR MEDIAN SIZE OF RIP RAP AND LENGTH, WIDTH AND DEPTH OF APRON TO BE DESIGNED BY THE ENGINEER.

REFER TO STANDARD NO. 20.17 FOR CONCRETE SPLASH PAD.

ALL SUBGRADE FOR STRUCTURE TO BE COMPACTED TO 95% OR GREATER.

BOTTOM GRADE SHALL BE 0.0%. WHEN USING SCS/MD. METHOD

SIDE SLOPES 2:1 OR FLATTER.

SIDEWALLS SHALL EXTEND UP AS SHOWN ON THE PLANS BUT NOT LESS THAN TWO-THIRDS THE PIPE DIAMETER.

THERE SHALL BE NO OVERFALL FROM THE END OF THE APRON TO THE SURFACE OF THE RECEIVING CHANNEL. THE AREA TO BE PAVED OR RIPRAPPED SHALL BE UNDERCUT SO THAT THE INVERT OF THE APRON SHALL BE AT THE SAME GRADE (FLUSH) WITH THE SURFACE OF THE RECEIVING CHANNEL. THE APRON SHALL HAVE A CUTOFF OR TOE WALL AT THE DOWNSTREAM END.

APRON DIMENSIONS AND RIPRAP SIZE OR CONCRETE THICKNESS MUST BE AS SHOWN ON THE PLANS.

THE WIDTH OF THE END OF THE APRON SHALL BE EQUAL TO THE BOTTOM WIDTH OF THE RECEIVING CHANNEL.

THE PLACING OF FILL, EITHER LOOSE OR COMPACTED IN THE RECEIVING CHANNEL SHALL NOT BE ALLOWED.

NO BENDS OR CURVES IN THE HORIZONTAL ALIGNMENT OF THE APRON WILL BE PERMITTED.

BOTTOM GRADE SHALL MATCH SLOPE OF CHANNEL WHEN USING N.Y. DOT. METHOD.

REVISIONS

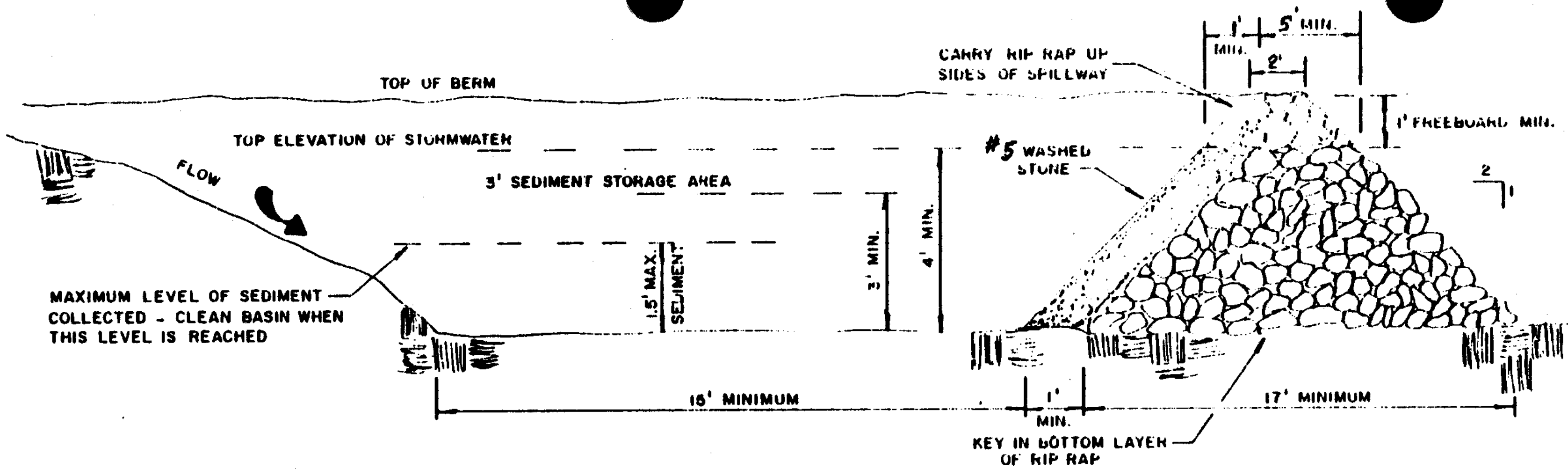
NO	DATE	DESCRIPTION
1	7-1-87	DETAIL

APPROVED DATE 7-1-84

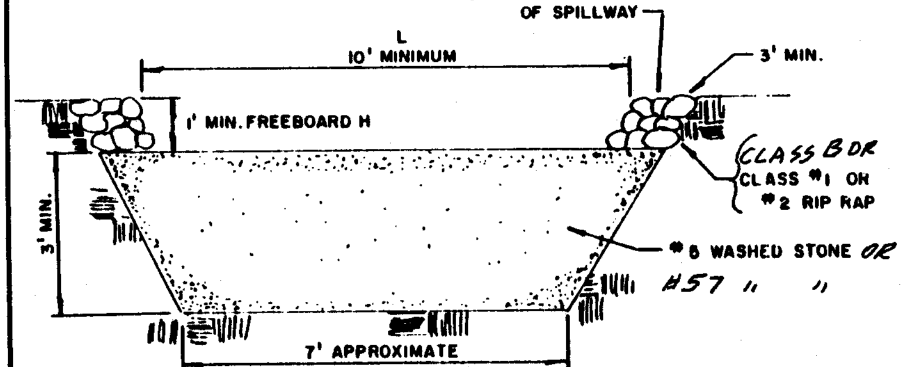
CHARLOTTE - MECKLENBURG LAND DEVELOPMENT STANDARDS

RIP RAP APRON FOR FLARED END SECTION

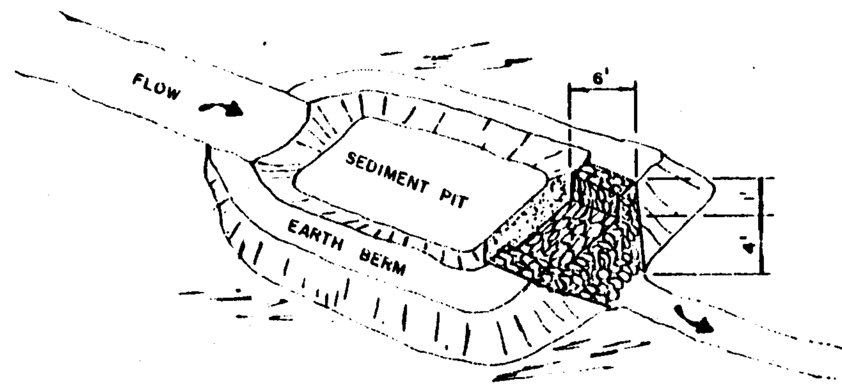
STD NO 20.23



SECTION THROUGH BASIN AND FILTER



SECTION THROUGH BERM AND FILTER



PERSPECTIVE VIEW

NO	DATE	DESCRIPTION

REVISIONS

ROUGHNESS COEFFICIENTS FOR RIP RAP n = 0.028 - 0.033

USE FORMULA FOR BROAD - CRESTED WIER TO DETERMINE L $Q = CLH^{1.5}$

APPROVED DATE 7-1-87

CHARLOTTE - MECKLENBURG LAND DEVELOPMENT STANDARDS

GRAVEL AND RIP RAP FILTER BASIN FOR (FOR AREA TWENTY ACRES OR LESS)

SHEET 1 OF 2

30.02

GENERAL NOTES :

AREA UNDER EMBANKMENT SHALL BE CLEANED, GRUBBED AND STRIPPED OF ANY VEGETATION AND ROOT MAT. THE POOL AREA SHALL BE CLEARED.

THE FILL MATERIAL FOR THE EMBANKMENT SHALL BE FREE OF ROOTS OR OTHER WOODY VEGETATION AS WELL AS OVER SIZED STONES, ROCKS, ORGANIC MATERIAL OR OTHER OBJECTIONABLE MATERIAL. THE EMBANKMENT SHALL BE COMPACTED BY TRAVERSING WITH EQUIPMENT WHILE BEING CONSTRUCTED.

SEDIMENT SHALL BE REMOVED AND TRAP RESTORED TO ITS ORIGINAL DIMENSIONS WHEN THE SEDIMENT HAS ACCUMULATED TO 1/2 THE DESIGN DEPTH OF THE TRAP. REMOVED SEDIMENT SHALL BE DEPOSITED IN A SUITABLE AREA IN SUCH A MANNER THAT IT WILL NOT ERODE.

THE TRAP SHALL BE INSPECTED AFTER EACH RAIN AND REPAIRS MADE AS NEEDED.

CONSTRUCTION OPERATIONS SHALL BE CARRIED OUT IN SUCH A MANNER THAT EROSION AND WATER POLLUTION IS MINIMIZED.

ALL CUT AND FILL SLOPES SHALL BE 2:1 OR FLATTER.

IF SEDIMENT TRAP IS IN USE 30 DAYS OR LONGER, EMBANKMENTS SHOULD BE SEEDED OR OTHERWISE PROPERLY STABILIZED.

STORAGE AREA SHOWN RECTANGULAR FOR ILLUSTRATIVE PURPOSES ONLY. MAY BE CONSTRUCTED IN ANY SHAPE AS LONG AS THE REQUIRED STORAGE IS PROVIDED.

REQUIRED STORAGE = 1800 C.F. PER UNCOVERED ACRE.

LENGTH OF STONE OUTLET SHOULD NOT BE LESS THAN 10 FT.

WHENEVER TOPOGRAPLY ALLOWS, BASIN LENGTH SHOULD BE 2x WIDTH TO ALLOW FOR SETTLING, BAFFLES SHOULD BE INSTALLED IN BASINS WHERE LENGTH IS LESS THAN TWICE THE WIDTH.

REVISIONS

NO	DATE	DESCRIPTION

APPROVED DATE 7-1-87

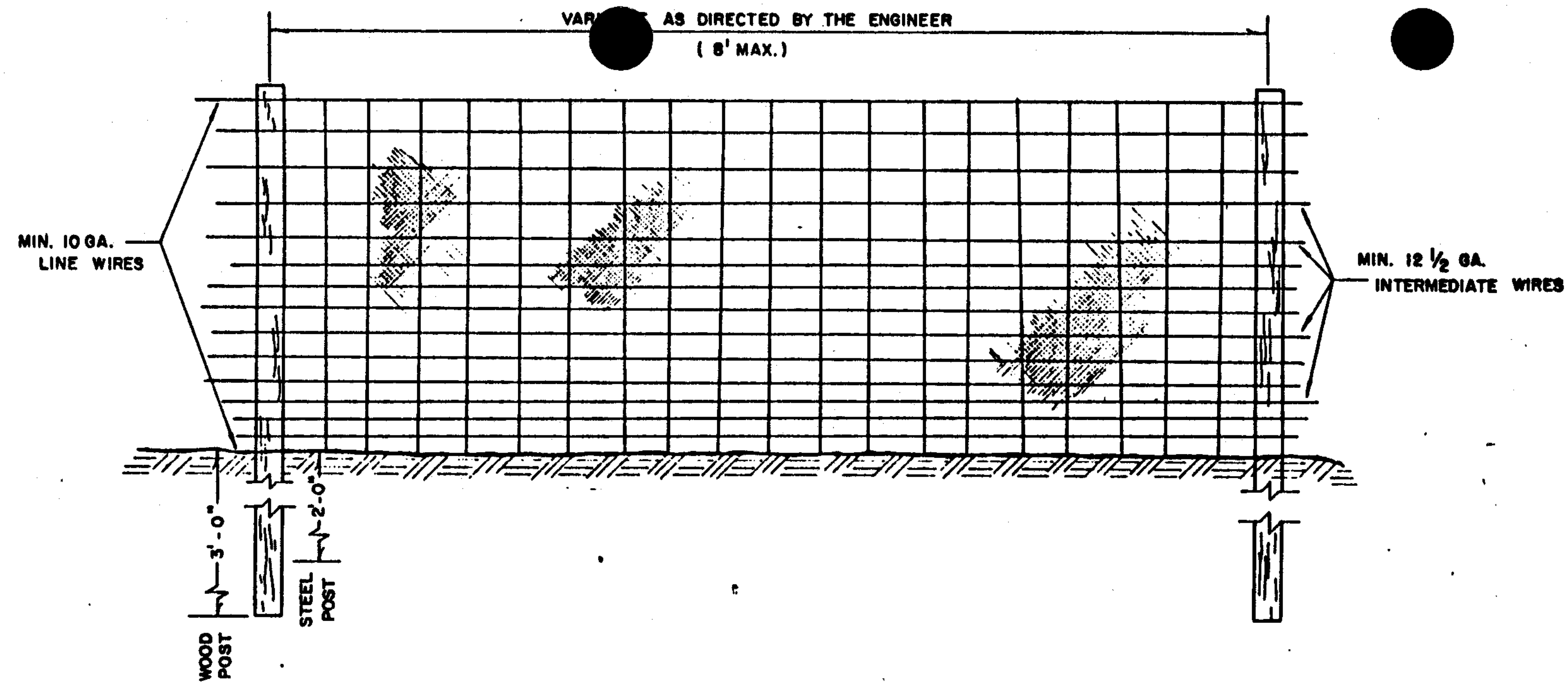
CHARLOTTE - MECKLENBURG LAND DEVELOPMENT STANDARDS

GRAVEL AND RIP RAP FILTER BASIN (FOR AREA TWENTY ACRES OR LESS)

SHEET 2 OF 2

[illegible]

30.02



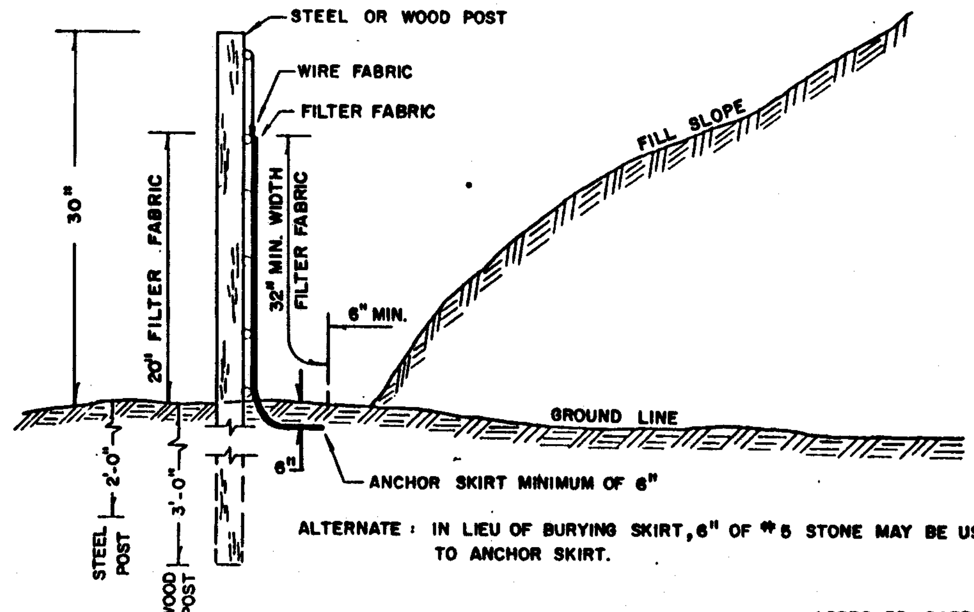
GENERAL NOTES:

FENCE FABRIC SHALL BE A MINIMUM OF 32" IN WIDTH AND SHALL HAVE A MINIMUM OF 6 LINE WIRES WITH 12" STAY SPACING.

FILTER FABRIC SHALL BE MIRAFI 100 FABRIC OR EQUIVALENT. BURLAP CANNOT BE USED WHERE SILT FENCE IS TO REMAIN FOR A PEROID OF MORE THAN 30 DAYS.

STEEL POSTS SHALL BE 5'-0" IN HEIGHT AND BE OF THE SELF-FASTENER ANGLE STEEL TYPE.

WOOD POST SHALL BE 6 TO 7 FEET IN HEIGHT AND 3 TO 4 INCHES IN DIAMETER. WIRE FABRIC SHALL BE FASTENED TO WOODEN POST WITH NOT LESS THAN #9 WIRE STAPLES 1 1/2" LONG.



ALTERNATE : IN LIEU OF BURYING SKIRT, 6" OF #5 STONE MAY BE USED TO ANCHOR SKIRT.

REVISIONS

NO.	DATE	DESCRIPTION
1	7-1-87	NOTES
2	6-27-87	MIRAFI SPEC.

APPROVED DATE 7-1-84

CHARLOTTE - MECKLENBURG LAND DEVELOPMENT STANDARDS

TEMPORARY SILT FENCE

SHEET 1 OF 2

STD. NO.	REV.
30.06	

MAINTENANCE NOTES :

FILTER BARRIERS SHALL BE INSPECTED IMMEDIATELY AFTER EACH RAINFALL AND AT LEAST DAILY DURING PROLONGED RAINFALL. ANY REQUIRED REPAIRS SHALL BE MADE IMMEDIATELY.

SHOULD THE FABRIC DECOMPOSE OR BECOME INEFFECTIVE PRIOR TO THE END OF THE EXPECTED USABLE LIFE AND THE BARRIER STILL BE NECESSARY, THE FABRIC SHALL BE REPLACED PROMPTLY.

SEDIMENT DEPOSITS SHOULD BE REMOVED AFTER EACH STORM EVENT THEY MUST BE REMOVED WHEN DEPOSITS REACH APPROXIMATELY HALF THE HEIGHT OF THE BARRIER.

ANY SEDIMENT DEPOSITS REMAINING IN PLACE AFTER THE SILT FENCE OR FILTER BARRIER IS NO LONGER REQUIRED SHALL BE DRESSED TO CONFORM WITH THE EXISTING GRADE, PREPARED AND SEEDED.

REVISIONS

NO	DATE	DESCRIPTION

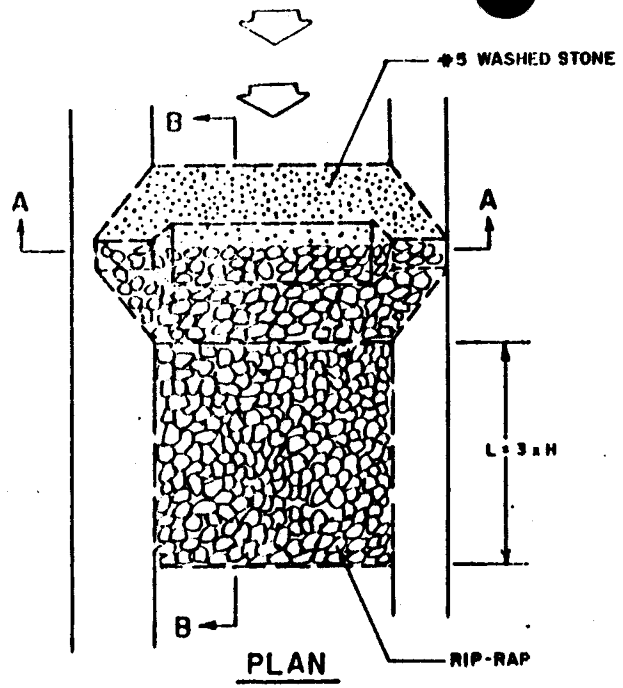
APPROVED DATE 7-1-87

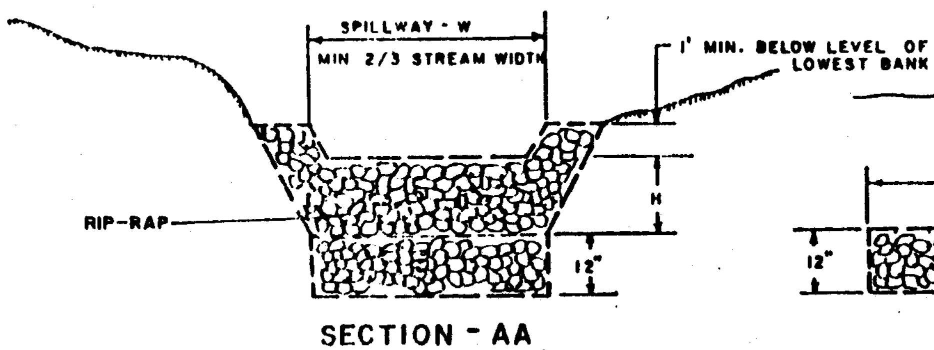
CHARLOTTE - MECKLENBURG
LAND DEVELOPMENT
STANDARDS

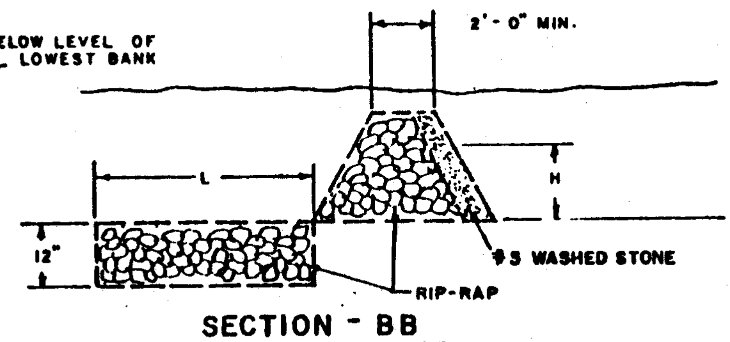
TEMPORARY SILT FENCE

SHEET 2 OF 2

30.06







GENERAL NOTE:

RIP-RAP SIZE TO BE DESIGNED BY ENGINEER.

Class I or Class B

REVISIONS

NO.	DATE	DESCRIPTION
1	7-1-87	DETAIL

APPROVED DATE 7-1-84

CHARLOTTE - MECKLENBURG LAND DEVELOPMENT STANDARDS

TEMPORARY ROCK CHECK DAM

STD. NO	REV.
30.10	

APPENDIX C

ATTACHMENT 2

As Revised 6/20/91

GROUND-WATER AND SURFACE-WATER MONITORING PLAN PROPOSED MCGUIRE LANDFILL SITE MECKLENBURG COUNTY, NORTH CAROLINA

Prepared for:

Duke Power Company
Charlotte, North Carolina

60-04

Prepared by:

Law Environmental, Inc.
Charlotte, North Carolina

June 20, 1991
LEI Job No. 56-1565

PROJECT INFORMATION

Duke Power Company is attempting to permit a solid-waste landfill at a site located south of Highway 73 (See Figure 1) near Duke Power's McGuire Nuclear Station and Cowans Ford Dam. Law Engineering prepared a Report of Geologic and Hydrogeologic Assessment (Law Job No. CHW 7210A, report dated June 1, 1990) for the subject site.

Duke Power also contracted with Law Engineering to develop a ground-water monitoring plan. The proposed plan was transmitted to Duke Power as Law Proposal No. 177EO, dated July 13, 1990. That document was submitted to the Solid Waste Section of the North Carolina Department of Environment, Health and Natural Resources for review. The Solid Waste Section responded to the proposed plan in an attachment to their letter dated June 13, 1991 to Duke Power. The attachment to the Solid Waste Section's letter described required revisions to the plan.

Law Environmental was requested to make the required revisions to the plan by Mr. Barry Thom of Duke Power Company in a telephone conversation with our Mr. Bryan T. Shane on June 13, 1991.

OBJECTIVES

The objective of this plan is to provide for monitoring facilities strategically placed to characterize ground-water and surface-water conditions both upgradient and downgradient of the proposed landfill. In order to accomplish this, we propose the measures and procedures outlined in the following sections, intended to be in accordance with the North Carolina Water Quality Guidance document for solid waste facilities (SW-1001-87).

FIELD ACTIVITIES

Monitoring Well Installation

Ten ground-water quality monitoring wells will be constructed at the approximate locations depicted on Figure 2, Monitoring Well Location Plan. The wells will be "nested" in sets of two at each of five locations. Each nest will include one shallow (water-table) monitoring well and one deep monitoring well. Wells MW-1 and MW-1A are proposed to monitor conditions upgradient of the waste cells. The remaining wells are proposed at downgradient locations, including downgradient monitoring of the proposed leachate collection pond (MW-5, MW-5A).

The shallow monitoring wells (MW-1, MW-2, MW-3, MW-4 and MW-5) will be constructed such that the shallow, unconfined aquifer would be penetrated and screened at the expected seasonal high water table. In order to accommodate seasonal fluctuations in the elevation of the water-table, the shallow wells will incorporate a 15-foot long well screen placed such that the stabilized water level at the time of well installation is located in the upper two feet of the screen. The deep monitoring wells (MW-1A, MW-2A, MW-3A, MW-4A and MW-5A) will be screened at the top of bedrock (soil drilling refusal), likely in partially weathered rock, or at a maximum depth of 100 feet, whichever occurs first. A 10-foot long well screen would be placed at the bottom of the deep wells.

The wells will be constructed in boreholes produced from auger drilling. The boreholes will be advanced by mechanically twisting a continuous-flight, hollow-stem steel auger into the soil. At regular intervals, soil samples will be obtained with a standard 1.4-inch I.D., 2-inch O.D., split-tube sampler. The sampler will first be seated 6 inches with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final 12 inches will be recorded and designated the "penetration resistance".

Representative portions of soil samples, thus obtained, will be examined in the field by a geologist, and Test Boring Records will be prepared. This information will be submitted to DEHNR, Solid Waste Section, along with well completion records (DHS3342) and typical well schematics for each monitoring well installed.

A Type II monitoring well will be constructed in each of the boreholes. The wells will consist of 2-inch diameter, Schedule 40, PVC pipe with flush-threaded joints. The bottom section of the PVC pipe will consist of manufactured well screen with 0.010-inch wide openings. Washed sand backfill will be placed around the outside of the pipe to about two feet above the top of the well screen. The sand backfill is used to stabilize the formation and to help yield a less turbid ground-water sample. A bentonite seal (approximately 1-ft thick) will be installed on top of the sand backfill to seal the monitoring well at the desired level. The remainder of the borehole will be grouted to the ground surface, using the tremie method, with a Portland cement/bentonite mixture. A lockable steel protective cover will then be placed over the well and concrete will be formed or mounded at the surface. A diagram of a Type II Monitoring Well is included herein as Figure 3.

The downhole drilling equipment will be decontaminated by steam cleaning prior to drilling at each location.

Following installation, the new wells will be developed by surge-block and evacuation methods. The purpose of this work is to allow water from the formation to more freely enter the borehole. The techniques also tend to remove fines within the sand filter pack to enhance the possibility of sampling ground water relatively free of suspended solids.

Ground-Water Sampling

Each well will be fitted with a dedicated ground-water sampling system. A copy of the manufacturer's specifications is included in the appendix to this plan. The dedicated system will be used for purging the well prior to sampling and for acquiring samples of ground water. These systems are the same as those used in the ground-water monitoring wells at the existing landfill. The dedicated system includes a mechanism to measure ground-water depth in the wells. The measured value will be used in conjunction with the total casing depth to determine the height of the water column. The volume of water standing in each well will then be calculated. Representative ground-water samples will be collected following purging at least three times the volume of water within the wells or by evacuating twice to dryness.

Upon recovery of the water samples from the wells, pH, temperature and specific conductance will be measured in the field using portable, calibrated meters. The pH meter will be calibrated daily with three buffer solutions (e.g., pH of 4, 7 and 10). The specific conductance meter will also be calibrated daily using two, known, standard solutions.

Chain-of-custody documentation will be used to provide a written record tracing the possession and handling of the samples from the time of collection through laboratory analysis and final recording of the results.

Surface-Water Sampling

Surface-water samples will be collected from the stream just northwest of the subject site at the approximate locations shown on Figure 1, Site Location and Surface-Water Sampling Plan. Location S-1 is designated as the upgradient sampling location and S-2 as the downgradient location. These two locations will be prominently flagged in the field so they will be readily identifiable for each sampling event.

Measurements of temperature, pH and specific conductance will be made and recorded in the field as described above for ground-water samples. The surface-water samples will be collected in laboratory-supplied containers, appropriately preserved and delivered to a state approved laboratory. Chain-of-Custody documentation will be maintained as described above.

CHEMICAL ANALYSIS

The ground-water and surface-water samples will be analyzed for arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, chloride, copper, fluoride, iron, manganese, nitrate, sulphates, zinc, TOX (total organic halogens), TOC (total organic carbon), TDS (total dissolved solids), BOD (biological oxygen demand) and COD (chemical oxygen demand). In order to provide quality assurance, one laboratory trip blank and one field rinse blank will be tested for TOX, TOC and COD as part of each sampling event.

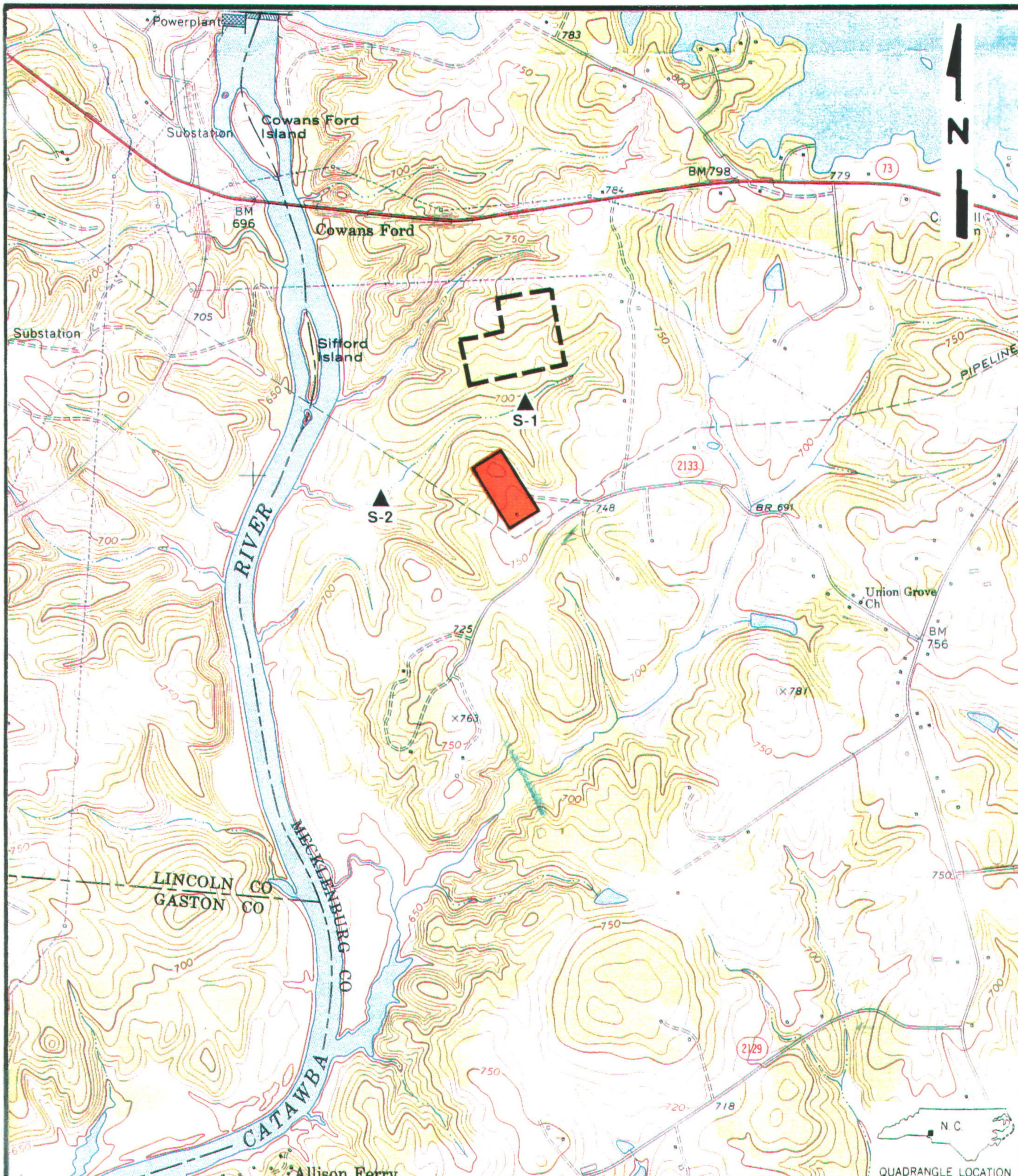
Radiological Parameters

MONITORING WELL SAMPLING SCHEDULE

After the installation and initial development of the monitoring wells, ground-water and surface-water samples will be collected to characterize water conditions prior to operation of the landfill. The wells and surface-water monitoring stations would be sampled upon start-up of landfilling activities and on a semi-annual basis thereafter.

REPORTING TEST RESULTS

Test results will be reported to the Solid Waste Hydrogeologist, Solid Waste Section, Department of Environment, Health and Natural Resources, P.O. Box 27687, Raleigh, NC, 27611 within 15 days of receipt of the results from the laboratory.



EXPLANATION

PROPOSED LANDFILL

SWITCHYARD

SURFACE-WATER SAMPLING POINT

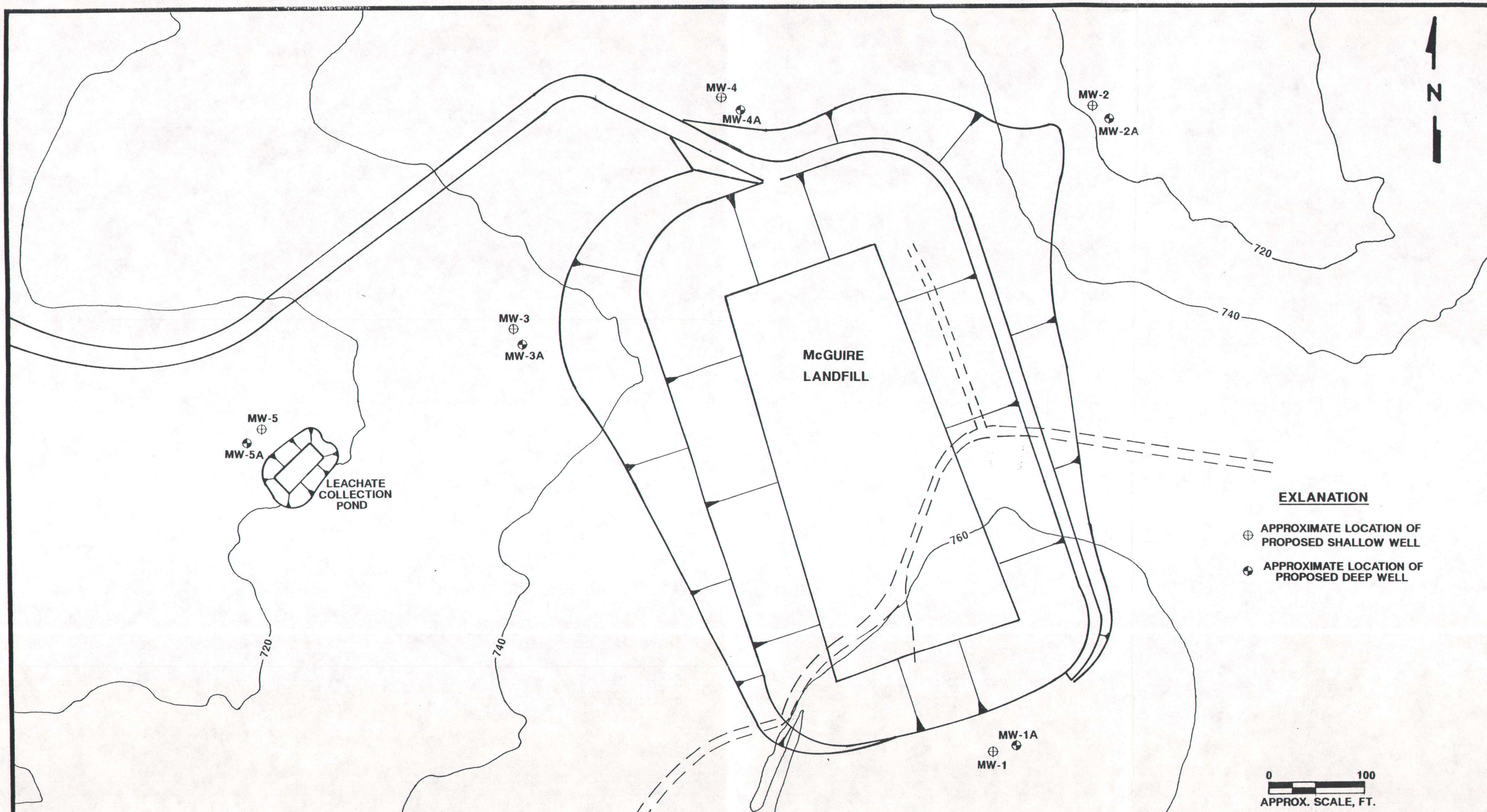
0 2000
APPROX. SCALE, FT.

REF.: U.S.G.S. 7.5 MIN. TOPOGRAPHIC MAP, LAKE NORMAN SOUTH, NORTH CAROLINA QUADRANGLE, DATED 1970.

LAW ENVIRONMENTAL, INC.
CHARLOTTE, NORTH CAROLINA

SITE LOCATION & SURFACE-WATER SAMPLING PLAN
DUKE POWER COMPANY
McGUIRE LANDFILL SITE
MECKLENBURG COUNTY, NORTH CAROLINA

JOB NO. 56-1565	FIGURE 1



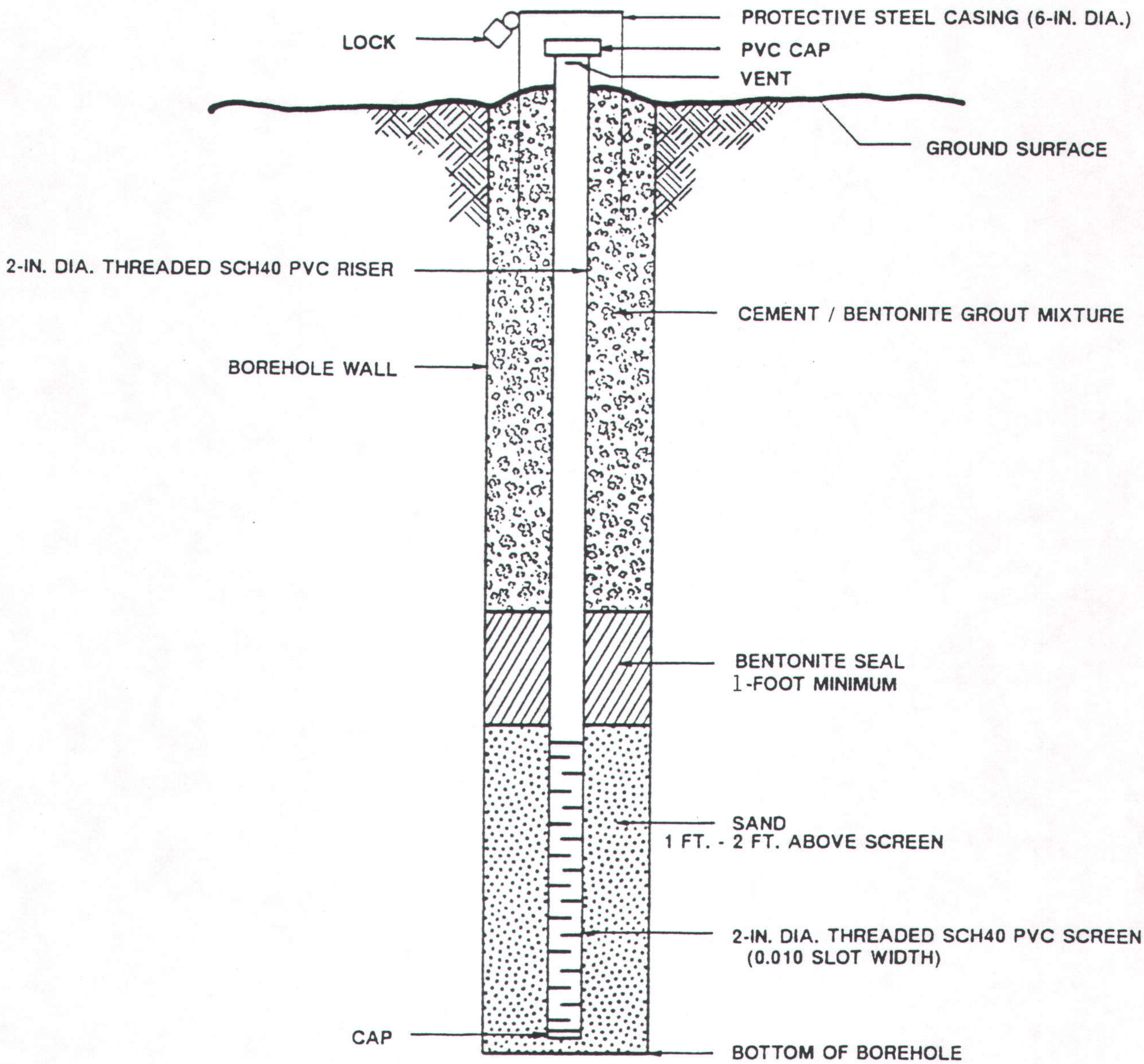
REF.: DUKE POWER CO., DWG. NO. CFD-MG-6433C-P-0010,
McGUIRE NUCLEAR STATION,
LANDFILL LEACHATE SYSTEM; DATED 8-30-90.

LAW ENVIRONMENTAL
CHARLOTTE, NORTH CAROLINA

MONITORING WELL LOCATION PLAN
DUKE POWER COMPANY
McGUIRE LANDFILL SITE
MECKLENBURG COUNTY, NORTH CAROLINA

JOB NO. 56-1159	FIGURE 2

TYPE II WELL



TYPE II MONITORING WELL CONSTRUCTION DIAGRAM	LAW ENVIRONMENTAL, INC. CHARLOTTE, NORTH CAROLINA	FIGURE 3

APPENDIX

WELL WIZARD

Sampling Pumps

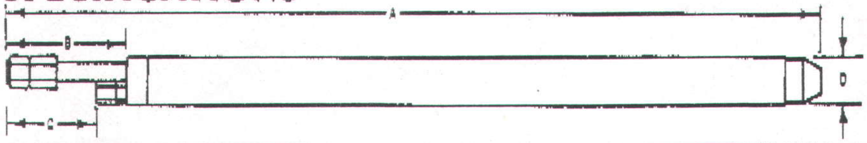
Choose the system that gives you the superior performance you deserve.

The whole reason you're selecting a dedicated bladder pump system for groundwater monitoring is because of its accuracy and long-term reliability. Don't settle for second best—get the high quality you deserve.

QED built the business of dedicated bladder pump systems. Our pumps are the heart of the system, so we spare no effort to make them the best.

Many of the details that make a superior pump are subtle modifications resulting from years of experience. They may not be obvious at first glance, but check the specs of our pumps. You'll find flow rates, pumping lifts, material quality, durability, and selection that clearly show our commitment to supplying you with the best pumps possible.

SPECIFICATIONS



MODEL NO.	BODY MATERIAL	BLADDER MATERIAL	TUBE FITTINGS †	MAXIMUM LIFT (Ft.)	A	B	C	D	PUMP WEIGHT (Lbs)
					(Dimension in inches)				
P-1100	PVC	PVC	Polypropylene	300	40.85	4.65	3.70	1.66	3
T-1100	Teflon	Teflon	Teflon	250	40.33	4.13	2.96	1.66	4
P-1101	PVC	Teflon	Polypropylene	300	40.85	4.65	3.70	1.66	3
P-1101H	PVC	Teflon	316 S.S.	600	40.75	4.50	3.70	1.66	3
ST-1101P	316 S.S.	Teflon	316 S.S.	1000	40.50	4.12	3.12	1.66	10
T-1200	Teflon/316 S.S.	Teflon	316 S.S.	300	41.14	3.93	3.06	1.50	5
P-1201	PVC/316 S.S.	Teflon	Polypropylene	300	41.23	4.02	3.06	1.50	4
P-1201H	PVC/316 S.S.	Teflon	316 S.S.	600	41.37	4.16	3.20	1.50	4
T-1300	Teflon/316 S.S.	Teflon	316 S.S.	200	15.87	3.87	2.87	1.00	3

† All Air Supply Tube Fittings: 0.25" O.D.
Discharge Tube Fittings: 0.5" O.D.
(Except T-1300: 0.375" O.D.)

