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State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Air Quality

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
Alan W. Klimek, P.E., Director

DEHNR

December 18, 1996

Mr. Kenneth L. Carter, R.S.
Director, Environmental Health
Guilford County Department of Public Health
301 North Eugene Street
Greensboro, North Carolina 27401

DEC 1996
RECEIVED

Mr. Robert Fulp, Director
Forsyth County Environmental Affairs Department
537 North Spruce Street
Winston-Salelm, North Carolina 27101-1362

Dear Mr. Carter and Mr. Fulp:

This letter is written in response to your letters of November 12, 1996 (Forsyth County) and November 7, 1996 (Guilford County), concerning the air quality jurisdiction over the Guilford County section of the Piedmont Landfill and Recycling Center (PLRC). The Division of Air Quality (DAQ) understands that the PLRC currently is under the sole jurisdiction of the Forsyth County Environmental Affairs Department (FCEAD), but that a future planned one hundred ten (110) acre expansion of the PLRC into Guilford County would split the facility between State and Forsyth County jurisdictions.

The FCEAD has requested that the DAQ amend the FCEAD local program certification to include jurisdiction over the Guilford County section of the PLRC. The DAQ understands that Guilford County has no objection to the State's amending Forsyth County's local program certification to allow the FCEAD to assume sole jurisdiction over the PLRC air quality permitting and enforcement.

The DAQ concurs that the best interests of the public will be served if a single agency maintains jurisdiction over the PLRC air quality requirements. The DAQ will therefore initiate an amendment to the FCEAD local program certification. The amendment procedure requires the approval of the Environmental Management Commission. This office will contact you once the amendment has been drafted and a projected approval schedule has been prepared.

Please contact Ms. Laura S. Butler at 919-715-6236 or Mr. Thomas Allen at 919-733-1489 if you have any questions or comments.

Sincerely,

Alan Klimek

Alan Klimek, P.E.

C: William Meyer
Myron Whitley

P.O. Box 29580, Raleigh, North Carolina 27626-0580
Voice (919) 715-6235 FAX (919) 733-5317

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GUILFORD COUNTY

PLANNING AND DEVELOPMENT DEPARTMENT

November 18, 1996

Mr. John G. Wolfe, III, Attorney
101 South Main Street
Kernersville, NC 27284

Dear John:

Based on our meeting with you and Henry Isaacson this morning, I have enclosed the following concerning the Special Use Permit Application for the proposed expansion of Piedmont Sanitary Landfill into Guilford County:

- DEHNR Solid Waste Management Rules for Siting and Design, Application, and Operational Requirements for Sanitary Landfills.
- A table from DEHNR summarizing statutory requirements for NOTIFICATION, FRANCHISE, and ZONING for a proposed Sanitary Landfill Application and a copy of pertinent sections of NCGS 130A-294.
- A copy of Guilford County's Franchise Ordinance for a Sanitary Landfill.
- A copy of a CERTIFICATE OF DETERMINATION FOR SANITARY LANDFILL CONSISTENCY within Guilford County.

As indicated in the DEHNR Summary Table and NCGS 130A-294, the following procedures must be strictly followed for the proposed sanitary landfill application and permit by DEHNR:

1. DEHNR/Solid Waste Section notifies the Clerk to the Board of County Commissioners of the application for the proposed sanitary landfill (NCGS 130A-294(b1)(2)).

2. The Board of County Commissioners must provide adequate notice of and conduct a public hearing on the application for the proposed sanitary landfill (NCGS 130A-294(b1)(2)).

3. Piedmont Landfill must obtain a franchise from the Guilford County Board of County Commissioners for the operation of the proposed sanitary landfill in Guilford County prior to applying to DEHNR for a sanitary landfill permit (NCGS 130A-294(b1)(3)).

Post Office Box 3427 • Greensboro, North Carolina 27402
Telephone: (910) 373-3334

TO: Brad Lewis
FAX #: 595-9735
FROM: John Wolfe
FAX #:
PHONE #:
DATE: 11
PAGES INCLUDING THIS PAGE: 2

4. Piedmont Landfill must request a Certificate of Determination for Sanitary Landfill Consistency from the Guilford County Department of Planning and Development as part of the sanitary landfill permit application to DEHNR/Solid Waste Section (NCGS 130A-294(b1)(4)).

A SPECIAL USE PERMIT for the proposed sanitary landfill must be approved by the Guilford County Planning Board or, on appeal, by the Guilford County Board of County Commissioners prior to the issuance of the Sanitary Landfill Consistency Determination.

The Special Use Permit application must include an approved or conditionally-approved sanitary landfill site plan from the Guilford County Technical Review Committee (TRC), and appropriate comments from DEHNR/Solid Waste Section. Any conditions which would mitigate the operation of the proposed sanitary landfill and which would achieve statutory solid waste recycling objectives should also be included in the Special Use Permit application.

Please contact Hugh Jernigan, DEHNR/Solid Waste Section, Winston-Salem Regional Office, concerning sanitary landfill permit application procedures.

Your assistance in this matter is appreciated.

Sincerely,

DeLacy M. Wyman

DeLacy M. Wyman, AICP
Director of Planning

/1

cc: Hugh Jernigan, DEHNR/Solid Waste Division/WSRO
Henry Isaacson, Attorney
Jim Elza, Director, Planning and Development
Mark Kirstner, Chief, Zoning Section
Jim Morrison, Chief, Planning Section
Betty Garrett, Environmental Services

PIEDMONT LANDFILL & RECYCLING CENTER

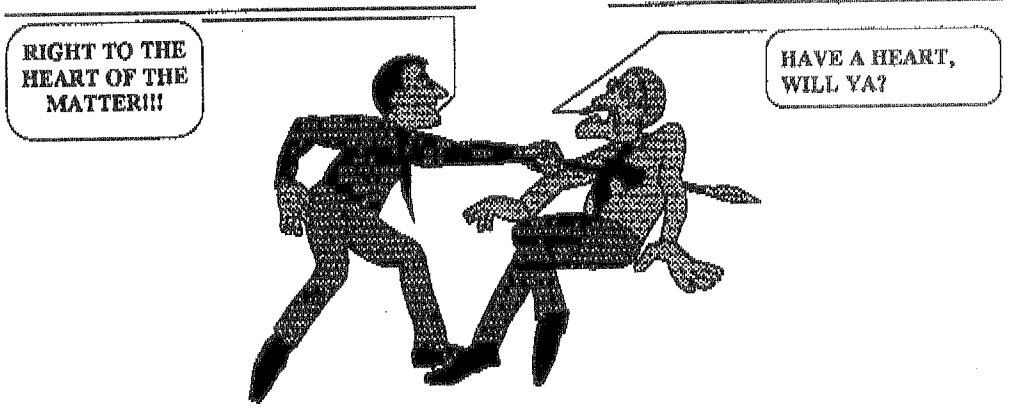
9900 FREEMAN ROAD
KERNERSVILLE, NC 27284
(910) 595-6677
FAX (910) 595-9735

FAX TRANSMISSION COVER SHEET

TO: Sherri Coghill

FROM: Ed Gibson

DATE: 12/4/96 TIME: ~~[illegible]~~ 815 Am



YOU SHOULD RECEIVE 3 PAGES *INCLUDING THIS COVER SHEET*. IF YOU DO NOT RECEIVE ALL THE PAGES, PLEASE CALL (910) 595-6677 IMMEDIATELY. THANK YOU.

COMMENTS:

in at least one newspaper of general circulation published in the county. After naming or renaming a public road, or assigning or reassigning street numbers on a public road, a county shall cause notice of its action to be given to the local postmaster with jurisdiction over the road, to the Board of Transportation, and to any city within five miles of the road. (1957, c. 1068; 1973, c. 507, s. 5; c. 822, s. 1; 1981, cc. 112, 518; 1987, c. 28, s. 2.)

Local Modification. — Alamance: 1987 (Reg. Sess., 1988), c. 900; 1989, c. 335, s. 1; Avery: 1983, c. 98; Brunswick: 1979, 2nd Sess., c. 1319; 1983, c. 98; Cabarrus: 1981, c. 568, amending 1979, 2nd Sess., c. 1319; 1983, c. 98; Cleveland: 1987 (Reg. Sess., 1988), c. 906; 1989, c. 156, s. 1; Forsyth: 1981, c. 558; Guilford: 1979, c. 283; McDowell: 1989, c. 335, s. 1; New Hanover: 1983, c. 98; Stokes: 1983, c. 299; 1989, c. 335, s. 1; Surry: 1983, c. 299; Wake (Incorporated municipalities therein, only): 1989, c. 511, s. 1.

Cross References. — As to naming roads and assigning street numbers in certain unincorporated areas of counties excepted from the application of this section, see § 153A-239.1.

Editor's Note. — Session Laws 1971, c. 1319, s. 1, as amended from time to time, excepts the following counties from the application of this section: Alamance, Avery, Brunswick, Burke, Cabarrus, Cleveland, Henderson, McDowell, New Hanover, Pender, Randolph, Sampson, Stokes and Surry Counties. See Cross Reference above.

The catchline of this section has been modified at the direction of the Revisor of Statutes.

§ 153A-241. Closing public roads or easements.

A county may permanently close any public road or any easement within the county and not within a city, except public roads or easements for public roads under the control and supervision of the Department of Transportation. The board of commissioners shall first adopt a resolution declaring its intent to close the public road or easement and calling a public hearing on the question. The board shall cause the resolution to be published once a week for ~~four~~ two successive weeks before the hearing, a copy of the resolution to be sent by registered or certified mail to each owner as shown on the county tax records of property adjoining the public road or easement who did not join in the request to have the road or easement closed, and a notice of the closing and public hearing to be prominently posted in at least two places along the road or easement. At the hearing the board shall hear all interested persons who appear with respect to whether the closing would be detrimental to the public interest or to any individual property rights. If, after the hearing, the board of commissioners is satisfied that closing the public road or easement is not contrary to the public interest and (in the case of a road) that no individual owning property in the vicinity of the road or in the subdivision in which it is located would thereby be deprived of reasonable means of ingress and egress to his property, the board may adopt an order closing the road or easement. A certified copy of the order (or judgment of the court) shall be filed in the office of the register of deeds of the county.

Any person aggrieved by the closing of a public road or an easement may appeal the board of commissioners' order to the appropriate division of the General Court of Justice within 30 days after the day the order is adopted. The court shall hear the matter de novo and has jurisdiction to try the issues arising and to order the road or easement closed upon proper findings of fact by the trier of fact.

Amended by Session Law - 1981 Chap 60.

No cause of action founded upon the invalidity of a proceeding taken in closing a public road or an easement may be asserted except in an action or proceeding begun within 30 days after the day the order is adopted.

Upon the closing of a public road or an easement pursuant to this section, all right, title, and interest in the right-of-way is vested in those persons owning lots or parcels of land adjacent to the road or easement, and the title of each adjoining landowner, for the width of his abutting land, extends to the center line of the public road or easement. However, the right, title or interest vested in an adjoining landowner by this paragraph remains subject to any public utility use or facility located on, over, or under the road or easement immediately before its closing, until the landowner or any successor thereto pays to the utility involved the reasonable cost of removing and relocating the facility. (1949, c. 1208, ss. 1-3; 1957, c. 65, s. 11; 1965, cc. 665, 801; 1971, c. 595; 1973, c. 507, s. 5; c. 822, s. 1; 1977, c. 464, s. 34.)

Local Modification. — Guilford: 1979, c. 282; 1981, c. 59.

Legal Periodicals. — For note discussing the disposition of property within the boundaries of a dedicated street when use of the street is discontinued, see 45 N.C.L. Rev. 564 (1967).

CASE NOTES

Editor's Note. — Some of the cases cited below were decided under corresponding sections of former law.

Owners of property on a street which is to be partially closed have an interest in the hearing on the request to close the street. In re City of Washington, 15 N.C. App. 505, 190 S.E.2d 309, cert. denied, 282 N.C. 151, 191 S.E.2d 601 (1972).

Legislative Intent as to Giving Notice. — The true legislative intent is that if a municipality wishes to close a street, or a part thereof, the notices required must be given. Such an intent if fair and just, because it affords all interested parties an opportunity to be heard. In re City of Washington, 15 N.C. App. 505, 190 S.E.2d 309, cert. denied, 282 N.C. 151, 191 S.E.2d 601 (1972).

Notice to Adjoining Property Owners Not to Be Limited to Those with Special Interest. — The statute requires notice by registered mail to the owners of property adjoining the street to be closed who did not join in the request for closing the street. The words of the statute are clear and unequivocal. There is nothing to indicate that only those with a "special interest" must be notified by registered mail. In re City of Washington, 15 N.C. App. 505, 190 S.E.2d 309, cert. denied, 282 N.C. 151, 191 S.E.2d 601 (1972).

Restrictions on County's Power to Close a Way of Passage. — From this section and § 153A-239, it is clear that a county does not have the power to close a way of passage which has not been dedicated to the public or in which the public has not acquired rights by prescription. In re Easement of Right of Way, 90 N.C. App. 303, 368 S.E.2d 639 (1988).

The closing of a street must not deprive a property owner of reasonable ingress or egress. Wofford v. North Carolina State Hwy. Comm'n, 263 N.C. 677, 140 S.E.2d 376, cert. denied, 382 U.S. 822, 86 S. Ct. 50, 15 L. Ed. 2d 67 (1965).

An individual may restrain the wrongful obstruction of a public way, of whatever origin, if he will suffer injury thereby as distinct from the inconvenience to the public generally, and he may recover such special damages as he has sustained by reason of the obstruction. Wofford v. North Carolina State Hwy. Comm'n, 263 N.C. 677, 140 S.E.2d 376, cert. denied, 382 U.S. 822, 86 S. Ct. 50, 15 L. Ed. 2d 67 (1965).

Applied in Whitehead Community Club v. Hoppers, 43 N.C. App. 671, 260 S.E.2d 94 (1979).

Sec. 7. This act is effective upon ratification.

In the General Assembly read three times and ratified, this the 27th day of February, 1981.

H. B. 133 CHAPTER 58

AN ACT TO PERMIT ONSLOW COUNTY TO CONSTRUCT TWO VEHICLE CROSSOVERS TO THE BEACH STRAND ON PRIVATE PROPERTY.

The General Assembly of North Carolina enacts:

Section 1. Onslow County is authorized to construct two vehicle crossovers to the beach strand on private property. The county may use only nonproperty tax funds for this purpose.

Sec. 2. This act is effective upon ratification.

In the General Assembly read three times and ratified, this the 27th day of February, 1981.

H. B. 139 CHAPTER 59

AN ACT TO AMEND CHAPTER 282 OF THE SESSION LAWS OF 1979 RELATING TO THE AUTHORITY OF THE BOARD OF COMMISSIONERS OF GUILFORD COUNTY TO DELEGATE TO THE GUILFORD COUNTY PLANNING BOARD THE AUTHORITY TO CLOSE PUBLIC ROADS OR EASEMENTS.