* T-1300 requires Clamp Tool No. 35188 for field attachment of tubing. Clamps are provided with pump.

PLEASE NOTE: Intake Screens are standard on T-1300, and are optional on other models. Please consult QED.

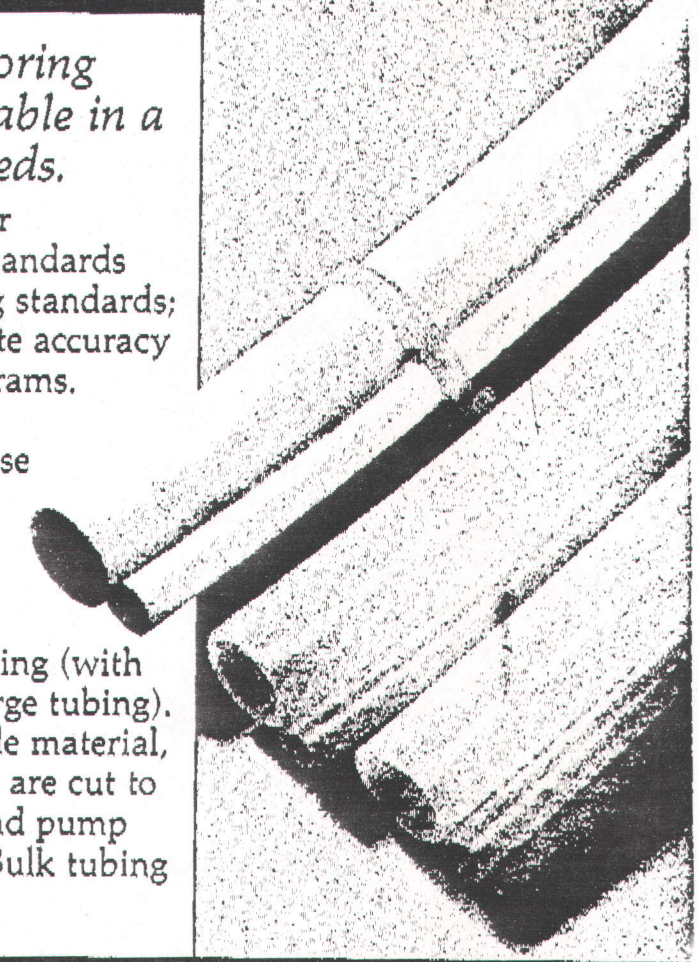
Field Replaceable Bladders

For Pumps	W/ Hand Tool	W/O Hand Tool
T-1100	14055	14065
P-1101	14057	14067
T-1200	35315	35320
P-1201	35315	35320

Note: All kits contain 2 bladder sleeves and seal replacement sets. 35315 includes pin punch.

WELL WIZARD®

Tubing & Accessories



A critical component of any monitoring system, tubing assemblies are available in a variety of materials for different needs.

QED has always recognized that groundwater monitoring demands much higher material standards than other applications. This applies to tubing standards; QED tubing enhancements ensure the ultimate accuracy of groundwater samples for monitoring programs.

Twin-line bonded tubing makes handling, installation, and portable water level probe use easier. Available in:

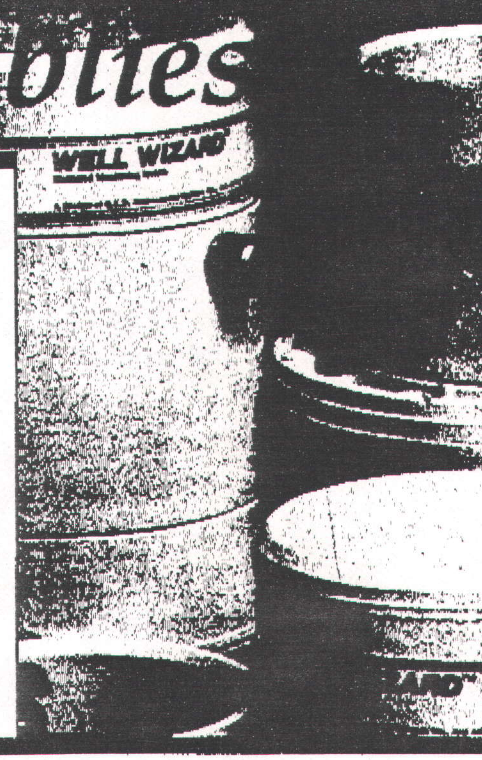
- all-Teflon® (recommended for use with Teflon and stainless steel pumps;
- polyethylene (for use with PVC pumps);
- economical Teflon-lined polyethylene tubing (with Teflon on the inside of the sample discharge tubing).

All tubing is controlled-quality, virgin-grade material, without printing. Standard tubing assemblies are cut to exact length and pre-assembled to well cap and pump per customer specifications at no extra cost. Bulk tubing is also available.

SPECIFICATIONS

MODEL NUMBER	MATERIAL	AIR SUPPLY O.D.	AIR SUPPLY I.D.	DISCHARGE O.D.	DISCHARGE I.D.	MAXIMUM WORKING PRESSURE	PUMP DEPTH	BOND TYPE	USED ON
P-5100	Polyethylene	0.250	0.170	0.500	0.375	125	250	Continuous Bond	Sampling Pumps 1100 and 1200
PT-5100	Teflon-lined PE	0.250	0.170	0.500	0.375	125	250	Continuous Bond	Sampling Pumps 1100 and 1200
T-5110	Teflon	0.250	0.170	0.500	0.375	240	500	Continuous Bond	Sampling Pumps T-1100 and T-1200
PR-5100	Polypropylene	0.250	0.170	0.500	0.375	300	600	Cable Wrap	Sampling Pumps P-1101H and P-1201H
P-5000	Polyethylene	0.250	0.170	0.375	0.250	125	250	Continuous Bond	Sampling Pump T-1300
PT-5000	Teflon-lined PE	0.250	0.170	0.375	0.250	125	250	Continuous Bond	Sampling Pump T-1300
T-5010	Teflon	0.250	0.170	0.375	0.250	240	500	Continuous Bond	Sampling Pump T-1300
P-5200	Polyethylene	0.250	0.170	0.250	0.170	170	340	Continuous Bond	Sampling Pumps 1100 and 1200
PT-5200	Teflon-lined PE	0.250	0.170	0.250	0.170	170	340	Continuous Bond	Sampling Pumps 1100 and 1200
T-5200	Teflon	0.250	0.170	0.250	0.170	320	640	Continuous Bond	Sampling Pumps 1100 and 1200
P-5610	Polyethylene	0.500	0.375	0.750	0.625	150	200*	Continuous Bond	Purge Pumps 4100, 4300/4500LB, 4600
T-5600	Teflon	0.500	0.375	0.750	0.625	125	200*	Teflon Ring	Purge Pumps HR-4200, HR-4700/HR-4700LB

*Couplers Available
Consult QED for maximum continuous lengths.
Maximum pump depth recommendations based upon Purge Pump intended use limits.

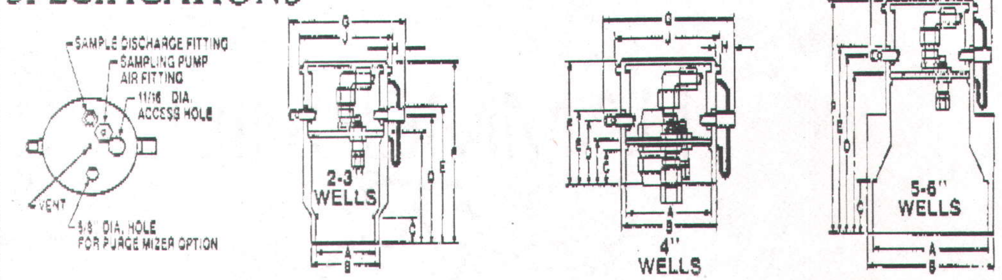


LOCKING WELL CAPS

The industry's broadest range of standard caps, engineered for hardware attachment and protection of the well—plus custom service for every need.

What tops off a well-dressed well? A cap from QED. A sampling system cap that fits the wellhead properly can be the difference between a smooth installation or problems requiring on-site modification. Our large stock of standard caps handles most sampling situations, but we've supplied hundreds of custom-fabricated designs—with rapid, responsive service to complete even the largest, tightest installation schedules on time. Protected caps have PVC bodies with locking covers; standard fittings are brass and polypropylene, with other materials available. QED carries more cap models and sizes than we can list here, for wells from 1-1/4" to 8" (even threaded and other special-purpose caps). Call us with your questions and special needs, and put our experience to work for you.

SPECIFICATIONS

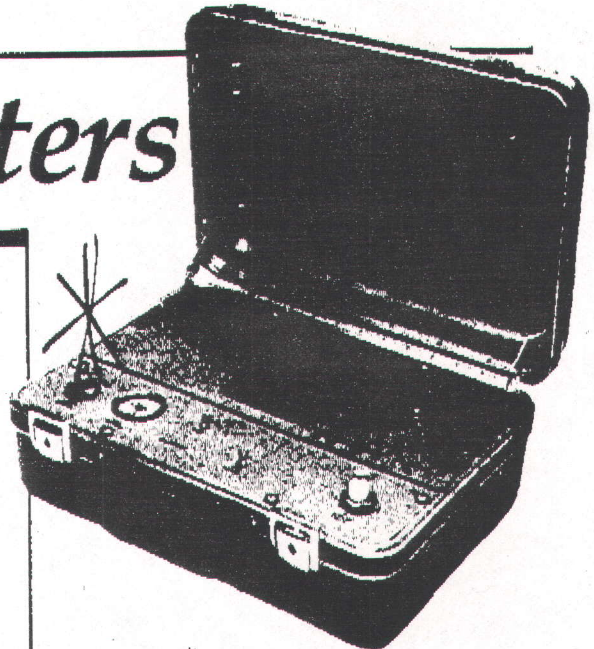


CASING SIZE*	MODEL NUMBER	A	B	C	D	E	F CLOSED	F OPEN	G	H	I	J
For use with 1" Sample pumps												
1.5	2001	1.92	2.69	1.37	8.64	9.14	11.76	14.26	6.38	0.50	11.75	5.50
For use with 1" Sample pumps and Purge Mizer												
2"	2052-A-Inch	2.38	2.69	0.75	7.75	8.26	10.88	13.38	6.38	0.50	6.38	5.50
For use with Sample pumps only												
2"	2000-A	2.38	2.69	0.75	3.75	4.25	6.50	9.00	6.38	0.50	2.48	5.50
For use with Sample Pumps and Purge Mizer												
2"	2020-A	2.38	2.69	0.75	7.76	8.26	10.88	13.38	6.38	0.50	6.38	5.50
3"	2020-B	3.50	3.94	1.50	8.07	8.57	11.18	13.68	6.38	0.50	6.68	5.50
4"	2020-C	4.50	5.06	1.75	3.25	3.75	6.38	8.88	6.38	0.50	2.25	5.50
5"	2020-D	5.56	6.18	3.00	10.63	11.13	13.75	16.25	6.38	0.50	9.25	5.50
6"	2020-E	6.62	7.25	3.06	10.75	11.25	13.875	16.38	6.38	0.50	9.38	5.12
For use with Purge Master												
2"	2052-A	2.38	2.69	0.75	7.75	8.26	10.88	13.38	6.38	0.50	6.38	5.50
3"	2052-B	3.5	3.94	1.50	8.07	8.57	11.18	13.68	6.38	0.50	6.38	5.50
4"	2050-C	4.50	5.06	1.75	3.25	3.75	6.38	8.88	6.38	0.50	2.25	5.50
5"	2050-D	5.56	6.18	3.00	10.63	11.13	13.75	16.25	6.38	0.50	9.25	5.50
6"	2050-E	6.62	7.25	3.06	10.75	11.25	13.875	16.38	6.38	0.50	9.38	5.12

*Casing sizes listed denote nominal pipe size designations. See page 4 for actual internal and external diameters.

WELL WIZARD®

Water Level Meters



DIGITAL ELECTRONIC METER

Dedicated probes & portable meter deliver readings accurate to ±.01 feet.

The Model 6010-E sets a new standard for precision under field conditions. Low-cost probes in each well complete the dedicated system, provide rapid water level measurement without introducing portable devices. Levels are read directly from LCD display—no judgment calls, variation from different techniques, or danger of cross-well contamination.

System is powered by standard AA batteries and internal compressed air charge. Compact metering unit weighs only 9 pounds, measures just 15" x 12" x 6½". Precision, field-rugged transducer and signal conditioning microprocessor deliver readings accurate to ±.01 ft., time after time. Built-in features for easy operation include preprogrammed warmup, auto-zero, operational prompting, and low battery warning. Includes precision calibration probe for adjustment.

PROBE SPECIFICATIONS

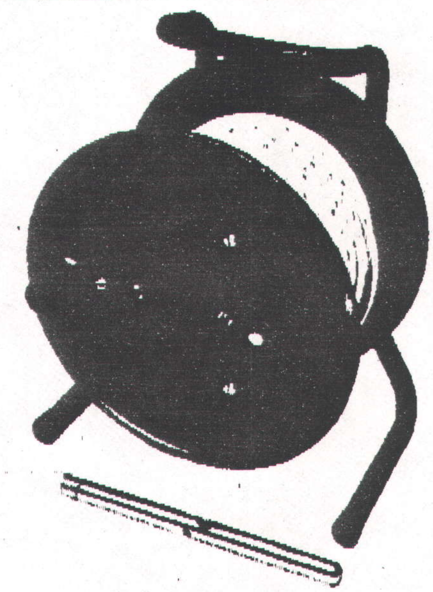
MODEL NO.	MATERIAL	O.D.	I.D.	LENGTH	CONNECTOR MATERIAL
6115	PVC	0.54	0.288	40.04	Polypropylene
→ 6111	316 S.S.	0.54	0.354	13.04	Polypropylene
6120	Teflon	0.54	0.270	19.40	Teflon

Probe and probe tubing must be ordered separately for each well.

PORTABLE WATER LEVEL METER

The portable Sample Pro 6000 series provides convenient, reliable measurement of static water level. The 5/8" diameter electronic probe is lowered into the well on a flat polyethylene tape until audio and visual alarms indicate contact with static water. Depth is measured from easy-to-read markings in .05 foot increments.

The probe is specially designed to eliminate false readings caused by cascading water. It operates for six months on a single 9-volt battery. Model 6000 water level meters are available in standard lengths of 100', 150', and 300'. Other lengths and markings are available.



Tubing is Teflon but no specs are available.

APPENDIX D

LAW ENGINEERING

REPORT

of

GEOLOGIC AND HYDROGEOLOGIC ASSESSMENT

PHASE I

PROPOSED LAND FILL DISPOSAL SITE

MCGUIRE NUCLEAR STATION

Mecklenburg County, North Carolina

Law Job No. CHW 7210A

-Prepared for-

Duke Power Company
Charlotte, North Carolina

June 1, 1990

June 1, 1990

LAW ENGINEERING

GEOTECHNICAL, ENVIRONMENTAL
& CONSTRUCTION MATERIALS
CONSULTANTS

Duke Power Company
P. O. Box 33189
Charlotte, North Carolina 28242

Attention: Mr. C. B. Thom

Subject: Report of Geologic and Hydrogeologic Assessment
Proposed Land Fill Disposal Site
McGuire Nuclear Station
Mecklenburg County, North Carolina
Law Job No. CHW 7210A

Gentlemen:

As authorized by your acceptance of our Proposal No. 303E9 dated November 17, 1989 and your letter of authorization to our Mr. Thomas H. Bolyard, Law Engineering is pleased to submit this report of our geologic and hydrogeologic assessment for the subject site. The purpose of this report was to develop information about the site and subsurface conditions that could be used in determining the feasibility of constructing a landfill for solid wastedisposal. This report describes the work performed and presents the soil testing data as outlined in Phase I of the referenced proposal.

We appreciate the opportunity to continue to provide our environmental-related services on this project. Please contact us if any questions arise or if we may be of further service.

Sincerely,

LAW ENGINEERING

Jerry L. Meade, P.E.
Project Engineer

Chris L. Corbitt

Chris L. Corbitt, P.G.
Project Geologist

Mel Y. Browning

Mel Y. Browning, P.E.
Senior Geotechnical Engineer

RECEIVED
McGUIRE CIVIL SECTION
JUN 4 . 1990

FILE NO:__________

JLM:CL:MYB:am
Attachments

P.O. BOX 11297
CHARLOTTE, NC 28220
501 MINUET LANE
CHARLOTTE, NC 28217
704-523-2022

TABLE OF CONTENTS

1.0 PROJECT INFORMATION

2.0 FIELD ACTIVITIES

2.1 Soil Test Borings
2.2 Observation Well Installation
2.3 Water Table Elevations
2.4 Well Permeability Testing

3.0 AREA GEOLOGY
4.0 SUBSURFACE CONDITIONS
5.0 LABORATORY PHYSICAL TESTING PROCEDURES AND RESULTS

TABLES

Table 1 - Summary of Observation Well Information
Table 2 - Summary of Water-Table Elevations
Table 3 - Summary of Hydraulic Conductivities
Table 4 - Summary of Soil Permeability Test Data
Table 5 - Summary of Physical Testing Data for Soils

FIGURES

Figure 1 - General Vicinity Map
Figure 2 - Observation Well Location Plan
Figure 3 - Stratagraphic Cross-Section A-A
Figure 4 - Stratagraphic Cross-Section B-B

Appendicies

Appendix A - Soil Test Boring Records
Appendix B - Well Construction Records
Appendix C - Particle Size Analysis of Soils (ASTM D 422)
Appendix D - Moisture-Density Relations of Soils and Soil-Aggregate Mixtures (ASTM D 698)
Appendix E - Triaxial Compression Tests
Appendix F - Constant Head Permeability (USACOA EM 1110-2-1906, Appendix VII)

1.0 PROJECT INFORMATION

We understand that Duke Power is interested in having site-specific, supporting information obtained for use in their permit application for a solid waste landfill on the subject site. The proposed site is located south of Highway 73 near Duke Power's McGuire Nuclear Facility, referenced on Figure 1. This information requested is necessary for submittal to the North Carolina Solid Waste Management Section as required for landfill permitting according to the North Carolina Administrative Code T10:10G, Section 0.0504, (1)(c).

Our understanding of the project information is based on a meeting with Mr. C.B. Thom of Duke Power and our Mr. Tom Bolyard on November 10, 1989 and on information supplied by Duke Power.

2.0 FIELD ACTIVITIES

2.1 Soil Test Borings

Five soil test borings OW-1, OW-2, OW-3, OW-4 and OW-5 were drilled at the subject site between December 13 and 28, 1989. These borings, which were subsequently converted to observation wells, were drilled at the approximate locations shown on Figure 2, Observation Well Location Plan. Observation well locations were located in the field by our Mr. Tom Bolyard and Mr. C.B. Thom of Duke Power.

The borings were drilled by mechanically advanced, hollow-stem steel augers. Soil sampling and penetration testing were performed in general accordance with ASTM D 1586. At regular intervals, soil sampled were obtained with a standard 1.4-inch I.D., 2-inch O.D., split-tube sampler. The sampler was first seated 6 inches to penetrate any loose cuttings, and then driven an addition 12 inches with blows of 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final 12 inches was recorded and is designated the "penetration resistance". To minimize the potential for cross-contamination between borings, all down-hole drilling equipment was steam-cleaned prior to drilling each boring. Representative portions of soil samples, thus obtained, were placed in containers and transported to our soils laboratory. In the laboratory, the samples were examined by a geotechnical engineer to verify the driller's field classifications. Test Boring Records are included in Appendix A, showing the soil descriptions and penetration resistances for each boring.

2.2 Observation Well Installation

Observation wells were constructed in each of the five 6-inch diameter boreholes previously described. The observation wells were constructed the same as Type II monitoring wells for planned ground-water monitoring purposes, except well covers were not installed for each well. The casing within the wells consisted of two-inch diameter, Schedule 40, PVC pipe with flush-threaded joints. The bottom 10-ft section of the PVC pipe consisted of manufactured well screen with 0.010-inch wide openings. The screens were set such that the 24-hour ground-water levels were approximately within the screened intervals. Washed sand backfill was used to stabilize the formation and to help yield a less turbid ground-water sample. An approximate 2-foot bentonite seal was installed on top of the sand backfill to seal the observation well from water influx above the screened interval. The remainder of the borehole was grouted with a cement-bentonite mixture to the ground surface. Each observation well was enclosed with a concrete collar. Well Installation Records are included in Appendix B. A Summary of Observation Well Information is presented in Table 1.

2.3 Water Table Elevations

The depth-to-water has been recorded at each observation well and presented in Table 2, Summary of Water-Table Elevations. Ground-water levels may fluctuate several feet with seasonal and rainfall variations and with changes in the water level in adjacent drainage features. Normally, the highest ground-water levels occur in late winter and spring and the lowest levels occur in late summer and fall. A potentiometric map of the surficial aquifer is referenced on Figure 2. The ground-water contours were recorded for the highest measured water table, May 11, 1990.

actually 3/4 is highest
not significant difference though

2.4 Well Permeability Testing

Inflow-type permeability tests were conducted in the three observation wells (OW-2, OW-3 and OW-4) to determine the in-situ saturated hydraulic conductivity, K, of the material through which ground water recharges these wells. The hydraulic conductivity is a constant of proportionality relating to the ease with which a fluid passes through a porous medium. The field procedure involves the measurement of the depth to the ground water in a well, removal of the water from the well by bailing and measurement of the rate of the recovering ground-water level. The hydraulic conductivity is then computed by the variable head method (NAVFAC DM-7.1, 1982). A summary of the well permeability test results is presented in Table 3.

3.0 AREA GEOLOGY

The project site is located in the Piedmont Physiographic Province, an area underlain by ancient igneous and metamorphic rocks. The virgin soils encountered in this area are the residual product of in-place chemical weathering of rock which was similar to the rock presently underlying the site. In areas not altered by erosion or disturbed by the activities of man, the typical residual soil profile consists of clayey soils near the surface, where soil weathering is more advanced, underlain by sandy silts and silty sands. The boundary between soil and rock is not sharply defined. This transitional zone termed "partially weathered rock" is normally found overlying the parent bedrock. Partially weathered rock is defined, for engineering purposes, as residual material with standard penetration resistances in excess of 100 blows per foot. Weathering is facilitated by fractures, joints and by the presence of less resistant rock types. Consequently, the profile of the partially weathered rock and hard rock is quite irregular and erratic, even over short horizontal distances. Also, it is not unusual to find lenses and boulders of hard rock and zones of partially weathered rock within the soil mantle, well above the general bedrock level.

4.0 SUBSURFACE CONDITIONS

A layer of topsoil was encountered in each boring. At boring OW-1, OW-2, OW-4 and OW-5, firm to very stiff micaceous fine sandy silt was encountered throughout the borings to approximately 50 feet.

Boring OW-3 encountered stiff to very stiff fine to medium sandy silts extending to a depth of about 27 feet. Below the silt, very firm to firm very silty fine to medium sand was encountered from 27 to 45 feet.

The above lithologic descriptions provide a general summary of the subsurface conditions encountered. The attached Test Boring Records (Appendix A) contain detailed information recorded at each of the deep boring locations. These Test Boring Records represent our interpretation of the field logs based on engineering examination of the field samples. The lines designating the interfaces between various strata represent approximate boundaries and the transition between strata may be gradual. Stratigraphic cross-sections of the soils are shown on Figures 3 and 4.

5.0 PHYSICAL TESTING PROCEDURES AND RESULTS

Selected soil samples were tested using the following procedures:

- ASTM D 2216 Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil Aggregate Mixtures (Table 5)
- ASTM D 854 Specific Gravity of Soils (Table 5)
- ASTM D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Table 5)
- ASTM D 422 Particle Size Analysis of Soils (Appendix C)
- ASTM D 698 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in (305-mm) Drop (Appendix D)
- ASTM D 4767 Triaxial Test (Appendix F)
- USACOE Constant Head Permeability (Appendix E)

EM 110-2-1906 Appendix VIII

The results of our physical laboratory data are included in the Appendices and tables as referenced above. A description of the method and results are presented below:

Natural Moisture Content

The natural moisture content of selected samples was determined in accordance with ASTM D 2216. The moisture content of the soil is the ratio, expressed as a percentage, of the weight of water in a given mass of soil to the weight of the soil particles. A summary of results are presented in Table 5, Summary of Physical Laboratory Test Data.

Soil Plasticity

Representative samples of the upper clayey soils (0 to 3 ft) were selected for Atterberg Limits testing to determine their soil plasticity characteristics. Table 5 presents the Summary of the data. The soil's Plasticity Index (PI) is representative of this characteristic and is bracketed by the Liquid Limit (LL) and the Plastic Limit (PL). These characteristics are determined in accordance with ASTM D 4318. The LL is the moisture content at which the soil will flow as a heavy viscous fluid. The PL is the moisture content at which the soil begins to lose its plasticity.

Certain soils swell and shrink with increases and decreases in soil moisture. The PI is related to this potential volume change ability. Past experience has shown that soils having a PI of less than 30 are only slightly susceptible to volume changes. Soils having a PI greater than 50 are generally very susceptible to these volume changes. Soils with a PI between these limits have moderate volume change potential. The soils at OW-5 (0-3 ft) are moderately susceptible to volume change. The shallow soils (0-3 ft) at borings OW-1, OW-2 and OW-4 were found slightly susceptible to volume change.

Grain Size Distribution

Grain size tests were performed on representative soil samples to determine the particle size distribution of these materials. After initial drying, the samples were washed over a U. S. standard No. 200 sieve to remove the fines (particles finer than a No. 200 mesh sieve). The samples were then dried and sieved through a standard set of nested sieves. This test was performed in a manner similar to that described by ASTM D 422. The results are presented as percent finer by weight versus particle size curves on the attached Grain Size Distribution sheets (Appendix C).

Compaction

Representative loose samples of soils from the project site were collected, placed in cloth sacks and returned to the laboratory for compaction testing. Standard Proctor compaction tests (ASTM D 698) were performed on selected samples to determine their compaction characteristics, including their maximum dry density and optimum moisture content. Test results are presented in Appendix D, with a summary presented below:

Boring No.	Depth (ft)	Optimum Moisture Content (present)
OW-1	0 - 3	25.9
	3 - 10	23.1
OW-2	3 - 9	22.2
OW-3	3 - 8	23.1
OW-4	0 - 3	27.6
	3 - 8	25.2
OW-5	0 - 3	30.5
	3 - 8	26.2

Triaxial Compression Test

Soils were remolded in Shelby tubes for triaxial compression testing. Sections of samples were extruded from the Shelby tubes for triaxial shear testing. The sections were then trimmed into cylinders 2.4 inches in diameter and encased in rubber membranes. Each was then placed in a compression chamber and confined by all-around water pressure. An increasing axial load was then applied until the sample failed in shear. The test results are presented in the form of Stress-Strain Curves and Mohr Diagrams on the accompanying Triaxial Compression Test in Appendix E.

Permeability

Permeability testing was conducted on soils remolded from boring OW-1, OW-2, OW-4 and OW-5 at the depth at 3 to 10 feet. The results of the soil permeability data is included in Appendix F, with a Summary of Soil Permeability data presented in Table 4. These permeabilities ranged from 8.2 x 10^{-6} cm/sec to 3.5 x 10^{-4} cm/sec. Based on these values, the average unsaturated soil permeability is moderately slow.

TABLES

TABLE 1

SUMMARY OF OBSERVATION WELL INFORMATION
Duke Power Company
Proposed McGuire Land Fill
Mecklenburg County, North Carolina
Law Job No. CH 7210A

Observation Well Number	Top of Pipe Elevation[1] (ft)	Total Depth of Well (ft)	Depth to Water[2] (ft)	Estimated Ground-Water Elevation (ft)
OW-1	764.33	50	46.10	718.23
OW-2	756.90	50	42.35	714.55
OW-3	741.43	45	34.90	706.53
OW-4	749.74	50	40.65	709.09
OW-5	751.31	50	47.47	703.84

1) Elevation based on Duke Power Survey

2) Measured on May 11, 1990

TABLE 2
SUMMARY OF WATER-TABLE ELEVATIONS[1]
Duke Power Company
Proposed McGuire Land Fill
Mecklenburg County, North Carolina
Law Job No. CHW 7210A

		Observation Well No.				
		1	2	3	4	5
Date	Time	(field)	(road)	(woods)	(brush)	(barn)
1/15/90	1:00	48.05	45.03	38.05	43.10	49.05
1/26/90	2:00	48.02	45.20	38.70	39.95	48.90
1/31/90	2:00	47.95	45.15	37.70	42.95	48.90
2/08/90	1:00	47.80	48.00	37.30	42.75	48.80
2/21/90	11:00	47.70	44.55	---	42.60	48.60
3/06/90	3:00	47.30	44.15	36.65	42.20	48.25
3/16/90	3:00	47.05	43.85	36.25	41.90	48.00
3/22/90	13:18	47.00	43.70	36.15	41.85	48.00
3/28/90	15:30	46.85	43.45	36.00	41.65	47.85
4/04/90	16:10	46.60	43.10	35.60	41.35	47.70
4/12/90	14:52	46.60	43.10	35.55	41.35	47.75
4/26/90	14:53	46.20	42.55	35.05	40.85	47.45
5/04/90	14:10	46.10	42.34	34.85	40.72	47.38
5/11/90	15:00	46.10	42.35	34.90	40.65	47.47

1) Data furnished by Duke Power Company

TABLE 3
SUMMARY OF HYDRAULIC CONDUCTIVITIES
Duke Power Company
Proposed McGuire Land Fill
Mecklenburg County, North Carolina
Law Job No. CHW 7210A

Well No.	In-Situ Hydraulic Conductivity - K (cm/sec)
OW-2	3.4×10^{-5}
OW-3	1.0×10^{-4}
OW-4	5.8×10^{-5}

TABLE 4

SUMMARY OF SOIL PERMEABILITY TEST DATA
Duke Power Company
Proposed McGuire Land Fill
Mecklenburg County, North Carolina
Law Job No. CHW 7210A

Observation Well No.	Depth of Soil Sample (ft)	Permeability - K (cm/sec)
OW-1	3.0 - 10.0	1.1×10^{-5}
OW-2	3.0 - 10.0	4.8×10^{-6}
OW-4	3.0 - 10.0	3.5×10^{-4}
OW-5	3.0 - 10.0	8.2×10^{-6}

TABLE 5

SUMMARY OF PHYSICAL TESTING DATA
Duke Power Company
Proposed McGuire Land Fill
Mecklenburg County, North Carolina
Law Job No. CHW 7210A

Boring No.	Sample Depth(ft)	Sample Type	Specific Gravity	Natural Moisture,%	Atterberg Limit		
					Liquid Limit	Liquid Limit	Plasticity Index
OW-1	0 - 3	Bulk	2.76	29.5	68	39	29
OW-2	0 - 3	Bulk	2.72	31.8	71	43	28
OW-4	0 - 3	Bulk	2.69	30.4	66	37	29
OW-5	0 - 3	Bulk	2.71	36.0	69	35	34

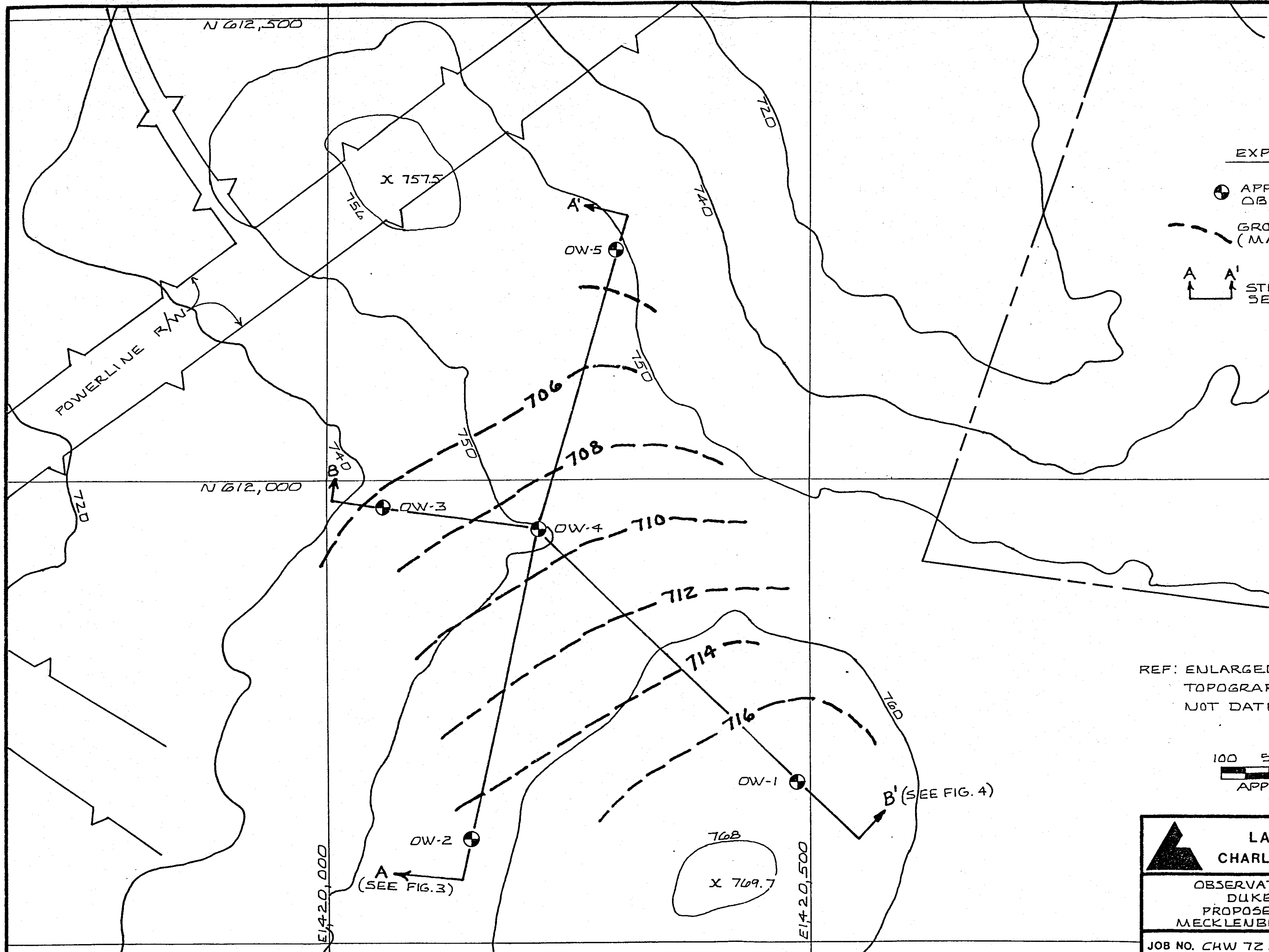
Figures

LAW ENGINEERING
CHARLOTTE, NORTH CAROLINA

GENERAL VICINITY MAP
DUKE POWER COMPANY
PROPOSED McGUIRE LANDFILL
MECKLENBURG COUNTY, NORTH CAROLINA

JOB NO. CHW 7210A	FIGURE 1

REF: USGS TOPOGRAPHIC MAP, LAKE NORMAN SOUTH, NORTH CAROLINA, DATED 1970



EXPLANATION

APPROX. LOCATION OF OBSERVATION WELL

GROUNDWATER CONTOUR (MAY 11, 1990)

A A' STRATIGRAPHIC CROSS-SECTION LINE

REF: ENLARGED DUKE POWER TOPOGRAPHIC MAP NO. MNSMAP.00, NOT DATED

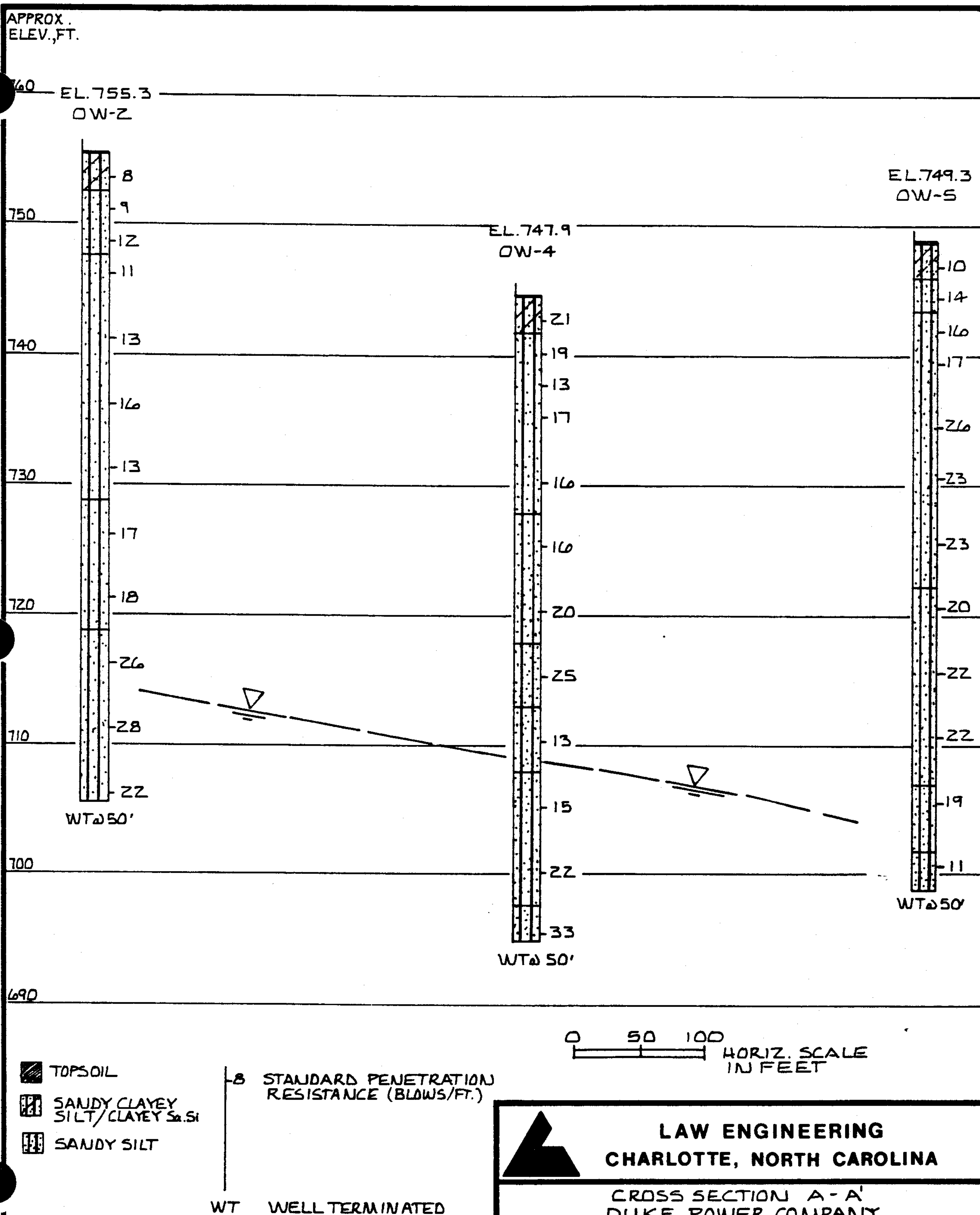
100 50 0 100

APPROX. SCALE, FT.

LAW ENGINEERING
CHARLOTTE, NORTH CAROLINA

OBSERVATION WELL LOCATION PLAN
DUKE POWER COMPANY
PROPOSED McGUIRE LANDFILL
MECKLENBURG COUNTY, NORTH CAROLINA

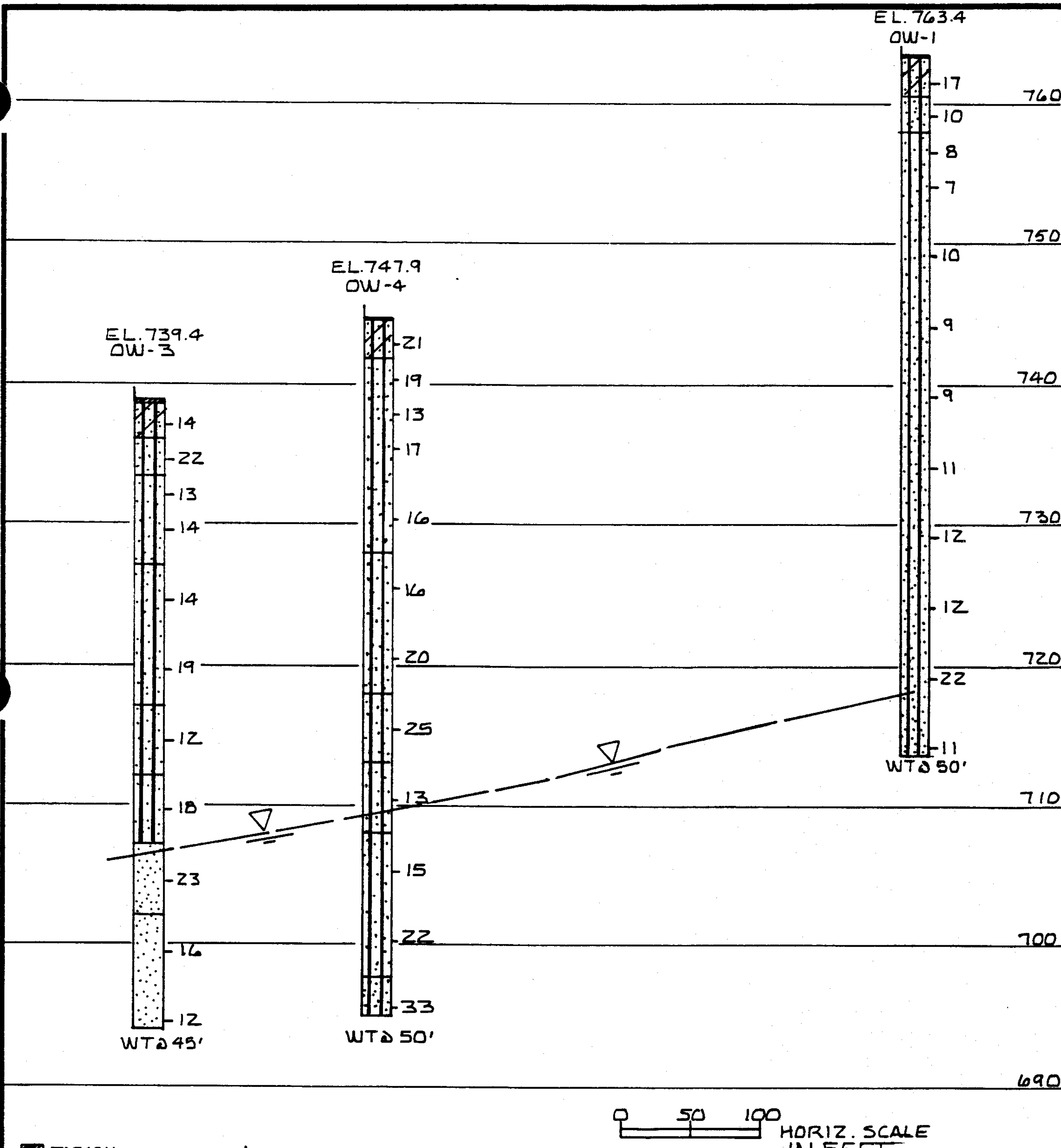
JOB NO. CHW 7210 A | FIGURE 2



LAW ENGINEERING
CHARLOTTE, NORTH CAROLINA

CROSS SECTION A - A'
DUKE POWER COMPANY
PROPOSED M^c GUIRE LANDFILL
MECKLENBURG COUNTY, NORTH CAROLINA

JOB NO. CHW7210A	**FIGURE** 3



TOPSOIL

SANDY CLAYEY SILT

SANDY SILT

SAND

14 STANDARD PENETRATION RESISTANCE (BLOWS/FT.)

WT WELL TERMINATED

LAW ENGINEERING
CHARLOTTE, NORTH CAROLINA

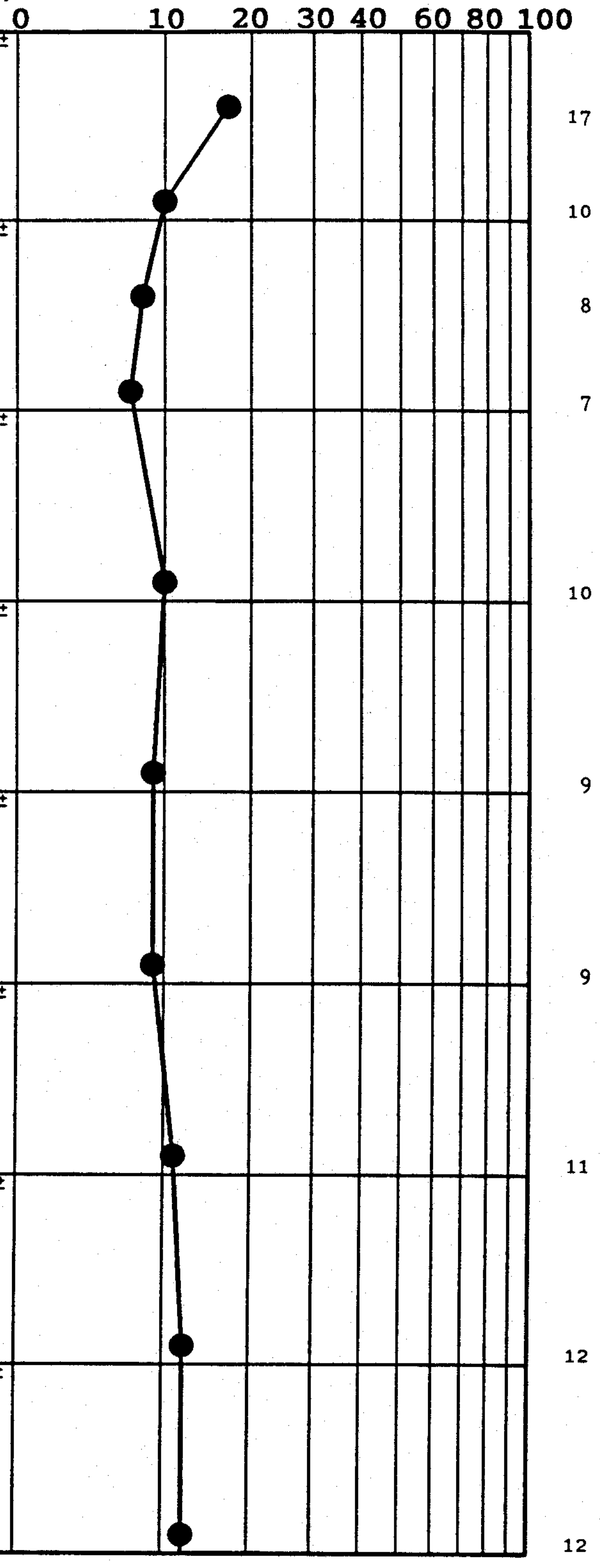
CROSS SECTION B-B'
DUKE POWER COMPANY
PROPOSED McGUIRE LANDFILL
MECKLENBURG COUNTY, NORTH CAROLINA

JOB NO. CHW 7210 A	**FIGURE** 4

Boring Logs

APPENDIX A

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	PENETRATION - BLOWS/FOOT
0.0		763.4±	
0.2	Topsoil		
	Residuum - Very Stiff Red Brown Micaceous Fine Sandy Clayey Silt		17
3.0	Stiff Light Redish Brown Micaceous Clayey Fine Sandy Silt		10
5.5	Firm to Stiff Light Yellowish Brown to Multi-Colored Micaceous Fine Sandy Silt	758.4±	8
			7
		753.4±	10
		748.4±	9
		743.4±	9
		738.4±	11
		733.4±	12
		728.4±	12
40.0			



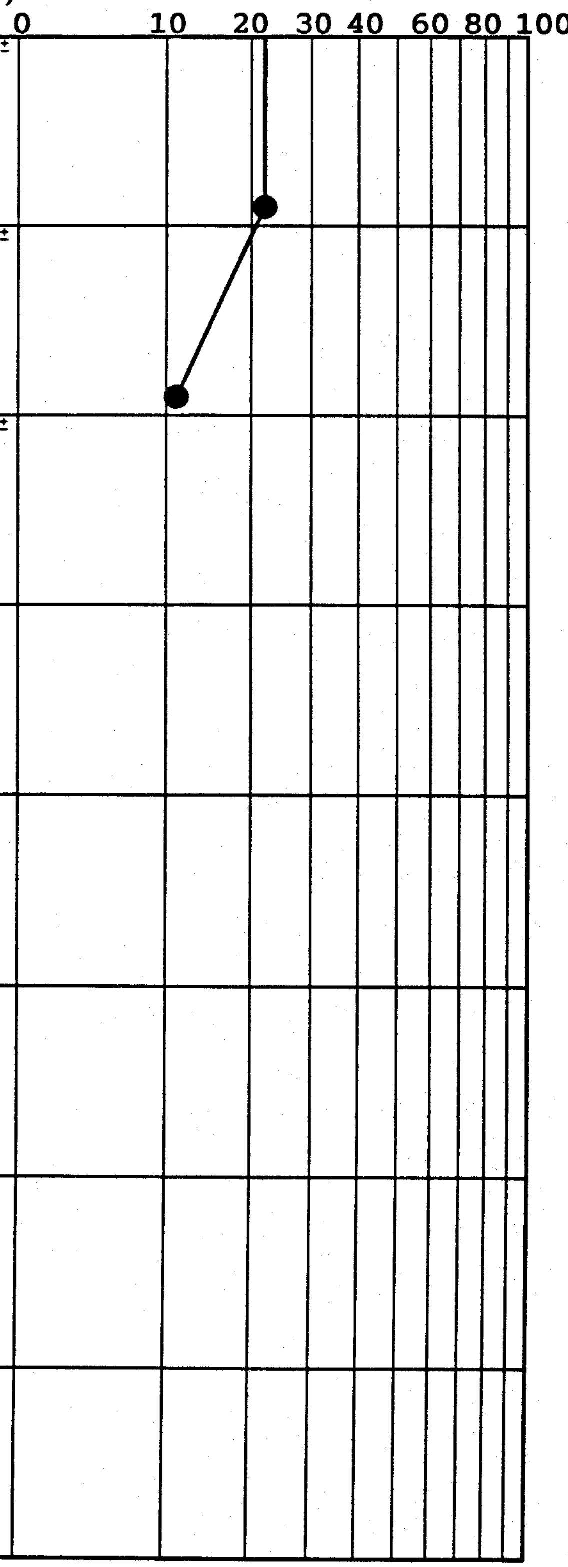
SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVATIONS USED ABOVE

TEST BORING RECORD

BORING NUMBER OW-1
DATE DRILLED 12-28-89
PROJECT NUMBER CHW 7210A
PROJECT MCGUIRE LANDFILL
PAGE 1 OF 2

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	● PENETRATION - BLOWS/FOOT	
40.0	Firm to Stiff Light Yellowish Brown to Multi-Colored Micaceous Fine Sandy Silt	723.4±		
		718.4±		22
50.0	Boring Terminated at 50 Ft. No Ground Water Encountered at Time of Boring.	713.4±		11



SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVATIONS USED ABOVE

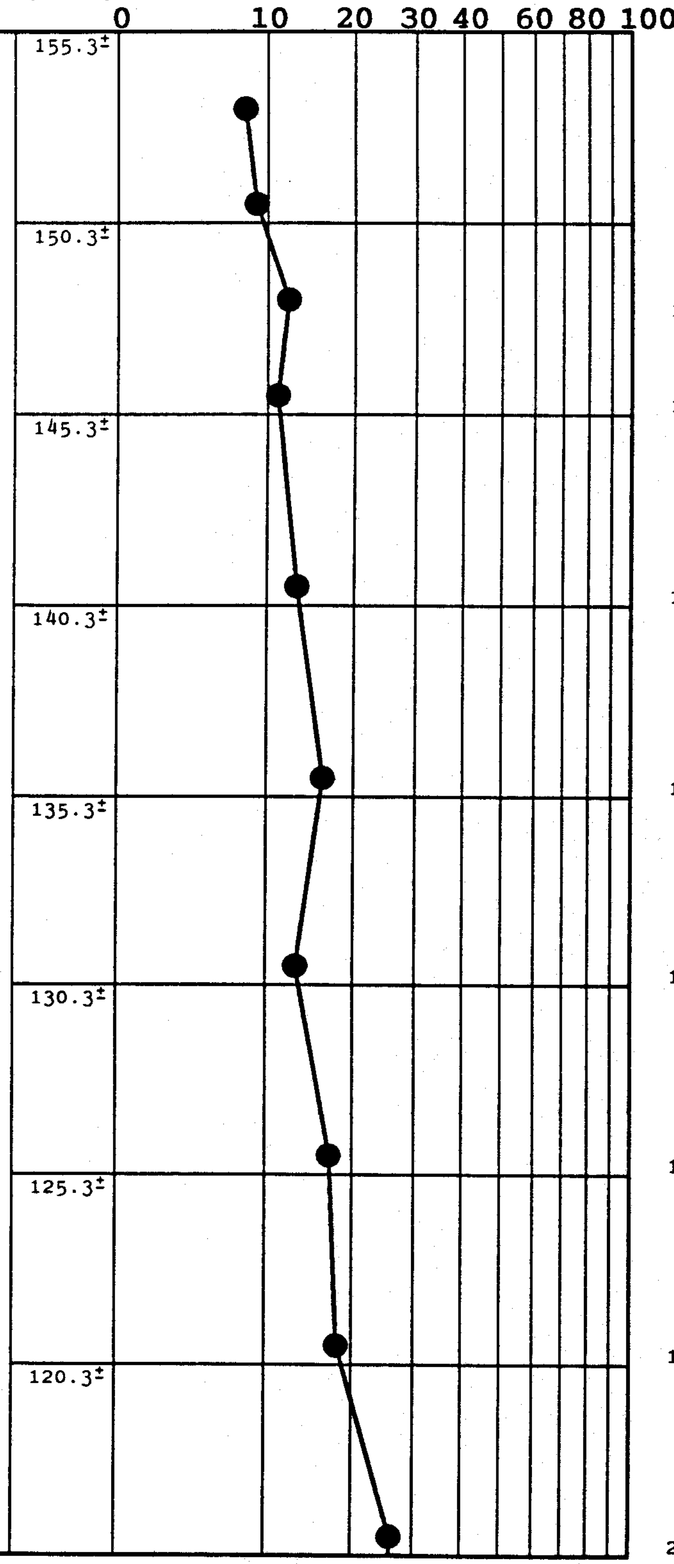
TEST BORING RECORD

BORING NUMBER OW-1
DATE DRILLED 12-28-89
PROJECT NUMBER CHW 7210A
PROJECT MCGUIRE LANDFILL
PAGE 2 OF 2

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION
0.0	
0.1	Topsoil
	Residuum - Firm Red Brown Micaceous Fine Sandy Clayey Silt
3.0	Stiff Purplish Brown and Yellow Brown Micaceous Fine Sandy Silt
8.0	Stiff to Very stiff Purplish Brown and Yellow Brown Micaceous Fine Slightly Sandy Silt
27.0	Very Stiff Purplish Yellow Brown to Multi-Colored Micaceous Fine to Medium Sandy Silt
37.0	Very Stiff Brownish Yellow and Black Fine to Medium Sandy Silt
40.0	

ELEVATION (FT.) ● PENETRATION - BLOWS/FOOT



Blows/Foot
8
9
12
11
13
16
13
17
18
26

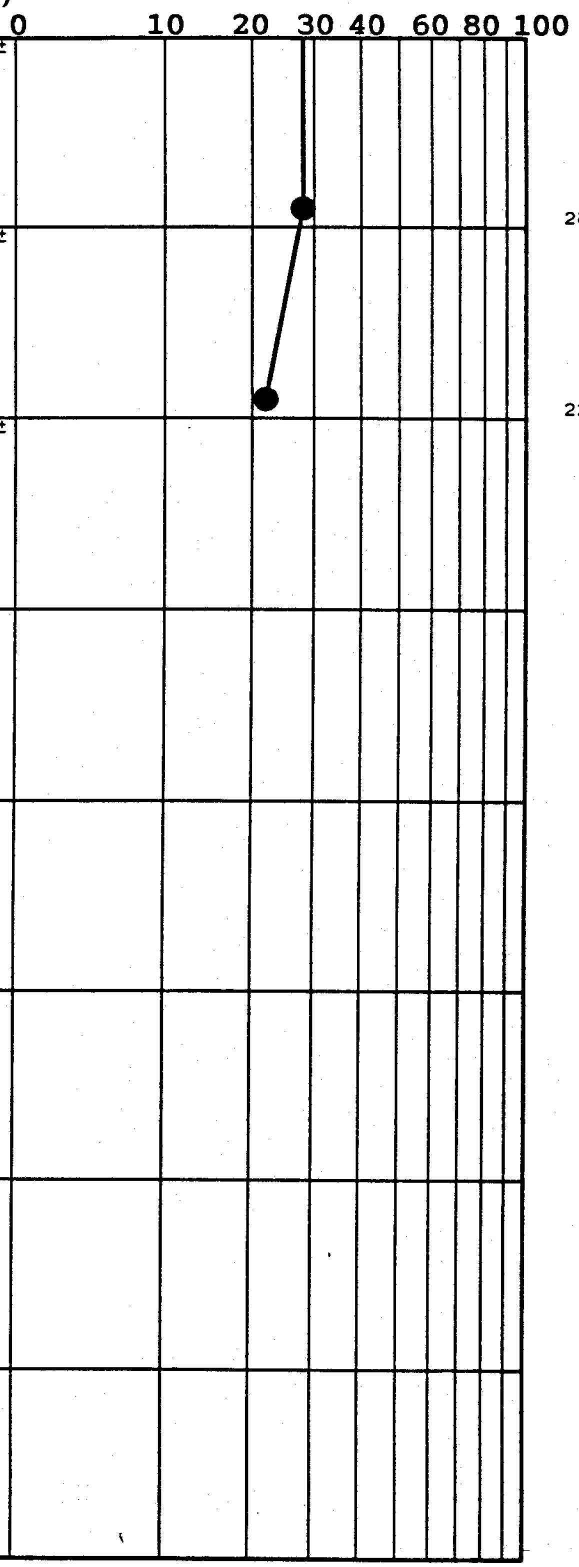
SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVATIONS USED ABOVE

TEST BORING RECORD

BORING NUMBER OW-2
DATE DRILLED 12-16-89
PROJECT NUMBER CHW 7210A
PROJECT MCGUIRE LANDFILL
PAGE 1 OF 2

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	PENETRATION - BLOWS/FOOT
40.0	Very Stiff Brownish Yellow and Black Micaceous Fine to Medium Sandy Silt	115.3±	
		110.3±	28
50.0	Boring Terminated at 50 Ft. No Ground Water Encountered at Time of Boring.	105.3±	22



SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVATIONS USED ABOVE

TEST BORING RECORD

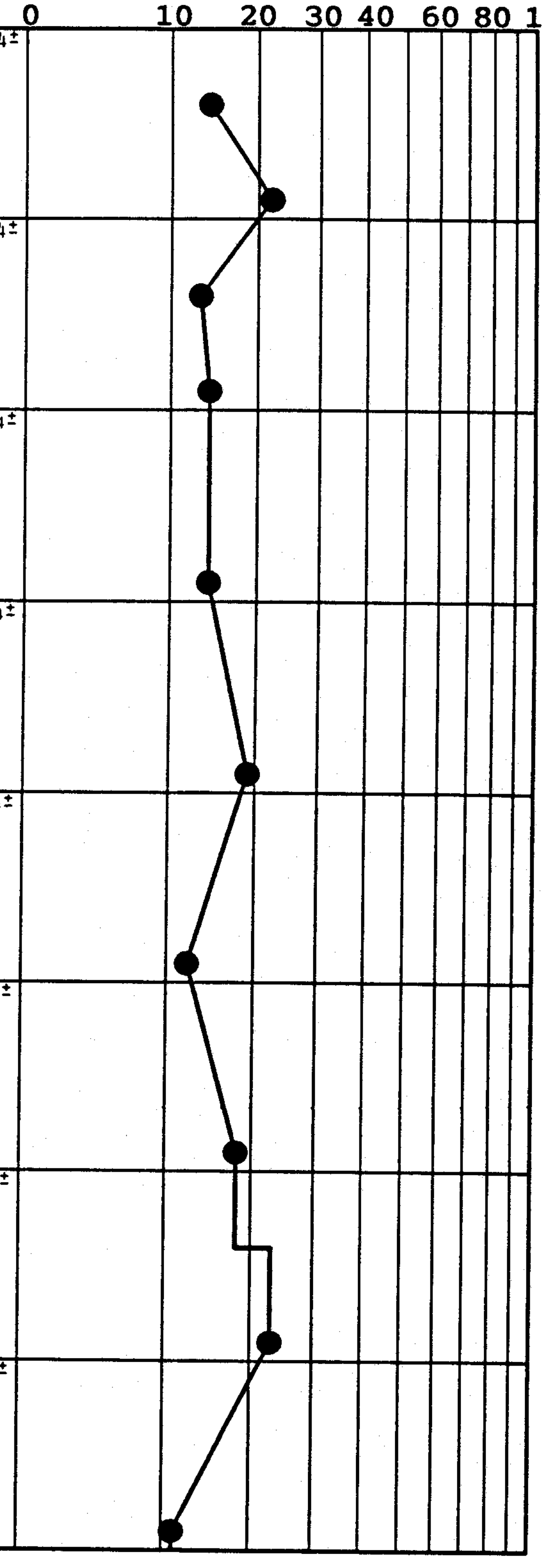
BORING NUMBER OW-2
DATE DRILLED 12-16-89
PROJECT NUMBER CHW 7210A
PROJECT MCGUIRE LANDFILL
PAGE 2 OF 2

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION
0.0	
0.3	Topsoil
	Residuum - Stiff Orange Brown Micaceous Fine Sandy Clayey Silt
3.0	Very Stiff Light Yellowish Brown Micaceous Fine Sandy Silt
5.5	Stiff Brownish Yellow Micaceous Fine to Medium Sandy Silt
12.0	Stiff Light Brownish Yellow Micaceous Fine Slightly Sandy Silt
22.0	Stiff Multi-Colored to Brownish Yellow Micaceous Fine to Medium Sandy Silt
27.0	Very Stiff Brownish Yellow and Black Micaceous Fine to Coarse Very Sandy Silt
32.0	Very Firm Multi-Colored Micaceous Very Silty Fine to Medium Sand (Moist)
37.0	Firm Brownish Yellow Micaceous Silty Fine to Medium Sand (Moist)
40.0	

ELEVATION (FT.): 739.4±, 734.4±, 729.4±, 724.4±, 719.4±, 714.4±, 709.4±, 704.4±

● PENETRATION - BLOWS/FOOT



Blows/Foot
14
22
13
14
14
19
12
18
23
11

TEST BORING RECORD

BORING NUMBER OW-3
DATE DRILLED 12-18-89
PROJECT NUMBER CHW 7210A
PROJECT MCGUIRE LANDFILL
PAGE 1 OF 2

LAW ENGINEERING

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVATIONS USED ABOVE

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	● PENETRATION - BLOWS/FOOT (0 10 20 30 40 60 80 100)	
40.0	Firm Brownish Yellow Micaceous Silty Fine to Medium Sand (Moist)	699.4±		
45.0	Boring Terminated at 45 Ft. No Ground Water Encountered at Time of Boring.	694.4±	●	12

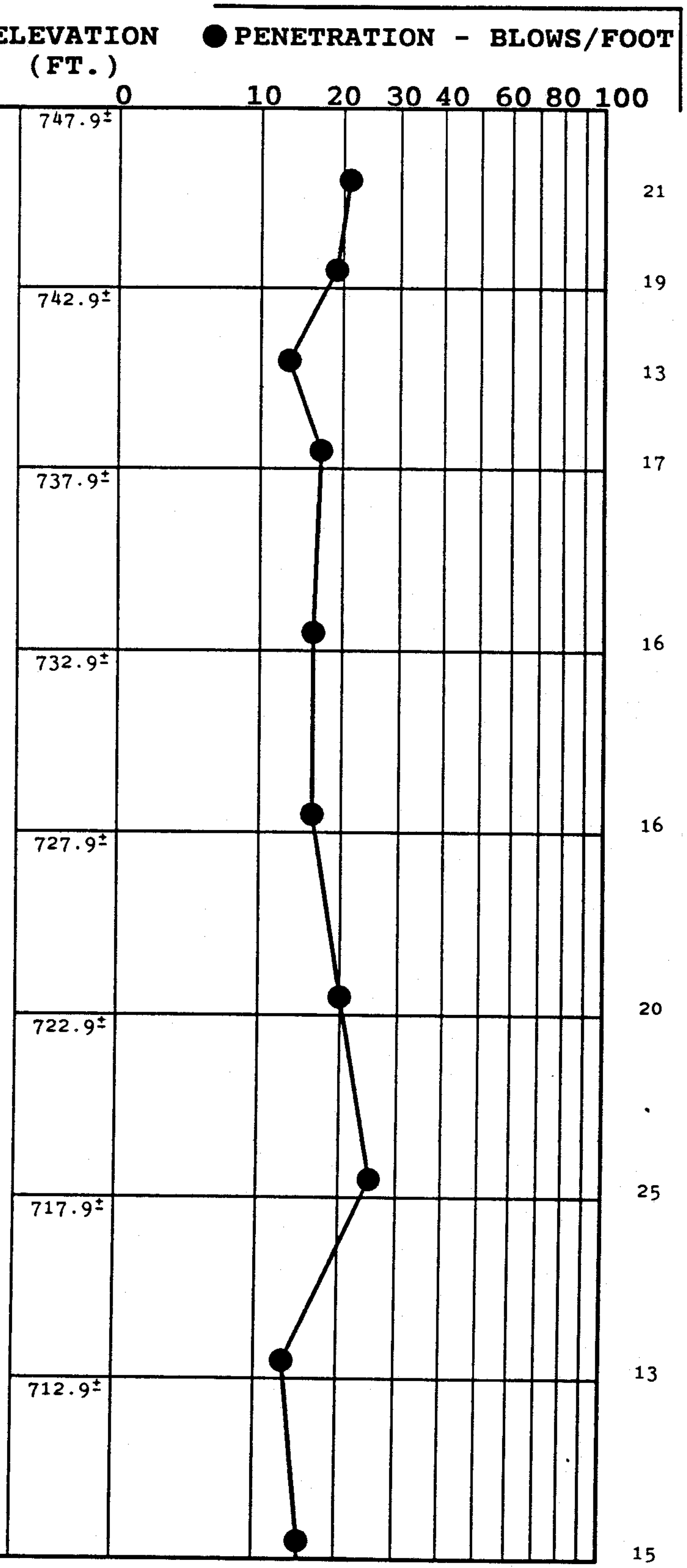
SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVATIONS USED ABOVE

TEST BORING RECORD

BORING NUMBER OW-3
DATE DRILLED 12-18-89
PROJECT NUMBER CHW 7210A
PROJECT MCGUIRE LANDFILL
PAGE 2 OF 2

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION
0.0	
0.1	Topsoil
	Residuum - Very Stiff Red Brown Micaceous Fine Sandy Clayey Silt
3.0	Very Stiff to Stiff Brownish Yellow Black Micaceous Fine Sandy Silt
17.0	Very Stiff Brownish Yellow and Black Micaceous Fine Slightly Sandy Silt
27.0	Very Stiff Brownish Yellow and Black Micaceous Fine to Medium Sandy Silt
32.0	Stiff Light Orangish Yellow Micaceous Fine Slightly Sandy Silt
37.0	Stiff to Very Stiff Brownish Yellow and Black Micaceous Fine to Medium Sandy Silt (Moist)
40.0	



21
19
13
17
16
16
20
25
13
15

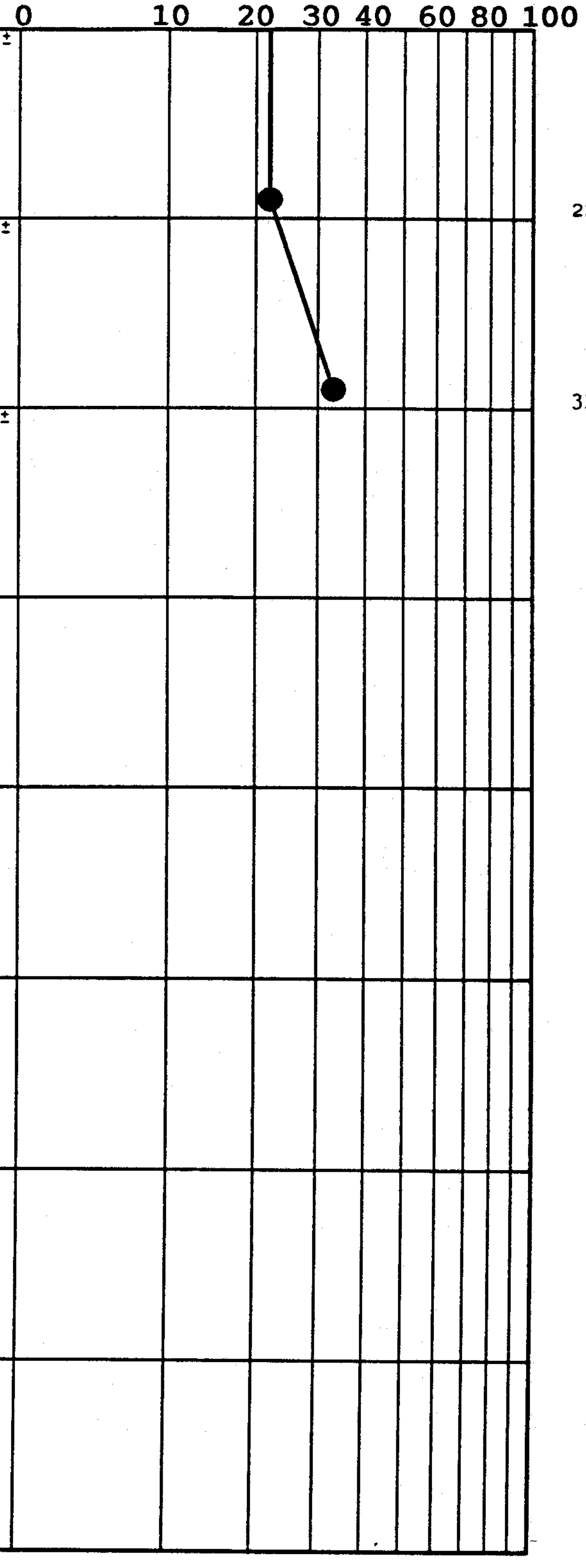
SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVATIONS USED ABOVE

TEST BORING RECORD

BORING NUMBER OW-4
DATE DRILLED 12-14-89
PROJECT NUMBER CHW 7210A
PROJECT MCGUIRE LANDFILL
PAGE 1 OF 2

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	● PENETRATION - BLOWS/FOOT
40.0	Stiff to Very Stiff Brownish Yellow and Black Micaceous Fine to Medium Sandy Silt (Moist)	707.9±	
			22
		702.9±	
47.0	Hard Olive Gray Micaceous Fine to Medium Sandy Silt (Moist)		
			33
50.0	Boring Terminated at 50 Ft. No Ground Water Encountered at Time of Boring.	697.9±	



SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVATIONS USED ABOVE

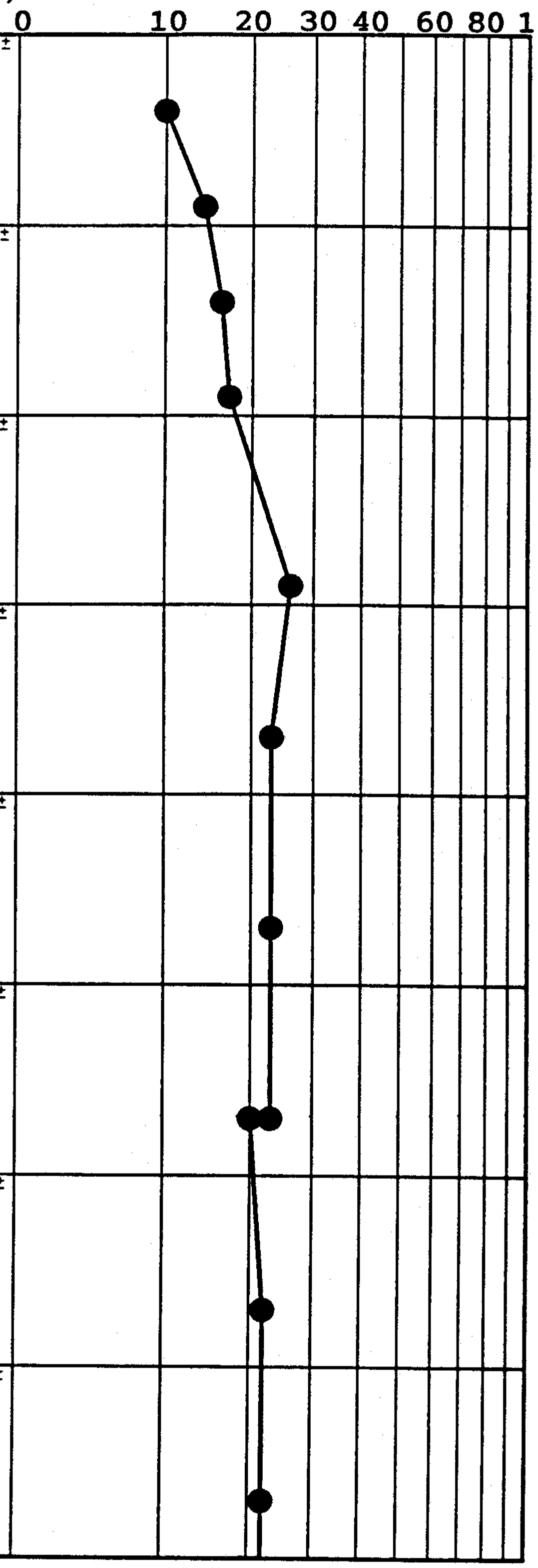
TEST BORING RECORD

BORING NUMBER	OW-4
DATE DRILLED	12-14-89
PROJECT NUMBER	CHW 7210A
PROJECT	MCGUIRE LANDFILL
PAGE 2 OF 2	

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)
0.0		749.3±
0.2	Topsoil	
	Residuum - Stiff Orange Brown Fine Sandy Clayey Silt	
3.0	Stiff Light Yellow Brown Micaceous Slightly Clayey Fine Sandy Silt	
5.5	Very Stiff Light Brownish Yellow to Multi-Colored Micaceous Fine Sandy Silt (Dessicated to 20 Ft)	744.3±
		739.3±
		734.3±
		729.3±
		724.3±
27.0	Firm to Very Firm Yellow Brown and Black Micaceous Fine to Medium Very Sandy Silt	
		719.3±
		714.3±
40.0		

● PENETRATION - BLOWS/FOOT



10
14
16
17
26
23
23
23
20
22
22

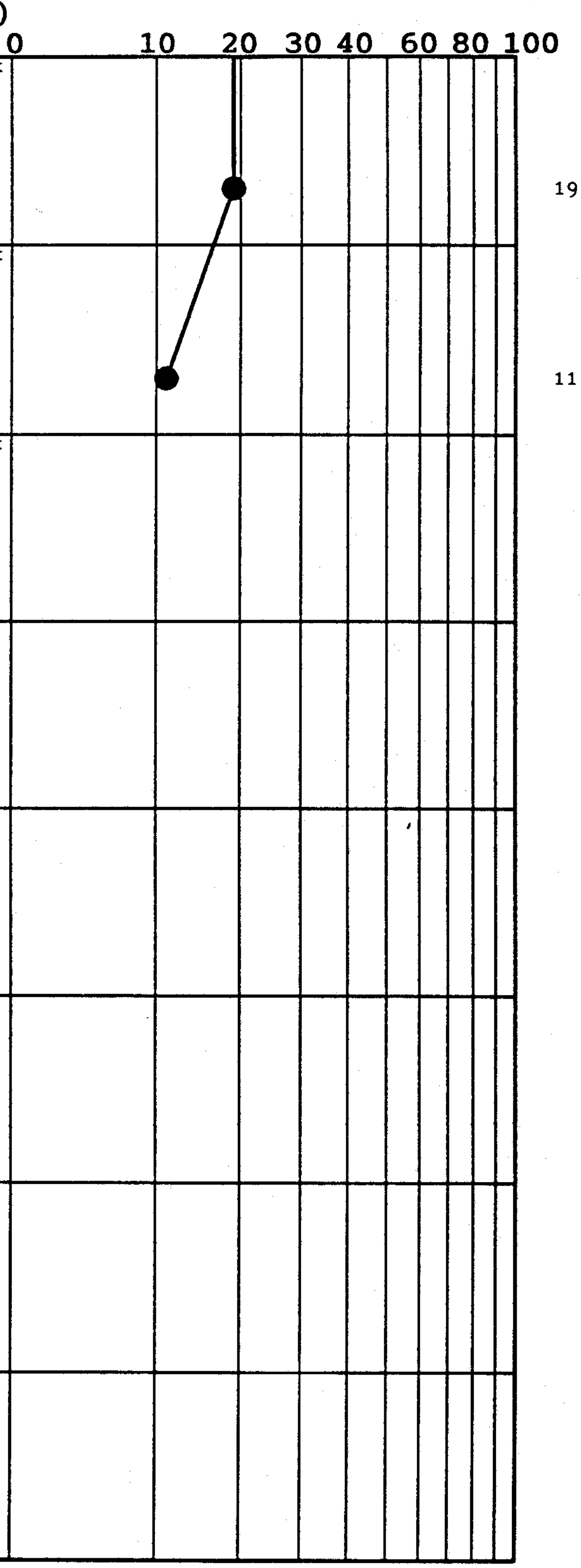
SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVATIONS USED ABOVE

TEST BORING RECORD

BORING NUMBER OW-5
DATE DRILLED 12-13-89
PROJECT NUMBER CHW 7210A
PROJECT MCGUIRE LANDFILL
PAGE 1 OF 2

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	PENETRATION - BLOWS/FOOT
40.0	Firm to Very Firm Yellow Brown and Black Micaceous Fine to Medium Very Sandy Silt	709.3±	
42.0	Very Stiff Yellow Brown and White Micaceous Fine to Medium Sandy Silt (Moist)	704.3±	19
47.0	Stiff Yellowish Gray and White Micaceous Fine to Medium Sandy Silt (Moist)		11
50.0	Boring Terminated at 50 Ft. No Ground Water Encountered at Time of Boring.	699.3±	



SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVATIONS USED ABOVE

TEST BORING RECORD

BORING NUMBER OW-5
DATE DRILLED 12-13-89
PROJECT NUMBER CHW 7210A
PROJECT MCGUIRE LANDFILL
PAGE 2 OF 2

LAW ENGINEERING

APPENDIX B

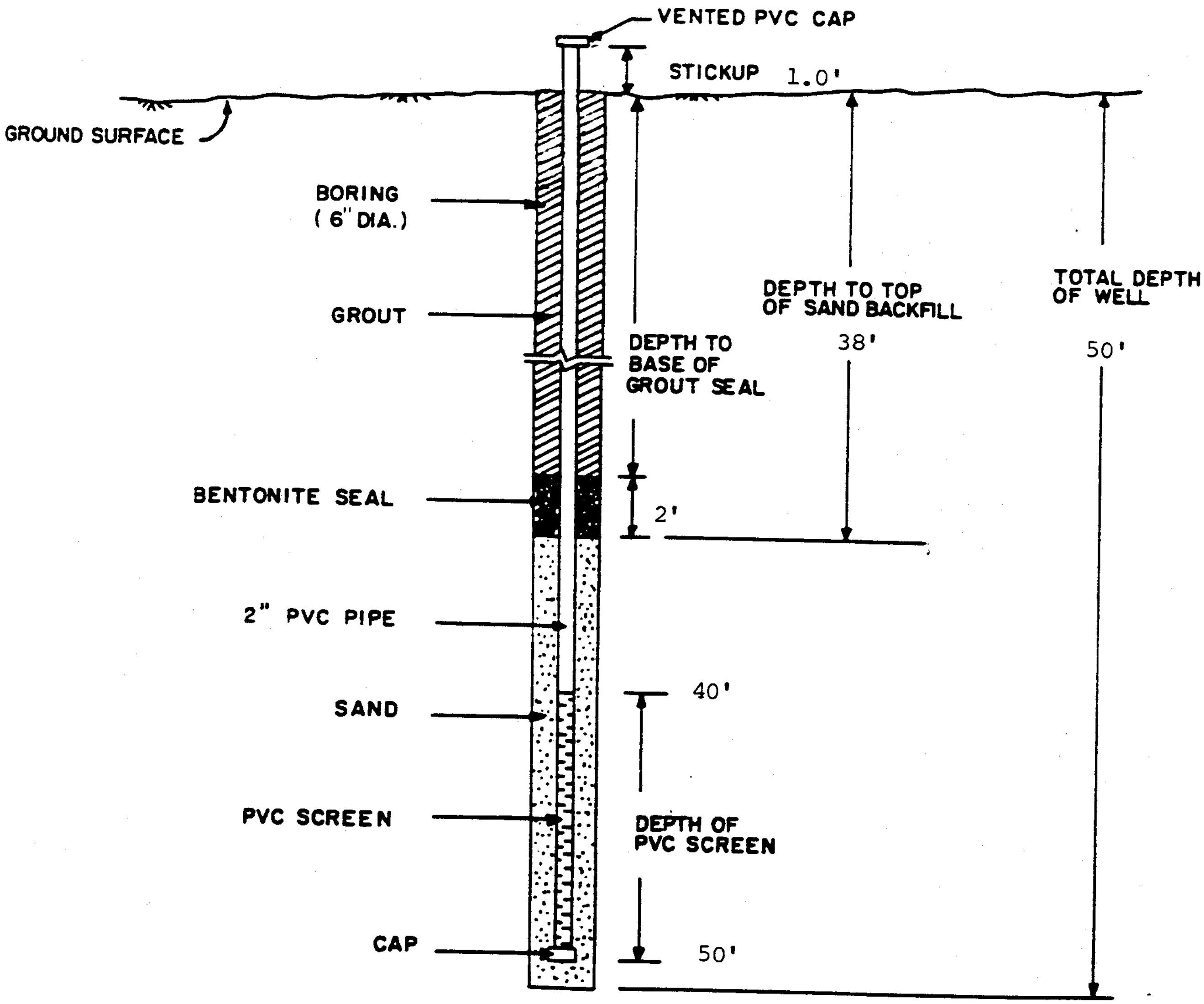
GROUND-WATER OBSERVATION WELL INSTALLATION RECORD

JOB NAME Duke Power Land Fill JOB NUMBER CHW 7210A

WELL NUMBER OW-1 GROUND SURFACE ELEVATION 763.4

LOCATION Northing: 611, 671; Easting: 1,420,485

INSTALLATION DATE 12-28-89



NOTE: ALL PVC PIPE JOINTS
HAVE SCREW CONNECTORS

LAW ENGINEERING, INC.
CHARLOTTE, NORTH CAROLINA

GROUND-WATER OBSERVATION WELL INSTALLATION RECORD

OW-1

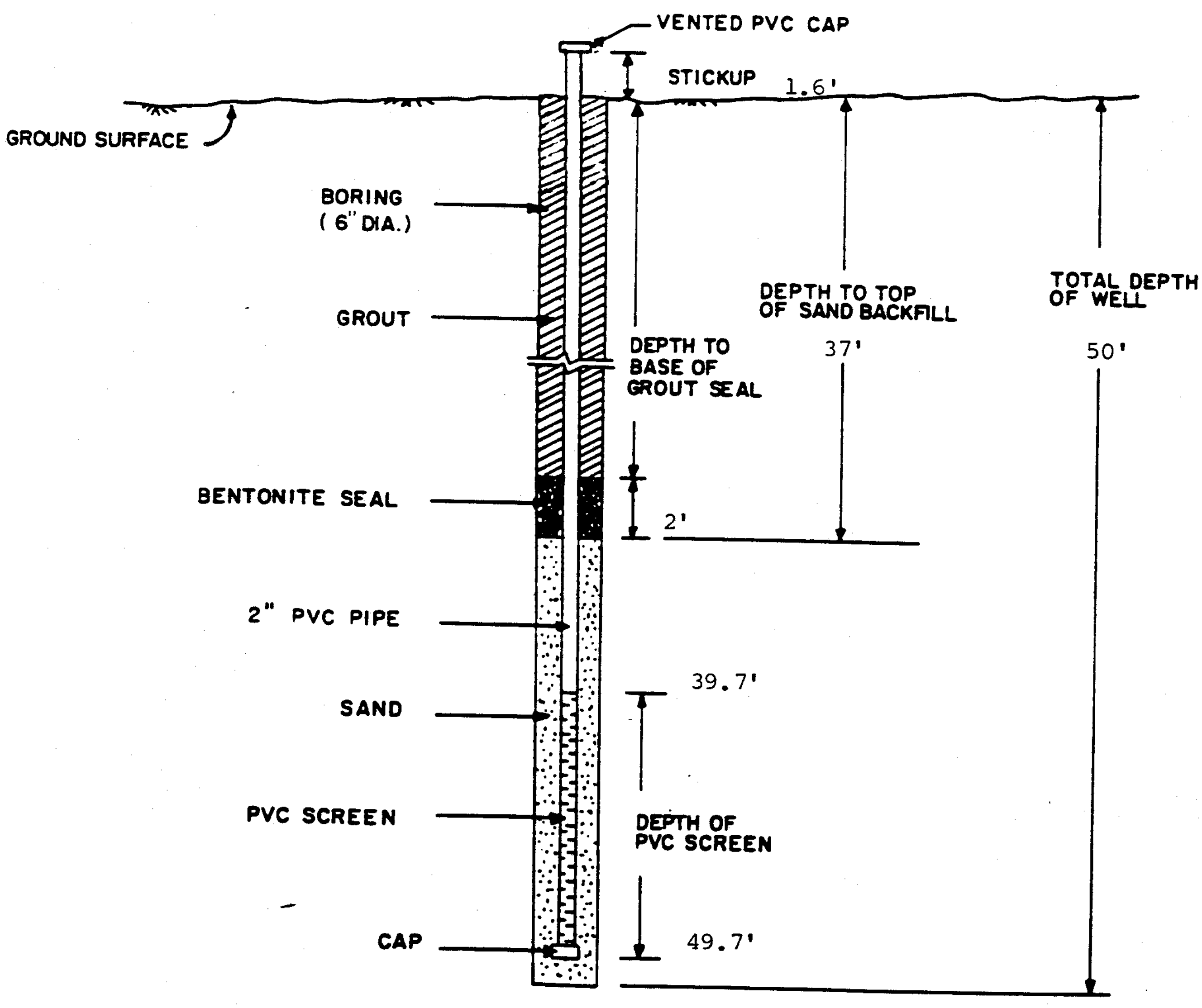
GROUND-WATER OBSERVATION WELL INSTALLATION RECORD