The General Assembly of North Carolina enacts:

Section 1. Section 3 of Chapter 282 of the 1979 Session Laws is amended by adding a new sentence at the end of the section, said section to read as follows:

"Sec. 3. For purposes of this act, references found in G.S. 153A-241 to the board of commissioners shall refer to the planning board except for purposes of appeal. References found in G.S. 153A-241 to the publishing of a resolution declaring its intent to close the public road or easement by advertising once a week for four successive weeks before the public hearing thereon shall be changed to provide that the resolution of intent need only be published once a week for two successive weeks."

Sec. 2. This act is effective upon ratification.

In the General Assembly read three times and ratified, this the 27th day of February, 1981.

H. B. 140 CHAPTER 60

AN ACT TO AUTHORIZE THE BOARD OF COMMISSIONERS OF GUILFORD COUNTY TO APPOINT OR DESIGNATE A DEPUTY CLERK TO THE BOARD.

The General Assembly of North Carolina enacts:

Section 1. The Board of Commissioners of Guilford County is hereby authorized and empowered to appoint or designate a deputy clerk to the board of county commissioners.

Sec. 2. This act is effective upon ratification.

In the General Assembly read three times and ratified, this the 27th day of February, 1981.

H. B. 647 **CHAPTER 281**

AN ACT TO ABOLISH THE OFFICE OF CORONER IN HERTFORD COUNTY.

The General Assembly of North Carolina enacts:

Section 1. The office of Coroner in Hertford County is abolished.

Sec. 2. Chapter 152 of the General Statutes is not applicable to Hertford County.

Sec. 3. This act is effective upon ratification.

In the General Assembly read three times and ratified, this the 3rd day of April, 1979.

H. B. 685 **CHAPTER 282**

AN ACT TO AUTHORIZE THE BOARD OF COMMISSIONERS OF GUILFORD COUNTY TO DELEGATE TO THE GUILFORD COUNTY PLANNING BOARD THE AUTHORITY TO CLOSE PUBLIC ROADS OR EASEMENTS.

The General Assembly of North Carolina enacts:

Section 1. The Board of Commissioners of Guilford County is hereby authorized and empowered to delegate to the Guilford County Planning Board the authority to close public roads or easements which power the county commissioners now have pursuant to G.S. 153A-241. Delegation pursuant to this section shall be by a resolution adopted at a regularly scheduled meeting of the board of county commissioners.

Sec. 2. The procedure for closing public roads or easements found in G.S. 153A-241 shall remain the same with the exceptions as noted in this act.

Sec. 3. For purposes of this act references found in G.S. 153A-241 to the board of commissioners shall refer to the planning board except for purposes of appeal.

Sec. 4. Any person aggrieved by the closing of a public road or an easement by the Guilford County Planning Board may appeal the planning board's decision to the Guilford County Board of Commissioners within 30 days after the decision to close a road or easement. The board of commissioners shall hear the matter de novo.

Sec. 5. Any person aggrieved by the closing of a public road or easement may appeal the board of commissioners' order to the appropriate division of the General Court of Justice within 30 days after the day the order is adopted. The court shall hear the matter de novo and has jurisdiction to try the issues arising and to order the road or easement closed upon proper findings of fact by the trier of fact.

Sec. 6. This act shall be in full force and effect from and after its ratification.

In the General Assembly read three times and ratified, this the 3rd day of April, 1979.

AN ORDINANCE REQUIRING A FRANCHISE FOR A SANITARY LANDFILL

WHEREAS, it has been determined by the Guilford County Board of Commissioners, that it is in the public interest and consistent with recent statutory requirements for the County to amend Chapter 15.5 of the Guilford County Code, to make it unlawful for any person to engage in the disposal of solid waste within unincorporated Guilford County without a franchise; and

WHEREAS, N.C.G.S. 153A-136 and N.C.G.S. 130A-294 authorize a county to grant a franchise for the disposal of solid waste within the County, and to make it unlawful for a person to operate such a public enterprise without a franchise.

NOW, THEREFORE, BE IT ORDAINED by the Board of County Commissioners that Chapter 15.5 of the Guilford County Code be amended by adding Section 15.5-5, entitled "Franchise Required", as follows:

(a) Grant of franchise required. It shall be unlawful for any person or applicant for a sanitary landfill permit from the State of North Carolina to operate a sanitary landfill (as defined in N.C.G.S. 130A-290, as amended) in unincorporated Guilford County without having been granted a non-exclusive franchise by the Guilford County Board of Commissioners to do so. This franchise shall be in addition to other approvals required by law, including but not limited to land use approvals. "Person" means an individual, corporation, company, association, partnership, unit of local government, state agency, federal agency, or other legal entity. Where applicable and unless a different meaning is required by the context, the words included herein and defined in N.C.G.S. 130A-290 or N.C.G.S. 130A-294 shall have the meaning stated in that statute.

(b) Information required. An applicant for a franchise must provide with the application complete, clear and accurate information regarding:

(1) a statement of the population to be served, including a description of the geographic area;

(2) a description of the volume, source and characteristics of the waste stream;

(3) a projection on the useful life of the landfill, an accurate estimate of any closure costs, and an undertaking in amount and form approved by the County Manager or his designee securing the full cost of said closure;

(4) number of employees the applicant expects to use in the business;

(5) name and address of the applicant and whether a sole proprietorship, corporation, or partnership, with disclosure of ownership interests;

(6) a list of equipment possessed, available to, or to be obtained by the applicant;

(7) the fee schedule for fees charged at the landfill;

(8) property description and site plan of the landfill; and

(9) liability insurance policies carried by the applicant. Said policies shall be good and sufficient, in the opinion of the County Manager or his designee, to insure payment for damages resulting from injury to property arising out of the collection, transportation or disposal of solid waste by the franchisee or its agents. Said policies shall contain a "hold harmless clause" indemnifying the County with respect to claims made against the franchise or County.

The franchise granted by the Board of Commissioners shall also contain that information. Applicants for a franchise should anticipate that the period of time for the processing of an application, including clarification requests by the County, could take up to six months. Provision of false or misleading information in the application may result in revocation of a franchise.

(c) Fees.

(1) The application fee for a franchise is hereby set by the Board of County Commissioners at $250.00. The fee may be waived by the Board as to a governmental landfill.

(2) The Board of Commissioners shall approve all fees to be charged by the applicant or operator of a sanitary landfill subject to a franchise under this ordinance. It shall be unlawful for the franchise to make charges greater or other than those approved by the Board. The franchisee may bill customers one month in advance of service. The fee to be charged by said operator may be changed by the Board as it deems necessary or expedient, by amendment to the franchise. The applicant or operator shall submit any proposed fee changes to the Board of Commissioners for approval by franchise amendment prior to the effective date of

the fee change.

(d) Term. A franchise shall be for a term determined by the Board, not greater than ten (10) years for any privately owned sanitary landfill. The term of the franchise for any landfill owned by a government entity shall be not greater than twenty (20) years. A franchise shall not be transferable in any manner whatsoever, by stock transfer, lease or otherwise.

(e) Compliance with franchise and applicable laws. Any person granted a franchise to operate and maintain a sanitary landfill shall be subject to the provisions and requirements of the franchise, this ordinance and all applicable laws, including N.C.G.S. 130A-294.

(f) Enforcement and revocation. Failure to comply with franchise requirements or applicable laws shall subject franchisee to revocation of the franchise, following notice and opportunity to be heard, and/or cause the franchisee to be subject to any other enforcement method or penalty allowed by law, including the Guilford County Code.

This ordinance shall be effective upon adoption. ADOPTED this _____ day of _____, 1995.

North Carolina Department of Cultural Resources

James B. Hunt Jr., Governor
Betty Ray McCain, Secretary

Division of Archives and History
Jeffrey J. Crow, Director

August 23, 1996

Richard A. Harper, R.F.
Project Manager
Rust Environment and Infrastructure, Inc.
P.O. Box 24000
Greenville, NC 29616

Re: Piedmont Landfill Expansion, Forsyth and Guilford Counties, ER 96-8153

Dear Mr. Harper:

Thank you for your letter of July 26, 1996, transmitting the archaeological survey report by Joel Gunn of Garrow and Associates concerning the above project.

During the course of the survey of the 310-acre landfill expansion area, Dr. Gunn located three archaeological sites. Site 31GF354**, a historic period artifact scatter, and 31GF353&353**, a prehistoric (Archaic) and historic period artifact scatter, have no integrity and no ability to yield information important to history or prehistory. We find that these sites are not significant nor are they eligible for listing in the National Register of Historic Places. No additional investigation of these two sites is recommended.

Historic period site 31GF352**, an antebellum farmstead, appears to contain intact features as well as a large variety and quantity of nineteenth century materials. Additional archaeological investigations in the form of Phase II testing are recommended for this site to fully assess its significance and determine its eligibility for inclusion in the National Register of Historic Places. Dr. Gunn has included an outline describing a testing phase for the site in his report. We concur that the proposed shovel tests, test units, feature sampling, and search for archaeobotanical remains are appropriate.

We recommend that the testing phase be undertaken as soon as possible to avoid project delays and to determine if mitigation measures will be needed.

Although the Lowe Memorial Holiness Church, located at the northwest intersection of SRs 2028 and 2027 is not located within the area to be developed, it may be within the project's area of potential effect. Please send a detailed project description (including traffic impacts) and photographs of the church. We cannot complete the review process until we receive these items.

These comments are made in accord with G.S. 121-12(a) and Executive Order XVI. If you have any questions regarding them, please contact Renee Gledhill-Earley, environmental review coordinator, at 919/733-4763.

Sincerely,

David Brook
Deputy State Historic Preservation Officer

DB:slw

cc: Jim Coffey
Solid Waste Section
Division of Waste Management, DEHNR

Dr. Joel Gunn
Garrow and Associates
417 North Boylan Avenue
Raleigh, NC 27603

Piedmont Landfill
and Recycling Center
9900 Freeman Road
Kernersville, North Carolina 27284
910/595-6677
FAX: 910/595-9735

A Waste Management Company

April 2, 1996

Mr.. James Coffey
North Carolina Dept. of Environment, Health, and Natural Resources
Department of Solid Waste Management (SWS)
401 Oberlin Road
Raleigh, NC 27611

Re: Request to Establish the Recycling of Wood Products at the Piedmont Landfill & Recycling Center (PLFRC), Kernersville, NC

Dear Mr. Coffey:

Please consider this as a request to begin the on-site recycling of wood products at the PLFRC. We have noticed over the past several months that there is a great deal of wood wastes being disposed of, and we believe we can put some of this wood waste to better use. The following is a brief description of the process we are requesting:

WASTES, WASTE SOURCES

It is expected that the following wood wastes would be the primary source of our recycling operations: pallets, land clearing debris, select construction debris, and select yard waste.

PROCESS DESCRIPTION

The PLFRC would receive the above waste as normal wastes, i.e., truck will be identified, weighed, etc. The waste will then be taken to a storage area and unloaded. When sufficient material has been accumulated, a chipper/grinder will be used to produce the end products. We envision that the size of the chip would be dependent upon the end use.

END USE OF THE WOOD PRODUCTS

The PLFRC hopes to be innovative in its use of these wood chips. We plan to use the chips as daily cover, roadway cover, and mulch for either use on site for sale/giveaway to the public.

Mr. Coffey, we are eager to begin this process as soon as possible, but in order to do our planning, we would first want to know if this operation would require a public notice/hearing period and/or local government approval. Please let us know if your decision concerning this matter.

If you have any questions, feel free to contact either Ed Gibson or myself @ (910) 595-6677.

Sincerely,

William R. Lewis, P.E.
Division President & General Manager

cc: Ed Gibson

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Piedmont Landfill
and Recycling Center
9900 Freeman Road
Kernersville, North Carolina 27284
910/595-6677
FAX: 910/595-9735

A Waste Management Company

April 2, 1996

Mr.. James Coffey
North Carolina Dept. of Environment, Health, and Natural Resources
Department of Solid Waste Management (SWS)
401 Oberlin Road
Raleigh, NC 27611

Re: Request to Recycle White Goods at the Piedmont Landfill & Recycling Center (PLFRC), Kernersville, NC

Dear Mr. Coffey:

Please consider this as a request to begin the on-site recycling of white goods at the PLFRC. We have noticed over the past several months that as we reject white goods at the PLFRC, some of these end up being dumped on the side of the road, creating an unsightly situation and an inconvenient one for us because we end up cleaning it up anyway. Therefore, we are requesting that the PLFRC be given permission to receive and store white goods onsite, remove the refrigerant, if necessary, and send the white goods to a metal recycler for processing. Mr. Coffey, we are eager to begin this process as soon as possible, but in order to do our planning, we would first want to know if this operation would require a public notice/hearing period and/or local government approval. Please let us know if your decision concerning this matter.

If you have any questions, feel free to contact either Ed Gibson or myself @ (910) 595-6677.

Sincerely,

William R. Lewis, P.E.
Division President & General Manager

cc: Ed Gibson

Printed on Recycled Paper

Piedmont Landfill
and Recycling Center
9900 Freeman Road
Kernersville, North Carolina 27284
910/595-6677
FAX: 910/595-9735

A Waste Management Company

March 1, 1996

Ms. Sherri Coghill
North Carolina Dept. of Environment, Health, and Natural Resources
Department of Solid Waste Management (SWS)
401 Oberlin Road
Raleigh, NC 27611

Re: Request to Revise the Final Cover Geomembrane Material and the PLFRC's Permitted CQA Plan; Piedmont Landfill & Recycling Center (PLFRC), Kernersville, NC

Dear Ms. Coghill:

Please consider this a request on behalf of the PLFRC to change the final cover geomembrane material and also the site's approved CQA Plan. Attached please find the following documents related to this request:

- Exhibit A, showing a new final cover profile. The only difference between this Exhibit and the permitted final cover profile is the geomembrane specified. The proposed exhibit requests 40 mil *FrictionSeal*™ instead of the permitted, 40 mil coextruded geomembrane If approved by the SWS, this new exhibit will replace detail No. 3 shown on Sheet No.9 of the approved design plans.

- A completely revised Construction Quality Assurance Plan (CQA Plan) for the Piedmont Landfill (text only, Appendices remain the same). The construction quality assurance for the ***base liner*** is the same as the approved CQA Plan. The enclosed plan revises the ***final cover*** CQA by excepting a number of superfluous requirements contained in the existing, permitted plan. This is discussed farther in the paragraphs below. If approved by the SWS, this new CQA Plan will replace the existing CQA plan.

- A spreadsheet comparing the major differences between the existing, permitted CQA Plan and the proposed requested changes. This spreadsheet is also accompanied by the appropriate justification for these changes.