JOB NAME Duke Power Land Fill JOB NUMBER CHW 7210A

WELL NUMBER OW-2 GROUND SURFACE ELEVATION 755.3

LOCATION Northing: 611,605; Easting: 1,420,143

INSTALLATION DATE 12-16-89



NOTE: ALL PVC PIPE JOINTS HAVE SCREW CONNECTORS

	LAW ENGINEERING, INC. CHARLOTTE, NORTH CAROLINA	GROUND-WATER OBSERVATION WELL INSTALLATION RECORD OW-2

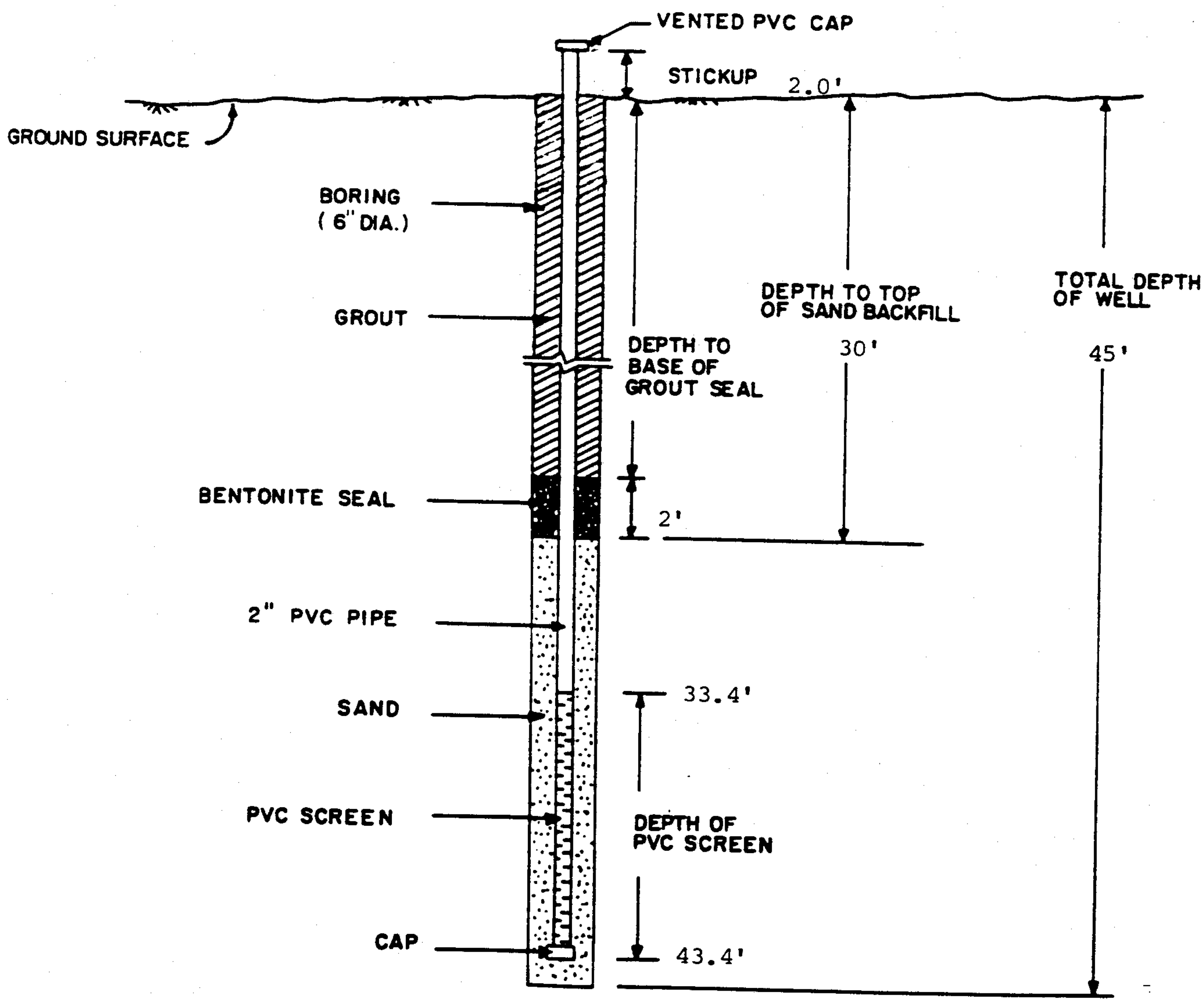
GROUND-WATER OBSERVATION WELL INSTALLATION RECORD

JOB NAME Duke Power Land Fill JOB NUMBER CHW 7210A

WELL NUMBER OW-3 GROUND SURFACE ELEVATION 739.4

LOCATION Northing: 611,966; Easting: 1,420,055

INSTALLATION DATE 12-18-89



NOTE: ALL PVC PIPE JOINTS HAVE SCREW CONNECTORS

	LAW ENGINEERING, INC. CHARLOTTE, NORTH CAROLINA	GROUND-WATER OBSERVATION WELL INSTALLATION RECORD OW-3

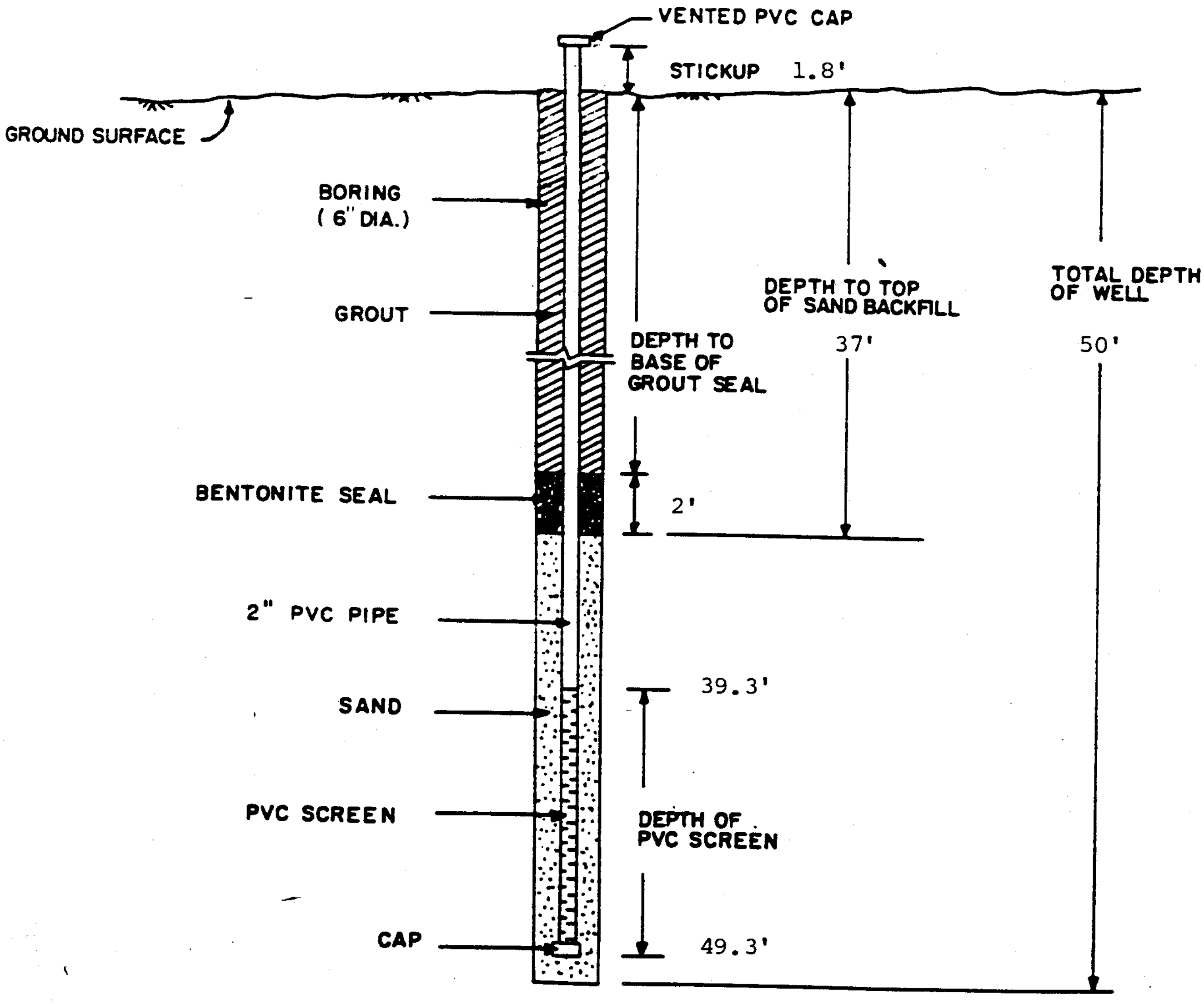
GROUND-WATER OBSERVATION WELL INSTALLATION RECORD

JOB NAME Duke Power Land Fill JOB NUMBER CHW 7210A

WELL NUMBER OW-4 GROUND SURFACE ELEVATION 747.9

LOCATION Northing: 611,950; Easting: 1,420,220

INSTALLATION DATE 12-14-89



NOTE: ALL PVC PIPE JOINTS HAVE SCREW CONNECTORS

	LAW ENGINEERING, INC. CHARLOTTE, NORTH CAROLINA	GROUND-WATER OBSERVATION WELL INSTALLATION RECORD OW-4

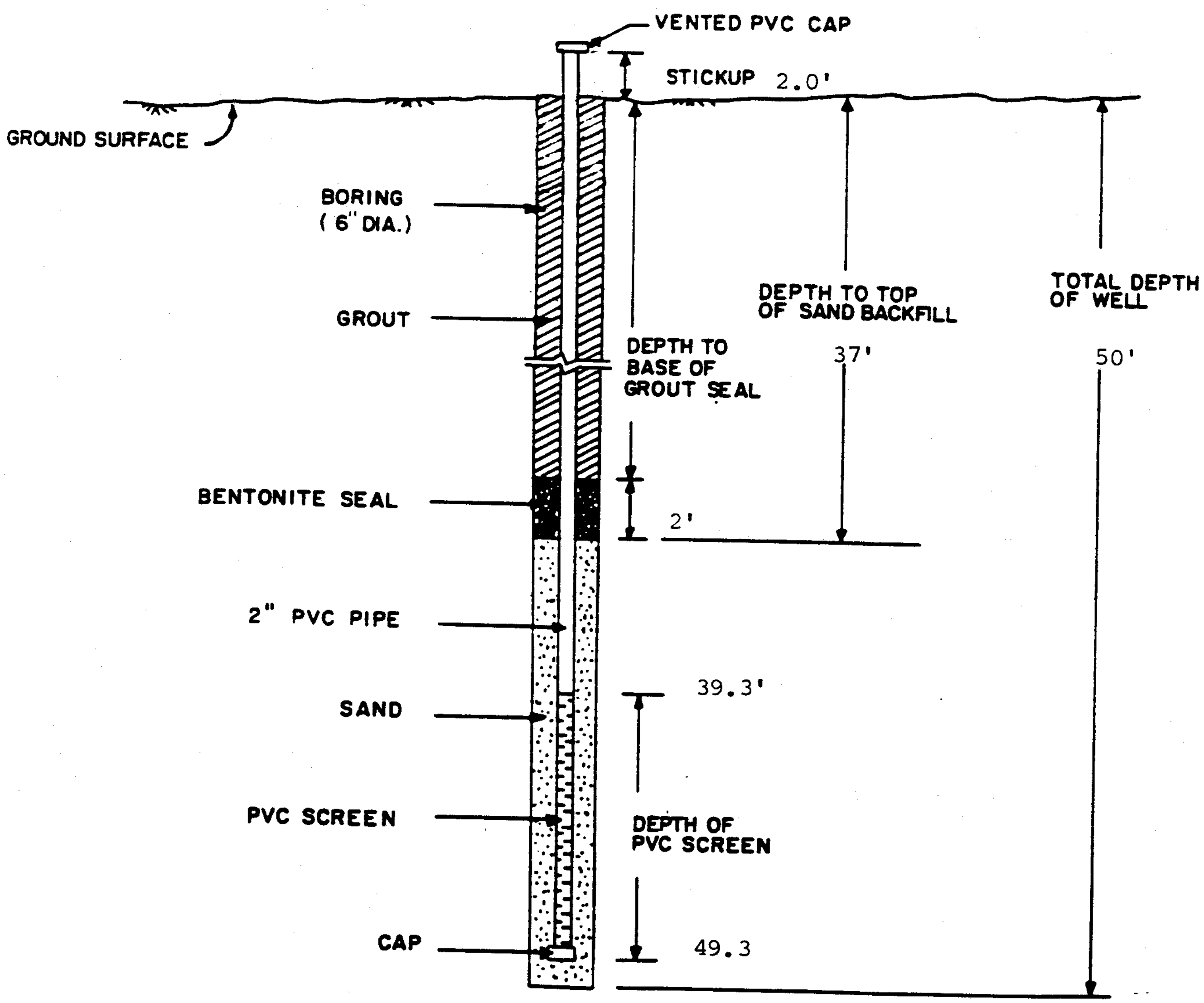
GROUND-WATER OBSERVATION WELL INSTALLATION RECORD

JOB NAME Duke Power Land Fill JOB NUMBER CHW 7210A

WELL NUMBER OW-5 GROUND SURFACE ELEVATION 749.3

LOCATION Northing: 612,241; Easting: 1,420,298

INSTALLATION DATE 12-13-89



NOTE: ALL PVC PIPE JOINTS HAVE SCREW CONNECTORS

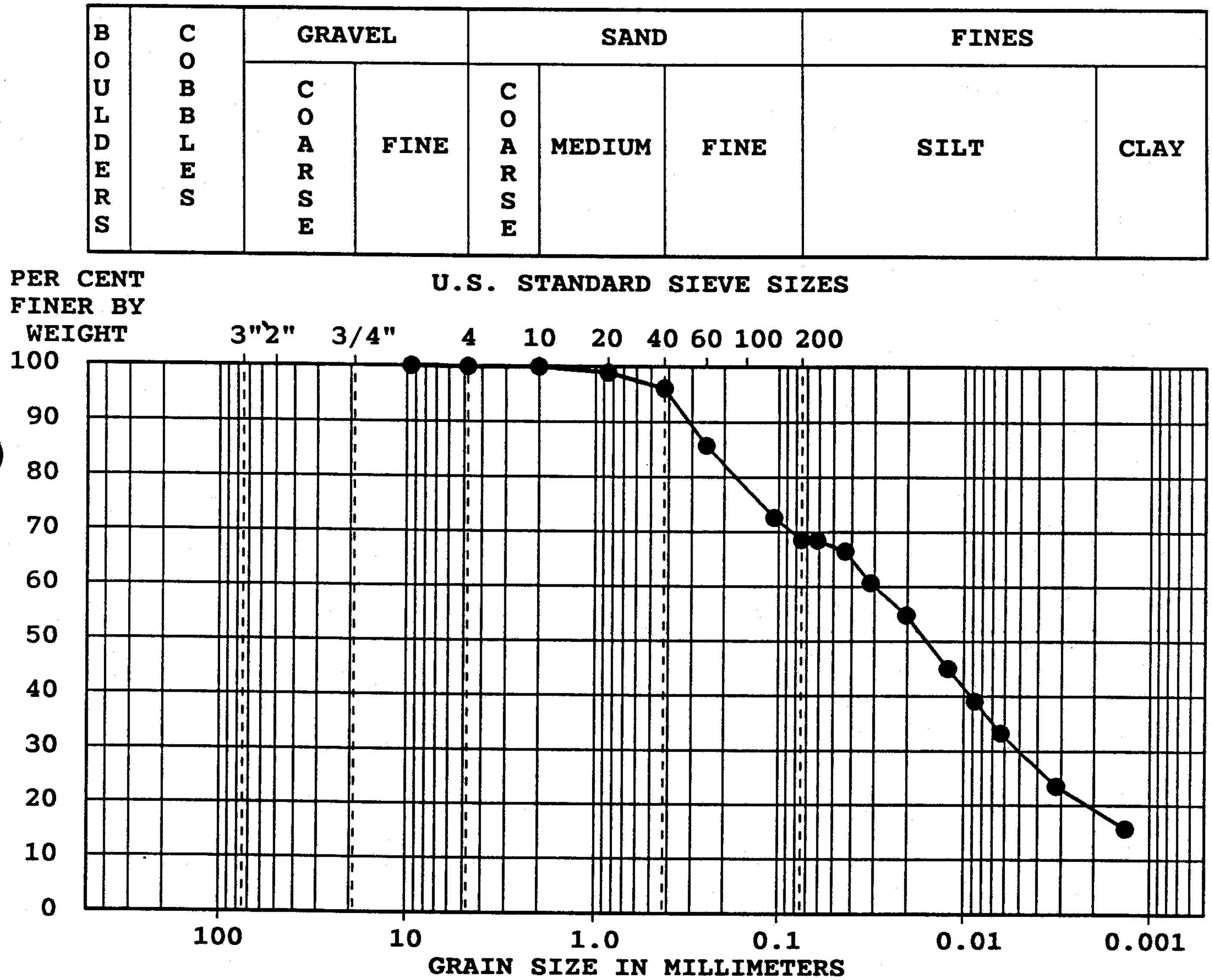
	LAW ENGINEERING, INC. CHARLOTTE, NORTH CAROLINA	GROUND-WATER OBSERVATION WELL INSTALLATION RECORD OW-5

APPENDIX C

LAW ENGINEERING

GRAIN SIZE REPORT

DATE: 3-19-90
PROJECT NUMBER: CHW 7210A
PROJECT NAME: DUKE POWER - MCGUIRE LANDFILL
BORING NUMBER: OW-1
DEPTH: 3.0' TO 10.0'
SPECIFIC GRAVITY: 2.74
FIELD MOISTURE:



SOIL DESCRIPTION		
LIQUID LIMIT 53	PLASTIC LIMIT 43	PLASTIC INDEX 10

LAW ENGINEERING

GRAIN SIZE REPORT

DATE:	3-19-90
PROJECT NUMBER:	CHW 7210A
PROJECT NAME:	DUKE POWER - MCGUIRE LANDFILL
BORING NUMBER:	OW-1
DEPTH:	3.0' TO 10.0'
SPECIFIC GRAVITY:	2.74
FIELD MOISTURE:	
HYDROMETER NUMBER:	146
SOIL DESCRIPTION:	

SIEVE ANALYSIS

SIEVE NUMBER	WEIGHT RETAINED	DIAMETER (MM.)	PER CENT FINER
3/8 in	0.0	9.500	100.0
#4	0.2	4.750	99.9
#10	0.7	2.000	99.9
#20	0.4	0.850	98.9
#40	1.8	0.425	96.1
#60	6.8	0.250	85.7
#140	13.2	0.106	72.6
#200	15.1	0.075	68.6

HYDROMETER ANALYSIS

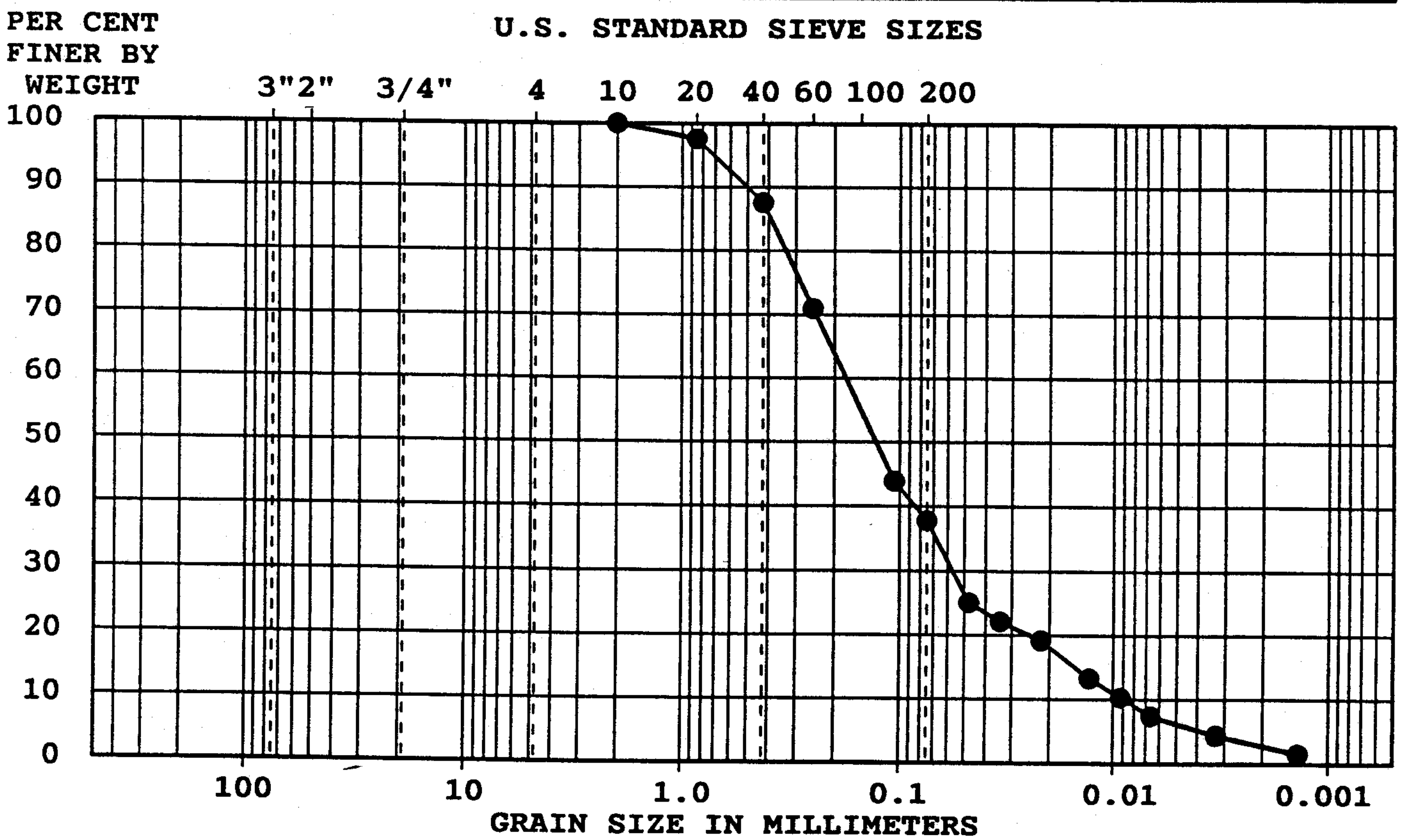
ELAPSED TIME	HYDROMETER READING	CORRECTED READING	TEMPERATURE (C)	DIAMETER (MM.)	PER CENT FINER
0.5	35.0	35.0	20.0	0.06118	68.5
1.0	34.0	34.0	20.0	0.04347	66.5
2.0	31.0	31.0	20.0	0.03145	60.7
5.0	28.0	28.0	20.0	0.02033	54.8
15.0	23.0	23.0	20.0	0.01213	45.0
30.0	20.0	20.0	20.0	0.00875	39.1
60.0	17.0	17.0	20.0	0.00630	33.3
250.0	12.0	12.0	20.0	0.00318	23.5
1440.0	8.0	8.0	20.0	0.00136	15.7

LAW ENGINEERING

GRAIN SIZE REPORT

DATE: 3-19-90
PROJECT NUMBER: CHW 7210A
PROJECT NAME: DUKE POWER - MCGUIRE LANDFILL
BORING NUMBER: OW-1
DEPTH: 28.5' TO 30.0'
SPECIFIC GRAVITY: 2.82
FIELD MOISTURE: 29.72

BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY



SOIL DESCRIPTION		
LIQUID LIMIT 50	PLASTIC LIMIT 45	PLASTIC INDEX 5

LAW ENGINEERING

GRAIN SIZE REPORT

DATE:	3-19-90
PROJECT NUMBER:	CHW 7210A
PROJECT NAME:	DUKE POWER - MCGUIRE LANDFILL
BORING NUMBER:	OW-1
DEPTH:	28.5' TO 30.0'
SPECIFIC GRAVITY:	2.82
FIELD MOISTURE:	29.72
HYDROMETER NUMBER:	146
SOIL DESCRIPTION:	

SIEVE ANALYSIS

SIEVE NUMBER	WEIGHT RETAINED	DIAMETER (MM.)	PER CENT FINER
#10	0.0	2.000	100.0
#20	1.5	0.850	97.6
#40	8.1	0.425	87.6
#60	18.8	0.250	71.0
#140	36.3	0.106	43.9
#200	40.2	0.075	37.8

HYDROMETER ANALYSIS

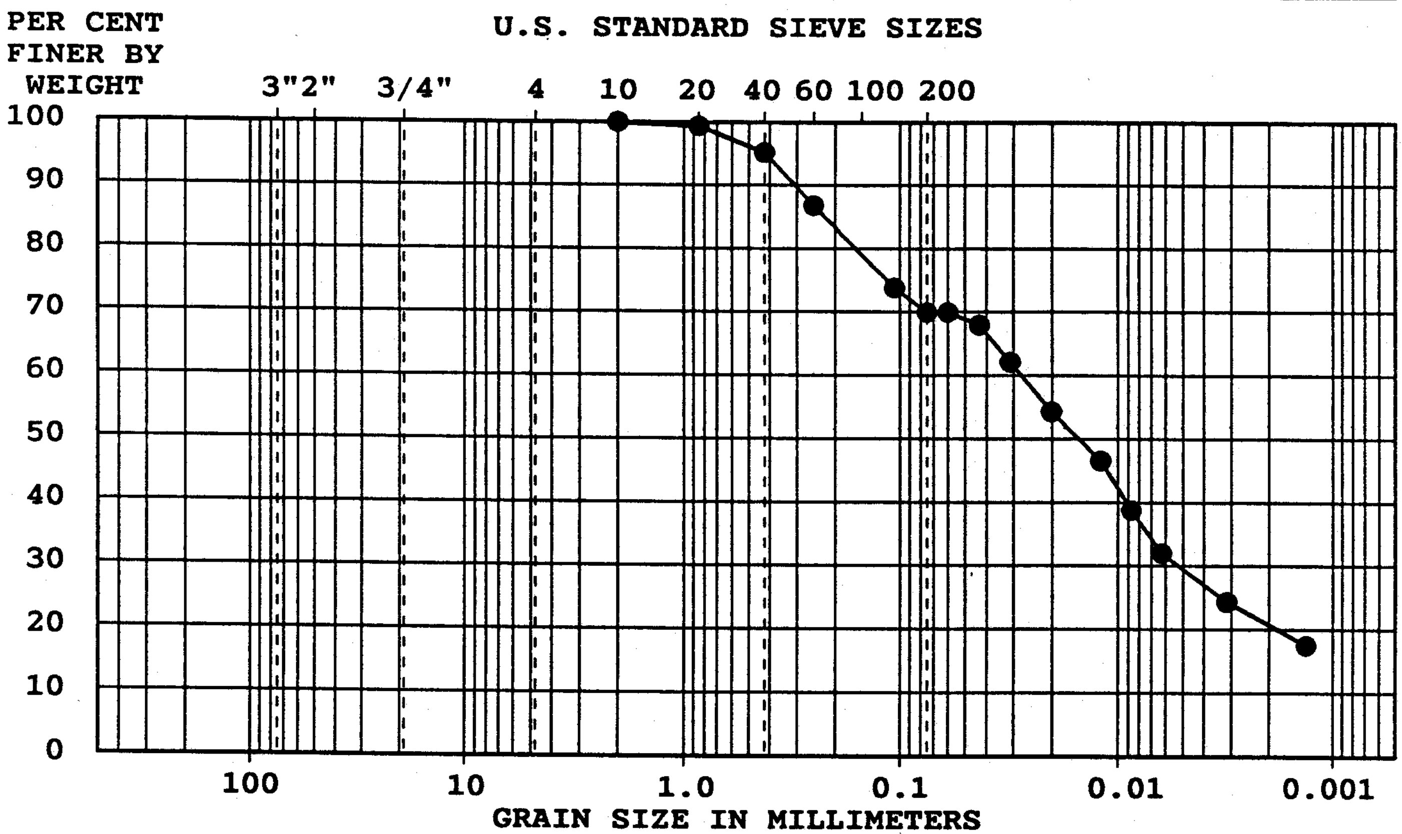
ELAPSED TIME	HYDROMETER READING	CORRECTED READING	TEMPERATURE (C)	DIAMETER (MM.)	PER CENT FINER
1.0	17.0	17.0	20.0	0.04776	25.1
2.0	15.0	15.0	20.0	0.03414	22.1
5.0	13.0	13.0	20.0	0.02190	19.2
15.0	9.0	9.0	20.0	0.01291	13.3
30.0	7.0	7.0	20.0	0.00925	10.3
60.0	5.0	5.0	20.0	0.00661	7.4
250.0	3.0	3.0	20.0	0.00327	4.4
1440.0	1.0	1.0	20.0	0.00137	1.5

LAW ENGINEERING

GRAIN SIZE REPORT

DATE: 3-19-90
PROJECT NUMBER: CHW 7210A
PROJECT NAME: DUKE POWER - MCGUIRE LANDFILL
BORING NUMBER: OW-2
DEPTH: 3.0' TO 10.0'
SPECIFIC GRAVITY: 2.77
FIELD MOISTURE: 27.34

BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY



SOIL DESCRIPTION		
LIQUID LIMIT 56	PLASTIC LIMIT 43	PLASTIC INDEX 13

LAW ENGINEERING

GRAIN SIZE REPORT

DATE:	3-19-90
PROJECT NUMBER:	CHW 7210A
PROJECT NAME:	DUKE POWER - MCGUIRE LANDFILL
BORING NUMBER:	OW-2
DEPTH:	3.0' TO 10.0'
SPECIFIC GRAVITY:	2.77
FIELD MOISTURE:	27.34
HYDROMETER NUMBER:	146
SOIL DESCRIPTION:	

SIEVE ANALYSIS

SIEVE NUMBER	WEIGHT RETAINED	DIAMETER (MM.)	PER CENT FINER
#10	0.0	2.000	100.0
#20	0.3	0.850	99.4
#40	2.4	0.425	95.2
#60	6.6	0.250	86.8
#140	13.0	0.106	73.8
#200	14.9	0.075	69.9

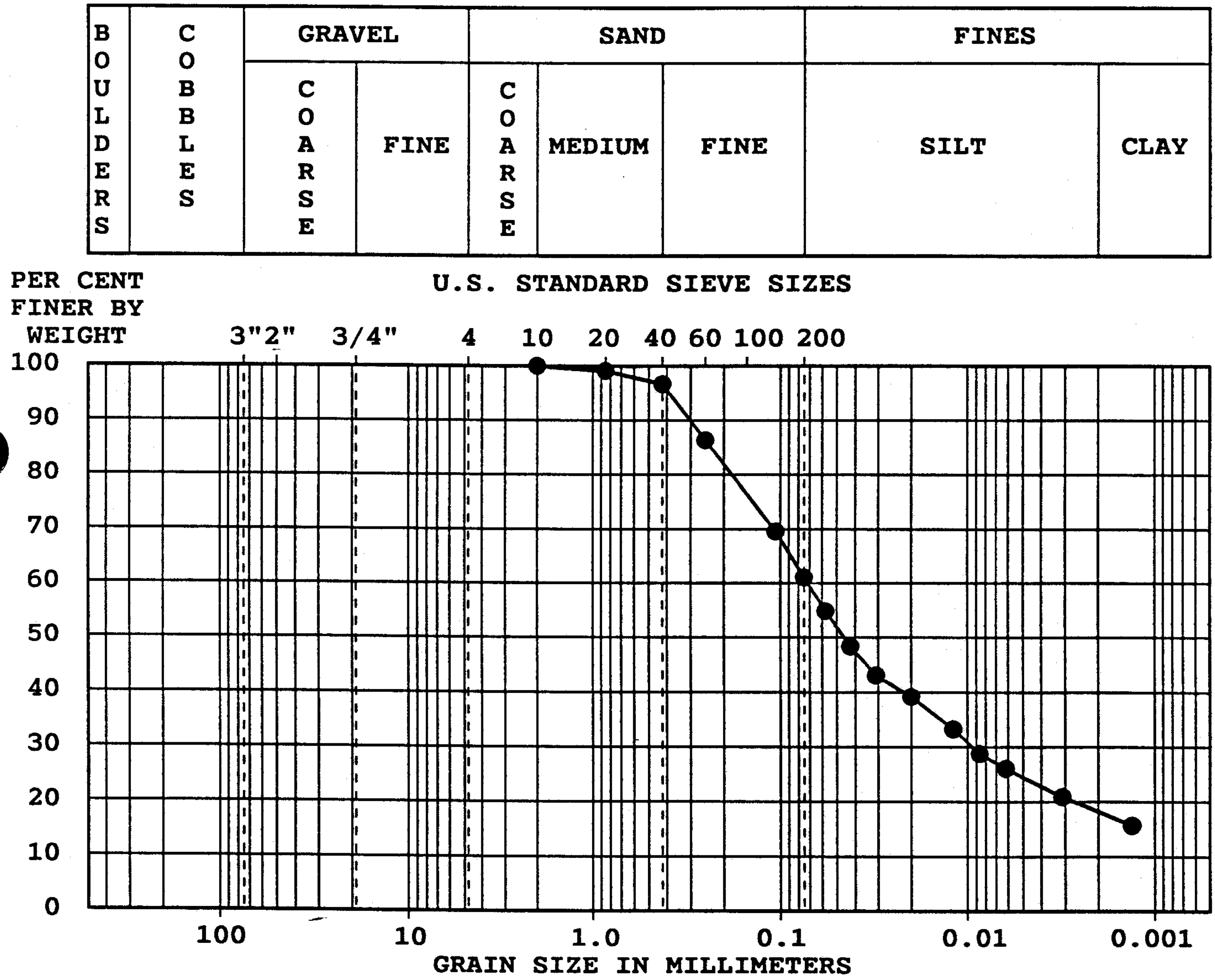
HYDROMETER ANALYSIS

ELAPSED TIME	HYDROMETER READING	CORRECTED READING	TEMPERATURE (C)	DIAMETER (MM.)	PER CENT FINER
0.5	36.0	36.0	20.0	0.06010	69.9
1.0	35.0	35.0	20.0	0.04290	67.9
2.0	32.0	32.0	20.0	0.03105	62.1
5.0	28.0	28.0	20.0	0.02016	54.3
15.0	24.0	24.0	20.0	0.01198	46.6
30.0	20.0	20.0	20.0	0.00867	38.8
60.0	16.5	16.5	20.0	0.00627	32.0
250.0	12.5	12.5	20.0	0.00315	24.3
1440.0	9.0	9.0	20.0	0.00134	17.5

LAW ENGINEERING

GRAIN SIZE REPORT

DATE: 3-19-90
PROJECT NUMBER: CHW 7210A
PROJECT NAME: DUKE POWER - MCGUIRE LANDFILL
BORING NUMBER: OW-2
DEPTH: 18.5' TO 20.0'
SPECIFIC GRAVITY: 2.75
FIELD MOISTURE: 40.20



SOIL DESCRIPTION		
LIQUID LIMIT 77	PLASTIC LIMIT 58	PLASTIC INDEX 19

LAW ENGINEERING

GRAIN SIZE REPORT

DATE:	3-19-90
PROJECT NUMBER:	CHW 7210A
PROJECT NAME:	DUKE POWER - MCGUIRE LANDFILL
BORING NUMBER:	OW-2
DEPTH:	18.5' TO 20.0'
SPECIFIC GRAVITY:	2.75
FIELD MOISTURE:	40.20
HYDROMETER NUMBER:	146
SOIL DESCRIPTION:	

SIEVE ANALYSIS

SIEVE NUMBER	WEIGHT RETAINED	DIAMETER (MM.)	PER CENT FINER
#10	0.0	2.000	100.0
#20	0.7	0.850	99.1
#40	2.4	0.425	96.7
#60	9.9	0.250	86.4
#140	22.1	0.106	69.6
#200	28.3	0.075	61.1

HYDROMETER ANALYSIS

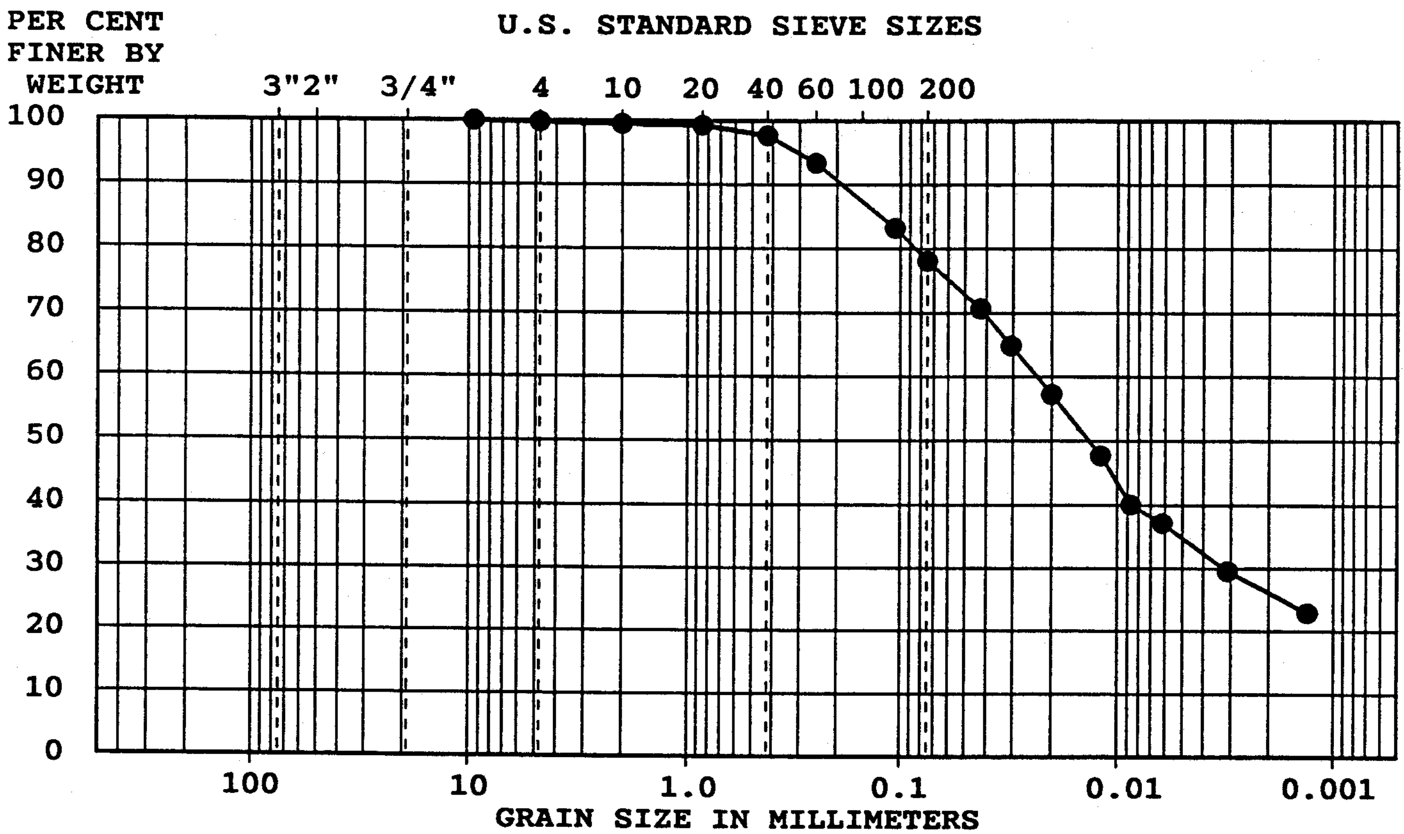
ELAPSED TIME	HYDROMETER READING	CORRECTED READING	TEMPERATURE (C)	DIAMETER (MM.)	PER CENT FINER
0.5	42.0	42.0	20.0	0.05745	54.9
1.0	37.0	37.0	20.0	0.04232	48.4
2.0	33.0	33.0	20.0	0.03093	43.1
5.0	30.0	30.0	20.0	0.02001	39.2
15.0	25.5	25.5	20.0	0.01190	33.3
30.0	22.0	22.0	20.0	0.00862	28.8
60.0	20.0	20.0	20.0	0.00617	26.1
250.0	16.0	16.0	20.0	0.00310	20.9
1440.0	12.0	12.0	20.0	0.00132	15.7

LAW ENGINEERING

GRAIN SIZE REPORT

DATE:	3-19-90
PROJECT NUMBER:	CHW 7210A
PROJECT NAME:	DUKE POWER - MCGUIRE LANDFILL
BORING NUMBER:	OW-4
DEPTH:	3.0' TO 10.0'
SPECIFIC GRAVITY:	2.75
FIELD MOISTURE:	32.1

BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY



SOIL DESCRIPTION		
LIQUID LIMIT 65	PLASTIC LIMIT 44	PLASTIC INDEX 21

LAW ENGINEERING

GRAIN SIZE REPORT

DATE:	3-19-90
PROJECT NUMBER:	CHW 7210A
PROJECT NAME:	DUKE POWER - MCGUIRE LANDFILL
BORING NUMBER:	OW-4
DEPTH:	3.0' TO 10.0'
SPECIFIC GRAVITY:	2.75
FIELD MOISTURE:	32.1
HYDROMETER NUMBER:	146
SOIL DESCRIPTION:	

SIEVE ANALYSIS

SIEVE NUMBER	WEIGHT RETAINED	DIAMETER (MM.)	PER CENT FINER
3/8 in	0.0	9.500	100.0
#4	1.3	4.750	99.8
#10	2.8	2.000	99.5
#20	0.1	0.850	99.3
#40	0.9	0.425	97.7
#60	3.0	0.250	93.4
#140	8.0	0.106	83.2
#200	10.5	0.075	78.1

HYDROMETER ANALYSIS

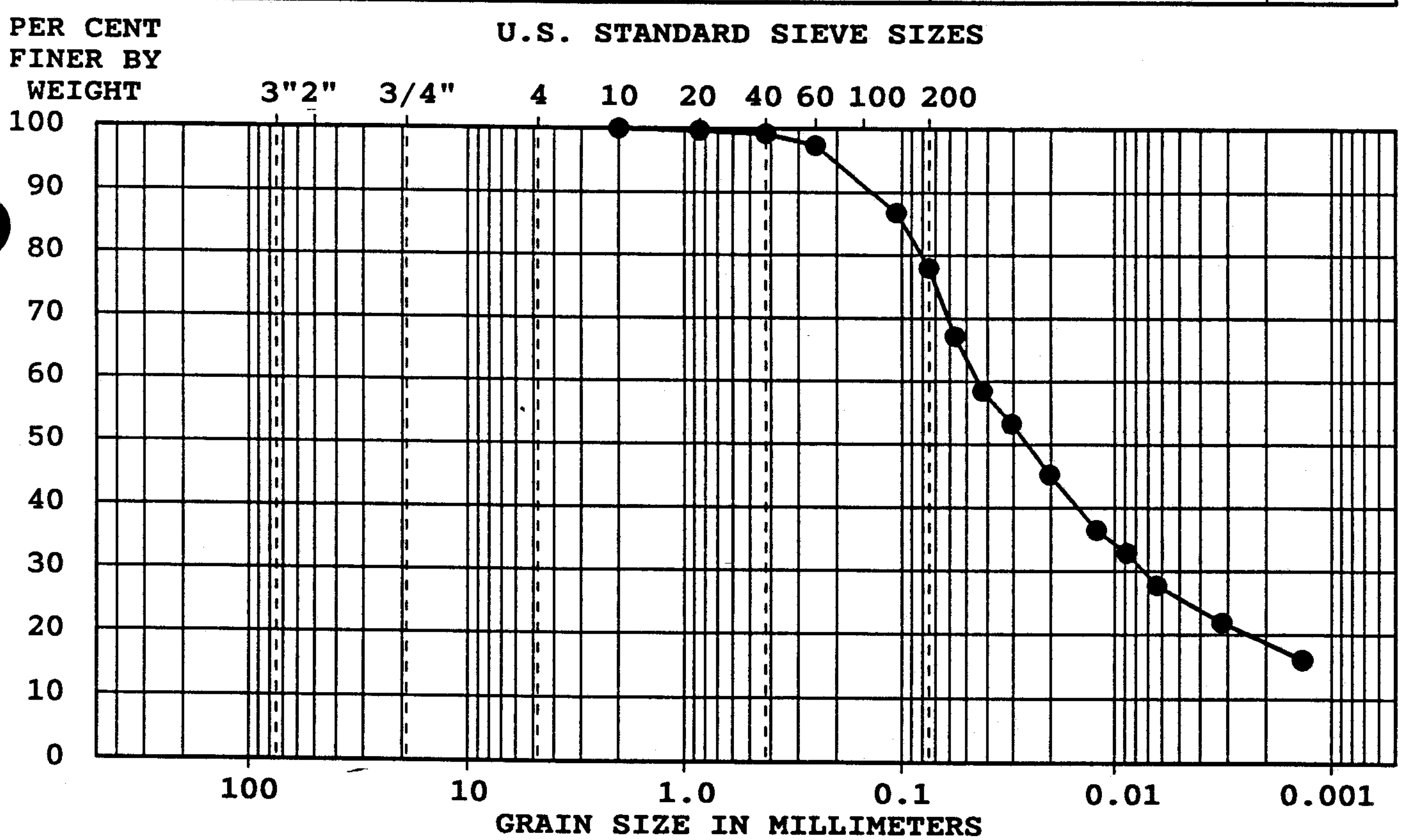
ELAPSED TIME	HYDROMETER READING	CORRECTED READING	TEMPERATURE (C)	DIAMETER (MM.)	PER CENT FINER
1.0	37.0	37.0	20.0	0.04232	70.7
2.0	34.0	34.0	20.0	0.03065	64.9
5.0	30.0	30.0	20.0	0.02001	57.3
15.0	25.0	25.0	20.0	0.01195	47.7
30.0	21.0	21.0	20.0	0.00869	40.1
60.0	19.5	19.5	20.0	0.00619	37.2
250.0	15.5	15.5	20.0	0.00311	29.6
1440.0	12.0	12.0	20.0	0.00132	22.9

LAW ENGINEERING

GRAIN SIZE REPORT

DATE:	3-19-90
PROJECT NUMBER:	CHW 7210A
PROJECT NAME:	DUKE POWER - MCGUIRE LANDFILL
BORING NUMBER:	OW-4
DEPTH:	13.5' TO 15.0'
SPECIFIC GRAVITY:	2.68
FIELD MOISTURE:	27.32

BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY



SOIL DESCRIPTION		
LIQUID LIMIT 56	PLASTIC LIMIT 47	PLASTIC INDEX 9

LAW ENGINEERING

GRAIN SIZE REPORT

DATE:	3-19-90
PROJECT NUMBER:	CHW 7210A
PROJECT NAME:	DUKE POWER - MCGUIRE LANDFILL
BORING NUMBER:	OW-4
DEPTH:	13.5' TO 15.0'
SPECIFIC GRAVITY:	2.68
FIELD MOISTURE:	27.32
HYDROMETER NUMBER:	146
SOIL DESCRIPTION:	

SIEVE ANALYSIS

SIEVE NUMBER	WEIGHT RETAINED	DIAMETER (MM.)	PER CENT FINER
#10	0.0	2.000	100.0
#20	0.2	0.850	99.7
#40	0.6	0.425	99.2
#60	1.7	0.250	97.4
#140	8.8	0.106	86.8
#200	14.6	0.075	78.0

HYDROMETER ANALYSIS

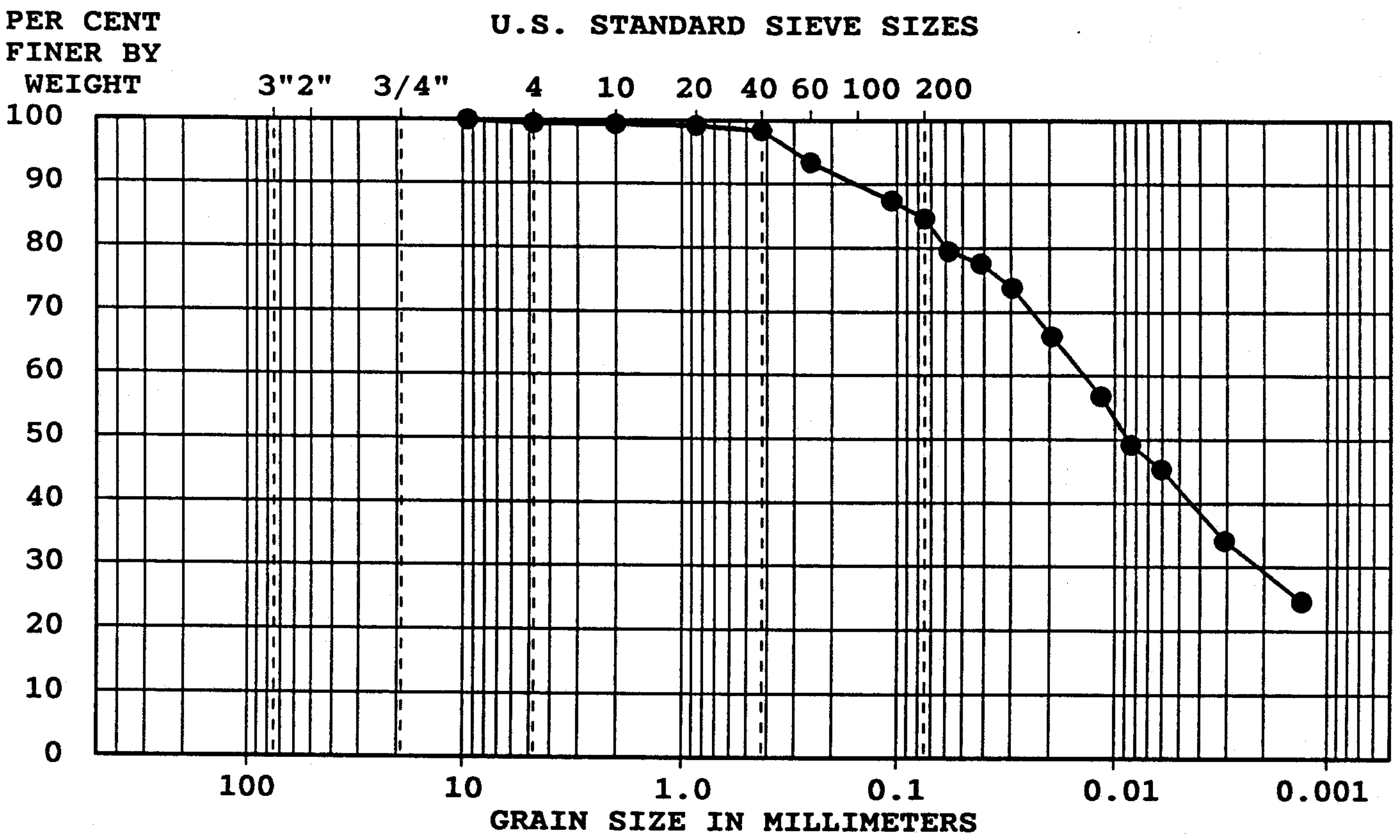
ELAPSED TIME	HYDROMETER READING	CORRECTED READING	TEMPERATURE (C)	DIAMETER (MM.)	PER CENT FINER
0.5	46.0	46.0	20.0	0.05674	67.2
1.0	40.0	40.0	20.0	0.04212	58.5
2.0	36.5	36.5	20.0	0.03069	53.3
5.0	31.0	31.0	20.0	0.02024	45.3
15.0	25.0	25.0	20.0	0.01220	36.5
30.0	22.5	22.5	20.0	0.00876	32.9
60.0	19.0	19.0	20.0	0.00634	27.8
250.0	15.0	15.0	20.0	0.00318	21.9
1440.0	11.0	11.0	20.0	0.00136	16.1

LAW ENGINEERING

GRAIN SIZE REPORT

DATE:	3-19-90
PROJECT NUMBER:	CHW 7210A
PROJECT NAME:	DUKE POWER - MCGUIRE LANDFILL
BORING NUMBER:	OW-5
DEPTH:	3.0' TO 10.0'
SPECIFIC GRAVITY:	2.73
FIELD MOISTURE:	30.7

BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY



SOIL DESCRIPTION		
LIQUID LIMIT 61	PLASTIC LIMIT 42	PLASTIC INDEX 19

LAW ENGINEERING

GRAIN SIZE REPORT

DATE:	3-19-90
PROJECT NUMBER:	CHW 7210A
PROJECT NAME:	DUKE POWER - MCGUIRE LANDFILL
BORING NUMBER:	OW-5
DEPTH:	3.0' TO 10.0'
SPECIFIC GRAVITY:	2.73
FIELD MOISTURE:	30.7
HYDROMETER NUMBER:	146
SOIL DESCRIPTION:	

SIEVE ANALYSIS

SIEVE NUMBER	WEIGHT RETAINED	DIAMETER (MM.)	PER CENT FINER
3/8 in	0.0	9.500	100.0
#4	2.9	4.750	99.5
#10	3.5	2.000	99.4
#20	0.1	0.850	99.2
#40	0.5	0.425	98.4
#60	3.0	0.250	93.4
#140	6.1	0.106	87.4
#200	7.5	0.075	84.6

HYDROMETER ANALYSIS

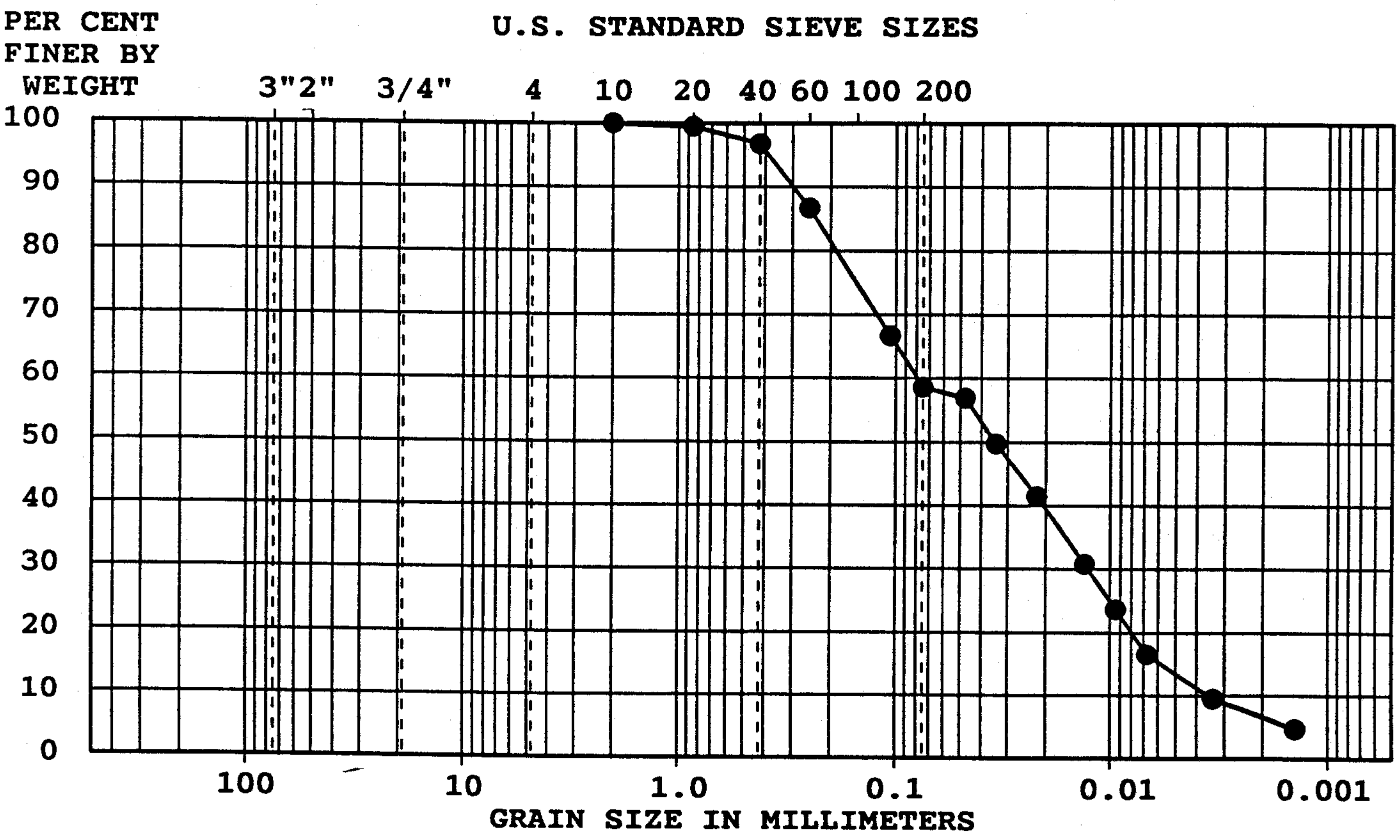
ELAPSED TIME	HYDROMETER READING	CORRECTED READING	TEMPERATURE (C)	DIAMETER (MM.)	PER CENT FINER
0.5	42.0	42.0	20.0	0.05778	79.5
1.0	41.0	41.0	20.0	0.04129	77.6
2.0	39.0	39.0	20.0	0.02965	73.8
5.0	35.0	35.0	20.0	0.01940	66.2
15.0	30.0	30.0	20.0	0.01162	56.8
30.0	26.0	26.0	20.0	0.00843	49.2
60.0	24.0	24.0	20.0	0.00606	45.4
250.0	18.0	18.0	20.0	0.00307	34.1
1440.0	13.0	13.0	20.0	0.00132	24.6

LAW ENGINEERING

GRAIN SIZE REPORT

DATE: 3-19-90
PROJECT NUMBER: CHW 7210A
PROJECT NAME: DUKE POWER - MCGUIRE LANDFILL
BORING NUMBER: OW-5
DEPTH: 13.5' TO 15.0'
SPECIFIC GRAVITY: 2.70
FIELD MOISTURE: 22.57

BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY



SOIL DESCRIPTION		
LIQUID LIMIT 62	PLASTIC LIMIT 49	PLASTIC INDEX 13

LAW ENGINEERING

GRAIN SIZE REPORT

DATE:	3-19-90
PROJECT NUMBER:	CHW 7210A
PROJECT NAME:	DUKE POWER - MCGUIRE LANDFILL
BORING NUMBER:	OW-5
DEPTH:	13.5' TO 15.0'
SPECIFIC GRAVITY:	2.70
FIELD MOISTURE:	22.57
HYDROMETER NUMBER:	146
SOIL DESCRIPTION:	

SIEVE ANALYSIS

SIEVE NUMBER	WEIGHT RETAINED	DIAMETER (MM.)	PER CENT FINER
#10	0.0	2.000	100.0
#20	0.2	0.850	99.5
#40	1.3	0.425	96.8
#60	5.4	0.250	86.7
#140	13.6	0.106	66.7
#200	16.8	0.075	58.6

HYDROMETER ANALYSIS

ELAPSED TIME	HYDROMETER READING	CORRECTED READING	TEMPERATURE (C)	DIAMETER (MM.)	PER CENT FINER
1.0	24.0	24.0	20.0	0.04733	56.9
2.0	21.0	21.0	20.0	0.03413	49.8
5.0	17.5	17.5	20.0	0.02200	41.5
15.0	13.0	13.0	20.0	0.01308	30.8
30.0	10.0	10.0	20.0	0.00941	23.7
60.0	7.0	7.0	20.0	0.00676	16.6
250.0	4.0	4.0	20.0	0.00336	9.5
1440.0	2.0	2.0	20.0	0.00142	4.7

APPENDIX D

LAW ENGINEERING

STANDARD PROCTOR REPORT
ASTM-D 698

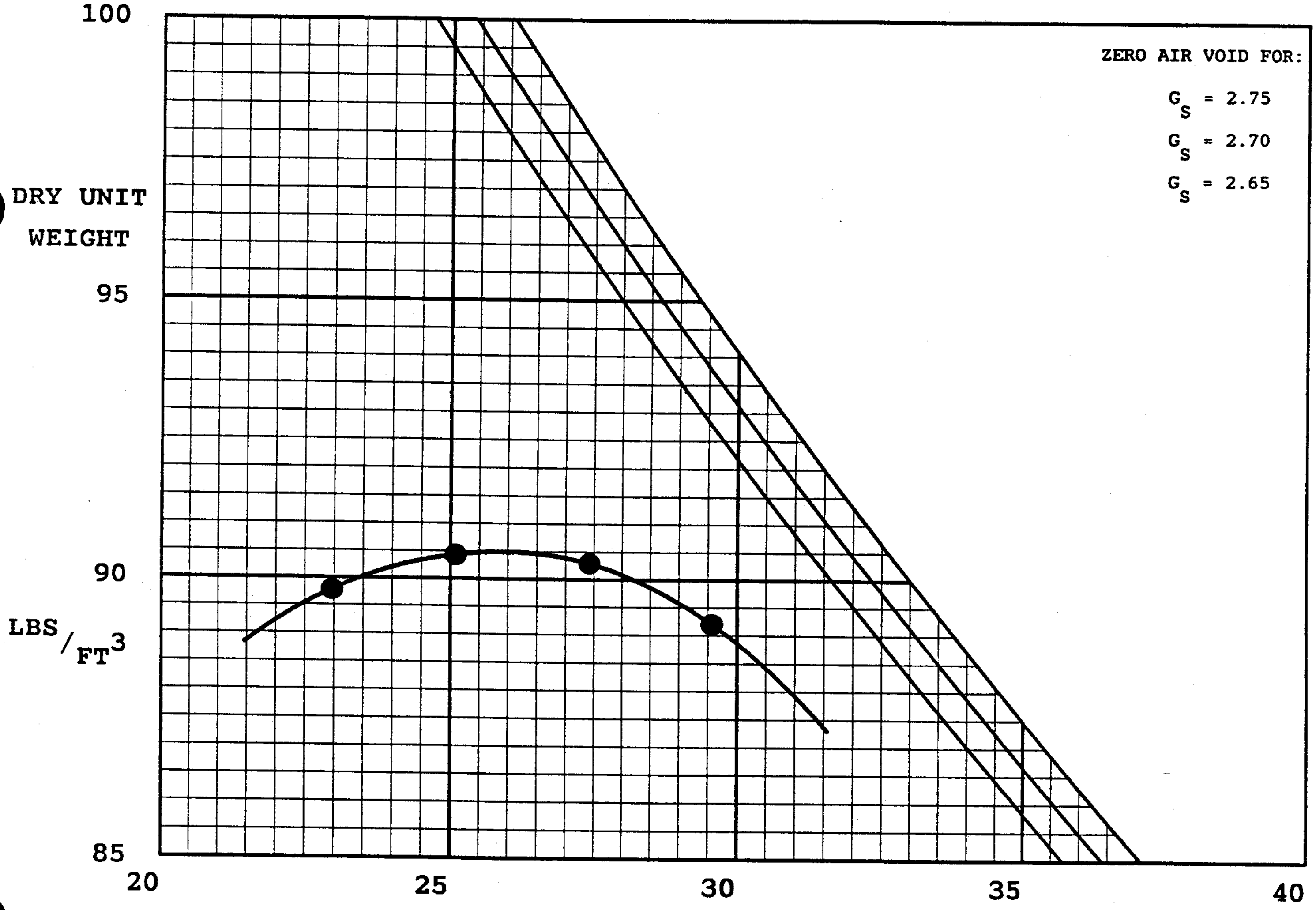
DATE:	2-20-90
PROJECT NUMBER:	CHW 7210A
PROJECT NAME:	DUKE POWER - MCGUIRE LANDFILL
CLIENT:	DUKE POWER
SAMPLE NUMBER:	CURVE #1
FIELD MOISTURE:	

SOIL DESCRIPTION:

PROPOSED USE:

SOURCE LOCATION:
OW-1 * 0'-3' * BAG SAMPLE

MOISTURE - DENSITY RELATIONSHIP



OPTIMUM MOISTURE CONTENT 25.9 MAXIMUM DRY DENSITY 90.5

LAW ENGINEERING

PROCTOR REPORT

DATE: 2-20-90
PROJECT NUMBER: CHW 7210A
PROJECT NAME: DUKE POWER - MCGUIRE LANDFILL
CLIENT: DUKE POWER
SAMPLE NUMBER: CURVE #1
PROCTOR TYPE: STANDARD ASTM-D 698
WEIGHT OF MOLD: 4230.00 grams
MOLD FACTOR: 30.06000
FIELD MOISTURE:
NUMBER OF POINTS: 4

SOIL DESCRIPTION:

PROPOSED USE:

SOURCE LOCATION:
OW-1 * 0'-3' * BAG SAMPLE

PROCTOR READINGS

NUMBER	WET SOIL & TARE	DRY SOIL & TARE	TARE	SOIL & MOLD WEIGHT
1	500.00	406.60	0.00	5896.00
2	500.00	399.70	0.00	5937.00
3	500.00	392.40	0.00	5966.00
4	500.00	385.90	0.00	5974.00

PROCTOR RESULTS

NUMBER	MOISTURE CONTENT	DRY DENSITY
1	23.0	89.8
2	25.1	90.4
3	27.4	90.3
4	29.6	89.2

LAW ENGINEERING

STANDARD PROCTOR REPORT
ASTM-D 698

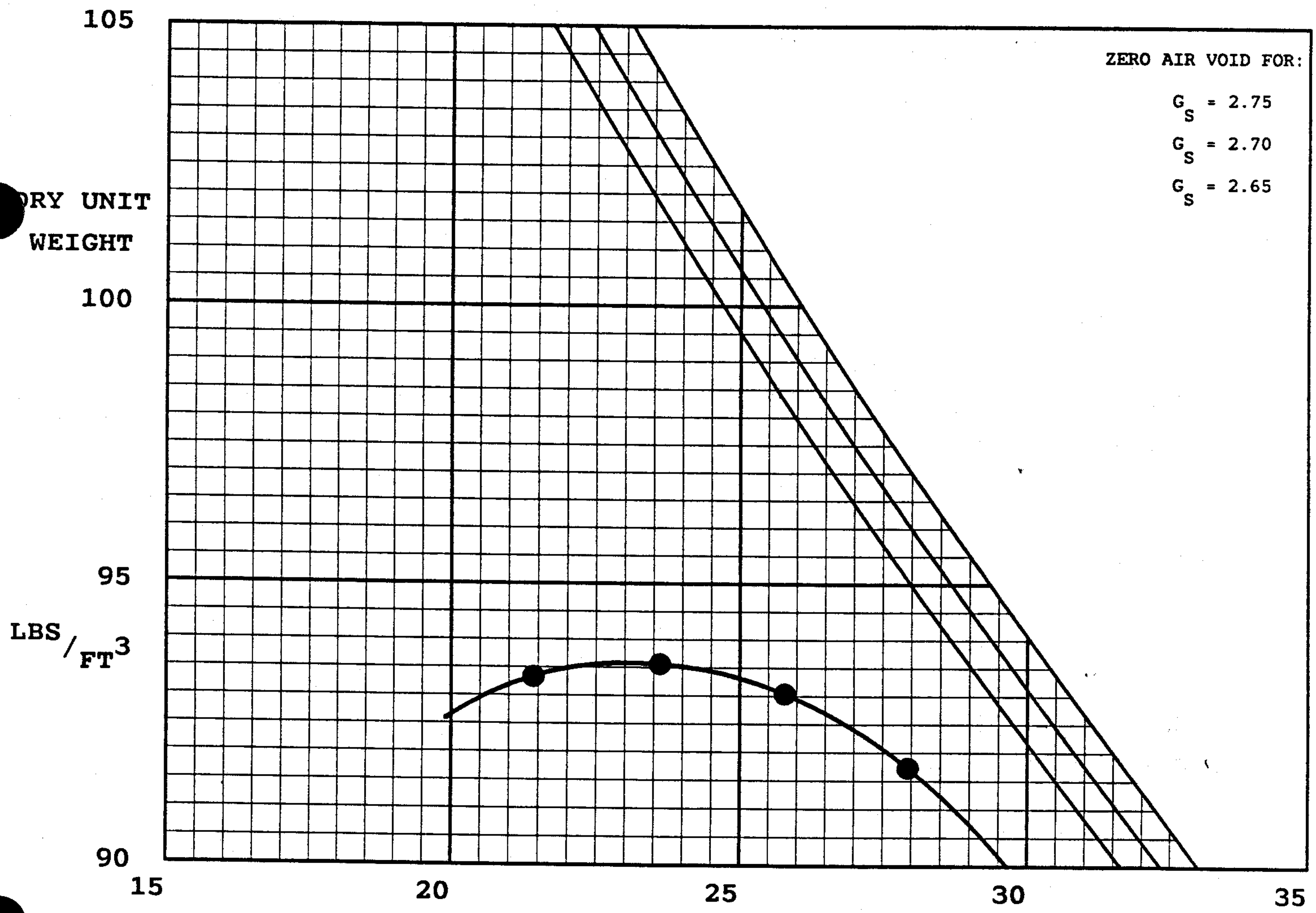
DATE: 2-14-90
PROJECT NUMBER: CHW 7210A
PROJECT NAME: DUKE POWER - MCGUIRE LANDFILL
CLIENT: DUKE POWER
SAMPLE NUMBER: CURVE #2
FIELD MOISTURE:

SOIL DESCRIPTION:

PROPOSED USE:

SOURCE LOCATION:
OW-1 * 3' TO 10' * BAG SAMPLE

MOISTURE - DENSITY RELATIONSHIP



WATER CONTENT - PERCENT OF DRY WEIGHT

OPTIMUM MOISTURE CONTENT 23.1 MAXIMUM DRY DENSITY 93.6

LAW ENGINEERING

PROCTOR REPORT

DATE:	2-14-90
PROJECT NUMBER:	CHW 7210A
PROJECT NAME:	DUKE POWER - MCGUIRE LANDFILL
CLIENT:	DUKE POWER
SAMPLE NUMBER:	CURVE #2
PROCTOR TYPE:	STANDARD ASTM-D 698
WEIGHT OF MOLD:	4230.00 grams
MOLD FACTOR:	30.06000
FIELD MOISTURE:	
NUMBER OF POINTS:	4

SOIL DESCRIPTION:

PROPOSED USE:

SOURCE LOCATION:
OW-1 * 3' TO 10' * BAG SAMPLE

PROCTOR READINGS

NUMBER	WET SOIL & TARE	DRY SOIL & TARE	TARE	SOIL & MOLD WEIGHT
1	500.00	411.80	0.00	5940.00
2	500.00	404.50	0.00	5975.00
3	500.00	397.50	0.00	5996.00
4	500.00	390.80	0.00	6001.00

PROCTOR RESULTS

NUMBER	MOISTURE CONTENT	DRY DENSITY
1	21.4	93.3
2	23.6	93.6
3	25.8	93.0
4	27.9	91.7

LAW ENGINEERING

STANDARD PROCTOR REPORT
ASTM-D 698

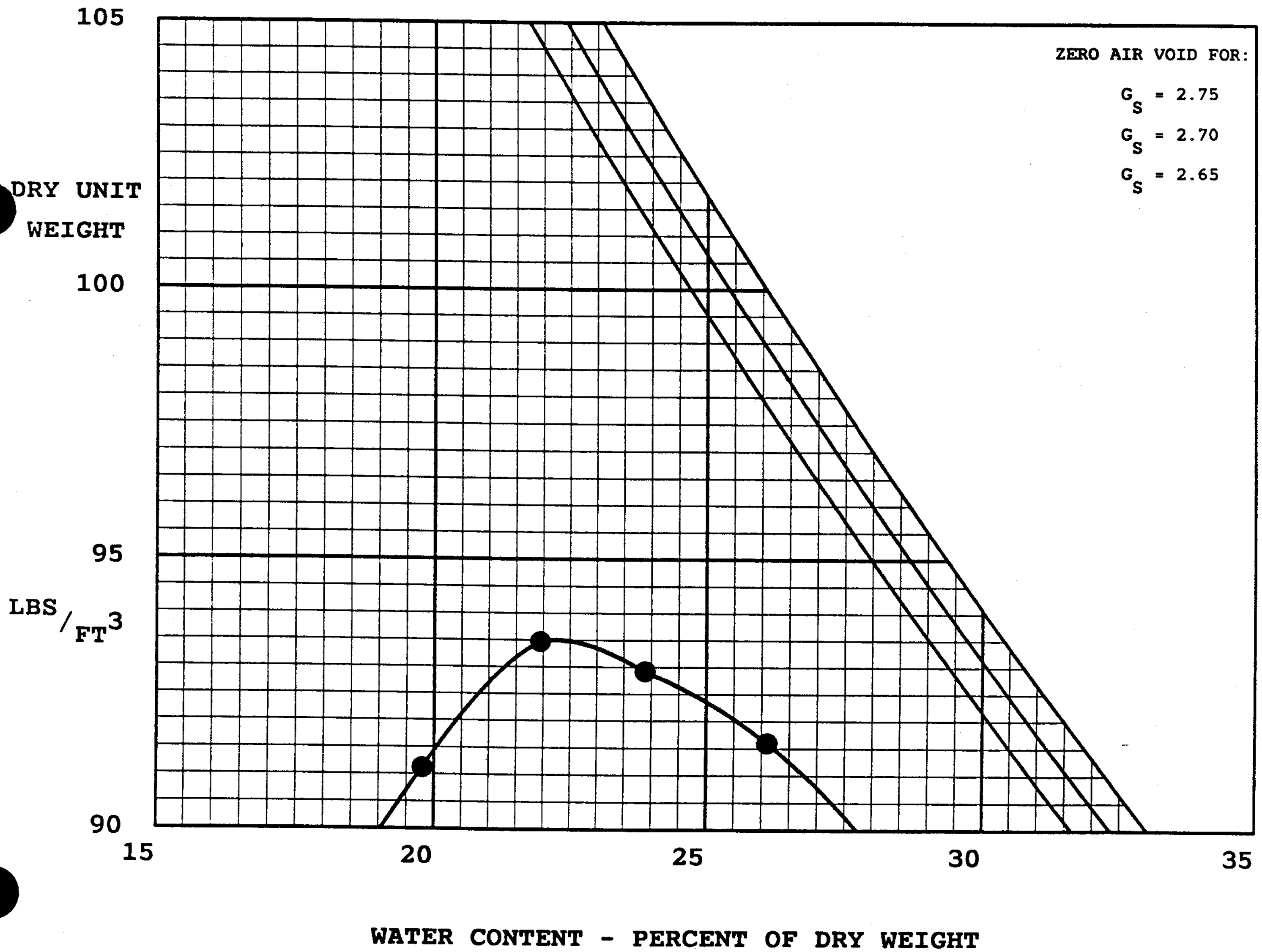
DATE: 2-21-90
PROJECT NUMBER: CHW 7210A
PROJECT NAME: DUKE POWER - MCGUIRE LANDFILL
CLIENT: DUKE POWER
SAMPLE NUMBER: CURVE #3
FIELD MOISTURE:

SOIL DESCRIPTION:

PROPOSED USE:

SOURCE LOCATION:
OW-2 * 9' TO 3' * BAG SAMPLE

MOISTURE - DENSITY RELATIONSHIP



OPTIMUM MOISTURE CONTENT 22.2 MAXIMUM DRY DENSITY 93.5

LAW ENGINEERING

PROCTOR REPORT

DATE: 2-21-90
PROJECT NUMBER: CHW 7210A
PROJECT NAME: DUKE POWER - MCGUIRE LANDFILL
CLIENT: DUKE POWER
SAMPLE NUMBER: CURVE #3
PROCTOR TYPE: STANDARD ASTM-D 698
WEIGHT OF MOLD: 4230.00 grams
MOLD FACTOR: 30.06000
FIELD MOISTURE:
NUMBER OF POINTS: 4

SOIL DESCRIPTION:

PROPOSED USE:

SOURCE LOCATION:
OW-2 * 9' TO 3' * BAG SAMPLE

PROCTOR READINGS

NUMBER	WET SOIL & TARE	DRY SOIL & TARE	TARE	SOIL & MOLD WEIGHT
1	500.00	417.40	0.00	5877.00
2	500.00	410.00	0.00	5950.00
3	500.00	403.60	0.00	5967.00
4	500.00	396.50	0.00	5973.00

PROCTOR RESULTS

NUMBER	MOISTURE CONTENT	DRY DENSITY
1	19.8	91.1
2	22.0	93.5
3	23.9	92.9
4	26.1	91.6

LAW ENGINEERING

STANDARD PROCTOR REPORT
ASTM-D 698

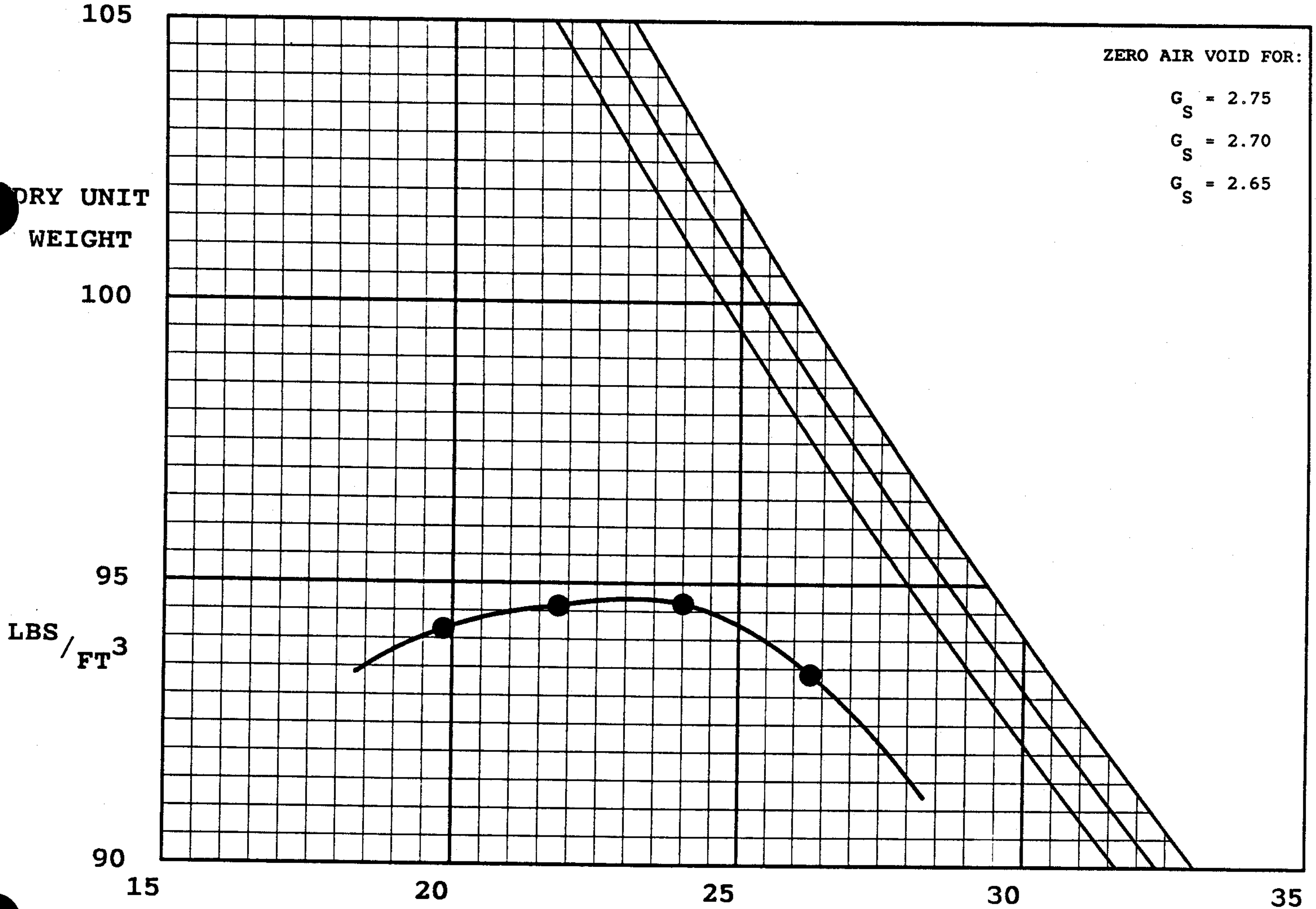
DATE: 2-14-90
PROJECT NUMBER: CHW 7210A
PROJECT NAME: DUKE POWER - MCGUIRE LANDFILL
CLIENT: DUKE POWER
SAMPLE NUMBER: CURVE #4
FIELD MOISTURE:

SOIL DESCRIPTION:

PROPOSED USE:

SOURCE LOCATION:
OW-2 * 3' TO 8' * BAG SAMPLE

MOISTURE - DENSITY RELATIONSHIP



WATER CONTENT - PERCENT OF DRY WEIGHT

OPTIMUM MOISTURE CONTENT 23.1 MAXIMUM DRY DENSITY 94.7

LAW ENGINEERING

PROCTOR REPORT

DATE: 2-14-90
PROJECT NUMBER: CHW 7210A
PROJECT NAME: DUKE POWER - MCGUIRE LANDFILL
CLIENT: DUKE POWER
SAMPLE NUMBER: CURVE #4
PROCTOR TYPE: STANDARD ASTM-D 698
WEIGHT OF MOLD: 4230.00 grams
MOLD FACTOR: 30.06000
FIELD MOISTURE:
NUMBER OF POINTS: 4

SOIL DESCRIPTION:

PROPOSED USE:

SOURCE LOCATION:
OW-2 * 3' TO 8' * BAG SAMPLE

PROCTOR READINGS

NUMBER	WET SOIL & TARE	DRY SOIL & TARE	TARE	SOIL & MOLD WEIGHT
1	500.00	417.20	0.00	5933.00
2	500.00	410.40	0.00	5969.00
3	500.00	403.20	0.00	6001.00
4	500.00	395.90	0.00	6010.00

PROCTOR RESULTS

NUMBER	MOISTURE CONTENT	DRY DENSITY
1	19.8	94.2
2	21.8	94.6
3	24.0	94.6
4	26.3	93.4

LAW ENGINEERING

STANDARD PROCTOR REPORT
ASTM-D 698

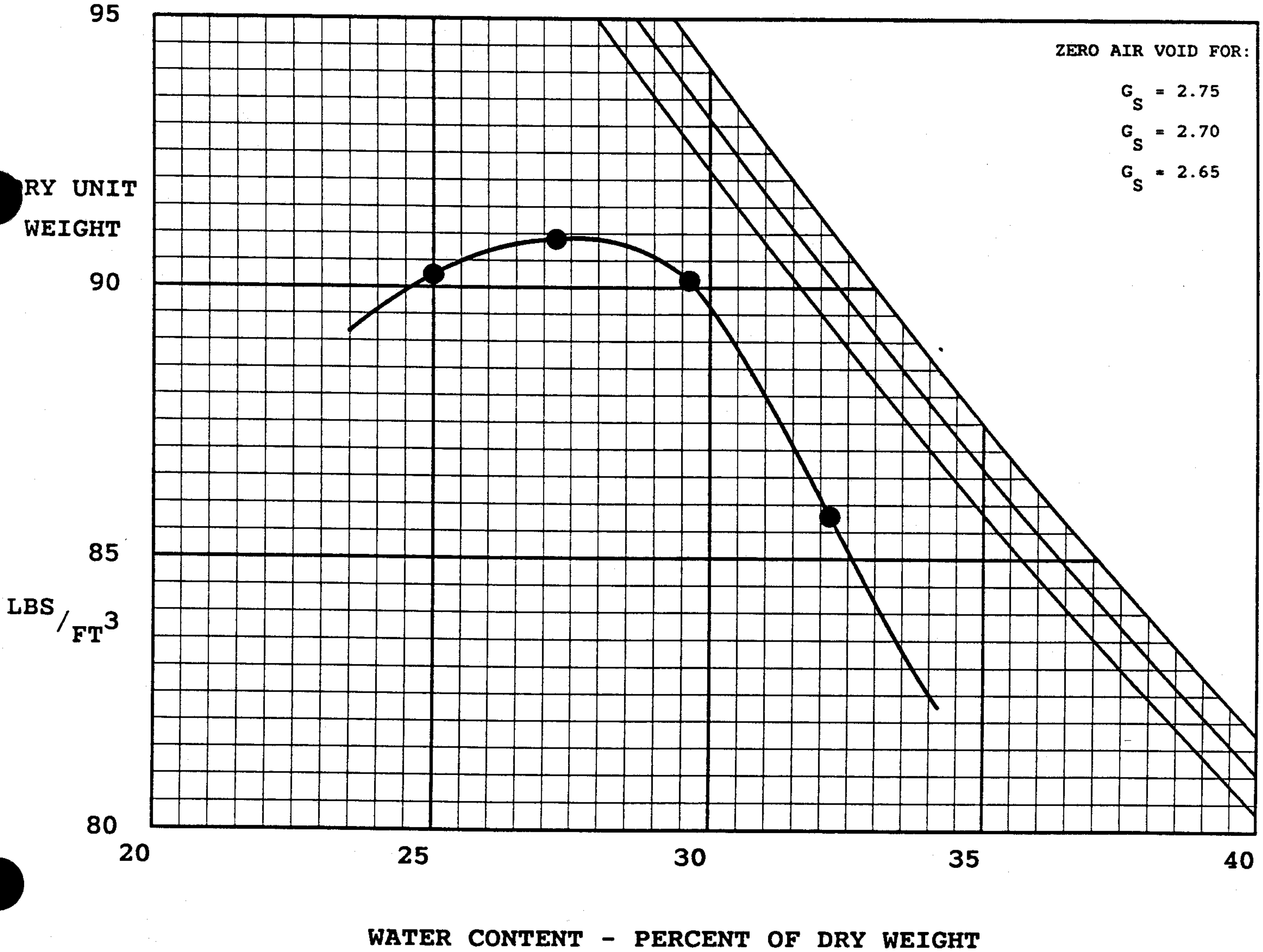
DATE: 2-15-90
PROJECT NUMBER: CHW 7210A
PROJECT NAME: DUKE POWER - MCGUIRE LANDFILL
CLIENT: DUKE POWER
SAMPLE NUMBER: CURVE #5
FIELD MOISTURE:

SOIL DESCRIPTION:

PROPOSED USE:

SOURCE LOCATION:
OW-4 * 0'-3' * BAG SAMPLE

MOISTURE - DENSITY RELATIONSHIP



OPTIMUM MOISTURE CONTENT 27.6 MAXIMUM DRY DENSITY 90.9

LAW ENGINEERING

PROCTOR REPORT

DATE:	2-15-90
PROJECT NUMBER:	CHW 7210A
PROJECT NAME:	DUKE POWER - MCGUIRE LANDFILL
CLIENT:	DUKE POWER
SAMPLE NUMBER:	CURVE #5
PROCTOR TYPE:	STANDARD ASTM-D 698
WEIGHT OF MOLD:	4230.00 grams
MOLD FACTOR:	30.06000
FIELD MOISTURE:	
NUMBER OF POINTS:	4

SOIL DESCRIPTION:

PROPOSED USE:

SOURCE LOCATION:
OW-4 * 0'-3' * BAG SAMPLE

PROCTOR READINGS

NUMBER	WET SOIL & TARE	DRY SOIL & TARE	TARE	SOIL & MOLD WEIGHT
1	500.00	400.00	0.00	5932.00
2	500.00	393.00	0.00	5975.00
3	500.00	385.70	0.00	5993.00
4	500.00	378.30	0.00	5941.00