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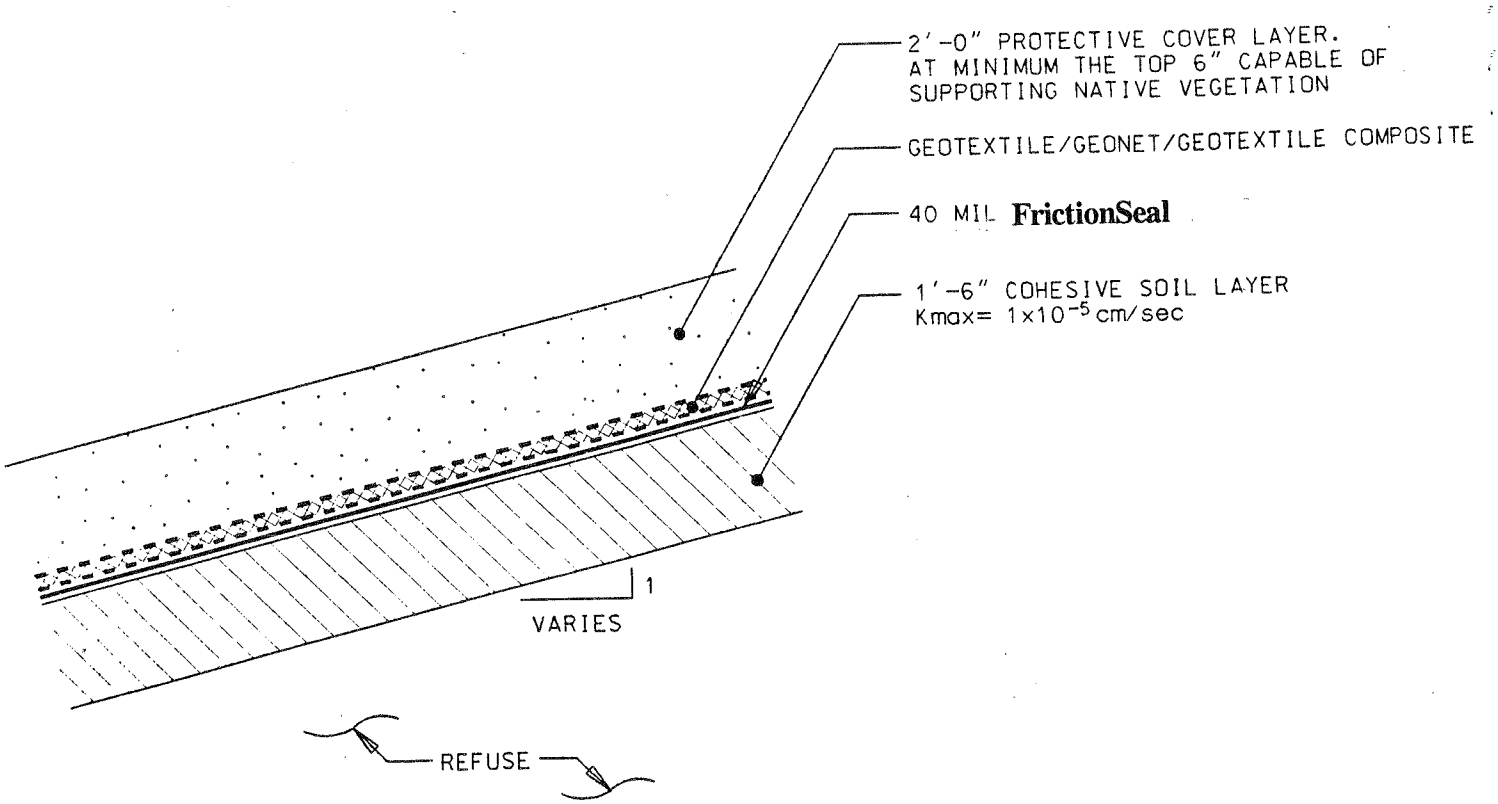
Sherri, it is the PLFRC's intention to commence final cover construction of a 30 acre portion of the landfill in May of this year. We would certainly appreciate your expedient response in this matter and if you have any questions, feel free to contact either Ed Gibson or myself @ (910) 595-6677.

Sincerely,

William R. Lewis, P.E.
Division President & General Manager

cc: Ed Gibson
Brent Rockett



FINAL COVER

Exhibit A

WASTE MANAGEMENT OF CAROLINAS, INC.

CONSTRUCTION QUALITY ASSURANCE PLAN

FOR

PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

DECEMBER 1993
REVISED APRIL 1994
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Prepared By:
WASTE MANAGEMENT OF CAROLINAS, INC.
KERNERSVILLE, NORTH CAROLINA

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CONSTRUCTION QUALITY ASSURANCE PLAN
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, FORSYTH COUNTY, NORTH CAROLINA

1.0 INTRODUCTION

The North Carolina Department of Environment, Health and Natural Resources - Division of Solid Waste Management requires a program of Construction Quality Control Assurance (CQA) for various elements of the Piedmont Landfill and Recycling Center (Piedmont LRC) in Forsyth County, North Carolina. The purpose of this document is to define the scope, formal organization and procedures used to verify that work performed meets the project requirements and the CQA plan. This document also details the formal procedures and test methods utilized to ensure conformance of construction to plans, specifications or other criteria established for the project.

The CQA plan details the necessary information and guidance to verify that the components of liner, and leachate collection system for Phase 3 and final cover are constructed in compliance with approved plans and specifications. Modifications to this plan may be allowed upon Construction Quality Assurance Project Manager and Design Engineer approval. The specified quality assurance testing and measures, along with the required frequency of tests, are also provided herein. Detailed in this plan are guidelines for organization and minimum qualifications of the CQA personnel as well as the minimum standards for construction, testing and documentation to assure quality construction.

2.0 PROJECT QUALITY ASSURANCE/QUALITY CONTROL TEAM

2.1 PROJECT TEAM RESPONSIBILITIES

The project team responsible for implementing the CQA plan will be accountable to the site owner or designated owner representatives. The CQA project team will generally consist of a Construction Quality Assurance Project Manager (CQAPM), Certifying Engineer (CE), Senior Site Quality Assurance (SSQA) Technician, and an appropriate number of assistants to accomplish the work plan. The CQA team will use sound engineering judgement when determining what additional procedures, other than those outlined in this plan, may be required in order to further assure the construction quality. The CQA team will operate independently of the contractors' quality control team.

2.2 CONSTRUCTION QUALITY ASSURANCE PROJECT MANAGER (CQAPM)

The CQAPM will manage the earthwork and geosynthetics testing for CQA programs and be responsible for preparation of a CQA documentation report. The CQAPM will have

knowledge of permit requirements, plans and specifications for the project. The CQAPM is responsible that the flow of information between the SSQA Technician and CE is presented to the Contractor and Owner for problem resolutions.

The CQAPM will visit the site to inspect and document the work activities during the duration of the project. The CQAPM will be responsible for the overall administration of the quality assurance procedures and for the control of construction quality control documents. The CQAPM will be responsible for oversight and coordination of the CQA program (CE, SSQA Technician and CQA technicians), surveying and testing laboratories. The CQAPM, CE and SSQA Technician shall have daily dialogue on project status.

2.3 CERTIFYING ENGINEER (CE)

The project CE will be a professional engineer registered in the State of North Carolina. The CE shall have knowledge of plans and specifications for the project and is responsible (in conjunction with the CQAPM) for informing the contractor or landfill operator of any portion of the work or construction procedures that does not meet the design specifications.

The CE will visit the site to inspect and document the work activities during the clay liner, geomembrane liner, and leachate collection system installation to ensure that the project specifications are being met. The CE will also review all field and laboratory test data and all field reports to ensure design specification compliance. Any item requiring attention or approval will be attended to promptly by the CE and CQAPM. The CE will have the ultimate responsibility for approving and disapproving any element of the project based on the above mentioned factors and will certify the final construction is in conformance with the project plans, specifications, and the site specific CQA Plan.

2.4 SENIOR SITE QUALITY ASSURANCE TECHNICIAN (SSQA)

The SSQA Technician is the primary on-site representative of the CQA team. The SSQA Technician is responsible for performing or assuring performance of the sampling and testing required for implementation of this CQA plan. The SSQA Technician is accountable to the CQAPM. The SSQA Technician will be familiar with the tests, processes, and materials involved in the construction of compacted clay liners, leachate collection systems, geosynthetics, and any other elements involving landfill construction.

The SSQA Technician will be on site daily and monitor all appropriate construction operations. He will oversee all sampling and field testing. The SSQA Technician will log the construction activities on a daily basis. If necessary the CQAPM or CE will assume the duties and responsibilities of the SSQA Technician.

2.5 QUALITY ASSURANCE TECHNICIANS

Quality Assurance technicians will be required to assist the SSQA Technician in performance of his duties. CQA technician(s) will report directly to the SSQA Technician. All test results will be forwarded daily to the SSQA Technician to be included in the daily field report.

2.6 COMMUNICATION

To help ensure a high degree of quality during installation and assure a final product that meets all project specifications, clear, open channels of communication are essential between all parties. This section discusses appropriate lines of communication and describes all meetings that will be necessary to achieve project goals. The typical lines of communication necessary during a project will be coordinated through the project manager. Details of the communication process will be discussed at the preconstruction meeting.

A preconstruction meeting shall be held at the site prior to beginning of lining system installation. Typically, the meeting shall be attended by the CQA Project Manager,~~r~~ Earthwork Contractor, Geosynthetic Installer, SSQA Technician and the Owner's technical representative. In addition, the Division will be invited to attend. Specific topics considered for this preconstruction meeting include review of the project CQA Plan for any problems or additions. The responsibilities of each party shall be established and understood clearly. During the preparation of and placement of the soil liner and the geosynthetic liner the CQA Certifying Engineer (CE) with support from the Owner or Owner's Representative (project manager) will have control of stop work due to conditions not meeting the requirements of the permit, specifications, drawings and or the site specific Construction Quality Assurance Plan. The Owner/Owner's Representative, CE, or SSQA Technician will notify the contractor of any conditions that does not meet requirements or material being installed (clay liner, geomembrane, etc.). The SSQA Technician shall keep the CE and the Owner's PM aware of site conditions on a daily basis. A recommended agenda with specific topics for the preconstruction meeting is presented in the attached example. The meeting shall be documented by a person designated at the beginning of the meeting, and minutes shall be transmitted to all parties.

A weekly progress meeting shall be held between the SSQA Technician, Earthwork Contractor's/Installer's Superintendent, Project Manager and any other concerned parties. this meeting shall discuss current progress, planned activities for the next week, issues requiring resolution, and any new business or revisions to the work. The SSQA Technician shall log any problems, decisions, or questions arising at this meeting in his weekly report. If any matter remains unresolved at the end of this meeting, the Project Manager shall be responsible for the resolution of the matter and the communication of the

decision to the appropriate parties. The Project Manager may require daily progress meetings at his discretion.

3.0 SOIL TESTING

3.1 SOIL LINER SOURCE IDENTIFICATION

Soil liner material may be obtained from off-site borrow sources and/or on-site soils may be admixed with bentonite to achieve permeability requirements. Overburden soils not segregated for use in the soil subbase or soil liner will be stockpiled separately on the site and used as daily or intermediate cover. Soils will be distinguished by visual/manual classification procedures (ASTM D-2488) and any other procedures that are appropriate.

3.2 PRE-CONSTRUCTION TESTING REQUIREMENTS

3.2.1 Soils

Soil material for use in compacted subbase and soil liner, which are stockpiled prior to construction of the landfill cells, will be tested at specified frequencies and whenever a change in material occurs. The test results will be evaluated for suitability prior to construction. The testing program shown in Table 1 for each material source will be utilized to define appropriate compaction specifications which will yield a high level of confidence that permeability requirements are met.

A soil liner test pad will be required to be constructed by the contractor using the same equipment intended for use during the construction of the actual soil subbase or clay liner in the landfill cell. This test strip will then be tested for actual field verification of the aforementioned soil properties by comparison with the laboratory test data. Correlations for the Atterberg limits, soil density, moisture content and permeability will be established. By compiling this data, the need for continuous testing is reduced. The established relationship can be used as a reference to compare the field results to predetermined moisture-density-permeability relationships. If materials change relative to the referenced lab data, a sample of the new material will be sent to the lab for evaluation and subsequently field verified using the previously described test strip method. The new test results will be added to the family of data thereby updating the reference.

3.2.2 Protective Cover Material

The protective cover materials will be placed and consist of material which will not cause damage to the underlying geosynthetic materials.

4.0 EARTHWORK

4.1 EXCAVATION

Excavation within the cell areas will proceed to the subgrade elevations provided in the permit drawings.

The SSQA Technician will verify that the excavated material is properly separated and stockpiled according to soil types. The SSQA Technician will inspect the excavation operation to verify that proper construction procedures are followed.

4.2 SUBBASE PREPARATION/CONSTRUCTION

The subbase will be constructed of suitable material as defined in the construction drawings and specifications. Unsuitable material such as organic, silt, or muck will be removed, replaced, and compacted with suitable soil material. Upon attainment of the final subbase beneath the soil liner, the entire subbase will be inspected, surveyed and approved by the SSQA Technician and CE.

4.3 CONSTRUCTION OBSERVATION

Observation of the soil liner construction will be coordinated with construction testing. At a minimum, the SSQA Technician will observe and record the following during the construction of soil
liners:

1. Moisture content and consistency of the soil during processing, placement, and compaction.

2. Type and level of compactive effort
   a. Roller type
   b. Roller weight
   c. Number of coverages

4.4 CONSTRUCTION TESTING

All construction quality assurance testing will be conducted in accordance with this CQA Plan. Field and laboratory tests will be conducted on samples taken from the soil liner materials during the course of the construction work. Testing and sampling procedures will be observed and documented by the SSQA Technician. Documentation and reporting of test results will be in accordance with the requirements identified in this CQA Plan.

4.4.1 Field Testing

The SSQA Technician will perform as a minimum, the following field tests on each lift of the compacted soil:

1. Field moisture content (ASTM D2216)
2. Field density (ASTM D2922, D1556, or D2167)
3. In-situ shear strength with pocket penetrometer.

Unless otherwise specified in the project specifications, these tests will be performed at a frequency of one per 10,000 ft^2 (1,000 m^2) area or less of each compacted lift. Sampling locations will be selected by the SSQA Technician.

Nuclear density tests (ASTM D2922) will be preferred for density (dry unit weight) testing for most projects. The location of routine in-place density tests can be determined using a non-biased sampling plan based on random selection of testing locations. Test penetrations will be backfilled with bentonite. Questions concerning the accuracy of any single test will be addressed by retesting in the same general location. Periodic checks using the Sand-Cone Method (ASTM D1556) or other standard techniques required in the project specifications may be performed to verify the nuclear density test results.