PROCTOR RESULTS

NUMBER	MOISTURE CONTENT	DRY DENSITY
1	25.0	90.2
2	27.2	90.9
3	29.6	90.1
4	32.2	85.8

LAW ENGINEERING

STANDARD PROCTOR REPORT
ASTM-D 698

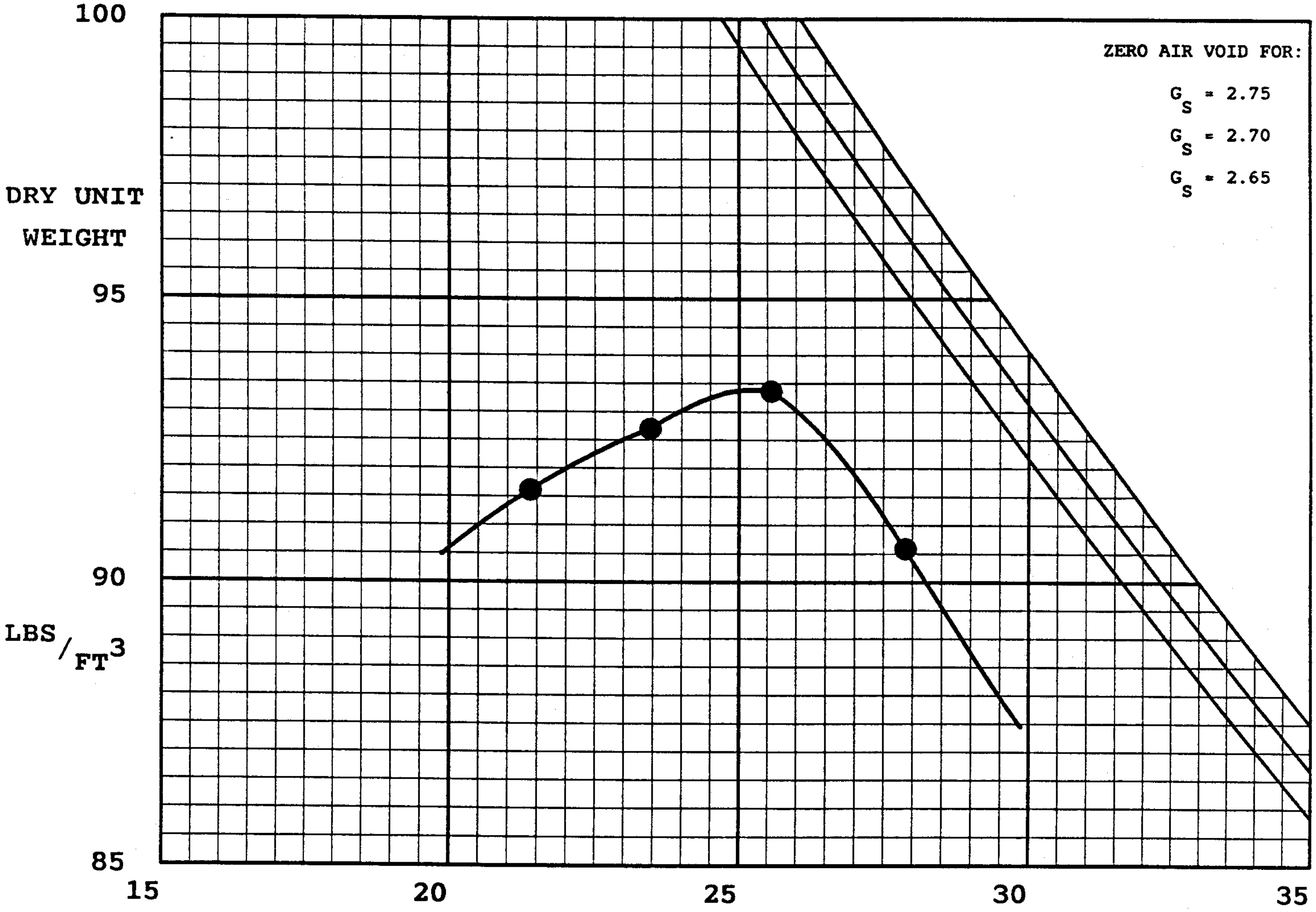
DATE: 2-21-90
PROJECT NUMBER: CHW 7210A
PROJECT NAME: DUKE POWER - MCGUIRE LANDFILL
CLIENT: DUKE POWER
SAMPLE NUMBER: CURVE #6
FIELD MOISTURE:

SOIL DESCRIPTION:

PROPOSED USE:

SOURCE LOCATION:
OW-4 * 3' TO 8' * BAG SAMPLE

MOISTURE - DENSITY RELATIONSHIP



WATER CONTENT - PERCENT OF DRY WEIGHT

OPTIMUM MOISTURE CONTENT 25.2 MAXIMUM DRY DENSITY 93.4

LAW ENGINEERING

PROCTOR REPORT

DATE: 2-21-90
PROJECT NUMBER: CHW 7210A
PROJECT NAME: DUKE POWER - MCGUIRE LANDFILL
CLIENT: DUKE POWER
SAMPLE NUMBER: CURVE #6
PROCTOR TYPE: STANDARD ASTM-D 698
WEIGHT OF MOLD: 4230.00 grams
MOLD FACTOR: 30.06000
FIELD MOISTURE:
NUMBER OF POINTS: 4

SOIL DESCRIPTION:

PROPOSED USE:

SOURCE LOCATION:
OW-4 * 3' TO 8' * BAG SAMPLE

PROCTOR READINGS

NUMBER	WET SOIL & TARE	DRY SOIL & TARE	TARE	SOIL & MOLD WEIGHT
1	500.00	411.90	0.00	5908.00
2	500.00	405.00	0.00	5957.00
3	500.00	398.20	0.00	5999.00
4	500.00	391.00	0.00	5978.00

PROCTOR RESULTS

NUMBER	MOISTURE CONTENT	DRY DENSITY
1	21.4	91.6
2	23.5	92.7
3	25.6	93.4
4	27.9	90.6

LAW ENGINEERING

STANDARD PROCTOR REPORT
ASTM-D 698

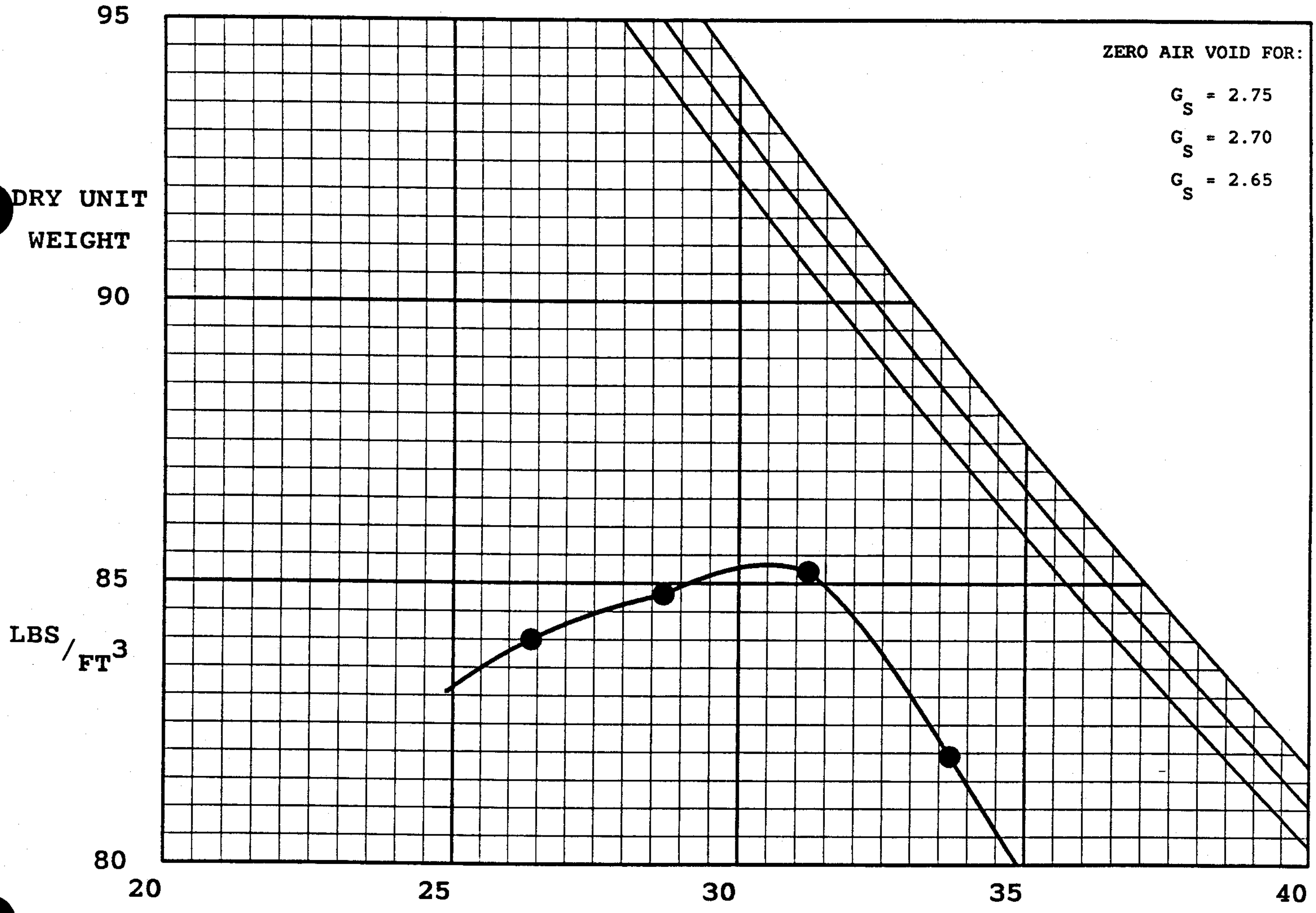
DATE: 2-20-90
PROJECT NUMBER: CHW 7210A
PROJECT NAME: DUKE POWER - MCGUIRE LANDFILL
CLIENT: DUKE POWER
SAMPLE NUMBER: CURVE #7
FIELD MOISTURE:

SOIL DESCRIPTION:

PROPOSED USE:

SOURCE LOCATION:
OW-5 * 0' TO 3' * BAG SAMPLE

MOISTURE - DENSITY RELATIONSHIP



OPTIMUM MOISTURE CONTENT 30.5 MAXIMUM DRY DENSITY 85.3

LAW ENGINEERING

PROCTOR REPORT

DATE:	2-20-90
PROJECT NUMBER:	CHW 7210A
PROJECT NAME:	DUKE POWER - MCGUIRE LANDFILL
CLIENT:	DUKE POWER
SAMPLE NUMBER:	CURVE #7
PROCTOR TYPE:	STANDARD ASTM-D 698
WEIGHT OF MOLD:	4230.00 grams
MOLD FACTOR:	30.06000
FIELD MOISTURE:	
NUMBER OF POINTS:	4

SOIL DESCRIPTION:

PROPOSED USE:

SOURCE LOCATION:
OW-5 * 0' TO 3' * BAG SAMPLE

PROCTOR READINGS

NUMBER	WET SOIL & TARE	DRY SOIL & TARE	TARE	SOIL & MOLD WEIGHT
1	500.00	395.60	0.00	5832.00
2	500.00	388.50	0.00	5877.00
3	500.00	381.10	0.00	5917.00
4	500.00	374.00	0.00	5883.00

PROCTOR RESULTS

NUMBER	MOISTURE CONTENT	DRY DENSITY
1	26.4	84.0
2	28.7	84.8
3	31.2	85.2
4	33.7	81.9

LAW ENGINEERING

STANDARD PROCTOR REPORT
ASTM-D 698

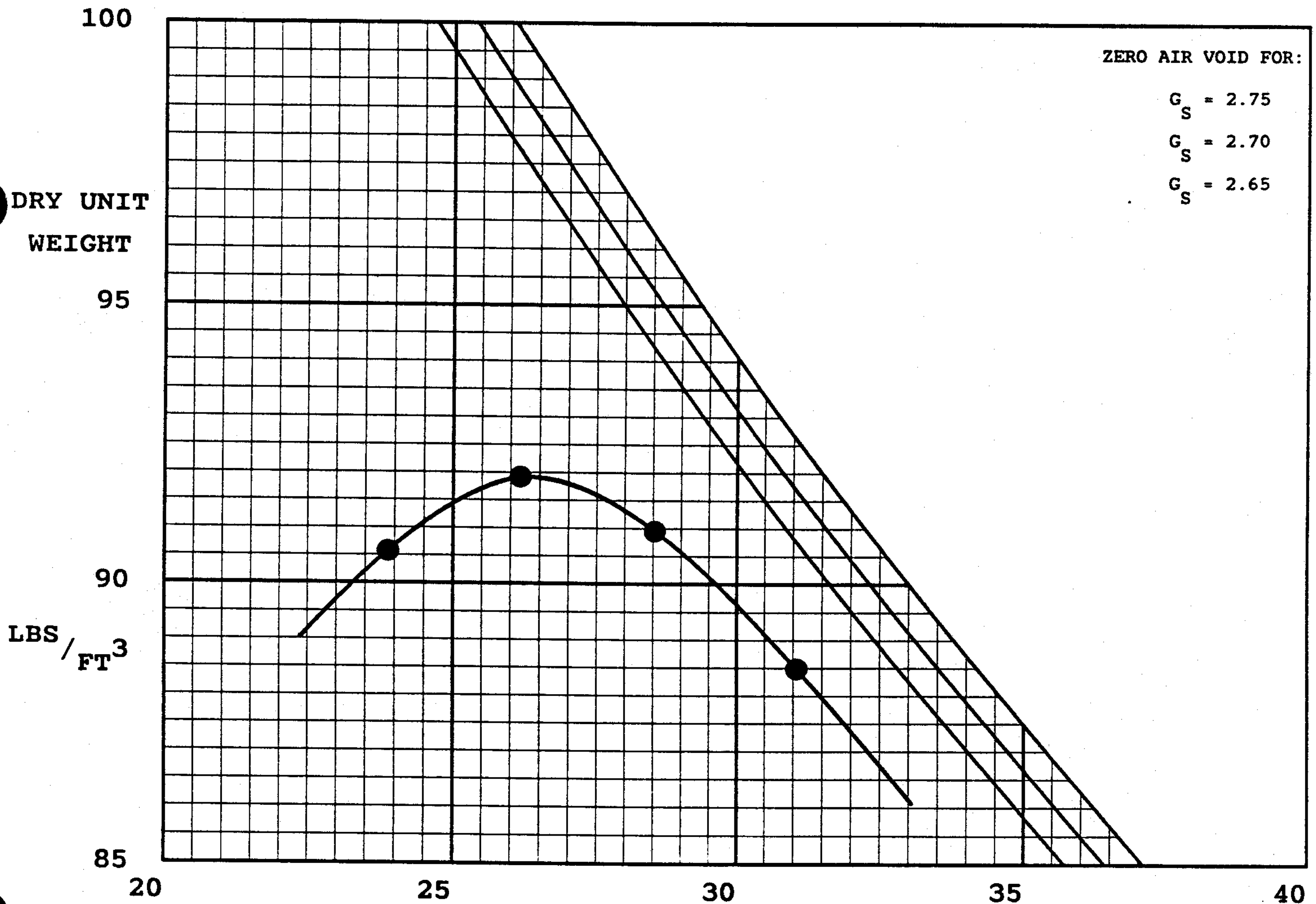
DATE:	2-15-90
PROJECT NUMBER:	CHW 7210A
PROJECT NAME:	DUKE POWER - MCGUIRE LANDFILL
CLIENT:	DUKE POWER
SAMPLE NUMBER:	CURVE #8
FIELD MOISTURE:	

SOIL DESCRIPTION:

PROPOSED USE:

SOURCE LOCATION:
OW-5 * 3' TO 8' * BAG SAMPLE

MOISTURE - DENSITY RELATIONSHIP



OPTIMUM MOISTURE CONTENT 26.2 MAXIMUM DRY DENSITY 91.9

LAW ENGINEERING

PROCTOR REPORT

DATE: 2-15-90
PROJECT NUMBER: CHW 7210A
PROJECT NAME: DUKE POWER - MCGUIRE LANDFILL
CLIENT: DUKE POWER
SAMPLE NUMBER: CURVE #8
PROCTOR TYPE: STANDARD ASTM-D 698
WEIGHT OF MOLD: 4230.00 grams
MOLD FACTOR: 30.06000
FIELD MOISTURE:
NUMBER OF POINTS: 4

SOIL DESCRIPTION:

PROPOSED USE:

SOURCE LOCATION:
OW-5 * 3' TO 8' * BAG SAMPLE

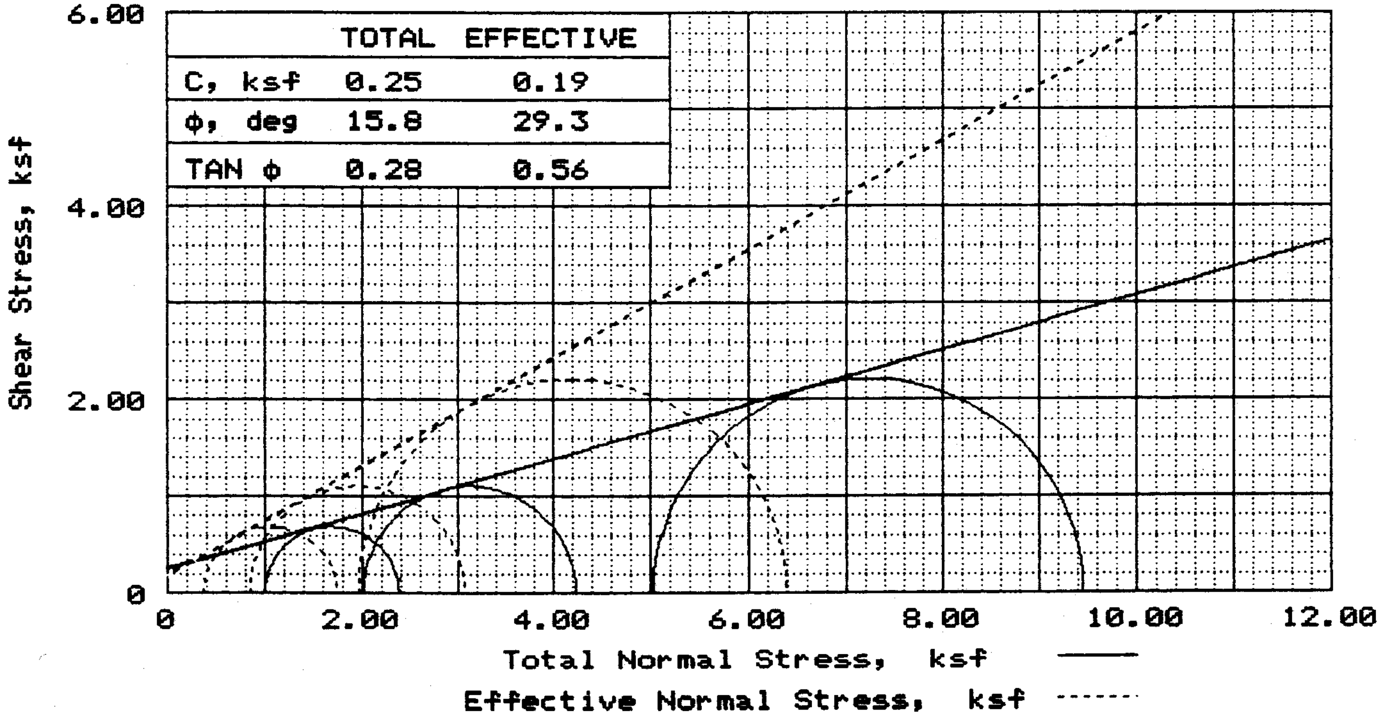
PROCTOR READINGS

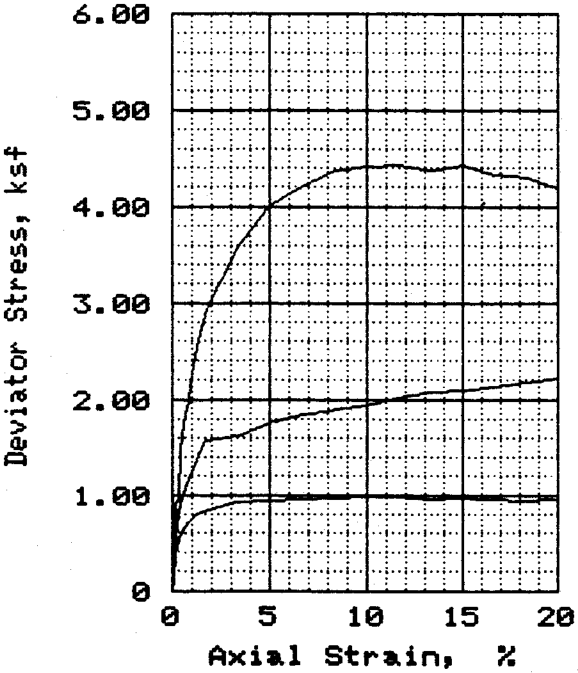
NUMBER	WET SOIL & TARE	DRY SOIL & TARE	TARE	SOIL & MOLD WEIGHT
1	500.00	403.60	0.00	5923.00
2	500.00	396.30	0.00	5980.00
3	500.00	389.00	0.00	5994.00
4	500.00	381.50	0.00	5980.00

PROCTOR RESULTS

NUMBER	MOISTURE CONTENT	DRY DENSITY
1	23.9	90.6
2	26.2	91.9
3	28.5	90.9
4	31.1	88.5

APPENDIX E





SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	23.5	21.9	23.1
	DRY DENSITY, pcf	74.5	77.6	75.7
	SATURATION, %	49.7	49.8	50.3
	VOID RATIO	1.297	1.205	1.258
	DIAMETER, in	2.87	2.84	2.86
	HEIGHT, in	6.04	6.00	6.00
AT TEST	WATER CONTENT, %	44.2	38.1	36.7
	DRY DENSITY, pcf	77.3	83.7	85.2
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	1.212	1.044	1.007
	DIAMETER, in	2.82	2.73	2.70
	HEIGHT, in	6.04	6.00	6.00
BACK PRESSURE, ksf		7.20	7.20	7.20
CELL PRESSURE, ksf		8.21	9.22	12.24
FAILURE STRESS, ksf		1.38	2.22	4.43
PORE PRESSURE, ksf		7.83	8.37	10.27
STRAIN RATE, %/min.		0.170	0.330	0.330
ULTIMATE STRESS, ksf				
PORE PRESSURE, ksf				
$\bar{\sigma}_1$ FAILURE, ksf		1.76	3.07	6.40
$\bar{\sigma}_3$ FAILURE, ksf		0.37	0.85	1.97

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: REMOLDED TO 80%
DESCRIPTION: LT YE BN - MULTI COLORED MI FI SA SI
LL= PL= PI=
SPECIFIC GRAVITY= 2.74
REMARKS:

FIG. NO. 1

CLIENT: DUKE POWER COMPANY

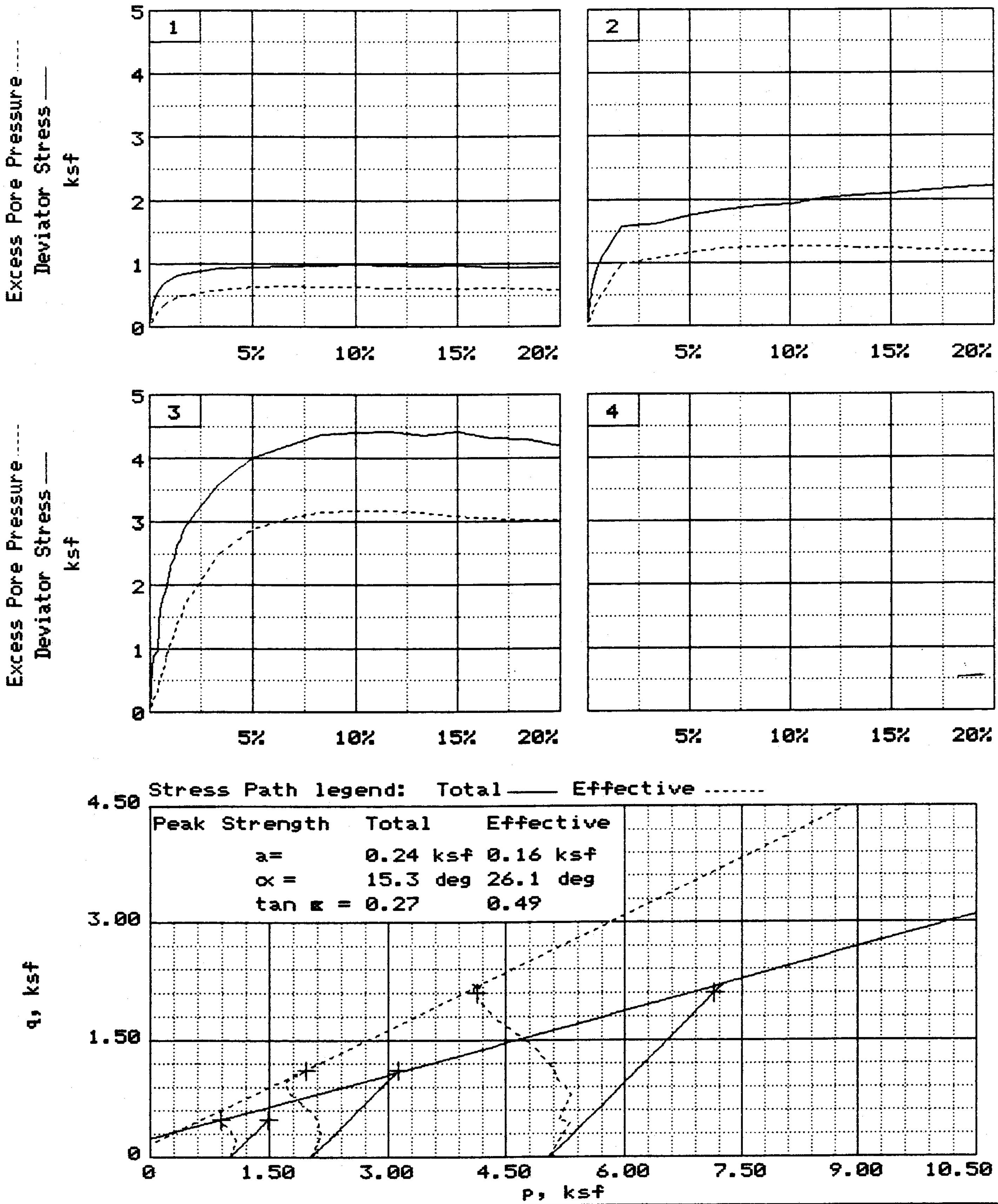
PROJECT: MCGUIRE LANDFILL

SAMPLE LOCATION: OW-1
3' TO 10'

PROJ. NO.: CHW 7210A DATE: 2/28/90

TRIAXIAL COMPRESSION TEST

LAW ENGINEERING



Client: DUKE POWER COMPANY
Project: MCGUIRE LANDFILL
Location: OW-1 3' TO 10'
File: 7210A_1 Project No.: CHW 7210A Page 2/2 Fig. No. 1

@==

TRIAXIAL COMPRESSION TEST

CU with pore pressures

3-21-1990
5:51 pm

==

Project Data

Project No.: CHW 7210A   Date: 2/28/90   Data file: 7210A_1
Client: DUKE POWER COMPANY
Project: MCGUIRE LANDFILL
Sample location: OW-1 3' TO 10'
Sample description: LT YE BN - MULTI COLORED MI FI SA SI
Remarks:
Fig No. 1

Sample No. 1 Data

Type of sample: REMOLDED TO 80%
Specific Gravity= 2.74   LL=   PL=   PI=

Sample Parameters	Before Test	At Testing	After Test
Diameter, in	2.87	2.82	
Height change, in		0.00	
Height, in	6.04	6.04	
Weight, grams	943.5		
Water volume change, cc		%-158.3	
Moisture, %	23.5	44.2	44.2
Dry density, pcf	74.5	77.3	
Saturation, %	49.7	100.0	
Void ratio	1.297	1.212	

Test Data

Deformation dial constant=   1 in per input unit
Primary load ring constant= 0.712 lbs. per input unit
Secondary load ring constant= 0 lbs. per input unit
Crossover reading for secondary load ring= 0 input units
Rate of strain= 0.170 % per minute
Consolidation cell pressure = 57 psi
Consolidation back pressure = 50 psi
Consolidation effective confining stress = 1.008 ksf
Peak deviator stress =   1.38 ksf at reading no. 15
Ult. deviator stress =

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.0	0.00	1.01	1.01	1.00	50.0	1.01	0.00
1	0.0100	0.010	23.0	16.4	0.2	0.38	0.89	1.27	1.42	50.8	1.08	0.19
2	0.0200	0.020	31.5	22.4	0.3	0.52	0.81	1.32	1.64	51.4	1.06	0.26
3	0.0300	0.030	37.0	26.3	0.5	0.61	0.72	1.33	1.84	52.0	1.02	0.30
4	0.0400	0.040	41.0	29.2	0.7	0.67	0.68	1.35	1.99	52.3	1.01	0.34
[illegible]	0.0500	0.050	44.0	31.3	0.8	0.72	0.63	1.35	2.13	52.6	0.99	0.36

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
6	0.0600	0.060	46.0	32.8	1.0	0.75	0.60	1.35	2.24	52.8	0.98	0.37
7	0.0700	0.070	48.0	34.2	1.2	0.78	0.58	1.36	2.36	53.0	0.97	0.39
8	0.0800	0.080	49.5	35.2	1.3	0.80	0.55	1.35	2.47	53.2	0.95	0.40
9	0.0900	0.090	50.5	36.0	1.5	0.82	0.52	1.34	2.58	53.4	0.93	0.41
10	0.1000	0.100	51.5	36.7	1.7	0.83	0.50	1.34	2.65	53.5	0.92	0.42
11	0.2000	0.200	58.0	41.3	3.3	0.92	0.42	1.34	3.21	54.1	0.88	0.46
12	0.3000	0.300	60.0	42.7	5.0	0.94	0.37	1.31	3.51	54.4	0.84	0.47
13	0.4000	0.400	62.0	44.1	6.6	0.95	0.36	1.31	3.65	54.5	0.84	0.48
14	0.5000	0.500	64.0	45.6	8.3	0.97	0.37	1.34	3.58	54.4	0.86	0.48
15	0.6000	0.600	66.5	47.3	9.9	0.99	0.37	1.36	3.63	54.4	0.87	0.49
16	0.7000	0.700	67.0	47.7	11.6	0.97	0.39	1.36	3.51	54.3	0.88	0.49
17	0.8000	0.800	67.0	47.7	13.2	0.96	0.39	1.35	3.46	54.3	0.87	0.48
18	0.9000	0.900	69.0	49.1	14.9	0.97	0.40	1.37	3.40	54.2	0.89	0.48
19	1.0000	1.000	69.0	49.1	16.6	0.95	0.39	1.34	3.44	54.3	0.86	0.47
20	1.1000	1.100	70.0	49.8	18.2	0.94	0.40	1.35	3.34	54.2	0.87	0.47
21	1.2000	1.200	72.0	51.3	19.9	0.95	0.42	1.37	3.27	54.1	0.89	0.47

@===

TRIAXIAL COMPRESSION TEST 3-21-1990
CU with pore pressures 5:52 pm

===

Project Data

Project No.: CHW 7210A Date: 2/28/90 Data file: 7210A_1
Client: DUKE POWER COMPANY
Project: MCGUIRE LANDFILL
Sample location: OW-1 3' TO 10'
Sample description: LT YE BN - MULTI COLORED MI FI SA SI
Remarks:
Fig No. 1

Sample No. 2 Data

Type of sample: REMOLDED TO 80%
Specific Gravity= 2.74 LL= PL= PI=

Sample Parameters	Before Test	At Testing	After Test
Diameter, in	2.84	2.73	
Height change, in		0.00	
Height, in	6.00	6.00	
Weight, grams	943.4		
Water volume change, cc		%-125.4	
Moisture, %	21.9	38.1	38.1
Dry density, pcf	77.6	83.7	
Saturation, %	49.8	100.0	
Void ratio	1.205	1.044	

Test Data

Deformation dial constant= 1 in per input unit
Primary load ring constant= 0.712 lbs. per input unit
Secondary load ring constant= 0 lbs. per input unit
Crossover reading for secondary load ring= 0 input units
Rate of strain= 0.330 % per minute
Consolidation cell pressure = 64 psi
Consolidation back pressure = 50 psi
Consolidation effective confining stress = 2.016 ksf
Peak deviator stress = 2.22 ksf at reading no. 21
Ult. deviator stress =

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.0	0.00	2.02	2.02	1.00	50.0	2.02	0.00
1	0.0100	0.010	32.0	22.8	0.2	0.56	1.86	2.42	1.30	51.1	2.14	0.28
2	0.0200	0.020	46.0	32.8	0.3	0.80	1.71	2.51	1.47	52.1	2.11	0.40
3	0.0300	0.030	55.5	39.5	0.5	0.96	1.61	2.58	1.60	52.8	2.09	0.48
4	0.0400	0.040	62.0	44.1	0.7	1.08	1.51	2.59	1.71	53.5	2.05	0.54
[illegible]	0.0500	0.050	67.0	47.7	0.8	1.16	1.44	2.60	1.81	54.0	2.02	0.58

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
[illegible]	0.0600	0.060	72.0	51.3	1.0	1.24	1.35	2.60	1.92	54.6	1.98	0.62
7	0.0700	0.070	77.0	54.8	1.2	1.33	1.27	2.60	2.05	55.2	1.93	0.66
8	0.0800	0.080	82.0	58.4	1.3	1.41	1.18	2.59	2.20	55.8	1.89	0.71
9	0.0900	0.090	87.0	61.9	1.5	1.50	1.11	2.61	2.35	56.3	1.86	0.75
10	0.1000	0.100	92.0	65.5	1.7	1.58	1.02	2.60	2.55	56.9	1.81	0.79
11	0.2000	0.200	96.0	68.4	3.3	1.62	0.94	2.56	2.73	57.5	1.75	0.81
12	0.3000	0.300	106.0	75.5	5.0	1.76	0.85	2.61	3.07	58.1	1.73	0.88
13	0.4000	0.400	113.0	80.5	6.7	1.84	0.78	2.62	3.37	58.6	1.70	0.92
14	0.5000	0.500	119.0	84.7	8.3	1.90	0.76	2.67	3.50	58.7	1.72	0.95
15	0.6000	0.600	123.0	87.6	10.0	1.93	0.75	2.68	3.58	58.8	1.72	0.97
16	0.7000	0.700	131.0	93.3	11.7	2.02	0.75	2.77	3.70	58.8	1.76	1.01
17	0.8000	0.800	137.0	97.5	13.3	2.07	0.78	2.85	3.67	58.6	1.81	1.04
18	0.9000	0.900	141.0	100.4	15.0	2.09	0.78	2.87	3.69	58.6	1.82	1.05
19	1.0000	1.000	147.0	104.7	16.7	2.14	0.81	2.95	3.65	58.4	1.88	1.07
20	1.1000	1.100	153.0	108.9	18.3	2.18	0.82	3.00	3.66	58.3	1.91	1.09
21	1.2000	1.200	159.0	113.2	20.0	2.22	0.85	3.07	3.61	58.1	1.96	1.11

@==

TRIAXIAL COMPRESSION TEST 3-21-1990
CU with pore pressures 5:55 pm

==

Project Data

Project No.: CHW 7210A Date: 2/28/90 Data file: 7210A_1
Client: DUKE POWER COMPANY
Project: MCGUIRE LANDFILL
Sample location: OW-1 3' TO 10'
Sample description: LT YE BN - MULTI COLORED MI FI SA SI
Remarks:
Fig No. 1

Sample No. 3 Data

Type of sample: REMOLDED TO 80%
Specific Gravity= 2.74 LL= PL= PI=

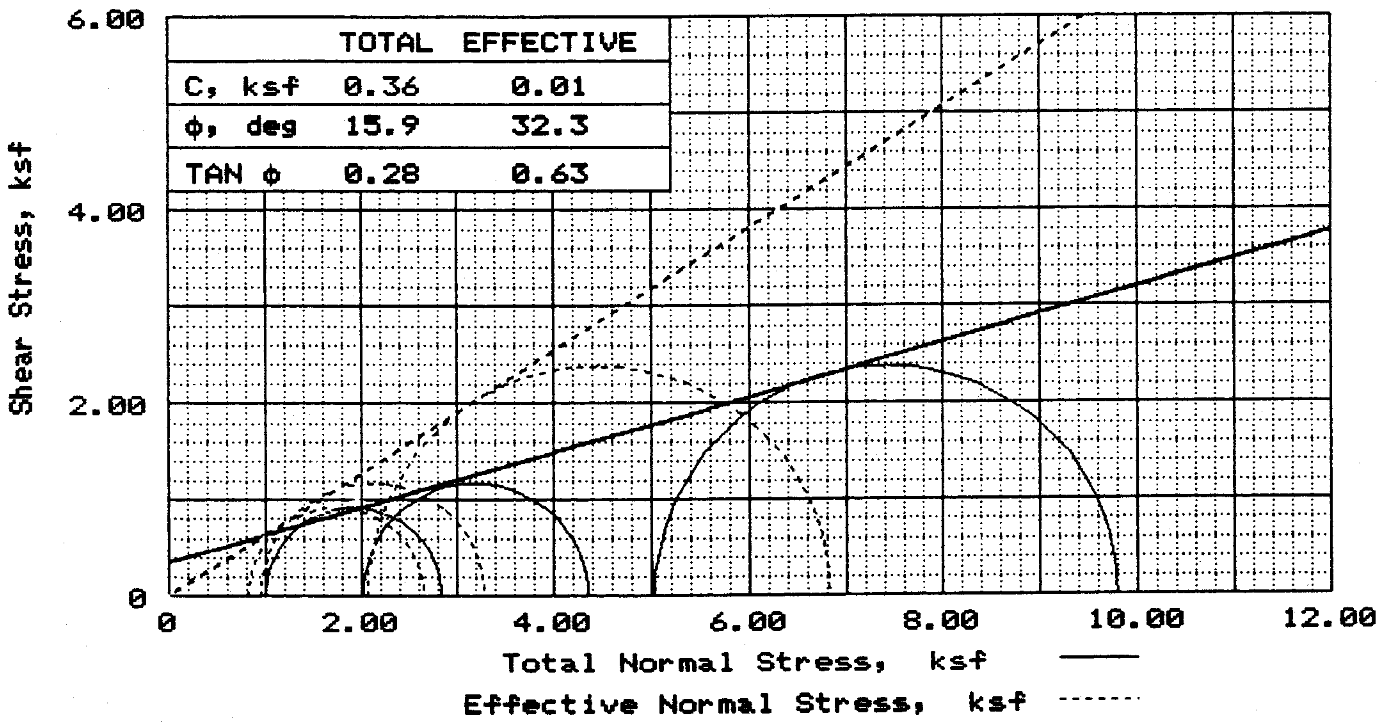
Sample Parameters	Before Test	At Testing	After Test
Diameter, in	2.86	2.70	
Height change, in		0.00	
Height, in	6.00	6.00	
Weight, grams	943.5		
Water volume change, cc		%-104.48	
Moisture, %	23.1	36.7	36.7
Dry density, pcf	75.7	85.2	
Saturation, %	50.3	100.0	
Void ratio	1.258	1.007	

Test Data

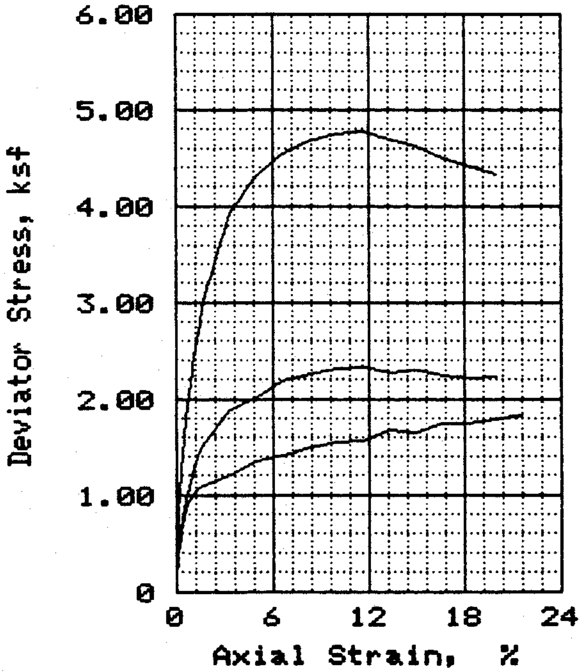
Deformation dial constant= 1 in per input unit
Primary load ring constant= 0.712 lbs. per input unit
Secondary load ring constant= 0 lbs. per input unit
Crossover reading for secondary load ring= 0 input units
Rate of strain= 0.330 % per minute
Consolidation cell pressure = 85 psi
Consolidation back pressure = 50 psi
Consolidation effective confining stress = 5.04 ksf
Peak deviator stress = 4.43 ksf at reading no. 18
Ult. deviator stress =

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.0	0.00	5.04	5.04	1.00	50.0	5.04	0.00
1	0.0100	0.010	50.0	35.6	0.2	0.90	4.85	5.75	1.18	51.3	5.30	0.45
2	0.0200	0.020	54.0	38.4	0.3	0.97	4.69	5.66	1.21	52.4	5.18	0.48
3	0.0300	0.030	90.5	64.4	0.5	1.62	4.51	6.12	1.36	53.7	5.32	0.81
	0.0400	0.040	104.0	74.0	0.7	1.86	4.31	6.16	1.43	55.1	5.23	0.93
	0.0500	0.050	112.0	79.7	0.8	1.99	4.15	6.14	1.48	56.2	5.14	1.00

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Effective Stresses Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
[illegible]	0.0600	0.060	128.0	91.1	1.0	2.28	3.96	6.24	1.57	57.5	5.10	1.14
7	0.0700	0.070	137.5	97.9	1.2	2.44	3.79	6.23	1.64	58.7	5.01	1.22
8	0.0800	0.080	147.0	104.7	1.3	2.61	3.64	6.25	1.72	59.7	4.95	1.30
9	0.0900	0.090	155.0	110.4	1.5	2.74	3.53	6.27	1.78	60.5	4.90	1.37
10	0.1000	0.100	163.0	116.1	1.7	2.88	3.38	6.26	1.85	61.5	4.82	1.44
11	0.2000	0.200	206.0	146.7	3.3	3.58	2.56	6.14	2.40	67.2	4.35	1.79
12	0.3000	0.300	235.0	167.3	5.0	4.01	2.16	6.17	2.86	70.0	4.16	2.00
13	0.4000	0.400	250.5	178.4	6.7	4.20	2.00	6.20	3.10	71.1	4.10	2.10
14	0.5000	0.500	265.5	189.0	8.3	4.37	1.89	6.26	3.32	71.9	4.07	2.19
15	0.6000	0.600	273.0	194.4	10.0	4.41	1.87	6.29	3.36	72.0	4.08	2.21
16	0.7000	0.700	279.0	198.6	11.7	4.43	1.87	6.30	3.36	72.0	4.09	2.21
17	0.8000	0.800	280.5	199.7	13.3	4.37	1.92	6.28	3.28	71.7	4.10	2.18
18	0.9000	0.900	290.0	206.5	15.0	4.43	1.97	6.40	3.24	71.3	4.19	2.21
19	1.0000	1.000	289.0	205.8	16.7	4.33	2.00	6.33	3.16	71.1	4.16	2.16
20	1.1000	1.100	293.0	208.6	18.3	4.30	2.03	6.33	3.12	70.9	4.18	2.15
21	1.2000	1.200	292.0	207.9	20.0	4.20	2.03	6.23	3.07	70.9	4.13	2.10



	TOTAL	EFFECTIVE
C, ksf	0.36	0.01
φ, deg	15.9	32.3
TAN φ	0.28	0.63



	SAMPLE NO.	1	2	3
INITIAL	WATER CONTENT, %	24.0	24.1	23.7
	DRY DENSITY, pcf	83.6	83.6	83.8
	SATURATION, %	62.8	63.1	62.2
	VOID RATIO	1.047	1.046	1.041
	DIAMETER, in	2.87	2.87	2.87
	HEIGHT, in	6.01	6.00	6.00
AT TEST	WATER CONTENT, %	33.7	31.6	28.3
	DRY DENSITY, pcf	88.9	91.7	96.3
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	0.924	0.865	0.777
	DIAMETER, in	2.78	2.74	2.68
	HEIGHT, in	6.01	6.00	6.00
	BACK PRESSURE, ksf	5.76	5.76	5.76
	CELL PRESSURE, ksf	6.77	7.78	10.80
	FAILURE STRESS, ksf	1.83	2.35	4.77
	PORE PRESSURE, ksf	5.95	6.83	8.73
	STRAIN RATE, %/min.	0.333	0.333	0.333
	ULTIMATE STRESS, ksf			
	PORE PRESSURE, ksf			
	$\bar{\sigma}_1$ FAILURE, ksf	2.66	3.30	6.84
	$\bar{\sigma}_3$ FAILURE, ksf	0.82	0.95	2.07