5.0-A <u>SOIL LINER</u>

5.0-A1 QUALITY CONTROL/QUALITY ASSURANCE PROCEDURES

Each soil liner lift will be compacted to a dry density of no less than the dry density required to attain acceptable permeability properties. Each lift thickness after compaction will no be greater than six (6) inches. Each compacted 6-inch thick lift will be tested for density and moisture content. The soil will be compacted within the specified range of water content. Loose thickness and initial (before compaction) water content will be tested at a frequency not less than one for every 10,000 sq. ft. of compacted clay area, but at least once per lift. The number and locations of the moisture-density tests will be at a frequency of one for every 10,000 sq. ft. and documented by the SSQA Technician.

The SSQA Technician may require additional testing in areas he believes may not meet specifications. Soil liner compaction should be monitored to locate and test any potential problem areas. If the compacted layer does not meet the required compactive effort, the SSQA Technician will perform additional tests, if necessary, to locate the extent of the area that needs to be recompacted and report it immediately to the CQAPM or CE and the Contractor. After corrective actions are taken, the SSQA Technician will perform additional tests to determine if the area has been brought up to design specifications.

5.0-A2 TESTING AND ACCEPTANCE

A grab sample of soil used for the soil liner will be obtained for at least every 5,000 cy for laboratory permeability testing. In order to ensure that correct material is being used, one sample of soil will be obtained for every 5,000 yd^3 for density testing. Classification tests will be performed for every 3,000 yd^3 of clay material. The frequency of confirmatory Proctor testing may be relaxed once the CQAPM has established a family of Moisture-Density curves relating to Atterberg limits and percent fines and permeability.

The SSQA Technician will verify that the required thickness of compacted soil has been installed; this verification will be performed by surveying prior to and after placement of the compacted soil liner. The total compacted soil liner thickness will be a minimum of 24 inches with a maximum permeability of 1×10^{-7} cm/sec and a smooth rolled surface. Any core holes performed for sampling or any other purposes, will be completely plugged with bentonite pellets. Any disturbance to the surface during sampling or any other activity will also be smooth rolled. The CE will certify the completed soil liner. The approval will be accompanied by a report which includes "as-built" drawings, and a description of the testing program, test results and any other necessary documentation.

5.0-A3 DEFECTS AND REPAIRS

5.0-A3.1 Identification

Acceptability criteria for testing will be as identified in the CQA Plan. At locations where the testing indicates the requirements of the project specifications are not met, the SSQA Technician will determine the extent and the nature of the defect and report the findings to the CQAPM or CE.

The SSQA Technician will confirm that no stones are present which may damage overlying geosynthetic components. If the compacted soil liner has been subject to adverse weather conditions, the SSQA Technician will reexamine the soil for possible damage.

5.0-A3.2 Notification

After determining the extent and nature of any defect, the SSQA Technician will promptly notify the Earthwork Contractor and the CQAPM or CE. A work deficiency meeting will be held as needed between the Earthwork Contractor, SSQA Technician, Designer, and other appropriate parties to assess the problem, review alternative solutions, and implement an action plan.

5.0-A3.3 Repairs and Retesting

The Earthwork Contractor will correct all deficiencies to meet the project specifications.

The SSQA Technician will schedule appropriate retests when the work defect has been corrected. All retests by the SSQA Technician will verify that the defect has been corrected before any additional work is performed by the Earthwork Contractor in the area of the deficiency.

The SSQA Technician will observe any repair and report any noncompliance with the above requirements in writing to the CQAPM or CE.

5.0-A4 SOIL LINER TEST PAD

The purpose of a test pad is to verify that the materials and installation requirements specified in the project plans and specifications to be used during construction of soil liners can meet the required performance standard. This test pad program will also allow the Earthwork Contractor, Designer, Owner, and CQAPM to identify appropriate placement and compaction procedures. Once the detailed construction procedures have been established during the test pad program, the Earthwork Contractor and the SSQA Technician will monitor the soil liner construction procedures as an indicator that the performance standards are being achieved. This test pad program may be modified based on site-specific design, and construction.

5.0-A4.1 Construction Preparation

5.0-A4.1.1 Test Pad Material

Source evaluation testing of the proposed soil liner material shall be performed prior to construction of the test pad. The material shall be evaluated in accordance with Section 5.4.3.1 of this document. These tests shall provide the basic relationship of hydraulic conductivity with varying water content, dry unit weight and compactive effort (Figure 1).

5.0-A4.1.2 Construction Equipment

The equipment to be used for a test pad shall be proposed by the Earthwork Contractor and approved by the CQAPM, CE and SSQA Technician. The equipment to be used for the test pad shall be consistent with the equipment which will be used during liner construction.

5.0-A4.1.3 Subgrade Preparation

The area within the limits of the test pad shall be cleared and grubbed of all trees, brushes, stumps, roots, debris, trash, and any other vegetation or objectionable material. Following clearing and grubbing, the area shall be stripped of topsoil.

The surface of the subgrade shall be proof-rolled so as to be free of soft zones, irregularities, loose earth, and abrupt changes in grade. The subgrade and test pad shall be sloped at an approximate 2 percent grade or as sloped in the cell. Line and grades shall be controlled by survey. No standing water or excessive moisture shall be allowed on the surface of the subgrade. The surface shall be observed by the SSQA Technician prior to beginning construction of the test pad.

5.0-A4.2 Test Pad Construction

The test pad shall be a rectangle approximately 100 feet long by 50 feet wide (Figure 2). The test pad shall be constructed in uniform horizontal lifts with a total thickness consistent with the project plans and specifications. The construction procedures, which vary with the lift considered, are intended to allow determination of a relationship between soil measurements and compaction method parameters. Soil measurements include water content, dry unit weight, and hydraulic conductivity. Compaction method parameters includes compactor characteristics, thickness of compacted/uncompacted layers, number of compactor passes, and water content.

5.0-A4.2.1 First Lift

A. Should the test pad be built outside the cell being constructed a geotextile or drainage layer shall be placed by the Earthwork Contractor over the subgrade area of the test pad. The geotextile or a drainage layer should extend beyond the edge of the test pad allowing an outlet for test pad infiltration.

B. The first lift of test pad material shall be placed to a thickness resulting in 6 inches after compaction or as required in the project specifications.

C. Soil water content shall be maintained in the Acceptable Zone as determined during source evaluation testing. The Earthwork Contractor shall adjust the water content as necessary to obtain the specified density criteria.

D. The test pad material shall be compacted with two one-way coverages using the previously agreed upon compaction equipment.

E. The Earthwork Contractor shall allow the SSQA Technician to perform in-place measurements of moisture content and density tests and collect soil samples.

F. Holes in each lift shall be repaired with a 50% soil and 50% bentonite mixture.

G. The test pad material shall be compacted a second time by applying two more one-way coverages with the selected compactor.

H. A second series of tests shall be taken near the original tests. Repeat Steps E and F.

I. The test pad material shall be compacted a third time by applying two more, one-way coverages.

J. A third series of tests shall be taken near the first and second tests. Repeat Steps E and F.

K. Steps I and J shall be repeated and continued until specified compaction criteria are obtained as identified by the SSQA Technician.

5.0-A4.2.2 Second Lift

A. The loose thickness of the second lift shall be such that the thickness of the compacted lift will be 6 inches after compaction or as required by the project specifications.

B. A competent bond with the first lift shall be achieved by the Earthwork Contractor and observed by the SSQA Technician.

C. Steps C through K of Section 5.4.2.1 shall be repeated.

5.0-A4.2.3 Remaining Lifts

A. The loose thickness of the remaining lifts shall be such that the thickness of the lifts will be 6 inches after compaction or as required by the project specifications.

B. The procedures for compacting and testing the remaining lifts shall be those that have been tested and proven effective during the compaction of the second lift.

5.0-A4.3 Testing and Observations

5.0-A4.3.1 Construction Preparation

The SSQA Technician shall perform testing on the soil liner material prior to its use in the test pad. Source evaluation testing will include at a minimum the following unless

otherwise specified in the project specifications:

- Water Content (ASTM D2216)
- Particle Size (ASTM D422, D1140)
- Atterberg Limits (ASTM D4318)
- Laboratory Compaction (ASTM D698 for standard Proctor or ASTM D1557 for modified Proctor)
- Laboratory Hydraulic Conductivity at a specified compaction (ASTM D5084)
- Soil Classification (ASTM D2487)

The SSQA Technician shall observe the prepared subgrade for firmness, smoothness, and absence of abrupt changes in grade. The subgrade shall be surveyed to serve as the origin for determining thicknesses.

5.0-A4.3.2 Test Pad Construction

The SSQA Technician shall perform tests and make observations during the construction of the test pad to enable development of a curve providing in-place dry unit weight versus number of compactor coverages (Figure 3). Test sample locations shall be selected by the Soil QAC. An example of test sample locations and configuration is provided in Figure 4.

During the construction of the first and second lifts, the SSQA Technician shall perform the following activities:

- Estimate the thickness of the loose lifts

- Count the number of compactor coverages and observe compactor coverage of the test pad

- Perform a minimum of eight nuclear gauge in-place measurements of water content and dry unit weight (ASTM D2922) for every two compactor coverages, and a minimum of one in-place test using the sand-cone method (ASTM D1556) to verify the nuclear gauge readings; compute degree of compaction (in-place dry unit weight divided by the Standard Proctor maximum dry unit weight); collect four additional soil samples for moisture content determination (ASTM D2216)

- Observe the repair of holes left in the lift as a result of testing and soil sample collection

During construction of the remaining lifts, the Soil QAC shall perform the following activities:

- Verify that the thickness of the loose lift thickness determined from testing of the second lift
- Count the number of compactor coverages, determined from testing of the second lift, which are necessary to achieve the compaction in the Acceptable Zone and observe compactor coverage of the test pad

- Perform a minimum of eight tests nuclear gauge in-place measurements (ASTM D2922) and one sand-cone test (ASTM D1556) per lift to verify the adequacy of the construction procedures previously established

During the construction of the test pad, the SSQA Technician shall collect a minimum of six undisturbed Shelby tube samples from varying depths of the completed test pad. The samples shall be waxed or otherwise protected to retain natural water. The samples should be tested in the laboratory for the following:

- Water Content (ASTM D2216)
- Particle Size (ASTM D422)
- Atterberg Limits (ASTM D4318)
- Laboratory Hydraulic Conductivity (ASTM D5084)
- Soil Classification (ASTM D2487)

The SSQA Technician shall observe the test pad to verify the adequacy of the bonding between adjacent lifts. Such observation shall be exercised on the portion of the test pad which has been excavated to permit removal of undisturbed soil block samples and/or the sand-cone density testing.

5.0-A4.3.3 Final Surface Preparation

The Soil QAC shall observe the prepared surface for firmness, smoothness, and absence of abrupt changes in grade. The final surface will be surveyed to verify the test pad thickness.

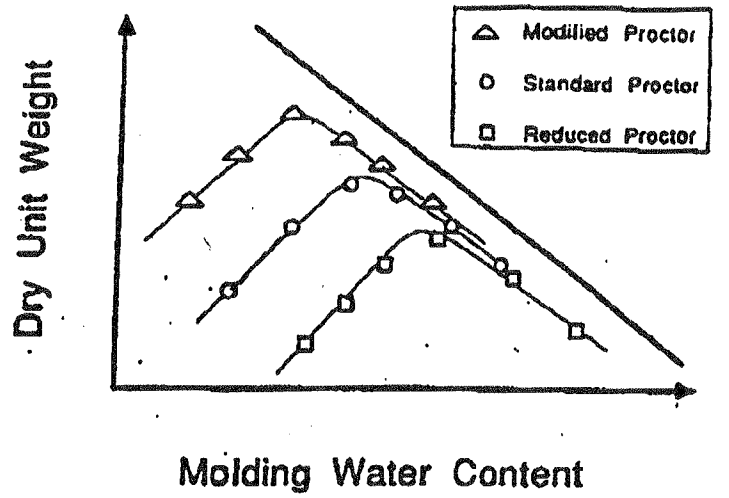
5.0-A4.4 Documentation

The SSQA Technician shall document activities associated with the preparation, construction, testing, and observation of the test pad and provide recommendations on placements and compaction procedures. A documentation summary report shall be prepared that contains information on the test pad material, construction equipment, subgrade preparation, test pad construction, and testing and observations. The report shall also include daily reports of construction activities and oral communications with the Earthwork Contractor, CQAPM and CE.

The SSQA Technician shall provide a water content/dry unit weight relationship for the test pad material and other source material test results. The SSQA Technician shall document testing and observations on subgrade preparation, test pad construction, and final surface preparation, including but not limited to:

- Compactor type, configuration, and weight for sheepsfoot compactors, drum diameter and length, empty and ballasted weight, length and face area of feet, and yoking arrangement
- Thicknesses of lifts prior to and after compaction
- Dry unit weight versus number of compactor coverages for each lift thickness, as specified in Section 5.4.3.2
- Number of compactor coverages which will provide the specified compaction in the Acceptable Zone and hydraulic conductivity that meets the performance standard
- Procedure to bond lifts
- Recommended installation procedures
- Results of water content, in-place density and degree of compaction
- Description of repair of holes left in the lift as a result of density testing and soil sample collection, as specified in Section 5.4.3.2
- Results of laboratory hydraulic conductivity testing and other soil property tests performed on undisturbed soil samples
- Drawings of the test pad and locations of all test samples for each lift
- Cross sections of the test pad showing number of lifts and lift thickness
- Description of actual construction procedures
- Test pad excavation for removal of undisturbed soil samples and observations of layer bonding.

The SSQA Technician, CE and CQAPM shall submit the final documentation summary report to the Owner. The Owner shall submit the report to the NCDEHNR.



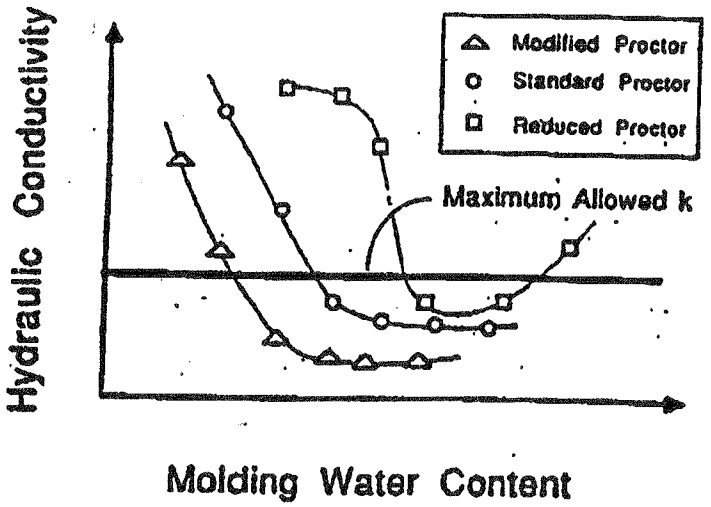


FIGURE 1 – COMPACTION CURVES AND HYDRAULIC CONDUCTIVITY CURVES

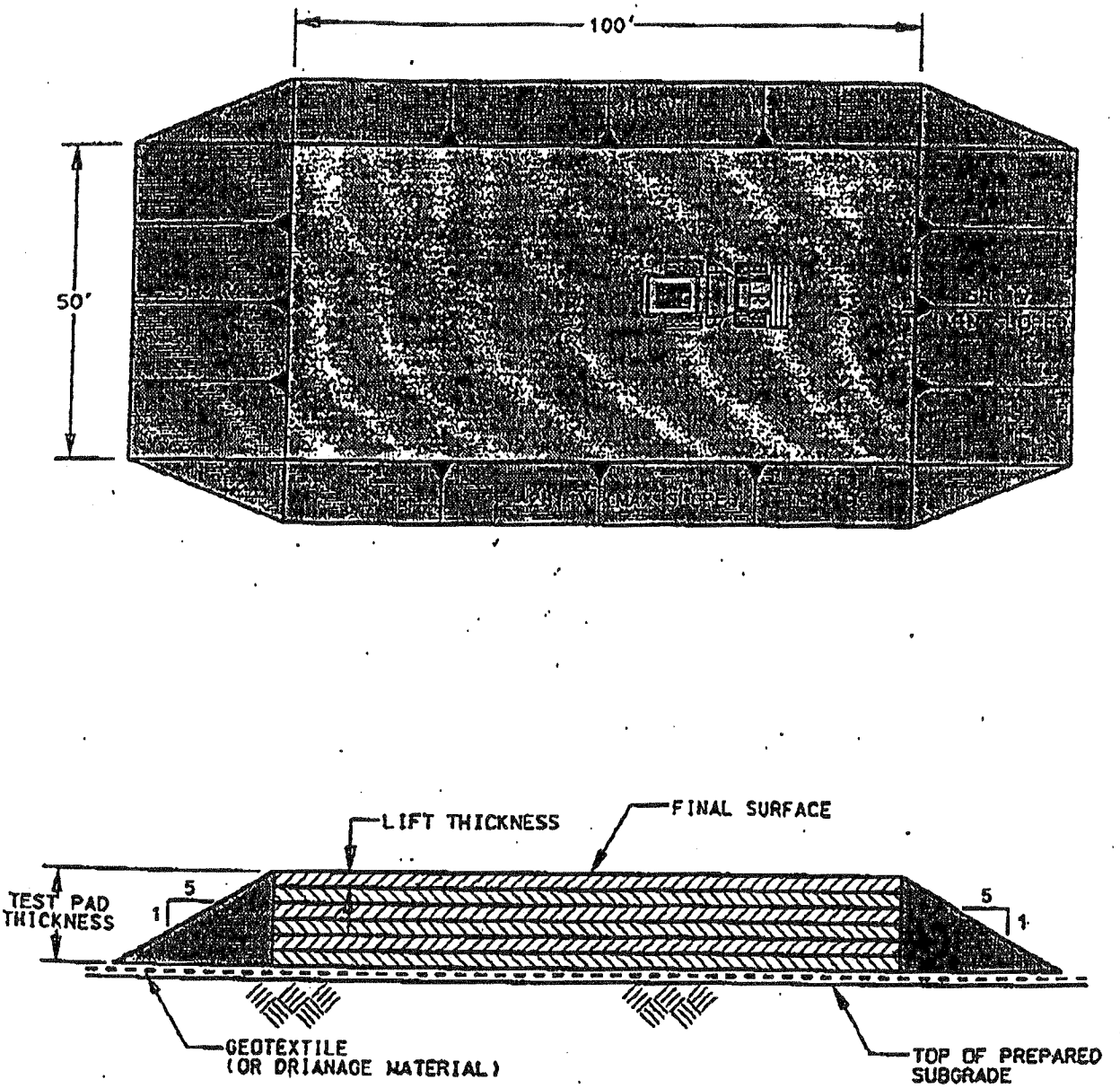


FIGURE 2 – TYPICAL TEST PAD CONFIGURATION

NTS

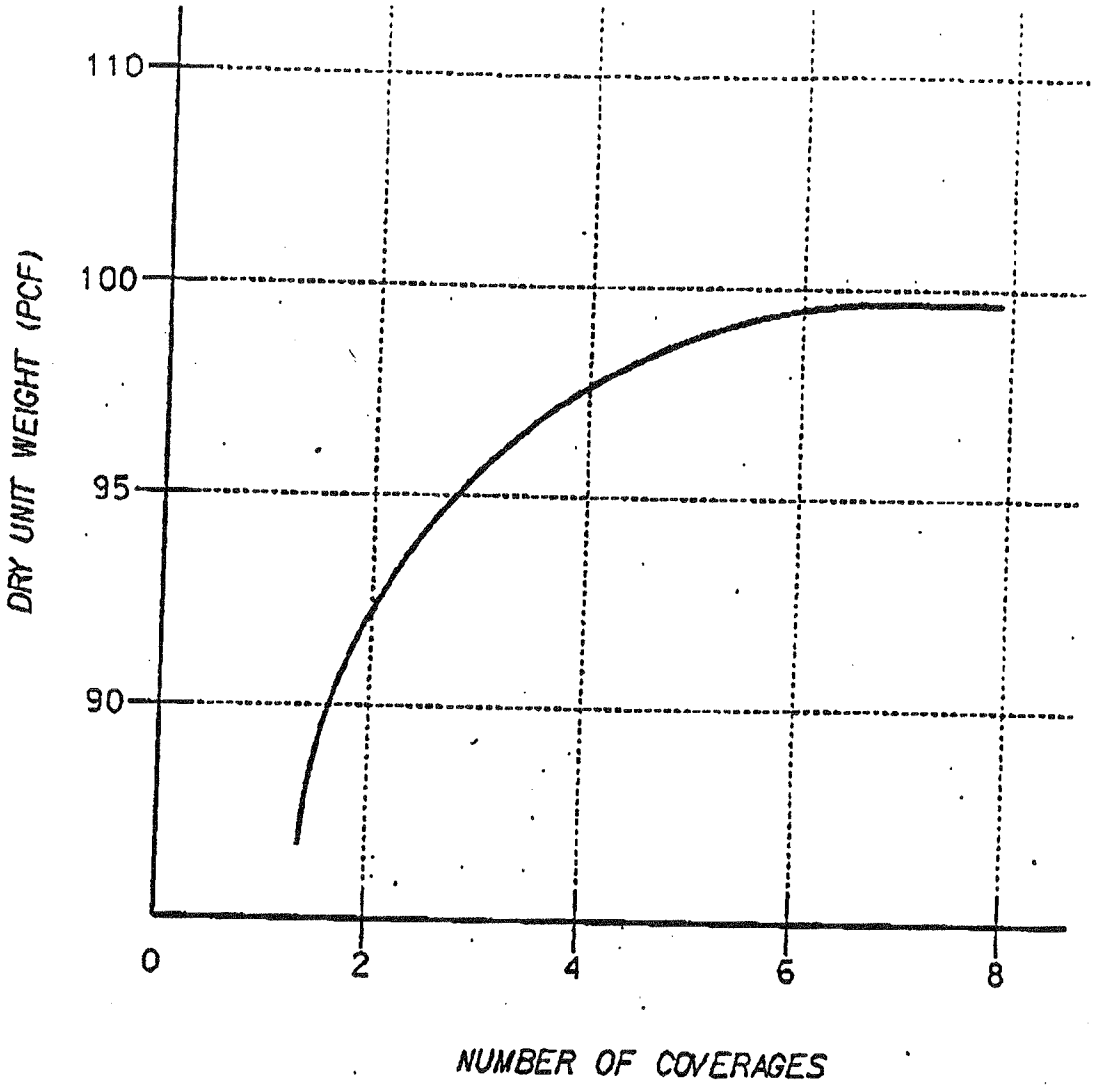
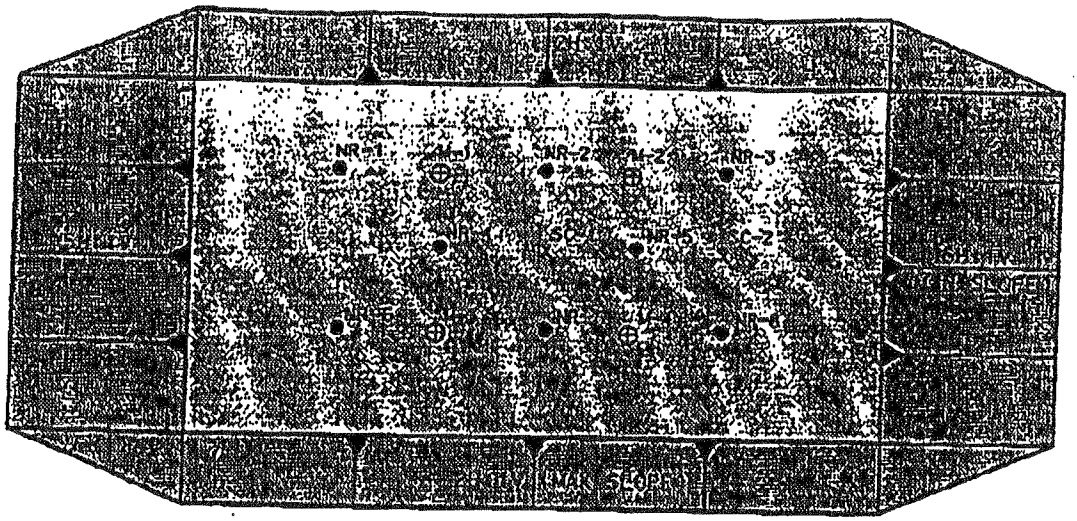
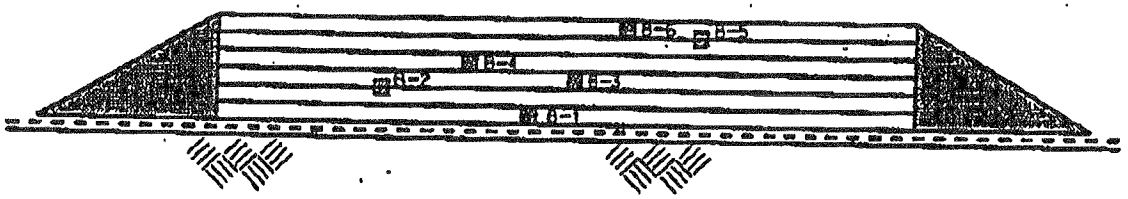


FIGURE 3 – EXAMPLE RELATIONSHIP BETWEEN DRY UNIT WEIGHT AND NUMBER OF COMPACTOR COVERAGES





LEGEND

NR-1	NUCLEAR GUAGE READING ON DENSITY AND MOISTURE (8 MIN/LIFT)
SC-1	SAND CONE TEST (2 MIN/LIFT)
M-1	MOISTURE CONTENT SAMPLE (4 MIN/LIFT))
B-1	SHELBY TUBE OR BLOCK SAMPLE FOR LABORATORY TESTING (6 MIN PER TEST FILL AT VARYING DEPTHS)

FIGURE 4 – TYPICAL TEST SAMPLING CONFIGURATION

NTS

5.0-B FINAL COVER

5.0-B1 *SOIL*

5.0-B1.1 Preconstruction Sampling and Testing

Preconstruction sampling and testing will be conducted to determine the properties and suitability of soils for construction of the recompacted cohesive soil cap. These requirements will be conducted according to Table IA.

The recompacted cohesive soil shall be constructed in accordance with the following specifications, except where required differently by the design plans and specifications.

a. Compaction as necessary to meet the required permeability.
b. Allowable moisture content greater than or equal to optimum as determined by standard Proctor (ASTM D 698) and as necessary to meet specified permeability.
c. Required soil hydraulic conductivity of 1.0×10^{-5} cm/sec as determined by ASTM D 5084.
d. Maximum compacted lift thickness of 8 inches or depth of sheepsfoot, whichever is less.
e. Minimum cohesive soil lift thickness of 1.5 feet.
f. Not placed below temperatures of 32 degrees F; unless material temperature is demonstrated as above freezing.

5.0-B1.2 Construction Monitoring and Conformance Testing

Quality control of the recompacted cohesive soil shall consist of monitoring the work as soil construction proceeds. Laboratory and field testing shall be performed in conjunction to ensure that recompacted cohesive material conformance and construction performance specifications are achieved.

1.) Monitoring and Observations.

A SSQA Technician will monitor and test the recompacted cohesive soil during construction to ensure performance specifications are achieved. The CE will visit the site periodically as construction progress warrants. Such visits will be frequent enough so that he/she is fully knowledgeable of the construction methods and performance so that he/she can determine that quality control monitoring and testing activities are adequate to meet the terms and intent of this document.

Observations shall include, but not be limited to, the following:

a. Classification, moisture content and distribution, particle size, and other physical properties of the soil during placement and compaction.
b. Type and level of compactive effort, including roller type and weight, drum size and foot length, and number of passes.
c. Action of compaction equipment on soil surface (i.e. foot penetration, rolling, pumping, or shearing).
d. Maximum clod size and breakdown of soil structure.
e. Method of bonding lifts together for fill locations.
f. Removal of stones, roots or other foreign materials which may damage overlying geosynthetic components or adversely affect compaction, lift bonding, and in-place testing/sampling.
g. Repair of areas where damage due to excess moisture, insufficient moisture, or freezing may have occurred.

2.) Construction Testing

During recompacted cohesive soil construction, the minimum testing and sampling program shown in Table 1 shall be conducted to ensure that adequate compaction and material conformance are being achieved.

5.0-B1.3 Post-Construction Care of the Recompacted Cohesive Soil

The constructed cohesive soil shall be protected from desiccation and frost damage. Conversely, the area shall be kept free of standing water by adequately grading and/or water removal. Damage caused by rain shall be repaired, and if the lift must be reworked, then appropriate retesting shall be performed.

5.0-B2 ***GEOSYNTHETICS***

This section presents general procedures, quality control and quality assurance testing requirements for the geosynthetic components used in construction. The geosynthetic liner system for this project will include the following components:

a. Geonet with heat bonded non-woven geotextile
b. 40- mil FRICTIONSEAL geomembrane

5.0-B2.1 Pre-Installation Material Evaluation

Prior to the installation of any geosynthetic layer (geomembrane or geocomposite), the manufacturer or installer shall provide the CQAPM with quality control certificates signed by an acceptable responsible party employed by the manufacturer. Each quality control certificate shall include roll identification numbers, testing procedures, and results of quality control tests. The quality control tests shall be performed in accordance with project-specific testing methods and subject to the following testing frequency. The quality control testing may be performed in the manufacturing plant. The CQAPM shall review the test results prior to acceptance to ensure that the certified minimum properties meet the project specifications. At a minimum, results shall be given for:

Geocomposite 1 per 40,000 ft^2	• Mass Per Unit Area (ASTM D 3776) • Thickness (ASTM D 1777) • Geotextile-Geonet Adhesion (ASTM D 413)
Geomembrane 1 per 100,000 ft^2	• Density (ASTM D 1505) • Carbon Black Content (ASTM D 1603) • Thickness (ASTM D 5199) • Tensile Properties (ASTM D 638) • Multi-Axial Tensile Elongation (GRI GM-4) (1 per 250,000 ft^2)

1.) <u>Handling and Storage of Geosynthetics</u>

Geosynthetics are usually shipped in rolls and shall be marked to show the following minimum information. Manufacturer's certificates should be cross-referenced to rolls delivered on site.

a. Name of manufacturer/fabricator
b. Product type
c. Product thickness
d. Manufacturing batch code or roll number
e. Date of manufacture
f. Physical dimensions (length and width)

The CQA technicians shall observe and document the geosynthetics delivered to the job site. The material shall be inspected for any damages from punctures, tears, blocking, and crumpling during preparation for shipment or unloading. The shipment should be rejected if the product is not consistent with what was originally approved.