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: REMOLDED TO 90%
DESCRIPTION: LT YE BN -MULTI COLORED MI FI SA SI
LL= PL= PI=
SPECIFIC GRAVITY= 2.74
REMARKS:

FIG. NO. 2

CLIENT: DUKE POWER COMPANY

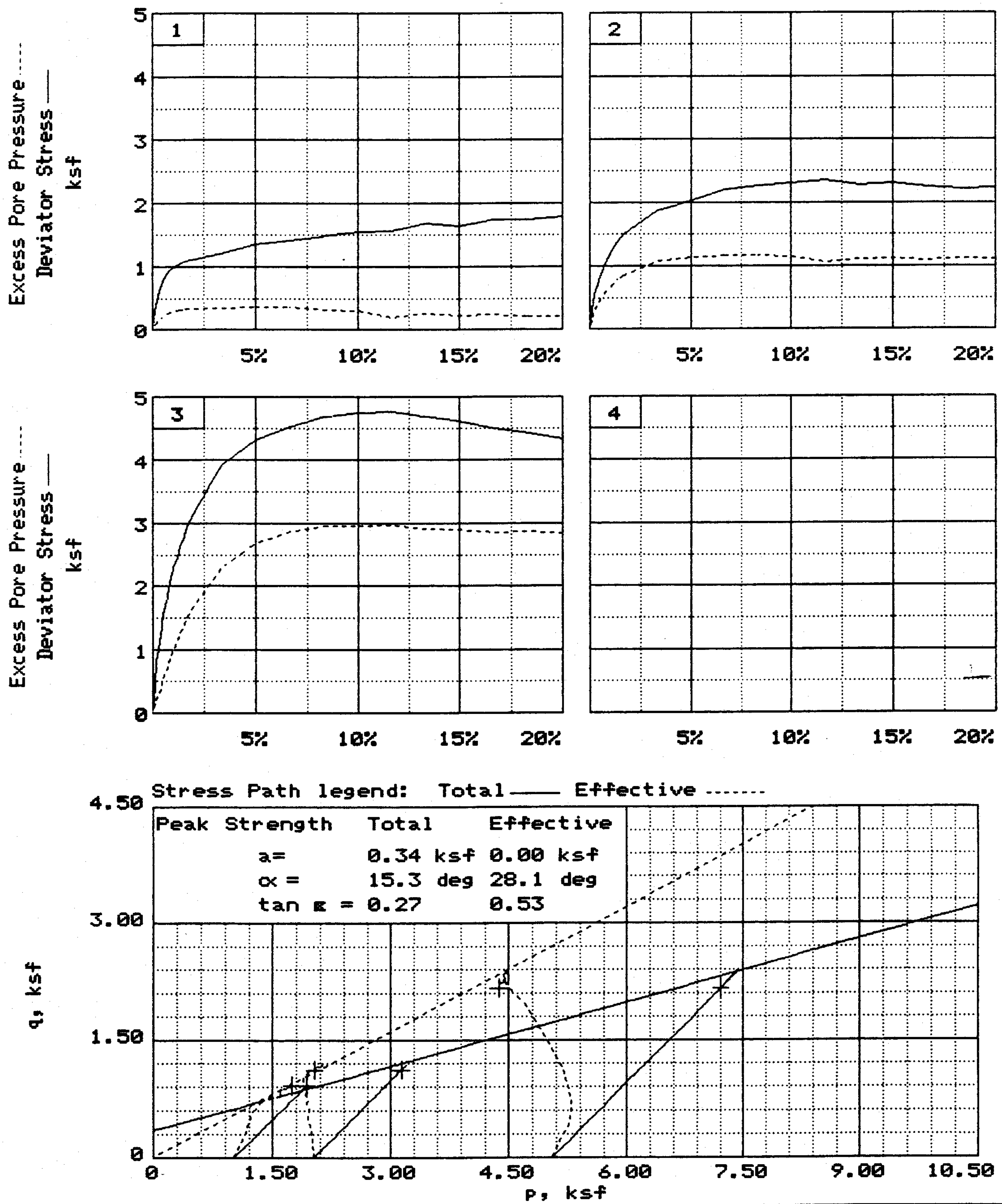
PROJECT: MCGUIRE LANDFILL

SAMPLE LOCATION: OW-1
3' TO 10'

PROJ. NO.: CHW 7210A DATE: 3/19/90

TRIAXIAL COMPRESSION TEST

LAW ENGINEERING



Client: DUKE POWER COMPANY

Project: MCGUIRE LANDFILL

Location: OW-1 3' TO 10'

File: 7210A_2 Project No.: CHW 7210A Page 2/2 Fig. No. 2

@==

TRIAXIAL COMPRESSION TEST
CU with pore pressures

3-20-1990
11:17 am

==

Project Data

Project No.: CHW 7210A   Date: 3/19/90   Data file: 7210A_2
Client: DUKE POWER COMPANY
Project: MCGUIRE LANDFILL
Sample location: OW-1 3' TO 10'
Sample description: LT YE BN -MULTI COLORED MI FI SA SI
Remarks:
Fig No. 2

Sample No. 1 Data

Type of sample: REMOLDED TO 90%
Specific Gravity= 2.74   LL=   PL=   PI=

Sample Parameters	Before Test	At Testing	After Test
Diameter, in	2.87	2.78	
Height change, in		0.00	
Height, in	6.01	6.01	
Weight, grams	1057.4		
Water volume change, cc		-83.00	
Moisture, %	24.0	33.7	35.6
Dry density, pcf	83.6	88.9	
Saturation, %	62.8	100.0	
Void ratio	1.047	0.924	

Test Data

Deformation dial constant= 1 in per input unit
Primary load ring constant= 0.711 lbs. per input unit
Secondary load ring constant= 0 lbs. per input unit
Crossover reading for secondary load ring= 0 input units
Rate of strain= 0.333 % per minute
Consolidation cell pressure = 47 psi
Consolidation back pressure = 40 psi
Consolidation effective confining stress = 1.008 ksf
Peak deviator stress = 1.83 ksf at reading no. 22
Ult. deviator stress =

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.0	0.00	1.01	1.01	1.00	40.0	1.01	0.00
1	0.0100	0.010	23.0	16.4	0.2	0.39	0.91	1.29	1.43	40.7	1.10	0.19
2	0.0200	0.020	37.0	26.3	0.3	0.62	0.85	1.47	1.73	41.1	1.16	0.31
3	0.0300	0.030	45.5	32.4	0.5	0.76	0.79	1.55	1.96	41.5	1.17	0.38
4	0.0400	0.040	51.5	36.6	0.7	0.86	0.76	1.62	2.13	41.7	1.19	0.43
5	0.0500	0.050	56.0	39.8	0.8	0.94	0.73	1.67	2.27	41.9	1.20	0.47

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Effective Stresses Major ksf	Effective Stresses 1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
	0.0600	0.060	59.0	41.9	1.0	0.98	0.72	1.70	2.37	42.0	1.21	0.49
	0.0700	0.070	61.0	43.4	1.2	1.02	0.71	1.72	2.44	42.1	1.21	0.51
8	0.0800	0.080	63.0	44.8	1.3	1.05	0.69	1.74	2.51	42.2	1.21	0.52
9	0.0900	0.090	65.0	46.2	1.5	1.08	0.69	1.77	2.56	42.2	1.23	0.54
10	0.1000	0.100	66.0	46.9	1.7	1.09	0.68	1.77	2.61	42.3	1.22	0.55
11	0.2000	0.200	74.0	52.6	3.3	1.20	0.66	1.87	2.82	42.4	1.26	0.60
12	0.3000	0.300	85.0	60.4	5.0	1.36	0.65	2.01	3.10	42.5	1.33	0.68
13	0.4000	0.400	90.0	64.0	6.7	1.41	0.65	2.06	3.18	42.5	1.36	0.71
14	0.5000	0.500	97.0	69.0	8.3	1.50	0.69	2.19	3.17	42.2	1.44	0.75
15	0.6000	0.600	102.0	72.5	10.0	1.55	0.71	2.25	3.19	42.1	1.48	0.77
16	0.7000	0.700	105.0	74.7	11.6	1.56	0.81	2.37	2.94	41.4	1.59	0.78
17	0.8000	0.800	115.0	81.8	13.3	1.68	0.75	2.43	3.24	41.8	1.59	0.84
18	0.9000	0.900	115.0	81.8	15.0	1.65	0.78	2.42	3.12	41.6	1.60	0.82
19	1.0000	1.000	124.0	88.2	16.6	1.74	0.76	2.50	3.28	41.7	1.63	0.87
20	1.1000	1.100	127.0	90.3	18.3	1.75	0.79	2.54	3.21	41.5	1.67	0.87
21	1.2000	1.200	133.0	94.6	20.0	1.79	0.79	2.58	3.26	41.5	1.69	0.90
22	1.3000	1.300	139.0	98.8	21.6	1.83	0.82	2.66	3.23	41.3	1.74	0.92

@===

TRIAXIAL COMPRESSION TEST — 3-20-1990

CU with pore pressures — 11:17 am

===

Project Data

Project No.: CHW 7210A   Date: 3/19/90   Data file: 7210A_2
Client: DUKE POWER COMPANY
Project: MCGUIRE LANDFILL
Sample location: OW-1 3' TO 10'
Sample description: LT YE BN -MULTI COLORED MI FI SA SI
Remarks:
Fig No. 2

Sample No. 2 Data

Type of sample: REMOLDED TO 90%
Specific Gravity= 2.74   LL=   PL=   PI=

Sample Parameters	Before Test	At Testing	After Test
Diameter, in	2.87	2.74	
Height change, in		0.00	
Height, in	6.00	6.00	
Weight, grams	1056.9		
Water volume change, cc		-63.70	
Moisture, %	24.1	31.6	33.0
Dry density, pcf	83.6	91.7	
Saturation, %	63.1	100.0	
Void ratio	1.046	0.865	

Test Data

Deformation dial constant= 1 in per input unit
Primary load ring constant= 0.711 lbs. per input unit
Secondary load ring constant= 0 lbs. per input unit
Crossover reading for secondary load ring= 0 input units
Rate of strain= 0.333 % per minute
Consolidation cell pressure = 54 psi
Consolidation back pressure = 40 psi
Consolidation effective confining stress = 2.016 ksf
Peak deviator stress = 2.35 ksf at reading no. 16
Ult. deviator stress =

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.0	0.00	2.02	2.02	1.00	40.0	2.02	0.00
1	0.0100	0.010	25.0	17.8	0.2	0.43	1.79	2.22	1.24	41.6	2.00	0.22
2	0.0200	0.020	38.0	27.0	0.3	0.66	1.66	2.31	1.40	42.5	1.98	0.33
3	0.0300	0.030	47.5	33.8	0.5	0.82	1.56	2.38	1.53	43.2	1.97	0.41
4	0.0400	0.040	55.5	39.5	0.7	0.96	1.47	2.43	1.65	43.8	1.95	0.48
[illegible]	0.0500	0.050	63.0	44.8	0.8	1.08	1.40	2.48	1.78	44.3	1.94	0.54

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
[illegible]	0.0600	0.060	69.9	49.7	1.0	1.20	1.35	2.56	1.89	44.6	1.95	0.60
[illegible]	0.0700	0.070	75.5	53.7	1.2	1.30	1.30	2.59	2.00	45.0	1.94	0.65
8	0.0800	0.080	80.5	57.2	1.3	1.38	1.24	2.62	2.11	45.4	1.93	0.69
9	0.0900	0.090	85.0	60.4	1.5	1.45	1.21	2.66	2.20	45.6	1.94	0.73
10	0.1000	0.100	88.5	62.9	1.7	1.51	1.17	2.68	2.30	45.9	1.92	0.76
11	0.2000	0.200	112.0	79.6	3.3	1.88	0.94	2.82	3.01	47.5	1.88	0.94
12	0.3000	0.300	122.5	87.1	5.0	2.02	0.88	2.90	3.30	47.9	1.89	1.01
13	0.4000	0.400	135.5	96.3	6.7	2.20	0.85	3.05	3.58	48.1	1.95	1.10
14	0.5000	0.500	142.0	101.0	8.3	2.26	0.85	3.11	3.66	48.1	1.98	1.13
15	0.6000	0.600	148.0	105.2	10.0	2.31	0.86	3.18	3.68	48.0	2.02	1.16
16	0.7000	0.700	153.0	108.8	11.7	2.35	0.95	3.30	3.47	47.4	2.12	1.17
17	0.8000	0.800	151.0	107.4	13.3	2.27	0.91	3.18	3.50	47.7	2.04	1.14
18	0.9000	0.900	156.0	110.9	15.0	2.30	0.89	3.20	3.58	47.8	2.04	1.15
19	1.0000	1.000	155.0	110.2	16.7	2.24	0.92	3.16	3.43	47.6	2.04	1.12
20	1.1000	1.100	156.0	110.9	18.3	2.21	0.89	3.11	3.48	47.8	2.00	1.11
21	1.2000	1.200	161.0	114.5	20.0	2.24	0.91	3.14	3.47	47.7	2.03	1.12

@===

TRIAXIAL COMPRESSION TEST 3-20-1990
CU with pore pressures 11:20 am

===

Project Data

Project No.: CHW 7210A Date: 3/19/90 Data file: 7210A_2
Client: DUKE POWER COMPANY
Project: MCGUIRE LANDFILL
Sample location: OW-1 3' TO 10'
Sample description: LT YE BN -MULTI COLORED MI FI SA SI
Remarks:
Fig No. 2

Sample No. 3 Data

Type of sample: REMOLDED TO 90%
Specific Gravity= 2.74 LL= PL= PI=

Sample Parameters	Before Test	At Testing	After Test
Diameter, in	2.87	2.68	
Height change, in		0.00	
Height, in	6.00	6.00	
Weight, grams	1055.8		
Water volume change, cc		-40.00	
Moisture, %	23.7	28.3	31.5
Dry density, pcf	83.8	96.3	
Saturation, %	62.2	100.0	
Void ratio	1.041	0.777	

Test Data

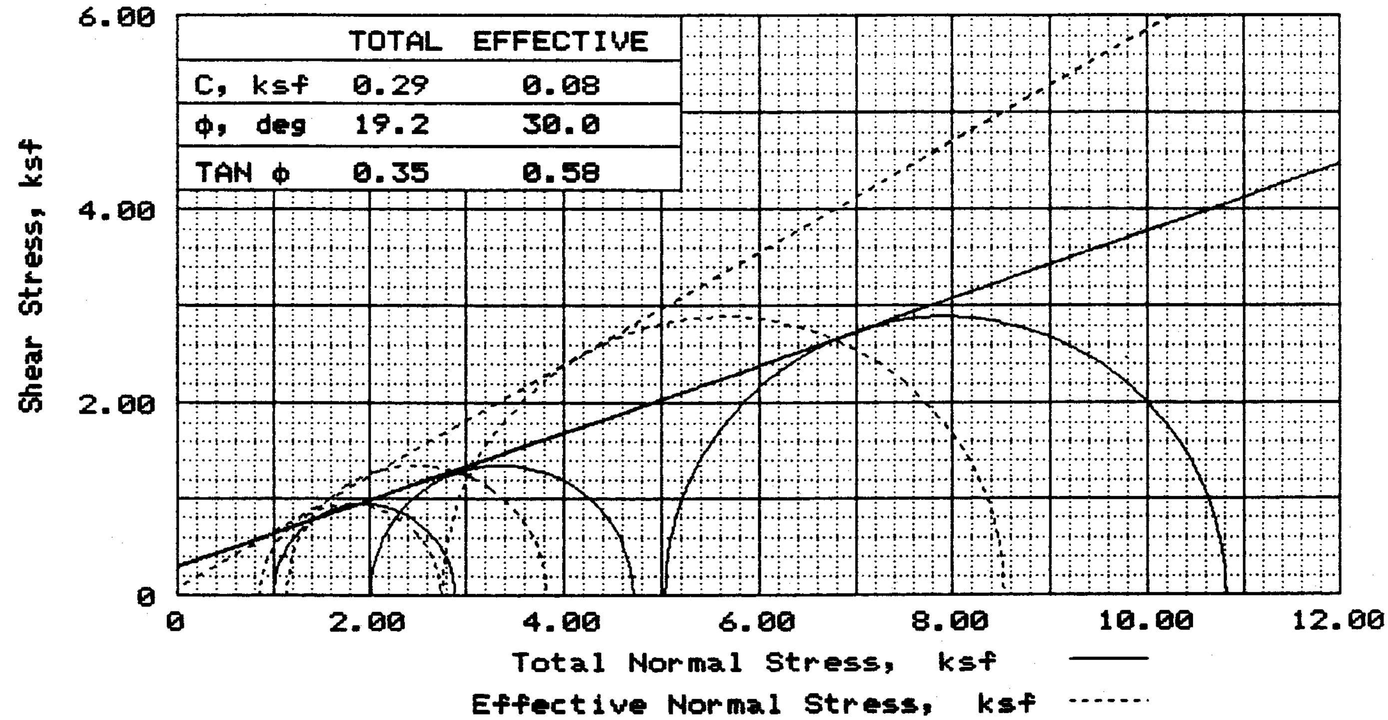
Deformation dial constant= 1 in per input unit
Primary load ring constant= 0.711 lbs. per input unit
Secondary load ring constant= 0 lbs. per input unit
Crossover reading for secondary load ring= 0 input units
Rate of strain= 0.333 % per minute
Consolidation cell pressure = 75 psi
Consolidation back pressure = 40 psi
Consolidation effective confining stress = 5.04 ksf
Peak deviator stress = 4.77 ksf at reading no. 16
Ult. deviator stress =

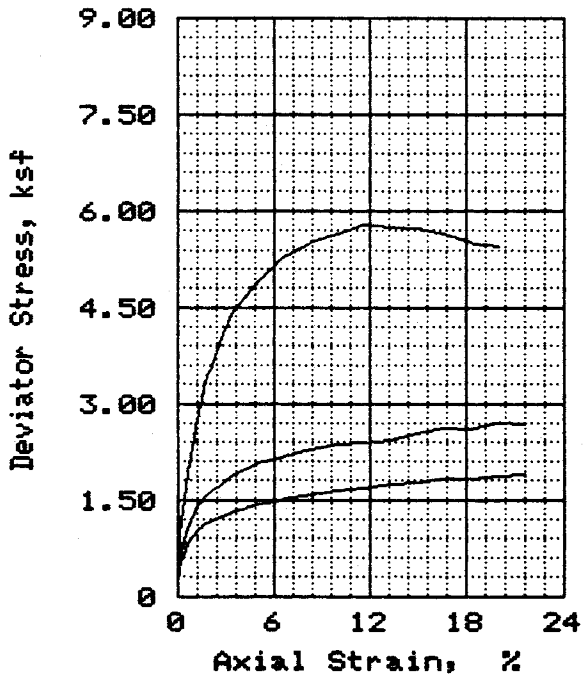
No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Effective Stresses Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.0	0.00	5.04	5.04	1.00	40.0	5.04	0.00
1	0.0100	0.010	46.0	32.7	0.2	0.84	4.84	5.67	1.17	41.4	5.26	0.42
2	0.0200	0.020	68.0	48.3	0.3	1.23	4.67	5.90	1.26	42.6	5.28	0.62
3	0.0300	0.030	86.0	61.1	0.5	1.56	4.49	6.05	1.35	43.8	5.27	0.78
4	0.0400	0.040	101.0	71.8	0.7	1.82	4.33	6.16	1.42	44.9	5.25	0.91
	0.0500	0.050	114.0	81.1	0.8	2.06	4.18	6.23	1.49	46.0	5.20	1.03

LAW ENGINEERING

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
[illegible]	0.0600	0.060	126.0	89.6	1.0	2.27	4.05	6.31	1.56	46.9	5.18	1.13
[illegible]	0.0700	0.070	136.0	96.7	1.2	2.44	3.90	6.35	1.63	47.9	5.12	1.22
8	0.0800	0.080	146.0	103.8	1.3	2.62	3.77	6.39	1.69	48.8	5.08	1.31
9	0.0900	0.090	156.0	110.9	1.5	2.79	3.64	6.44	1.77	49.7	5.04	1.40
10	0.1000	0.100	164.5	117.0	1.7	2.94	3.53	6.47	1.83	50.5	5.00	1.47
11	0.2000	0.200	223.0	158.6	3.3	3.92	2.75	6.67	2.43	55.9	4.71	1.96
12	0.3000	0.300	250.0	177.8	5.0	4.32	2.35	6.67	2.84	58.7	4.51	2.16
13	0.4000	0.400	267.0	189.8	6.7	4.53	2.17	6.71	3.08	59.9	4.44	2.27
14	0.5000	0.500	281.0	199.8	8.3	4.68	2.09	6.77	3.24	60.5	4.43	2.34
15	0.6000	0.600	290.0	206.2	10.0	4.75	2.09	6.83	3.27	60.5	4.46	2.37
16	0.7000	0.700	297.0	211.2	11.7	4.77	2.07	6.84	3.30	60.6	4.46	2.39
17	0.8000	0.800	298.0	211.9	13.3	4.70	2.13	6.83	3.20	60.2	4.48	2.35
18	0.9000	0.900	299.0	212.6	15.0	4.62	2.15	6.77	3.15	60.1	4.46	2.31
19	1.0000	1.000	297.0	211.2	16.7	4.50	2.19	6.69	3.06	59.8	4.44	2.25
20	1.1000	1.100	297.5	211.5	18.3	4.42	2.17	6.59	3.03	59.9	4.38	2.21
21	1.2000	1.200	298.0	211.9	20.0	4.34	2.20	6.54	2.97	59.7	4.37	2.17

	TOTAL	EFFECTIVE
C, ksf	0.29	0.08
φ, deg	19.2	30.0
TAN φ	0.35	0.58





SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	22.8	22.9	22.7
	DRY DENSITY, pcf	85.1	85.1	85.3
	SATURATION, %	61.2	61.4	61.4
	VOID RATIO	1.033	1.033	1.027
	DIAMETER, in	2.87	2.87	2.87
	HEIGHT, in	6.01	6.01	6.00
AT TEST	WATER CONTENT, %	32.8	31.5	28.7
	DRY DENSITY, pcf	90.6	92.4	96.4
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	0.908	0.872	0.794
	DIAMETER, in	2.78	2.75	2.70
	HEIGHT, in	6.01	6.01	6.00
BACK PRESSURE, ksf		4.32	4.32	4.32
CELL PRESSURE, ksf		5.33	6.34	9.36
FAILURE STRESS, ksf		1.89	2.70	5.78
PORE PRESSURE, ksf		4.46	5.20	6.60
STRAIN RATE, %/min.		0.333	0.333	0.333
ULTIMATE STRESS, ksf				
PORE PRESSURE, ksf				
$\bar{\sigma}_1$ FAILURE, ksf		2.75	3.83	8.55
$\bar{\sigma}_3$ FAILURE, ksf		0.86	1.14	2.76

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: REMOLDED TO 90%
DESCRIPTION: PU BN & YE BN
MI FI SA SI
LL= PL= PI=
SPECIFIC GRAVITY= 2.77
REMARKS:

FIG. NO. 3

CLIENT: DUKE POWER COMPANY

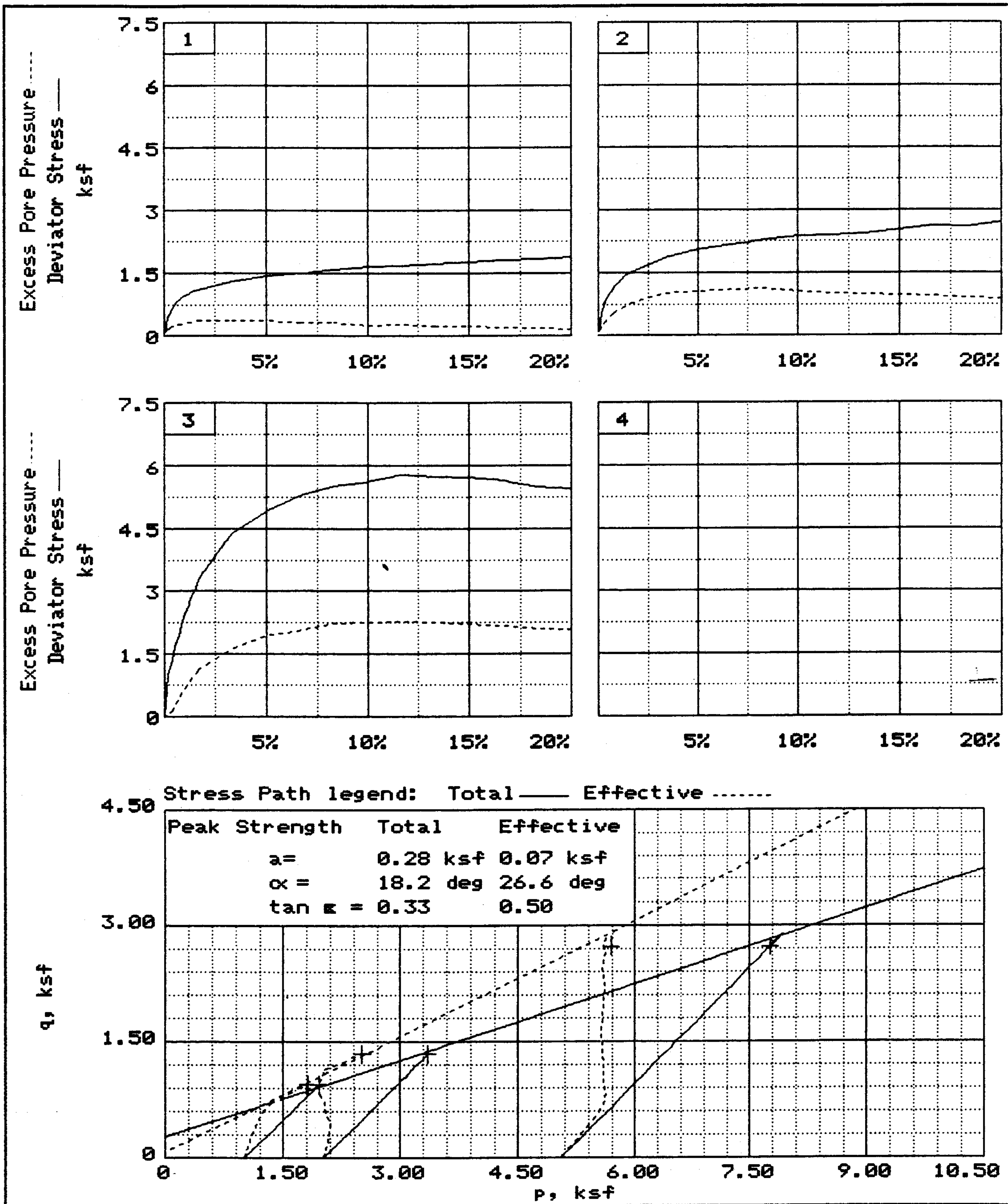
PROJECT: MCGUIRE LANDFILL

SAMPLE LOCATION: OW-2
3' TO 8'

PROJ. NO.: CHW 7210A DATE: 3/19/90

TRIAXIAL COMPRESSION TEST

LAW ENGINEERING



Client: DUKE POWER COMPANY
Project: MCGUIRE LANDFILL
Location: OW-2 3' TO 8'
File: 7210A_3 Project No.: CHW 7210A Page 2/2 Fig. No. 3

TRIAXIAL COMPRESSION TEST
CU with pore pressures

3-20-1990
11:50 am

Project Data

Project No.: CHW 7210A   Date: 3/19/90   Data file: 7210A_3
Client: DUKE POWER COMPANY
Project: MCGUIRE LANDFILL
Sample location: OW-2 3' TO 8'
Sample description: PU BN & YE BN MI FI SA SI
Remarks:
Fig No. 3

Sample No. 1 Data

Type of sample: REMOLDED TO 90%
Specific Gravity= 2.77   LL=   PL=   PI=

Sample Parameters	Before Test	At Testing	After Test
Diameter, in	2.87	2.78	
Height change, in		0.00	
Height, in	6.01	6.01	
Weight, grams	1066.3		
Water volume change, cc		-86.40	
Moisture, %	22.8	32.8	36.9
Dry density, pcf	85.1	90.6	
Saturation, %	61.2	100.0	
Void ratio	1.033	0.908	

Test Data

Deformation dial constant= 1 in per input unit
Primary load ring constant= 0.715 lbs. per input unit
Secondary load ring constant= 0 lbs. per input unit
Crossover reading for secondary load ring= 0 input units
Rate of strain= 0.333 % per minute
Consolidation cell pressure = 37 psi
Consolidation back pressure = 30 psi
Consolidation effective confining stress = 1.008 ksf
Peak deviator stress = 1.89 ksf at reading no. 22
Ult. deviator stress =

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Effective Stresses Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.0	0.00	1.01	1.01	1.00	30.0	1.01	0.00
1	0.0100	0.010	25.0	17.9	0.2	0.42	0.86	1.29	1.49	31.0	1.08	0.21
2	0.0200	0.020	35.5	25.4	0.3	0.60	0.81	1.41	1.74	31.4	1.11	0.30
3	0.0300	0.030	43.0	30.7	0.5	0.73	0.76	1.49	1.95	31.7	1.13	0.36
4	0.0400	0.040	49.0	35.0	0.7	0.83	0.73	1.56	2.12	31.9	1.15	0.41
	0.0500	0.050	53.5	38.3	0.8	0.90	0.72	1.62	2.25	32.0	1.17	0.45

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Effective Stresses Major ksf	Effective Stresses 1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
6	0.0600	0.060	57.0	40.8	1.0	0.96	0.71	1.66	2.36	32.1	1.18	0.48
7	0.0720	0.072	60.0	42.9	1.2	1.01	0.69	1.70	2.45	32.2	1.19	0.50
8	0.0800	0.080	62.5	44.7	1.3	1.05	0.68	1.72	2.55	32.3	1.20	0.52
9	0.0900	0.090	65.0	46.5	1.5	1.09	0.66	1.75	2.64	32.4	1.21	0.54
10	0.1000	0.100	66.5	47.5	1.7	1.11	0.65	1.76	2.71	32.5	1.20	0.55
11	0.2000	0.200	80.0	57.2	3.3	1.31	0.63	1.95	3.07	32.6	1.29	0.66
12	0.3000	0.300	89.0	63.6	5.0	1.43	0.65	2.08	3.21	32.5	1.36	0.72
13	0.4000	0.400	95.5	68.3	6.7	1.51	0.69	2.20	3.19	32.2	1.45	0.76
14	0.5000	0.500	102.0	72.9	8.3	1.59	0.69	2.28	3.29	32.2	1.48	0.79
15	0.6000	0.600	108.0	77.2	10.0	1.65	0.75	2.40	3.20	31.8	1.57	0.82
16	0.7000	0.700	112.5	80.4	11.6	1.69	0.73	2.42	3.30	31.9	1.58	0.84
17	0.8000	0.800	118.0	84.4	13.3	1.73	0.78	2.51	3.23	31.6	1.64	0.87
18	0.9000	0.900	123.0	87.9	15.0	1.77	0.78	2.55	3.28	31.6	1.66	0.89
19	1.0000	1.000	128.5	91.9	16.6	1.82	0.81	2.62	3.25	31.4	1.71	0.91
20	1.1000	1.100	132.0	94.4	18.3	1.83	0.82	2.65	3.23	31.3	1.74	0.91
21	1.2000	1.200	138.0	98.7	20.0	1.87	0.84	2.71	3.24	31.2	1.77	0.94
22	1.3000	1.300	142.0	101.5	21.6	1.89	0.86	2.75	3.18	31.0	1.81	0.94

@==

TRIAXIAL COMPRESSION TEST 3-20-1990
CU with pore pressures 11:55 am

==

Project Data

Project No.: CHW 7210A Date: 3/19/90 Data file: 7210A_3
Client: DUKE POWER COMPANY
Project: MCGUIRE LANDFILL
Sample location: OW-2 3' TO 8'
Sample description: PU BN & YE BN MI FI SA SI
Remarks:
Fig No. 3

Sample No. 2 Data

Type of sample: REMOLDED TO 90%
Specific Gravity= 2.77 LL= PL= PI=

Sample Parameters	Before Test	At Testing	After Test
Diameter, in	2.87	2.75	
Height change, in		0.00	
Height, in	6.01	6.01	
Weight, grams	1066.9		
Water volume change, cc		-74.50	
Moisture, %	22.9	31.5	34.9
Dry density, pcf	85.1	92.4	
Saturation, %	61.4	100.0	
Void ratio	1.033	0.872	

Test Data

Deformation dial constant= 1 in per input unit
Primary load ring constant= 0.715 lbs. per input unit
Secondary load ring constant= 0 lbs. per input unit
Crossover reading for secondary load ring= 0 input units
Rate of strain= 0.333 % per minute
Consolidation cell pressure = 44 psi
Consolidation back pressure = 30 psi
Consolidation effective confining stress = 2.016 ksf
Peak deviator stress = 2.70 ksf at reading no. 21
Ult. deviator stress =

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Effective Stresses Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.0	0.00	2.02	2.02	1.00	30.0	2.02	0.00
1	0.0100	0.010	32.0	22.9	0.2	0.55	1.81	2.37	1.30	31.4	2.09	0.28
2	0.0200	0.020	46.0	32.9	0.3	0.79	1.70	2.49	1.47	32.2	2.10	0.40
3	0.0300	0.030	56.0	40.0	0.5	0.96	1.60	2.56	1.60	32.9	2.08	0.48
4	0.0400	0.040	62.0	44.3	0.7	1.06	1.53	2.59	1.70	33.4	2.06	0.53
[illegible]	0.0500	0.050	69.0	49.3	0.8	1.18	1.45	2.64	1.81	33.9	2.05	0.59

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
[illegible]	0.0600	0.060	74.0	52.9	1.0	1.27	1.40	2.66	1.91	34.3	2.03	0.63
7	0.0700	0.070	79.0	56.5	1.2	1.35	1.35	2.70	2.00	34.6	2.03	0.67
8	0.0800	0.080	84.0	60.1	1.3	1.43	1.31	2.74	2.09	34.9	2.03	0.72
9	0.0900	0.090	87.0	62.2	1.5	1.48	1.27	2.75	2.17	35.2	2.01	0.74
10	0.1000	0.100	90.0	64.4	1.7	1.53	1.22	2.75	2.25	35.5	1.99	0.76
11	0.2000	0.200	111.5	79.7	3.3	1.86	1.01	2.87	2.85	37.0	1.94	0.93
12	0.3000	0.300	126.0	90.1	5.0	2.07	0.96	3.03	3.14	37.3	2.00	1.03
13	0.4000	0.400	135.0	96.5	6.7	2.18	0.92	3.10	3.36	37.6	2.01	1.09
14	0.5000	0.500	144.0	103.0	8.3	2.28	0.89	3.17	3.56	37.8	2.03	1.14
15	0.6000	0.600	152.0	108.7	10.0	2.36	0.95	3.32	3.49	37.4	2.13	1.18
16	0.7000	0.700	157.0	112.3	11.6	2.40	1.01	3.41	3.38	37.0	2.21	1.20
17	0.8000	0.800	162.0	115.8	13.3	2.43	1.02	3.45	3.37	36.9	2.24	1.21
18	0.9000	0.900	172.0	123.0	15.0	2.53	1.05	3.58	3.40	36.7	2.31	1.26
19	1.0000	1.000	181.0	129.4	16.6	2.61	1.08	3.69	3.41	36.5	2.38	1.30
20	1.1000	1.100	184.0	131.6	18.3	2.60	1.11	3.71	3.34	36.3	2.41	1.30
21	1.2000	1.200	195.0	139.4	20.0	2.70	1.14	3.83	3.37	36.1	2.49	1.35
22	1.3000	1.300	198.0	141.6	21.6	2.68	1.17	3.85	3.30	35.9	2.51	1.34

@==

TRIAXIAL COMPRESSION TEST 3-20-1990
CU with pore pressures 12:02 pm

==

Project Data

Project No.: CHW 7210A Date: 3/19/90 Data file: 7210A_3
Client: DUKE POWER COMPANY
Project: MCGUIRE LANDFILL
Sample location: OW-2 3' TO 8'
Sample description: PU BN & YE BN MI FI SA SI
Remarks:
Fig No. 3

Sample No. 3 Data

Type of sample: REMOLDED TO 90%
Specific Gravity= 2.77 LL= PL= PI=

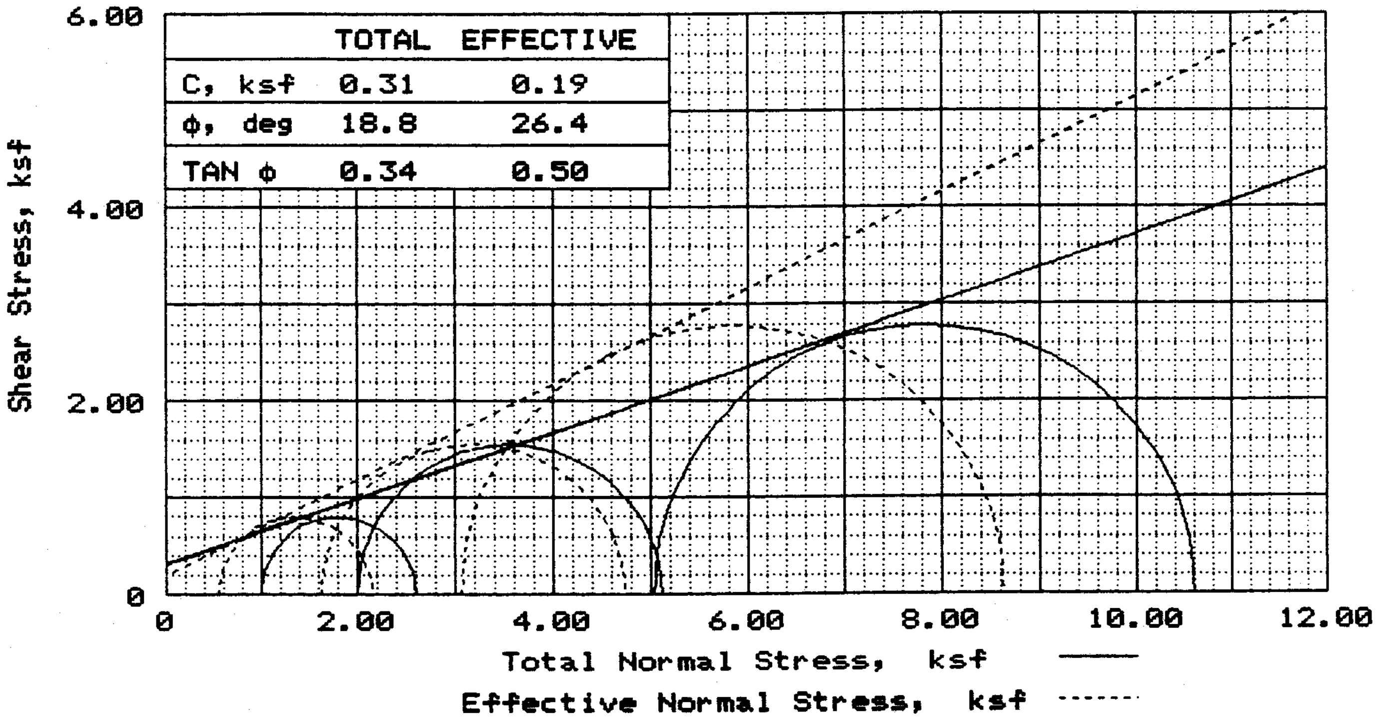
Sample Parameters	Before Test	At Testing	After Test
Diameter, in	2.87	2.70	
Height change, in		0.00	
Height, in	6.00	6.00	
Weight, grams	1067.0		
Water volume change, cc		-51.40	
Moisture, %	22.7	28.7	31.1
Dry density, pcf	85.3	96.4	
Saturation, %	61.4	100.0	
Void ratio	1.027	0.794	

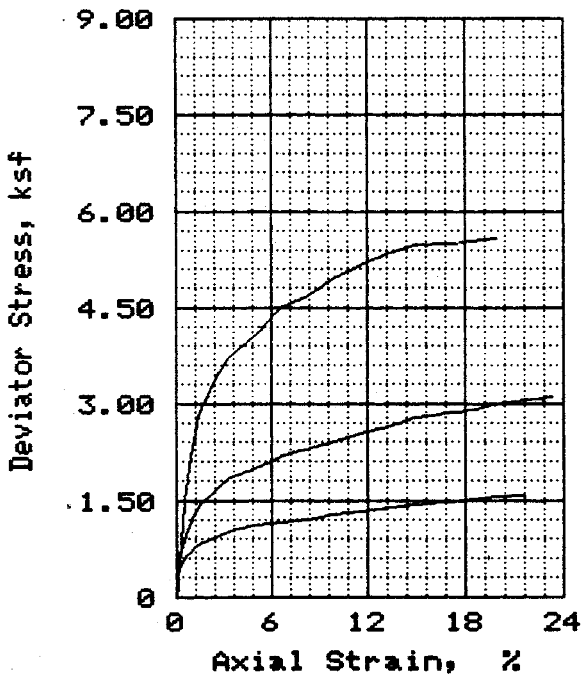
Test Data

Deformation dial constant= 1 in per input unit
Primary load ring constant= 0.715 lbs. per input unit
Secondary load ring constant= 0 lbs. per input unit
Crossover reading for secondary load ring= 0 input units
Rate of strain= 0.333 % per minute
Consolidation cell pressure = 65 psi
Consolidation back pressure = 30 psi
Consolidation effective confining stress = 5.04 ksf
Peak deviator stress = 5.78 ksf at reading no. 16
Ult. deviator stress =

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.0	0.00	5.04	5.04	1.00	30.0	5.04	0.00
1	0.0100	0.010	54.0	38.6	0.2	0.97	4.97	5.94	1.20	30.5	5.45	0.48
2	0.0200	0.020	75.0	53.6	0.3	1.34	4.91	6.25	1.27	30.9	5.58	0.67
3	0.0300	0.030	93.5	66.9	0.5	1.67	4.78	6.45	1.35	31.8	5.62	0.84
4	0.0400	0.040	109.0	77.9	0.7	1.95	4.62	6.57	1.42	32.9	5.60	0.97
5	0.0500	0.050	122.5	87.6	0.8	2.18	4.49	6.68	1.49	33.8	5.59	1.09

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
	0.0600	0.060	137.0	98.0	1.0	2.44	4.36	6.80	1.56	34.7	5.58	1.22
	0.0700	0.070	150.0	107.3	1.2	2.67	4.25	6.91	1.63	35.5	5.58	1.33
8	0.0800	0.080	162.0	115.8	1.3	2.87	4.13	7.01	1.70	36.3	5.57	1.44
9	0.0900	0.090	173.0	123.7	1.5	3.06	4.03	7.10	1.76	37.0	5.56	1.53
10	0.1000	0.100	184.0	131.6	1.7	3.25	3.93	7.18	1.83	37.7	5.56	1.63
11	0.2000	0.200	252.0	180.2	3.3	4.38	3.41	7.79	2.28	41.3	5.60	2.19
12	0.3000	0.300	288.0	205.9	5.0	4.92	3.11	8.03	2.58	43.4	5.57	2.46
13	0.4000	0.400	315.5	225.6	6.7	5.30	2.97	8.26	2.79	44.4	5.61	2.65
14	0.5000	0.500	335.0	239.5	8.3	5.52	2.82	8.34	2.96	45.4	5.58	2.76
15	0.6000	0.600	348.5	249.2	10.0	5.64	2.79	8.43	3.02	45.6	5.61	2.82
16	0.7000	0.700	364.0	260.3	11.7	5.78	2.76	8.55	3.09	45.8	5.66	2.89
17	0.8000	0.800	368.0	263.1	13.3	5.74	2.79	8.53	3.05	45.6	5.66	2.87
18	0.9000	0.900	374.0	267.4	15.0	5.72	2.84	8.55	3.02	45.3	5.70	2.86
19	1.0000	1.000	377.0	269.6	16.7	5.65	2.88	8.53	2.96	45.0	5.70	2.82
20	1.1000	1.100	375.0	268.1	18.3	5.51	2.94	8.44	2.87	44.6	5.69	2.75
21	1.2000	1.200	379.0	271.0	20.0	5.45	2.97	8.42	2.84	44.4	5.69	2.73





SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	24.9	25.0	24.9
	DRY DENSITY, pcf	84.3	84.5	84.3
	SATURATION, %	66.1	66.6	66.1
	VOID RATIO	1.036	1.033	1.037
	DIAMETER, in	2.87	2.87	2.87
	HEIGHT, in	6.01	6.00	6.01
AT TEST	WATER CONTENT, %	35.9	34.3	31.1
	DRY DENSITY, pcf	86.4	88.3	92.6
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	0.988	0.943	0.854
	DIAMETER, in	2.84	2.81	2.74
	HEIGHT, in	6.01	6.00	6.01
BACK PRESSURE, ksf		4.32	4.32	4.32
CELL PRESSURE, ksf		5.33	6.34	9.36
FAILURE STRESS, ksf		1.59	3.10	5.57
PORE PRESSURE, ksf		4.77	4.69	6.29
STRAIN RATE, %/min.		0.333	0.333	0.333
ULTIMATE STRESS, ksf				
PORE PRESSURE, ksf				
$\bar{\sigma}_1$ FAILURE, ksf		2.16	4.74	8.64
$\bar{\sigma}_3$ FAILURE, ksf		0.56	1.64	3.07

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: REMOLDED TO 90%
DESCRIPTION: BN YE & BK
MI FI SA SI
LL= PL= PI=
SPECIFIC GRAVITY= 2.75
REMARKS:

FIG. NO. 4

CLIENT: DUKE POWER COMPANY

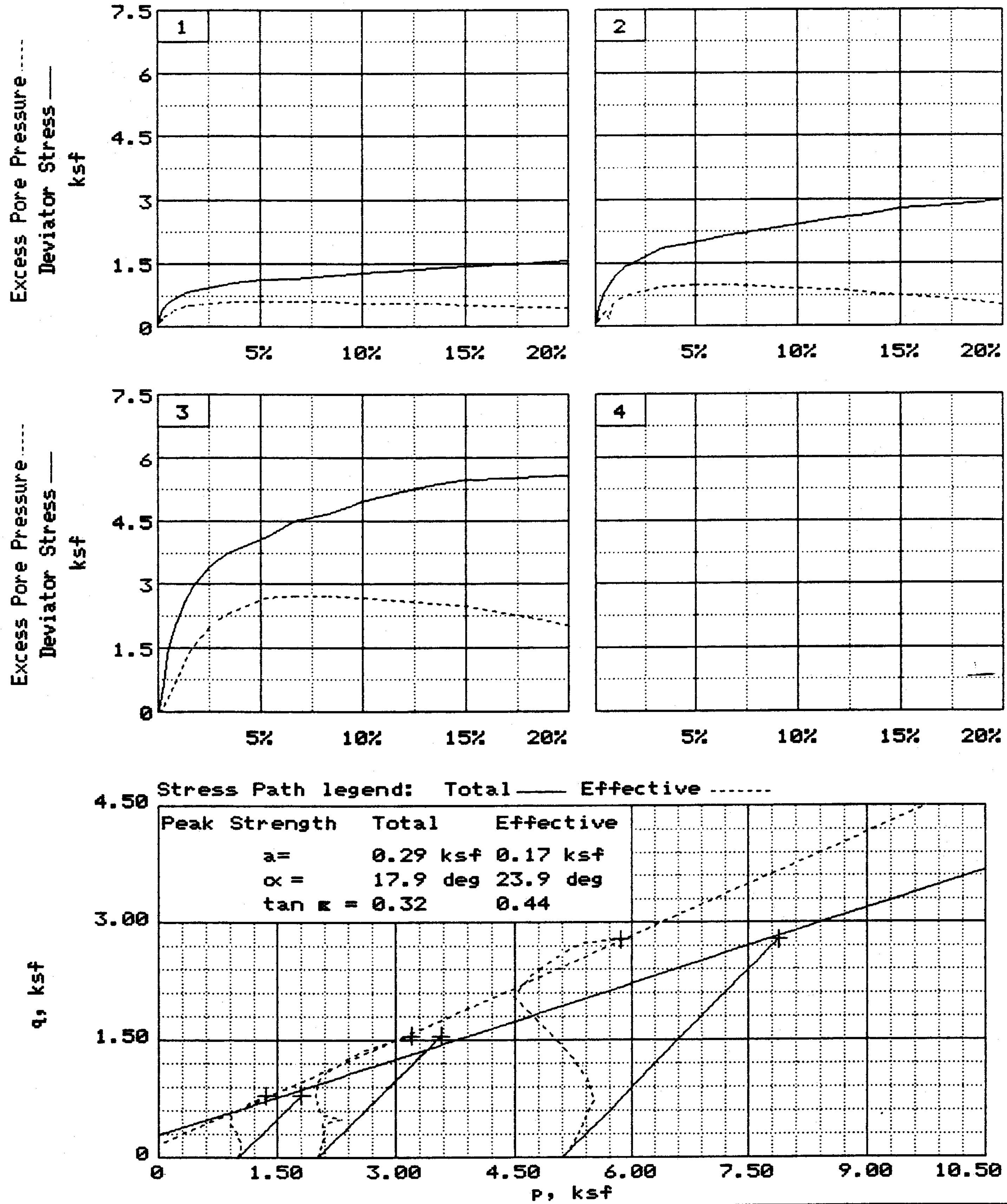
PROJECT: MCGUIRE LANDFILL

SAMPLE LOCATION: OW-4
3' TO 10'

PROJ. NO.: CHW 7210A DATE: 3/19/90

TRIAXIAL COMPRESSION TEST

LAW ENGINEERING



Client: DUKE POWER COMPANY
Project: MCGUIRE LANDFILL
Location: OW-4 3' TO 10'
File: 7210A_4 Project No.: CHW 7210A Page 2/2 Fig. No. 4

TRIAXIAL COMPRESSION TEST

CU with pore pressures

3-20-1990
1:10 pm

Project Data

Project No.: CHW 7210A   Date: 3/19/90   Data file: 7210A_4
Client: DUKE POWER COMPANY
Project: MCGUIRE LANDFILL
Sample location: OW-4 3' TO 10'
Sample description: BN YE & BK MI FI SA SI
Remarks:
Fig No. 4

Sample No. 1 Data

Type of sample: REMOLDED TO 90%
Specific Gravity= 2.75   LL=   PL=   PI=

Sample Parameters	Before Test	At Testing	After Test
Diameter, in	2.87	2.84	
Height change, in		0.00	
Height, in	6.01	6.01	
Weight, grams	1075.1		
Water volume change, cc		-94.80	
Moisture, %	24.9	35.9	35.9
Dry density, pcf	84.3	86.4	
Saturation, %	66.1	100.0	
Void ratio	1.036	0.988	

Test Data

Deformation dial constant= 1 in per input unit
Primary load ring constant= 0.715 lbs. per input unit
Secondary load ring constant= 0 lbs. per input unit
Crossover reading for secondary load ring= 0 input units
Rate of strain= 0.333 % per minute
Consolidation cell pressure = 37 psi
Consolidation back pressure = 30 psi
Consolidation effective confining stress = 1.008 ksf
Peak deviator stress = 1.59 ksf at reading no. 21
Ult. deviator stress =

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Effective Stresses Major ksf	Effective Stresses 1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.0	0.00	1.01	1.01	1.00	30.0	1.01	0.00
1	0.0100	0.010	21.5	15.4	0.2	0.35	0.86	1.21	1.40	31.0	1.04	0.17
2	0.0200	0.020	30.0	21.5	0.3	0.49	0.76	1.25	1.64	31.7	1.01	0.24
3	0.0300	0.030	35.5	25.4	0.5	0.58	0.71	1.28	1.82	32.1	0.99	0.29
	0.0400	0.040	39.5	28.2	0.7	0.64	0.66	1.30	1.97	32.4	0.98	0.32
	0.0500	0.050	42.5	30.4	0.8	0.69	0.60	1.29	2.14	32.8	0.95	0.34

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
[illegible]	0.0600	0.060	45.0	32.2	1.0	0.73	0.58	1.30	2.26	33.0	0.94	0.36
[illegible]	0.0700	0.070	48.0	34.3	1.2	0.77	0.55	1.32	2.41	33.2	0.93	0.39
8	0.0800	0.080	50.0	35.8	1.3	0.80	0.52	1.32	2.55	33.4	0.92	0.40
9	0.0900	0.090	51.5	36.8	1.5	0.83	0.49	1.32	2.69	33.6	0.90	0.41
10	0.1000	0.100	53.0	37.9	1.7	0.85	0.48	1.32	2.79	33.7	0.90	0.42
11	0.2240	0.224	67.0	47.9	3.7	1.05	0.39	1.44	3.70	34.3	0.91	0.53
12	0.3000	0.300	72.0	51.5	5.0	1.11	0.40	1.52	3.77	34.2	0.96	0.56
13	0.4000	0.400	76.0	54.3	6.7	1.16	0.40	1.56	3.87	34.2	0.98	0.58
14	0.5000	0.500	81.0	57.9	8.3	1.21	0.40	1.61	4.00	34.2	1.01	0.61
15	0.6000	0.600	87.0	62.2	10.0	1.28	0.43	1.71	3.95	34.0	1.07	0.64
16	0.7000	0.700	92.0	65.8	11.6	1.32	0.43	1.76	4.07	34.0	1.09	0.66
17	0.8000	0.800	98.0	70.1	13.3	1.38	0.45	1.83	4.10	33.9	1.14	0.69
18	0.9000	0.900	103.0	73.6	15.0	1.43	0.48	1.90	4.00	33.7	1.19	0.71
19	1.0000	1.000	109.0	77.9	16.6	1.48	0.50	1.98	3.94	33.5	1.24	0.74
20	1.2000	1.200	120.0	85.8	20.0	1.57	0.55	2.11	3.86	33.2	1.33	0.78
21	1.3000	1.300	124.0	88.7	21.6	1.58	0.56	2.15	3.82	33.1	1.35	0.79

@==

TRIAXIAL COMPRESSION TEST 3-20-1990
CU with pore pressures 1:12 pm

==

Project Data

Project No.: CHW 7210A Date: 3/19/90 Data file: 7210A_4
Client: DUKE POWER COMPANY
Project: MCGUIRE LANDFILL
Sample location: OW-4 3' TO 10'
Sample description: BN YE & BK MI FI SA SI
Remarks:
Fig No. 4

Sample No. 2 Data

Type of sample: REMOLDED TO 90%
Specific Gravity= 2.75 LL= PL= PI=

Sample Parameters	Before Test	At Testing	After Test
Diameter, in	2.87	2.81	
Height change, in		0.00	
Height, in	6.00	6.00	
Weight, grams	1075.6		
Water volume change, cc		-80.10	
Moisture, %	25.0	34.3	34.3
Dry density, pcf	84.5	88.3	
Saturation, %	66.6	100.0	
Void ratio	1.033	0.943	

Test Data

Deformation dial constant= 1 in per input unit
Primary load ring constant= 0.715 lbs. per input unit
Secondary load ring constant= 0 lbs. per input unit
Crossover reading for secondary load ring= 0 input units
Rate of strain= 0.333 % per minute
Consolidation cell pressure = 44 psi
Consolidation back pressure = 30 psi
Consolidation effective confining stress = 2.016 ksf
Peak deviator stress = 3.10 ksf at reading no. 23
Ult. deviator stress =

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.0	0.00	2.02	2.02	1.00	30.0	2.02	0.00
1	0.0100	0.010	28.0	20.0	0.2	0.47	1.86	2.32	1.25	31.1	2.09	0.23
2	0.0200	0.020	41.0	29.3	0.3	0.68	1.74	2.42	1.39	31.9	2.08	0.34
3	0.0300	0.030	52.0	37.2	0.5	0.86	1.64	2.50	1.52	32.6	2.07	0.43
[illegible]	0.0400	0.040	59.0	42.2	0.7	0.98	1.83	2.80	1.53	31.3	2.32	0.49
[illegible]	0.0500	0.050	67.0	47.9	0.8	1.11	1.50	2.60	1.74	33.6	2.05	0.55

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
[illegible]	0.0600	0.060	73.0	52.2	1.0	1.20	1.43	2.63	1.84	34.1	2.03	0.60
7	0.0700	0.070	78.0	55.8	1.2	1.28	1.37	2.65	1.94	34.5	2.01	0.64
8	0.0800	0.080	82.5	59.0	1.3	1.36	1.32	2.68	2.02	34.8	2.00	0.68
9	0.0900	0.090	87.0	62.2	1.5	1.43	1.30	2.72	2.10	35.0	2.01	0.71
10	0.1000	0.100	89.5	64.0	1.7	1.47	1.25	2.72	2.17	35.3	1.99	0.73
11	0.2000	0.200	115.0	82.2	3.3	1.85	1.07	2.92	2.74	36.6	1.99	0.93
12	0.3000	0.300	126.0	90.1	5.0	1.99	1.04	3.03	2.92	36.8	2.03	1.00
13	0.4000	0.400	140.0	100.1	6.7	2.18	1.04	3.21	3.10	36.8	2.12	1.09
14	0.5500	0.550	155.0	110.8	9.2	2.34	1.09	3.44	3.14	36.4	2.27	1.17
15	0.6000	0.600	161.0	115.1	10.0	2.41	1.11	3.52	3.18	36.3	2.31	1.21
16	0.7000	0.700	173.0	123.7	11.7	2.54	1.14	3.68	3.24	36.1	2.41	1.27
17	0.8000	0.800	182.5	130.5	13.3	2.63	1.20	3.83	3.20	35.7	2.51	1.32
18	0.9000	0.900	197.0	140.9	15.0	2.79	1.27	4.05	3.20	35.2	2.66	1.39
19	1.0000	1.000	205.0	146.6	16.7	2.84	1.34	4.18	3.12	34.7	2.76	1.42
20	1.1000	1.100	213.0	152.3	18.3	2.90	1.41	4.31	3.05	34.2	2.86	1.45
21	1.2000	1.200	225.5	161.2	20.0	3.00	1.48	4.49	3.02	33.7	2.98	1.50
22	1.3000	1.300	234.0	167.3	21.7	3.05	1.68	4.74	2.81	32.3	3.21	1.53
23	1.4000	1.400	243.0	173.7	23.3	3.10	1.64	4.74	2.89	32.6	3.19	1.55

@==

TRIAXIAL COMPRESSION TEST 3-20-1990
CU with pore pressures 1:14 pm

==

Project Data

Project No.: CHW 7210A Date: 3/19/90 Data file: 7210A_4
Client: DUKE POWER COMPANY
Project: MCGUIRE LANDFILL
Sample location: OW-4 3' TO 10'
Sample description: BN YE & BK MI FI SA SI
Remarks:
Fig No. 4

Sample No. 3 Data

Type of sample: REMOLDED TO 90%
Specific Gravity= 2.75 LL= PL= PI=

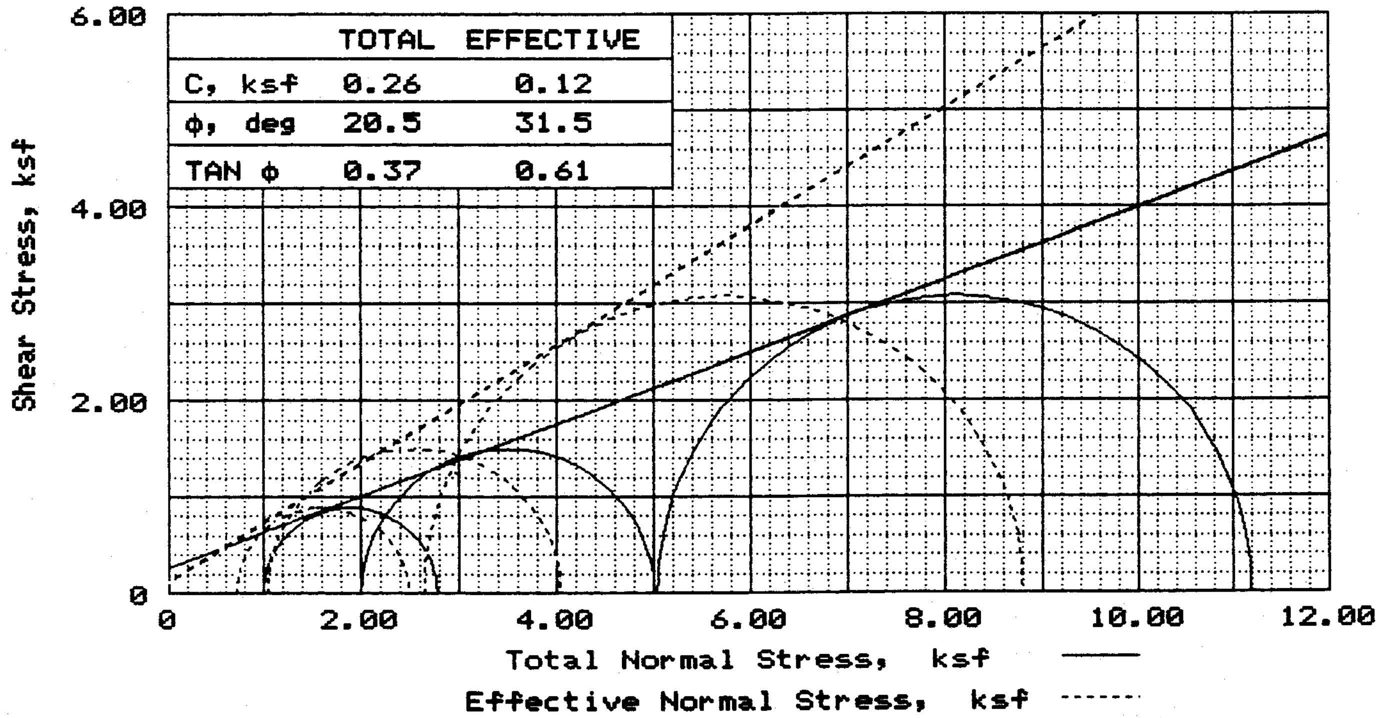
Sample Parameters	Before Test	At Testing	After Test
Diameter, in	2.87	2.74	
Height change, in		0.00	
Height, in	6.01	6.01	
Weight, grams	1074.5		
Water volume change, cc		-52.80	
Moisture, %	24.9	31.1	31.1
Dry density, pcf	84.3	92.6	
Saturation, %	66.1	100.0	
Void ratio	1.037	0.854	

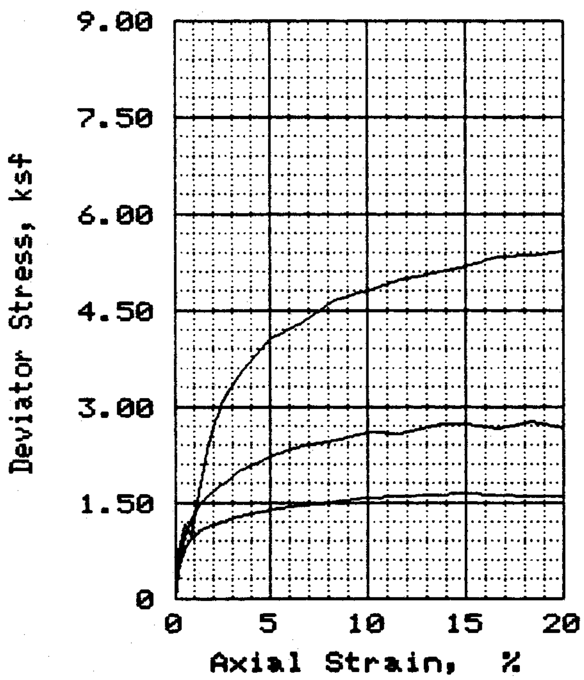
Test Data

Deformation dial constant= 1 in per input unit
Primary load ring constant= 0.715 lbs. per input unit
Secondary load ring constant= 0 lbs. per input unit
Crossover reading for secondary load ring= 0 input units
Rate of strain= 0.333 % per minute
Consolidation cell pressure = 65 psi
Consolidation back pressure = 30 psi
Consolidation effective confining stress = 5.04 ksf
Peak deviator stress = 5.57 ksf at reading no. 18
Ult. deviator stress =

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.0	0.00	5.10	5.10	1.00	29.6	5.10	0.00
1	0.0050	0.005	11.0	7.9	0.1	0.19	5.08	5.28	1.04	29.7	5.18	0.10
2	0.0100	0.010	20.0	14.3	0.2	0.35	5.07	5.42	1.07	29.8	5.24	0.17
3	0.0300	0.030	84.0	60.1	0.5	1.46	4.77	6.23	1.31	31.9	5.50	0.73
4	0.0500	0.050	115.0	82.2	0.8	1.99	4.42	6.41	1.45	34.3	5.42	1.00
	0.0750	0.075	147.0	105.1	1.2	2.54	3.96	6.50	1.64	37.5	5.23	1.27

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
[illegible]	0.1000	0.100	170.0	121.6	1.7	2.92	3.60	6.52	1.81	40.0	5.06	1.46
7	0.1500	0.150	200.0	143.0	2.5	3.41	3.12	6.53	2.09	43.3	4.83	1.70
8	0.2000	0.200	220.0	157.3	3.3	3.72	2.81	6.53	2.32	45.5	4.67	1.86
9	0.3150	0.315	248.0	177.3	5.2	4.11	2.42	6.53	2.70	48.2	4.47	2.05
10	0.4000	0.400	275.0	196.6	6.7	4.49	2.39	6.88	2.88	48.4	4.63	2.24
11	0.5000	0.500	292.0	208.8	8.3	4.68	2.39	7.07	2.96	48.4	4.73	2.34
12	0.6000	0.600	315.0	225.2	10.0	4.96	2.43	7.39	3.04	48.1	4.91	2.48
13	0.7000	0.700	334.0	238.8	11.6	5.16	2.49	7.65	3.07	47.7	5.07	2.58
14	0.8000	0.800	353.0	252.4	13.3	5.35	2.55	7.90	3.10	47.3	5.22	2.68
15	0.9000	0.900	368.0	263.1	15.0	5.47	2.64	8.11	3.08	46.7	5.37	2.74
16	1.0250	1.025	379.0	271.0	17.1	5.50	2.81	8.30	2.96	45.5	5.56	2.75
17	1.1000	1.100	388.0	277.4	18.3	5.54	2.91	8.45	2.91	44.8	5.68	2.77
18	1.2000	1.200	398.0	284.6	20.0	5.57	3.07	8.64	2.82	43.7	5.85	2.78





SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	27.3	27.2	27.1
	DRY DENSITY, pcf	82.2	82.3	82.5
	SATURATION, %	69.3	69.3	69.5
	VOID RATIO	1.073	1.071	1.065
	DIAMETER, in	2.87	2.87	2.87
	HEIGHT, in	6.01	6.00	5.99
AT TEST	WATER CONTENT, %	39.4	38.1	34.3
	DRY DENSITY, pcf	82.1	83.5	88.1
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	1.076	1.041	0.935
	DIAMETER, in	2.87	2.85	2.78
	HEIGHT, in	6.01	6.00	5.99
BACK PRESSURE, ksf		4.32	4.32	4.32
CELL PRESSURE, ksf		5.33	6.34	9.36
FAILURE STRESS, ksf		1.78	3.00	6.16
PORE PRESSURE, ksf		4.61	5.28	6.71
STRAIN RATE, %/min.		0.333	0.333	0.333
ULTIMATE STRESS, ksf				
PORE PRESSURE, ksf				
$\bar{\sigma}_1$ FAILURE, ksf		2.50	4.05	8.81
$\bar{\sigma}_3$ FAILURE, ksf		0.72	1.05	2.65

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: REMOLDED TO 90%
DESCRIPTION: LT YE BN
MI SLI CL FI SA SI
LL= PL= PI=
SPECIFIC GRAVITY= 2.73
REMARKS:

FIG. NO. 5

CLIENT: DUKE POWER COMPANY

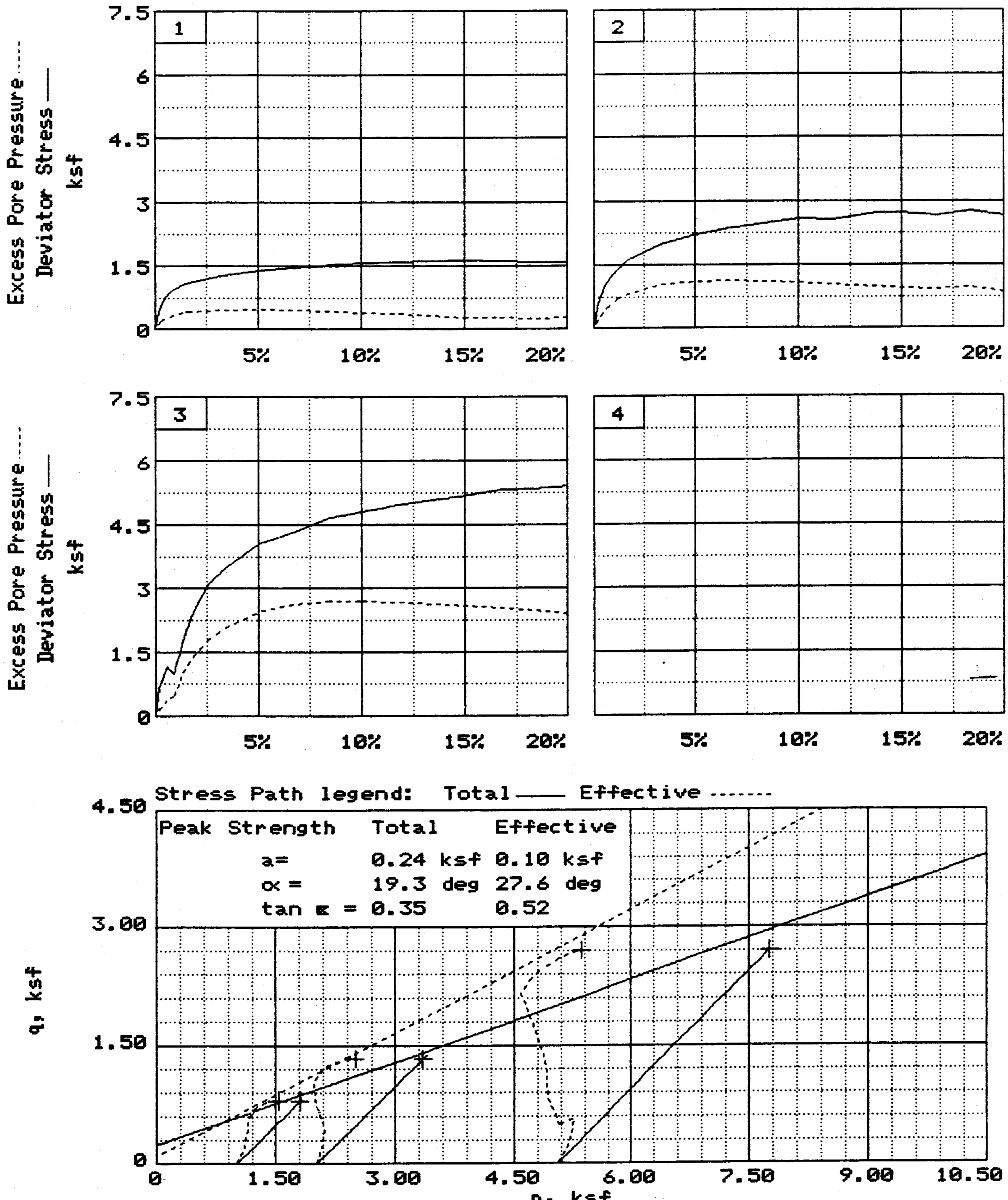
PROJECT: MCGUIRE LANDFILL

SAMPLE LOCATION: OW-5
3' TO 10'

PROJ. NO.: CHW 7210A DATE: 3/19/90

TRIAXIAL COMPRESSION TEST

LAW ENGINEERING



Client: DUKE POWER COMPANY
Project: MCGUIRE LANDFILL
Location: OW-5 3' TO 10'
File: 7210A_5 Project No.: CHW 7210A Page 2/2 Fig. No. 5

TRIAXIAL COMPRESSION TEST CU with pore pressures	3-20-1990 2:14 pm

Project Data

Project No.: CHW 7210A   Date: 3/19/90   Data file: 7210A_5
Client: DUKE POWER COMPANY
Project: MCGUIRE LANDFILL
Sample location: OW-5 3' TO 10'
Sample description: LT YE BN MI SLI CL FI SA SI
Remarks:
Fig No. 5

Sample No. 1 Data

Type of sample: REMOLDED TO 90%
Specific Gravity= 2.73   LL=   PL=   PI=

Sample Parameters	Before Test	At Testing	After Test
Diameter, in	2.87	2.87	
Height change, in		0.00	
Height, in	6.01	6.01	
Weight, grams	1067.6		
Water volume change, cc		%-102	
Moisture, %	27.3	39.4	39.5
Dry density, pcf	82.2	82.1	
Saturation, %	69.3	100.0	
Void ratio	1.073	1.076	

Test Data

Deformation dial constant=   1 in per input unit
Primary load ring constant= 0.715 lbs. per input unit
Secondary load ring constant= 0 lbs. per input unit
Crossover reading for secondary load ring= 0 input units
Rate of strain= 0.333 % per minute
Consolidation cell pressure = 37 psi
Consolidation back pressure = 30 psi
Consolidation effective confining stress = 1.008 ksf
Peak deviator stress =   1.78 ksf at reading no. 18
Ult. deviator stress =

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.0	0.00	1.01	1.01	1.00	30.0	1.01	0.00
1	0.0100	0.010	26.0	18.6	0.2	0.41	0.89	1.31	1.46	30.8	1.10	0.21
2	0.0200	0.020	39.0	27.9	0.3	0.62	0.81	1.42	1.77	31.4	1.12	0.31
3	0.0300	0.030	47.5	34.0	0.5	0.75	0.76	1.51	1.98	31.7	1.14	0.38
4	0.0400	0.040	54.0	38.6	0.7	0.85	0.72	1.57	2.18	32.0	1.15	0.43
[illegible]	0.0500	0.050	58.5	41.8	0.8	0.92	0.69	1.61	2.33	32.2	1.15	0.46

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Effective Stresses Major ksf	Effective Stresses 1:3 Ratio	Pore Pres. psi	P ksf	Q ks
6	0.0600	0.060	62.0	44.3	1.0	0.98	0.66	1.64	2.47	32.4	1.15	0.49
7	0.0700	0.070	65.0	46.5	1.2	1.02	0.63	1.65	2.61	32.6	1.14	0.51
8	0.0800	0.080	68.0	48.6	1.3	1.07	0.62	1.69	2.72	32.7	1.15	0.53
9	0.0900	0.090	69.5	49.7	1.5	1.09	0.60	1.69	2.80	32.8	1.15	0.54
10	0.1000	0.100	71.0	50.8	1.7	1.11	0.59	1.70	2.88	32.9	1.15	0.55
11	0.2000	0.200	83.0	59.3	3.3	1.28	0.55	1.82	3.33	33.2	1.18	0.64
12	0.3000	0.300	92.0	65.8	5.0	1.39	0.53	1.92	3.61	33.3	1.23	0.69
13	0.4000	0.400	98.0	70.1	6.7	1.45	0.55	2.00	3.66	33.2	1.27	0.73
14	0.5000	0.500	104.0	74.4	8.3	1.52	0.58	2.09	3.63	33.0	1.33	0.76
15	0.6000	0.600	110.0	78.7	10.0	1.57	0.62	2.19	3.54	32.7	1.41	0.79
16	0.7000	0.700	113.0	80.8	11.6	1.59	0.65	2.23	3.45	32.5	1.44	0.79
17	0.8000	0.800	117.0	83.7	13.3	1.61	0.68	2.29	3.38	32.3	1.48	0.81
18	0.9000	0.900	121.0	86.5	15.0	1.64	0.72	2.36	3.27	32.0	1.54	0.82
19	1.0000	1.000	121.5	86.9	16.6	1.61	0.73	2.34	3.19	31.9	1.54	0.80
20	1.1000	1.100	123.0	87.9	18.3	1.60	0.75	2.35	3.13	31.8	1.55	0.80
21	1.2000	1.200	125.0	89.4	20.0	1.59	0.73	2.32	3.17	31.9	1.53	0.80

@===

TRIAXIAL COMPRESSION TEST 3-20-1990
CU with pore pressures 2:16 pm

===

Project Data

Project No.: CHW 7210A   Date: 3/19/90   Data file: 7210A_5
Client: DUKE POWER COMPANY
Project: MCGUIRE LANDFILL
Sample location: OW-5 3' TO 10'
Sample description: LT YE BN MI SLI CL FI SA SI
Remarks:
Fig No. 5

Sample No. 2 Data

Type of sample: REMOLDED TO 90%
Specific Gravity= 2.73   LL=   PL=   PI=

Sample Parameters	Before Test	At Testing	After Test
Diameter, in	2.87	2.85	
Height change, in		0.00	
Height, in	6.00	6.00	
Weight, grams	1066.3		
Water volume change, cc		-92.00	
Moisture, %	27.2	38.1	38.1
Dry density, pcf	82.3	83.5	
Saturation, %	69.3	100.0	
Void ratio	1.071	1.041	

Test Data

Deformation dial constant= 1 in per input unit
Primary load ring constant= 0.715 lbs. per input unit
Secondary load ring constant= 0 lbs. per input unit
Crossover reading for secondary load ring= 0 input units
Rate of strain= 0.333 % per minute
Consolidation cell pressure = 44 psi
Consolidation back pressure = 30 psi
Consolidation effective confining stress = 2.016 ksf
Peak deviator stress = 3.00 ksf at reading no. 20
Ult. deviator stress =

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.0	0.00	2.02	2.02	1.00	30.0	2.02	0.00
1	0.0100	0.010	31.0	22.2	0.2	0.50	1.84	2.34	1.27	31.2	2.09	0.25
2	0.0200	0.020	48.0	34.3	0.3	0.77	1.73	2.50	1.45	32.0	2.11	0.39
3	0.0300	0.030	60.0	42.9	0.5	0.96	1.61	2.58	1.60	32.8	2.09	0.48
4	0.0400	0.040	69.0	49.3	0.7	1.11	1.53	2.63	1.73	33.4	2.08	0.55
[illegible]	0.0500	0.050	76.0	54.3	0.8	1.22	1.44	2.66	1.85	34.0	2.05	0.61

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
[illegible]	0.0600	0.060	82.0	58.6	1.0	1.31	1.38	2.69	1.95	34.4	2.04	0.66
7	0.0700	0.070	87.5	62.6	1.2	1.40	1.32	2.72	2.05	34.8	2.02	0.70
8	0.0800	0.080	92.0	65.8	1.3	1.47	1.28	2.75	2.14	35.1	2.01	0.73
9	0.0900	0.090	97.0	69.4	1.5	1.54	1.24	2.78	2.25	35.4	2.01	0.77
10	0.1000	0.100	101.0	72.2	1.7	1.60	1.20	2.80	2.34	35.7	2.00	0.80
11	0.2000	0.200	128.0	91.5	3.3	2.00	0.98	2.98	3.04	37.2	1.98	1.00
12	0.3000	0.300	145.0	103.7	5.0	2.22	0.91	3.13	3.45	37.7	2.02	1.11
13	0.4000	0.400	158.0	113.0	6.7	2.38	0.89	3.27	3.67	37.8	2.08	1.19
14	0.5000	0.500	167.0	119.4	8.3	2.47	0.91	3.38	3.72	37.7	2.14	1.24
15	0.6000	0.600	179.0	128.0	10.0	2.60	0.94	3.54	3.78	37.5	2.24	1.30
16	0.7000	0.700	180.5	129.1	11.7	2.57	0.98	3.55	3.63	37.2	2.27	1.29
17	0.8240	0.824	195.0	139.4	13.7	2.72	1.02	3.74	3.66	36.9	2.38	1.36
18	0.9000	0.900	199.0	142.3	15.0	2.73	1.07	3.80	3.56	36.6	2.43	1.37
19	1.0000	1.000	197.0	140.9	16.7	2.65	1.09	3.75	3.42	36.4	2.42	1.33
20	1.1000	1.100	210.0	150.2	18.3	2.77	1.05	3.82	3.63	36.7	2.44	1.38
21	1.2000	1.200	206.0	147.3	20.0	2.66	1.17	3.83	3.28	35.9	2.50	1.33

@==

TRIAXIAL COMPRESSION TEST 3-20-1990
CU with pore pressures 2:27 pm

==

Project Data

Project No.: CHW 7210A Date: 3/19/90 Data file: 7210A_5
Client: DUKE POWER COMPANY
Project: MCGUIRE LANDFILL
Sample location: OW-5 3' TO 10'
Sample description: LT YE BN MI SLI CL FI SA SI
Remarks:
Fig No. 5

Sample No. 3 Data

Type of sample: REMOLDED TO 90%
Specific Gravity= 2.73 LL= PL= PI=

Sample Parameters	Before Test	At Testing	After Test
Diameter, in	2.87	2.78	
Height change, in		0.00	
Height, in	5.99	5.99	
Weight, grams	1066.9		
Water volume change, cc		-60.00	
Moisture, %	27.1	34.3	34.2
Dry density, pcf	82.5	88.1	
Saturation, %	69.5	100.0	
Void ratio	1.065	0.935	

Test Data

Deformation dial constant= 1 in per input unit
Primary load ring constant= 0.715 lbs. per input unit
Secondary load ring constant= 0 lbs. per input unit
Crossover reading for secondary load ring= 0 input units
Rate of strain= 0.333 % per minute
Consolidation cell pressure = 65 psi
Consolidation back pressure = 30 psi
Consolidation effective confining stress = 5.04 ksf
Peak deviator stress = 6.16 ksf at reading no. 18
Ult. deviator stress =

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ks
0	0.0000	0.000	0.0	0.0	0.0	0.00	5.05	5.05	1.00	29.9	5.05	0.00
1	0.0050	0.005	27.0	19.3	0.1	0.46	4.95	5.41	1.09	30.6	5.18	0.23
2	0.0100	0.010	43.0	30.7	0.2	0.73	4.87	5.60	1.15	31.2	5.23	0.36
3	0.0300	0.030	68.0	48.6	0.5	1.15	4.68	5.83	1.25	32.5	5.25	0.57
4	0.0500	0.050	58.0	41.5	0.8	0.98	4.58	5.56	1.21	33.2	5.07	0.49
	0.0750	0.075	99.0	70.8	1.3	1.66	4.09	5.75	1.41	36.6	4.92	0.83

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs.	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf
[illegible]	0.1000	0.100	139.0	99.4	1.7	2.32	3.74	6.07	1.62	39.0	4.90	1.16
7	0.1520	0.152	187.0	133.7	2.5	3.10	3.27	6.36	1.95	42.3	4.82	1.55
8	0.2000	0.200	212.0	151.6	3.3	3.48	3.00	6.48	2.16	44.2	4.74	1.74
9	0.3000	0.300	251.0	179.5	5.0	4.05	2.61	6.66	2.55	46.9	4.63	2.02
10	0.4000	0.400	272.0	194.5	6.7	4.31	2.42	6.73	2.78	48.2	4.57	2.16
11	0.5000	0.500	299.0	213.8	8.3	4.65	2.36	7.02	2.97	48.6	4.69	2.33
12	0.6000	0.600	315.0	225.2	10.0	4.81	2.36	7.18	3.04	48.6	4.77	2.41
13	0.7000	0.700	331.0	236.7	11.7	4.96	2.38	7.34	3.09	48.5	4.86	2.48
14	0.8000	0.800	345.0	246.7	13.4	5.08	2.43	7.51	3.09	48.1	4.97	2.54
15	0.9000	0.900	359.0	256.7	15.0	5.18	2.46	7.64	3.10	47.9	5.05	2.59
16	1.0000	1.000	376.0	268.8	16.7	5.32	2.52	7.84	3.11	47.5	5.18	2.66
17	1.1000	1.100	386.0	276.0	18.4	5.35	2.58	7.93	3.08	47.1	5.25	2.68
18	1.2000	1.200	398.0	284.6	20.0	5.41	2.65	8.06	3.04	46.6	5.35	2.70

APPENDIX F

SUMMARY OF LABORATORY TESTING
Duke Power Company
McGuire Landfill
LAW Job No. CHG 7210A

CONSTANT HEAD PERMEABILITY TEST

I. Date of Test: 3/20/90

II. Test Location: Boring Number: OW-1 * 3.0 Ft-10.0 Ft

III. Material Description:

IV. Material Condition: Remolded

V. Proctor Data:
Maximum Dry Density (pcf): 93.6
Optimum Moisture Content (%): 23.1

VI. Test Data:

Dry Density (pcf):	84.2
Initial Moisture Content (%):	23.3
Sample Length (cm)	5.2
Sample Area (cm^2):	41.7
Head (cm):	351.7
Quantity of Water Passing Through Sample (cm^3):	252.8
Elapsed Time (sec):	8160
Temperature (^oC):	23
Correction Factor:	None
Coefficient of Permeability -k (cm/sec):	1.1×10^{-5}

VII. Comments: None

SUMMARY OF LABORATORY TESTING
Duke Power Company
McGuire Landfill
LAW Job No. CHG 7210A

CONSTANT HEAD PERMEABILITY TEST

I. Date of Test: 3/20/90

II. Test Location: Boring Number: OW-2 * 3.0 Ft-10.0 Ft

III. Material Description:

IV. Material Condition: Remolded

V. Proctor Data:
Maximum Dry Density (pcf): 94.7
Optimum Moisture Content (%): 23.1

VI. Test Data:

Dry Density (pcf):	85.2
Initial Moisture Content (%):	23.1
Sample Length (cm):	5.2
Sample Area (cm^2):	41.6
Head (cm):	351.7
Quantity of Water Passing Through Sample (cm^3):	259.1
Elapsed Time (sec):	6420
Temperature (^oC):	23
Correction Factor:	None
Coefficient of Permeability -k (cm/sec):	4.8×10^{-6}

VII. Comments: None

SUMMARY OF LABORATORY TESTING
Duke Power Company
McGuire Landfill
LAW Job No. CHG 7210A

CONSTANT HEAD PERMEABILITY TEST

I. Date of Test: 3/20/90

II. Test Location: Boring Number: OW-4 * 3.0 Ft-10.0 Ft

III. Material Description:

IV. Material Condition: Remolded

V. Proctor Data:
Maximum Dry Density (pcf): 93.4
Optimum Moisture Content (%): 25.2

VI. Test Data:

Dry Density (pcf):	84.1
Initial Moisture Content (%):	25.7
Sample Length (cm):	5.1
Sample Area (cm^2):	41.7
Head (cm):	351.7
Quantity of Water Passing Through Sample (cm^3):	232.1
Elapsed Time (sec):	6900
Temperature (^{o}C):	23
Correction Factor:	None
Coefficient of Permeability -k (cm/sec):	3.5×10^{-4}

VII. Comments: None

SUMMARY OF LABORATORY TESTING
Duke Power Company
McGuire Landfill
LAW Job No. CHG 7210A

CONSTANT HEAD PERMEABILITY TEST

I. Date of Test: 3/20/90

II. Test Location: Boring Number: OW-5 * 3.0 Ft-10.0 Ft

III. Material Description:

IV. Material Condition: Remolded

V. Proctor Data:
Maximum Dry Density (pcf): 91.9
Optimum Moisture Content (%): 25.9

VI. Test Data:

Dry Density (pcf):	82.7
Initial Moisture Content (%):	26.9
Sample Length (cm):	5.2
Sample Area (cm^2):	41.4
Head (cm):	351.7
Quantity of Water Passing Through Sample (cm^3):	186.1
Elapsed Time (sec):	8040
Temperature (^oC):	23
Correction Factor:	None
Coefficient of Permeability -k (cm/sec):	8.2×10^{-6}

VII. Comments: None