5.0-B2.2 Conformance Testing

The manufacturer's quality control certificates will be used to show conformance to the project specifications. The quality control certificates shall be submitted to CQAPM for review, comment and inclusion into the final report.

The CQAPM or his qualified field staff shall ensure that geomembrane property values guaranteed by the manufacturer in its specifications are met.

5.0-B2.3 Geomembrane Installation

1). Liner Subgrade Preparation and Acceptance

Prior to the installation of the geomembrane, the liner subgrade shall be checked for irregularities, protrusions, debris, stones, standing water, and abrupt changes in grade. The soil liner surface shall be prepared by rolling with a smooth-drum roller or hand-worked to minimize the surface roughness and flatten protruding soil or rock particles prior to geomembrane deployment. Loose rocks/stones which could damage the geomembrane shall be removed. Excessive voids, dimples or pit marks shall be filled in with a similar soil mixture. The surface shall not exhibit excessive desiccation or pumping prior to geomembrane deployment. Written acceptance of the subgrade is required from both the geomembrane's installer and the CQAPM prior to deployment.

2.) Geomembrane Deployment

The geomembrane shall be installed in direct and uniform contact with the recompacted cohesive soil and shall not be placed during inclement weather. Seaming should not take place when ambient temperatures are below 40 or above 104 degrees F unless trial seams reveal acceptable results at lower/higher temperatures. In general, no support equipment shall be allowed on the geomembrane. Personnel working on the geomembrane shall not smoke, wear damaging shoes, or engage in any other activity likely to damage the geomembrane. Only those sections of the geomembrane that are to be placed and seamed in one day should be unrolled.

3.) Panel Marking

For this project, liner markings shall be color coded. Any spray paint used must be environmentally safe and be water-based. Writing on the liner shall be strictly limited to documentation purposes only.

4.) Panel Installation

In general, seams should be oriented parallel to the line of maximum slope, i.e., oriented

up and down, not across the slope. In corners and odd-shaped geometric locations, the number of field seams should be minimized. When horizontal seams are necessary, adjacent seams shall be staggered horizontally, with the up slope panel overlapping the lower panel ("shingling"). Avoid locating panel intersections closer than 5 feet to the toe of the slope. Objects such as leachate collection sump riser, cleanout riser pipes, and gas vents which will penetrate the liner shall be booted as necessary to prevent infiltration of water or migration of landfill gas.

Panels shall have a minimum four inches finished overlap. Field seaming shall only be performed by the method or methods approved by the manufacturer, either by extrusion welding or double-tracked fusion welding. Fishmouths or wrinkles at the seam overlap shall be cut along the ridge of the wrinkle in order to achieve a flat overlap and the cut shall be seamed and/or patched. Patches shall extend at least 6" beyond the cut in all directions. Seams shall extend to the outside edge of panels placed in the anchor trench.

Panel layout and field seams shall be given an identification code, mapped and logged to record relevant installation information. Minor, superficial scars that are extruded will not appear on the As-Built Drawings or receive a repair number. All T Joints will be extruded and will appear on the As-Built drawing but will not receive a repair number. All butt seams, inner cell tie-ins, perimeter envelope seams shall be treated as one seam and have continuous stationing.

5.0-B2.4 Installation Quality Control

The CQA technicians will visually monitor sheet quality and seaming procedures during installation. The installer is responsible for providing and documenting quality control testing of the installed material in accordance with the drawings and specifications.

The installer's QC technicians shall monitor and document the following installation and testing operations and provide a copy to the SSQA/CE for review:

a. Trial Seams
b. Panel Placement
c. Panel Seaming
d. Nondestructive Testing
e. Destructive Seam Testing
f. Test Failures and Repairs

Refer to Table 2 for minimum acceptable values for peel and shear testing.

5.0-B2.5 Geocomposite Installation

The installer shall handle all geocomposite in such a manner as to ensure that it is not

damaged in any way. During placement of geocomposite, care shall be taken not to entrap dirt or excessive dust in the geonet that could cause clogging of the drainage system, and/or stones that could damage the adjacent geomembrane. If dirt or excessive dust is entrapped in the geonet, it should be cleaned prior to placement of the next material on top of it. In this regard, care shall be taken with the handling of sandbags, to prevent puncturing the sandbag.

Geonet seams and overlaps must, at a minimum, meet the following requirements:

a. Adjacent rolls shall be overlapped by at least 4 in.
b. The geonet overlaps shall be tied with plastic fasteners. Tying devices shall be white or yellow for easy inspection. Metallic devices are not allowed.
c. Tying shall be every 5 ft. along the length at the adjacent rolls, every 6 in. in the anchor trench and every 6 in. along end-to-end seams.
d. In the corners of the sideslopes of rectangular landfills, where overlaps between perpendicular geonet strips are required, an extra layer of geonet shall be unrolled along the slope, on top of the previously installed geonet, from top to bottom of the slope.

Geotextiles shall be overlapped a minimum of 3 in. prior to seaming. In general, seams should be oriented parallel to line of maximum slope, i.e., oriented up and down, not across the slope. When horizontal seams are necessary, adjacent seams shall be staggered horizontally.

Geotextiles shall be continuously sewn. Spot sewing is not allowed. On bottoms, geotextiles shall be continually sewn, or a minimum of a three foot overlap with the flap away from the direction of sand placement.

Any sewing shall be done using thread with chemical and ultraviolet light resistance properties equal to or exceeding those of the geotextile. The color of the sewing thread shall contrast the background color of the geotextile. Sewing shall be done using machinery and stitch types specified in the project specifications or as approved in writing by the Project Manager and the CE.

5.0-B2.6 Geocomposite Repairs

Any holes or tears in the geocomposite shall be repaired using the following two procedures.

a. On sideslopes, a patch made from the same geocomposite shall be thermally bonded into place in accordance with the project specifications. Should any tear exceed 10% of the width of the roll, that roll shall be removed from the slope and replaced.

b. On non-sideslope areas, a patch made from the same geocomposite shall be thermally bonded into place with a minimum of 12 in. overlap in all directions. Care shall be taken to remove any soil or other material which may have penetrated the torn geocomposite.

5.0-B3 ***PROTECTIVE/VEGETATIVE COVER***

The 24-inch protective and vegetative cover system is installed to protect the components of the lining system and help minimize erosion by supporting vegetative growth. Before the vegetative or protective cover is placed over the geomembrane, all destructive and nondestructive testing must be completed and approved by the CQAPM.

1.) Preconstruction Material Evaluation

Materials selected for use in the protective/vegetative cover system shall be verified by the CQA PM to comply with the design plans for the project. Materials for the vegetative layer and protective cover layer shall be selected to meet the performance requirements

specified in the design which should include requirements for particle size. Representative samples of the protective\vegetative layers shall be obtained and tested in accordance with the following schedule:

Preconstruction Material Testing
for
Protective/Vegetative Materials

Test	Method	Frequency
Particle-Size Analysis	ASTM D 422	1/source or change in material type, whichever is greater.

2.) Construction Conformance Testing

Protective Cover materials selected for use shall be tested at regular intervals for minimum thickness verifications. Minimum testing frequency shall be one thickness measurement per acre.

Placement of protective cover materials over geosynthetic liners shall generally not proceed at ambient temperatures below 32° F or above 104° F, but should be conducted at the coolest part of the day to minimize the development of wrinkles or folding of the geosynthetic materials. A minimum of one foot of material is required between low ground pressure dozers and the geomembrane. Greater material thickness must be maintained above the geomembrane to support heavier spreading equipment and hauling vehicles. In such cases, a minimum thickness of 2 feet of protective cover shall be used unless otherwise specified in the design. The vegetative layer or protective cover does not necessarily require compaction control. The firmness of the vegetative cover varies with the type of vegetation specified for the cover. Care shall be exercised in placement so as not to shift or damage the underlying geosynthetic layers.

The overall thickness of protective/vegetative cover materials shall be verified by either survey methods or careful excavations with thickness measurements. The final thickness of the layers shall not be less than 24 inches.

specified in the design which should include requirements for particle size. Representative samples of the protective\vegetative layers shall be obtained and tested in accordance with the following schedule:

Preconstruction Material Testing
for
Protective/Vegetative Materials

Test	Method	Frequency
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The overall thickness of protective/vegetative cover materials shall be verified by either survey methods or careful excavations with thickness measurements. The final thickness of the layers shall not be less than 24 inches.

Table 1

QA Testing Frequencies and Criteria for Final Cover Compacted Cohesive Soil

Pre-construction Qualification		
Test	**ASTM Method**	**Quantity**
Atterberg Limits	D 4318	1 per Source
Compaction	D 698	1 per Source
Particle Size	D 1140	1 per Source
Moisture Content	D 2216	1 per Source
Permeability	D 5084	1 per Source
Construction Testing		
Test	**ASTM Method**	**Quantity (min.)**
Thickness Measurements	None	One per acre
Permeability	D 5084	One per acre
Testing Criteria		
Particle Size		Maximum size 4"
Organics	PT, OH, MH, OL not suitable for fill	
Thickness		Minimum 18"
Permeability		Maximum $1x10^{-5}$ cm/sec

6.0 GEOMEMBRANE LINER (Liner)

6.1 DESCRIPTION

A high density polyethylene (HDPE) liner is specified for this project.

6.2 QUALITY CONTROL DOCUMENTATION

Prior to the installation of any geomembrane, the Manufacturer or Installer will provide the Project Manager with the following information:

1. The origin (supplier's name and production plant) and identification (brand name and number) of the resin used to manufacture the geomembrane.
2. Copies of dated quality control certificates issued by the resin supplier.
3. Results of tests conducted by the Manufacturer to verify that the resin used to manufacture the geomembrane meets the project specifications.
4. A statement indicating that the amount of reclaimed polymer added to the resin during manufacturing was done with appropriate cleanliness.
5. A list of the materials which comprise the geomembrane, expressed in the following categories as percent by weight: polyethylene, carbon black, other additives.
6. A specification for the geomembrane which includes all properties contained in the project specifications measured using the appropriate test methods.
7. Written certification that minimum values given in the specification are guaranteed by the Manufacturer.
8. Quality control certificates, signed by a responsible party employed by the Manufacturer. Each quality control certificate will include roll identification numbers, testing procedures, and results of quality control tests. At a minimum, results will be given for:

   a. Density (ASTM D1505)
   b. Carbon black content (ASTM D1603)
   c. Carbon black dispersion (ASTM D3015)
   d. Thickness (ASTM D751)
   e. Tensile properties (ASTM D638)
   f. Puncture resistance (ASTM D4833)

   These quality control tests will be performed in accordance with the test methods for every 50,000 ft^2 (5,000 m^2).

9. Results of environmental stress crack resistance tests (GM-5). At a minimum, tests will be performed once every resin lot.

The Manufacturer will identify all rolls of geomembranes with the following:

1. Manufacturer's name
2. Product identification
3. Thickness
4. Roll number
5. Roll dimensions

The CQAPM & CE will review these documents and will report any discrepancies.

1. Property values certified by the Manufacturer meet all of its guaranteed specifications.
2. Measurements of properties by the Manufacturer are properly documented and that the test methods used are acceptable.
3. Quality control certificates have been provided at the specified frequency for all rolls, and that each certificate identifies the rolls related to it.
4. Rolls are appropriately labeled.
5. Certified minimum properties meet the project specifications.

6.3 CONFORMANCE TESTING

Upon delivery of the rolls of the geomembrane, conformance test samples will be obtained from the geomembrane. The geomembrane rolls to be sampled will be selected by the SSQA Technician. Samples will be taken across the entire width of the roll judged by the SSQA Technician not to be damaged. Unless otherwise specified, samples will be 3 ft (1 m) long by the roll width. The SSQA Technician will mark the machine direction on the samples with an arrow.

A lot will be defined as a group of consecutively numbered rolls from the same manufacturing line. Alternatively, a lot may be designated by the SSQA Technician based on a review of all roll information including quality control documentation and manufacturing records.

Samples will be taken at a rate of one per lot and not less than one per 100,000 ft^2 (10,000 m^2) of geomembrane. These samples will be forwarded to the Geosynthetic Laboratory for testing.

The following conformance tests will be conducted:

1. Density (ASTM D1505)
2. Carbon black content (ASTM D1603)
3. Carbon black dispersion (ASTM D3015)
4. Thickness (ASTM D751)
5. Tensile properties (ASTM D638)

All conformance test results will be reviewed and accepted or rejected by the CE and SSQA Technician prior to the deployment of the geomembrane. The CE and SSQA Technician will examine all results from laboratory conformance testing. CE and SSQA Technician will be responsible for checking that all test results meet or exceed the property values listed for the project.

If a test result is in nonconformance, all material from the lot represented by the failing test will be considered out-of-specification and rejected. Additional conformance test samples may be taken to "bracket" the portion of the lot not meeting the project specification. This procedure is valid only when all rolls in the lot are consecutively produced and numbered from one manufacturing line. To isolate the out-of-specification material, additional samples must be taken from rolls that have roll numbers immediately adjacent to the roll that was sampled and failed. If both additional tests pass, the roll that represents the initial failed test and the roll manufactured immediately after that roll (next larger roll number) will be rejected. If one or both of the additional tests fail, then the entire lot will be rejected.

6.4 SOIL LINER PREPARATION

The Earthwork Contractor will be responsible for preparing the underlying soil liner prior to geomembrane placement.

Before the geomembrane installation begins, the SSQA Technician will verify that:

1. A licensed land surveyor has verified all lines and grades.
2. The CE has verified that the underlying soil meets the criteria specified in the project specifications.
3. The underlying soil liner surface to be lined has been rolled, compacted, or hand-worked so as to be free of irregularities, protrusions, loose soil, and abrupt changes in grade.
4. The surface of the underlying soil liner does not contain stones which may be damaging to the geomembrane.
5. There is no area excessively softened by high water content.
6. There is no area where the underlying soil surface contains desiccation cracks which may damage the geomembrane.

The Installer will certify in writing that the surface on which the geomembrane will be installed is acceptable. A certificate of acceptance will be given by the Installer to the SSQA Technician and the Earthwork Contractor prior to commencement of geomembrane deployment in the area under consideration.

After the underlying soil has been accepted by the Installer, it is the Installer's responsibility to indicate to the SSQA Technician any change in the underlying soil condition that requires repair work.

At any time before or during the geomembrane installation, the SSQA Technician will indicate to the Earthwork Contractor any locations which may not be adequately prepared for the geomembrane.

6.5 ANCHOR TRENCH

The SSQA Technician will verify:

1. The anchor trench has been constructed according to the project plans and specifications.
2. If the anchor trench is excavated in a clay material susceptible to desiccation, the amount of trench open at any time is minimized. The SSQA Technician will inform the Earthwork Contractor of any signs of significant desiccation associated with the anchor trench construction.
3. Rounded corners are provided in the trench so as to avoid sharp bends in the geomembrane.
4. Excessive amounts of loose soil are not allowed to underlie the geomembrane in the anchor trench.
5. The anchor trench is adequately drained to prevent ponding or softening of the adjacent soils while the trench is open.
6. The anchor trench is backfilled with cohesive soils and compacted as specified.

Care will be taken when backfilling the trenches to prevent any damage to the geosynthetic components. The SSQA Technician will observe the backfilling operation and advise the Earthwork Contractor. Any problems will be documented by the SSQA Technician in his daily report.

6.6 GEOMEMBRANE DEPLOYMENT

6.6.1 Panel Nomenclature

A field panel is defined as a unit of geomembrane which is to seamed in the field. A field panel is a roll or a portion of a roll cut in the field. The SSQA Technician will be responsible to ensure that each field panel is given an identification code (number or letter-number) consistent with the layout plan. This identification code will be as simple and logical as possible and will be agreed upon with the Installer.

In general, it is not appropriate to identify panels using roll numbers since roll numbers established in the manufacturing plant are usually cumbersome and are not related to location in the field. The SSQA Technician will establish a table or chart showing correspondence between roll numbers and field panel identification codes. The field panel identification code will be used for all quality assurance records.

6.6.2 Panel Deployment Procedure

The CE and SSQA Technician will review the panel deployment progress of the Installer as to compliance with the approved panel layout drawing. The CE and SSQA Technician will also review the panel deployment for suitability to actual field condition such as issues relating to wind, rain, soil liner desiccation and other site-specific conditions. Once approved, changes to the panel deployment procedure will not be taken unless changed in a formal meeting of all parties. The SSQA Technician will verify that the condition of the underlying soil does not change detrimentally during installation.

The SSQA Technician will verify that field panels are installed at the locations indicated on the Installer's layout plan. The SSQA Technician will record the identification code, location, and date of installation of each field panel.

6.6.3 Deployment Weather Conditions

Geomembrane deployment will not be undertaken if weather conditions will preclude material seaming following deployment.

The normal required weather conditions for seaming are as follows:

1. Ambient temperature between 32°F (0°C) and 104°F (40°C).
2. Dry conditions (no precipitation or other excessive moisture)
3. No excessive winds.

The CE or SSQA Technician will verify that these weather conditions are fulfilled and notify in writing if they are not. Ambient temperature will be measured by the SSQA Technician in the area in which the panels are to be placed.

The SSQA Technician will inform the Installer of any weather-related problems which may not allow geomembrane placement to proceed.

6.6.4 Method of Deployment

Before the geomembrane is handled on site, the CE and SSQA Technician will verify that handling equipment to be used on the site is adequate and does not pose risk of damage to the geomembrane. During handling, the SSQA Technician will observe and verify that the Installer's personnel handle the geomembrane with care.

The CE and SSQA Technician will verify the following:

1. Equipment used does not damage the geomembrane by handling.
2. The prepared surface underlying the geomembrane is acceptable immediately prior to geomembrane placement.

3. Geosynthetic elements immediately underlying the geomembrane are clean and free of debris.
4. Personnel do not smoke or wear damaging shoes while working on the geomembrane, or engage in other activities which could damage the geomembrane.
5. The method used to unroll the panels does not cause excessive scratches or crimps in the geomembrane and does not damage the supporting soil.
6. The method used to place the panels minimizes wrinkles, especially differential wrinkles between adjacent panels.
7. Adequate temporary loading and/or anchoring (such as sand bags or tires), not likely to damage the geomembrane, are placed to prevent uplift by wind. In case of high winds, continuous loading is recommended along edges of panels to minimize risk of wind flow under the panels.
8. Direct contact with the geomembrane is minimized, and the geomembrane is protected by geotextiles, extra geomembrane, or other suitable materials, in areas where excessive traffic may be expected.

Conditions differing from the above will be brought to the attention of the Installer or Earthwork Contractor.

6.6.5 Damage and Defects

Upon delivery to the site, the SSQA Technician will conduct a surface observation of all rolls for defects and for damage. This examination will be conducted without unrolling rolls unless defects or damages are found or suspected. The SSQA Technician will advise the Installer of any rolls or portions of rolls which should be rejected and removed from the site because they have severe flaws, and/or minor repairable flaws.

The SSQA Technician will examine each panel, after placement and prior to seaming, for damage and/or defects. The SSQA Technician will advise the Installer which panels, or portions of panels, should be rejected, repaired, or accepted. Damaged panels, or portions of damaged panels, which have been rejected will be marked and their removal from the work area recorded by the SSQA Technician.

6.6.6 Writing on the Liner

To avoid confusion, the Installer and the SSQA Technician will each use different colored markers that are readily visible for writing on the geomembrane. The markers used must be semi-permanent and compatible with the geomembrane. The Installer will use a white marker to write on the geomembrane while the SSQA Technician will use a yellow marker.

6.7 FIELD SEAMING

6.7.1 Seam Layout

Before installation begins, the Installer will provide the SSQA Technician with a panel layout drawing. This drawing will present all the proposed seams of the lining system at the facility. The CE and SSQA Technician will review the panel layout drawing and verify that it is consistent with accepted state of practice. In addition, panels not specifically shown on the panel layout drawing may not be used without prior approval.

In general, seams should be oriented parallel to the line of maximum slope, thus, 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 ft (1.5 m) from the toe or crest of the slope, or areas of potential stress concentrations, unless otherwise authorized by the Design Engineer.

A seam numbering system compatible with the panel numbering system will be used by the SSQA Technician.

6.7.2 Accepted Seaming Methods

Approved processes for field seaming are fusion welding and extrusion welding. Only apparatus which have been specifically approved by make and model will be used. Submit all documentation regarding seaming methods to be used to the CQAPM and CE.

6.7.2.1 Fusion Process

The SSQA Technician will log ambient, seaming apparatus, and geomembrane surface temperatures at appropriate intervals and report any noncompliances to the Installer.

The SSQA Technician will also verify that:

1. The Installer maintains on-site a minimum of 2 spare operable seaming apparatus.
2. Equipment used for seaming is not likely to damage the geomembrane.
3. The electric generator is placed on a smooth base such that no damage occurs to the geomembrane.
4. A smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage such that no damage occurs to the geomembrane.
5. A movable protective layer is used as required by the Installer directly below each overlap of geomembrane that is to be seamed to prevent buildup of moisture between the sheets and to prevent debris from collecting around the pressure rollers.

6. In general, the geomembrane panels are aligned to have an overlap of 4 to 6 in (100 mm to 150 mm) for fusion welding. In any event, the final overlap will be sufficient to allow peel tests to be performed on the seam.
7. No solvent or adhesive is used.
8. The geomembrane is protected from damage in heavy traffic areas.

6.7.2.2 Extrusion Process

The SSQA Technician will log ambient, seaming apparatus, and geomembrane surface temperatures at appropriate intervals.

The SSQA Technician will verify that:

1. The Installer maintains on-site a minimum of two spare operable seaming apparatus.
2. Equipment used for seaming is not likely to damage the geomembrane.
3. Prior to beginning a seam, the extruder is purged until all heat-degraded extrudate has been removed from the barrel.
4. Clean and dry welding rods or extrudate pellets are used.
5. The electric generator is placed on a smooth base such that no damage occurs to the geomembrane.
6. Grinding is completed no more than one hour prior to seaming.
7. A smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage such that no damage occurs.
8. The geomembrane is protected from damage in heavy traffic areas.
9. Exposed grinding marks adjacent to an extrusion weld will be minimized. In no instance will exposed grinding marks extend more than 1/4 in (6 mm) from the finished seamed area.
10. In general, the geomembrane panels are aligned to have a nominal overlap of 3 in (75 mm) for extrusion welding. In any event, the final overlap will be sufficient to allow peel tests to be performed on the seam.
11. No solvent or adhesive is used.
12. The procedure used to temporarily bond adjacent panels together does not damage the geomembrane; in particular, the temperature of hot air at the nozzle of any temporary welding apparatus is controlled such that the geomembrane is not damaged.

6.7.3 Seam Preparation

The SSQA Technician will verify that prior to seaming, the seam area is clean and free of moisture, dust, dirt, debris or foreign material of any kind. If seam overlap grinding is required, SSQA Technician must ensure that the process is completed according to the Manufacturer's instructions within one hour of the seaming operation, and in a way that does not damage the geomembrane. The SSQA Technician will also verify that seams are

aligned with the fewest possible number of wrinkles and "fishmouths."

6.7.4 Trial Seams

Trial seams will be made on fragment pieces of geomembrane liner to verify that conditions are adequate for production seaming. Such trial seams will be made at the beginning of each seaming period, and at least once each five hours, for each production seaming apparatus used that day. Trial seams will be made under the same conditions as production seams.

The trial seam sample will be at least 5 ft (1.6 m) long by 1 ft (0.3 m) wide (after seaming) with the seam centered lengthwise. Seam overlap will be as indicated in Section 6.7.2. Two specimens will be cut from the sample with a 1 in (25 mm) wide die. The specimens will be cut by the Installer at locations selected randomly along the trial seam sample by the SSQA Technician.

The specimens will be tested in peel using a field tensiometer. The tensiometer will be capable of maintaining a constant jaw separation rate of two inches per minute. If a specimen fails, the entire trial seam operation will be repeated. If the additional specimen fails, the seaming apparatus and seamer will not be accepted and will not be used for seaming until the deficiencies are corrected and two consecutive successful trial seams are achieved. The SSQA Technician will observe all trial seam procedures.

The remainder of the successful trial seam sample will be retained in the Owner archives for possible laboratory testing. Each sample will be assigned a number and marked accordingly by the SSQA Technician, who will also log the date, hour, ambient temperature, number of seaming unit, name of seamer, and pass or fail description.

If a trial seam sample fails a test conducted by the SSQA Technician a destructive seam test sample will be taken from each of the seams completed by the seamer during the shift related to the subject trial seam. These samples will be forwarded to the Geosynthetic Laboratory and, if they fail the tests, the procedure indicated in Section 6.9.7 will apply. The conditions of this paragraph will be considered satisfied for a given seam if a destructive seam test sample has already been taken.

6.7.5 General Seaming Procedures

During general seaming, the SSQA Technician will ensure the following:

1. Fishmouths or wrinkles at the seam overlaps will be cut along the ridge of the wrinkle in order to achieve a flat overlap. The cut fishmouths or wrinkles will be seamed and any portion where the overlap is inadequate will then be patched with an oval or round patch of the same geomembrane extending a minimum of 6 in (150 mm) beyond the cut in all directions.

2. Seaming will extend to the outside edge of panels placed in the anchor trench.3.All cross seam tees should be extrusion welded to a minimum distance of 4 in (100 mm) on each side of the tee.
4. No field seaming will take place without the Master Seamer being present.
5. A firm substrate may be required to be provided by using a flat board, a conveyor belt, or similar hard surface directly under the seam overlap to achieve proper support.

The SSQA Technician will verify that the above seaming procedures are followed, and will report any nonconformance.

6.7.6 Seaming Weather Conditions

At ambient temperatures above 104°F, no seaming of the geomembrane will be permitted unless the Installer can demonstrate to the satisfaction of the CE and SSQA Technician that geomembrane seam quality is not compromised. Trial seaming, as described in Section 6.7.4 will be conducted under the same ambient temperature conditions as the production seams. At the option of the SSQA Technician, additional destructive tests may be required for any suspect areas.

6.8 NONDESTRUCTIVE SEAM TESTING

6.8.1 Concept

The Installer will nondestructively test all field seams over their full length using an air pressure test (for double fusion seams only), a vacuum test or other approved method. Air pressure testing and vacuum testing are described in Sections 6.8.2 and 6.8.3, respectively. The purpose of nondestructive tests is to check the continuity of seams. It does not provide quantitative information on seam strength. Nondestructive testing will be carried out as the seaming work progresses, not at the completion of all field seaming.

For all seams, the SSQA Technician:

1. Observe nondestructive testing procedures.
2. Record location, data, test unit number, name of tester, and outcome of all testing.
3. Inform the Installer of any required repairs.

Any seams that cannot be nondestructively tested will be cap-stripped with the same geomembrane. The cap-stripping operations will be observed by the SSQA Technician and Installer for uniformity and completeness.

6.8.2 Air Pressure Testing

Air pressure testing is applicable to double fusion welding which produces a double seam

with an enclosed space.

1. The equipment for air pressure testing will consist of the following:

    a. An air pump (manual or motor driven), equipped with pressure gauge and capable of generating and sustaining a pressure between 24 and 35 psi (160 and 240 kPa) and mounted on a cushion to protect the geomembrane.
    b. A rubber hose with fittings and connections.
    c. A sharp hollow needle, or other pressure feed device.

2. The following procedures will be followed:

    a. Seal both ends of the seam to be tested.
    b. Insert needle or other approved pressure feed device into the air channel created by the fusion weld.
    c. Insert a protective cushion between the air pump and the geomembrane.
    d. Pressurize the air channel to a pressure of approximately 30 psi (200 kPa). Close valve, allow 2 minutes for pressure to stabilize, and sustain pressure for at least 5 minutes.
    e. If loss of pressure exceeds 3 psi, or does not stabilize, locate faulty area and repair in accordance with Section 6.10.3.
    f. Cut opposite end of tested seam area once testing is completed to verify continuity of the air channel. If air does not escape, locate blockage and retest unpressurized area. Seam the cut end of the air channel.
    g. Remove needle or other approved pressure feed device and seal the hole in the geomembrane.

6.8.3 Vacuum Testing

Vacuum testing is applicable to extrusion welding.

1. The equipment will consist of the following:

    a. A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, a porthole or valve assembly, and a vacuum gauge.
    b. A pump assembly equipped with a pressure controller and pipe connections.
    c. A rubber pressure/vacuum hose with fittings and connections.
    d. A soapy solution.
    e. A bucket and side paint brush, or other means of applying the soapy solution.

2. The following procedures will be followed:

   a. Wet a strip of geomembrane approximately 12 in x 48 in (0.3 m x 1.2 m) with the soapy solution.
   b. Place the box over the wetted area.
   c. Close the bleed valve and open the vacuum valve.
   d. Ensure that a leak-tight seal is created.
   e. Energize the vacuum pump and reduce the applied pressure to approximately 5 psi (10 in of Hg/35 kPa) gauge.
   f. For a minimum of 10 seconds, apply vacuum with the box placed and maintaining a seal, examine the geomembrane through the viewing window for the presence of soap bubbles.
   g. If no bubble appears after 10 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3 in (75 mm) overlap, and repeat the process.
   h. All areas where soap bubbles appear will be marked and repaired in accordance with Section 6.10.3.

6.8.4 Test Failure Procedures

The Installer will complete any required repairs in accordance with Section 6.10. For repairs, the SSQA Technician will:

1. Observe the repair and testing of the repair.
2. Mark on the geomembrane that the repair has been made.
3. Document the repair procedures and test results.

6.9 DESTRUCTIVE SEAM TESTING

6.9.1 Concept

The purpose of destructive tests is to evaluate seam strength. Destructive seam tests will be performed at selected locations. Seam strength testing will be done as the seaming work progresses, not at the completion of all field seaming.

6.9.2 Location and Frequency

The SSQA Technician will select where seam samples will be cut out for laboratory testing. The frequency and locations will be established as follows:

1. A minimum frequency of one test location per 500 ft (150 m) of seam length performed by each welding machine. This frequency is to be determined as an average taken throughout the entire facility.

2. Test locations will be determined during seaming at the SSQA Technician's discretion. Special consideration will be given to locations where the potential for imperfect welding, such as overheating, contamination, offset welds exists.

The Installer will not be informed in advance of the locations where the seam samples will be taken.

6.9.3 Sampling Procedures

Samples will be cut by the Installer at locations chosen by the SSQA Technician as the seaming progresses so that laboratory test results are available before the geomembrane is covered by another material. The SSQA Technician will:

1. Observe sample cutting.
2. Assign a number to each sample, and mark it accordingly.
3. Record sample location on layout drawing.
4. Record reason for taking the sample at this location (e.g., statistical routine, suspicious feature of the geomembrane).

All holes in the geomembrane resulting from destructive seam sampling will be repaired in accordance with repair procedures described in Section 6.10.3 immediately following receipt of successful test results. The continuity of the new seams in the repaired area will be tested according to Section 6.8.3.

6.9.4 Sample Dimensions

At each sampling location, two types of samples will be taken by the Installer. First, two specimens for field testing should be taken. Each of these samples will be cut with a 1 in (25 mm) wide die, with the seam centered parallel to the width. The distance between these two samples will be 42 in (1.1 m). If both samples pass the field test described in Section 6.9.5, a sample for laboratory testing will be taken.

The sample for laboratory testing will be located between the samples for field testing. The sample for laboratory testing will be 12 in (0.3 m) wide by 42 in (1.1 m) long with the seam centered lengthwise. The sample will be cut into three parts and distributed as follows:

1. One 12 in wide x 18 in long (0.3 m x 0.5 m) portion for Geosynthetic Laboratory for testing.
2. One 12 in wide x 12 in long (0.3 m x 0.3 m) portion to the Installer for optional laboratory testing.
3. One 12 in wide x 12 in long (0.3 m x 0.3 m) portion to the Owner for archive storage.

6.9.5 Field Testing

The two 1 in (25 mm) wide specimens mentioned in Section 6.7.4 and Section 6.9.4 will be tested in the field using a tensiometer for peel adhesion and will not fail according to the criteria in Table 3B. The tensiometer will be capable of maintaining a constant jaw separation rate of two inches per minute. If it fails, the seam should be repaired in accordance with Section 6.9.7. Final judgements regarding seam acceptability, based on the failure criteria provided in the Table 3B, rests with the SSQA Technician.

The SSQA Technician will witness all field tests and mark all samples and portions with their number. The SSQA Technician will also log the date and time, ambient temperature, number of seaming unit, name of seamer, welding apparatus temperatures and pressures, and pass or fail description, and attach a copy to each sample portion.

6.9.6 Laboratory Testing

Destructive test samples will be packaged and shipped, to the Geosynthetic Laboratory in a manner which will not damage the test sample. The sample will be shipped as soon as possible to expedite laboratory testing. The SSQA Technician will collect and turnover to the Owner archive samples.

Testing will include seam strength and peel adhesion (ASTM D4437). The minimum acceptable values to be obtained in these tests will be per Table 3B. At least 5 specimens will be tested, each in both shear and peel. Specimens will be selected alternately by test from the samples (i.e., peel, shear, peel, shear). A passing test will meet the minimum acceptable values in at least 4 of the 5 specimens tested for each method.

The Geosynthetic Laboratory will provide test results within 24 hours of receiving the samples. The SSQA Technician will review laboratory test results as soon as they become available, and make appropriate recommendations to the CE and Owner.

6.9.7 Destructive Test Failure

When a sample fails a destructive test, whether that test is conducted by the Geosynthetic Laboratory or by field tensiometer, the Installer has two options:

1. The Installer can repair the seam between any two passing destructive test locations.
2. The Installer can trace the welding path to an intermediate location 10 ft (3 m) minimum from the point of the failed test in each direction and take a sample with a 1 in (25 mm) wide die for an additional field test at each location. If these additional samples pass the test, then full laboratory samples are taken. If these laboratory samples pass the tests, then the seam is repaired between these locations. If either sample fails, then the process is repeated to establish the zone

in which the seam should be repaired.

All acceptable repaired seams will be bound by two locations from which samples passing laboratory destructive tests have been taken. Passing laboratory destructive tests of trial seam samples taken as indicated in Section 6.7.4 may be used as a boundary for the failing seam. In cases exceeding 150 ft (50 m) of repaired seam, a sample taken from the zone in which the seam has been repaired must pass destructive testing. Repairs will be made in accordance with Section 6.10.

The SSQA Technician will document all actions taken in conjunction with destructive test failures.

6.10 DEFECTS AND REPAIRS

6.10.1 Identification

All seams and non-seam areas of the geomembrane will be examined by the SSQA Technician for identification of defects, holes, blister, undispersed raw materials, large wrinkles and any sign of contamination by foreign matter. The geomembrane surface will be cleaned by the Installer prior to examination if the SSQA Technician determines that the amount of dust, water, or mud inhibits examination.

6.10.2 Evaluation

Each suspect location both in seam and non-seam areas will be nondestructively tested using the methods described in Section 6.8. Each location which fails the nondestructive testing will be marked by the SSQA Technician and repaired by the Installer. Work will not proceed with any materials which will cover locations which have been repaired until successful nondestructive and/or laboratory tests are obtained.

When seaming of the geomembrane is completed, and prior to placing overlying materials, the SSQA Technician will indicate to the Installer any large wrinkles which should be cut and reseamed. The number of wrinkles to be repaired should be kept to an absolute minimum. Therefore, wrinkles should be located during the coldest part of the installation period, while keeping in mind the forecasted weather to which the uncovered geomembrane may be exposed. Wrinkles are considered to be large when the geomembrane can be folded over on to itself which is generally a wrinkle that extends 12 in (0.3 m) from the subgrade. Seams produced while repairing wrinkles will be nondestructively tested.

When placing overlying material on the geomembrane, every effort must be made to minimize wrinkle development. If possible, cover should be placed during the coolest weather. In addition, small wrinkles should be isolated and covered as quickly as possible to prevent their growth. The placement of cover materials will be observed by the SSQA

Technician to ensure that wrinkle formation is minimized and that, in all cases, the geomembrane is not folded over on itself.

6.10.3 Repair Procedures

Any portion of the geomembrane exhibiting a flaw, or failing a destructive or nondestructive test, will be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure will be agreed upon between the Installer, Designer, and CE or SSQA Technician.

1. The repair procedures available include:

    a. Patching, used to repair holes, tears, undispersed raw materials, and contamination by foreign matter.
    b. Spot welding used to repair pinholes, or other minor, localized flaws.
    c. Capping, used to repair large lengths of failed seams.
    d. Extrusion welding the flap, used to repair areas of inadequate fusion seams which have an exposed edge. Repairs of this type will be approved by the SSQA Technician and will not exceed 100 ft (30 m) in total length.
    e. Removing bad seam and replacing with a strip of new material welded into place.

2. For any repair method, the following provisions will be satisfied:

    a. Surfaces of the geomembrane which are to be repaired using extrusion methods will be ground no more than one hour prior to the repair.
    b. All surfaces will be clean and dry at the time of the repair.
    c. All seaming equipment used in repairing procedures will meet the requirements of the project specifications.
    d. Patches or caps will extend at least 6 in (150 mm) beyond the edge of the defect, and all corners of patches will be rounded with a radius of approximately 3 in (75 mm).

6.10.4 Repair Verification

The SSQA Technician will observe all nondestructive testing of repairs and will record the number of each repair, date and test outcome. Each repair will be nondestructively tested using the methods described in Section 6.8 as appropriate. Repairs which pass the nondestructive test will be taken as an indication of an adequate repair. Repairs more than 150 ft (50 m) long require destructive test sampling. Failed tests require that the repair will be redone and retested until a passing test results.

When placing overlying material on the geomembrane, every effort must be made to minimize wrinkle development. If possible, cover should be placed during the coolest

weather available. In addition, small wrinkles should be isolated and covered as quickly as possible to prevent their growth. The placement of cover materials will be observed by the SSQA Technician to ensure that wrinkle formation is minimized and that, in all cases, the geomembrane is not folded over on itself.

6.11 GEOMEMBRANE PROTECTION

The quality assurance procedures indicated in this Section are intended only to assure that the installation of adjacent materials does not damage the geomembrane. The quality assurance of the adjacent materials themselves are covered in separate Sections.

6.11.1 Soils

A copy of the project specifications prepared by the Designer for placement of soils will be given to the CE or SSQA Technician. The CE and SSQA Technician will verify that these project specifications are consistent with geosynthetic state-of-practice such as:

1. Placement of soils on the geomembrane will not proceed at an ambient temperature below 32°F (0°C) nor above 104°F (40°C) unless otherwise specified.
2. Placement of soil on the geomembrane should be done during the coolest part of the day to minimize the development of wrinkles in the geomembrane.
3. Equipment used for placing soil will not be driven directly on the geomembrane.
4. A minimum thickness of 1 ft (0.3 m) of soil is specified between a light dozer, ground pressure of 5 psi (35 kPa) or lighter, and the geomembrane.
5. In any areas traversed by heavy construction, any vehicles other than low ground pressure vehicles approved by the SSQA Technician, the soil layer will have a minimum thickness of 3 ft (0.9 m). This requirement may be waived if provisions are made to protect the geomembrane through an engineered design. Drivers will proceed with caution when on the overlying soil and prevent spinning of tires or sharp turns.

The SSQA Technician will measure soil thickness and verify that the required thickness is present. The SSQA Technician must also verify that final thickness is consistent with the design and verify that placement of the soil is done in such a manner that geomembrane damage is unlikely.

6.11.2 Sumps and Appurtenances

A copy of the plans and project specifications prepared by the Designer for sumps and appurtenances will be given to the CQAPM and CE. The CQAPM and CE will review these plans and verify that:

1. Installation of the geomembrane in sump and appurtenant areas, and connection of geomembrane to sumps and appurtenances have been made according to

project specifications.

2. Extreme care is taken while welding around appurtenances since neither non-destructive nor destructive testing may be feasible in these areas.
3. The geomembrane has not been visibly damaged while making connections to sumps and appurtenances.
4. A representative of the SSQA Technician will be present at all times when the Installer is welding geomembrane to appurtenant structures.

7.0 GEOTEXTILES

7.1 DESCRIPTION

Geotextiles are used in protection and filtering applications in this lining system.

7.2 QUALITY CONTROL DOCUMENTATION

Prior to the installation of any geotextile, the Manufacturer or Installer will provide the Project Manager with the following information:

1. The origin (resin supplier's name and resin production plant) and identification (brand name and number) of the resin used to manufacture the geotextile.
2. Copies of dated quality control certificates issued by the resin supplier.
3. Results of tests conducted by the Manufacturer to verify that resin used to manufacture the geotextile meets the project specifications.
4. Results of quality control tests conducted by the Manufacturer to verify that the geotextile manufactured for the project meets the project specifications.
5. A statement indicating that the reclaimed polymer added to the resin during manufacturing was done with appropriate cleanliness.
6. A list of the materials which comprise the geotextile, expressed in the following categories as percent by weight: base polymer, carbon black, other additives.
7. A specification for the geotextile which includes all properties published by the Manufacturer, measured using the appropriate test methods.
8. Written certification that minimum values given in the specification are guaranteed by the Manufacturer.
9. Written certification that the Manufacturer has continuously inspected the geotextile for the presence of needles and found the geotextile to be needle-free.
10. Quality control certificates will include roll identification numbers, testing procedures and results of quality control tests. At a minimum, results will be given for:

    a. Mass per unit area (ASTM D3776)
    b. Grab strength (ASTM D4632)
    c. Trapezoidal tear strength (ASTM D4533)
    d. Burst strength (ASTM D3786)

e. Puncture strength (ASTM D4833)

These quality control tests will be performed in accordance with the test methods for at least every 100,000 ft^2 (10,000 m^2) of geotextile produced.

The Manufacturer will identify all rolls of geotextiles with the following:

1. Manufacturer's name
2. Product identification
3. Roll number
4. Roll dimensions

The CQAPM and CE will review these documents and will report any discrepancies. The CQAPM and CE will verify that:

1. Property values certified by the Manufacturer meet all of its guaranteed specifications.
2. Measurements of properties by the Manufacturer are properly documented and that the test methods used are acceptable.
3. Quality control certificates have been provided at the specified frequency for all rolls, and that each certificate identifies the rolls related to it.
4. Roll packages are appropriately labeled.
5. Certified minimum roll properties meet the project specifications.

7.3 CONFORMANCE TESTING

Upon delivery of the rolls of geotextiles, conformance test samples will be obtained for the geotextile. The rolls to be sampled will be selected by the SSQA Technician. Samples will be taken from any portion of a roll which has not been deemed damaged by the SSQA Technician. Unless otherwise specified, samples will be 3 ft (1 m) long by the roll width. The SSQA Technician will mark the machine direction on the samples with an arrow. All lots of material and the particular test sample that represents each lot should be defined before the samples are taken.

A lot will be defined as a group of consecutively numbered rolls from the same manufacturing line. Alternatively, a lot may be designated by the SSQA Technician based on a review of all roll information including quality control documentation and manufacturing records.

Samples will be taken at a rate of one per lot and not less than one per 100,000 ft^2 (10,000 m^2) of geotextile. These samples will then be forwarded to the Geosynthetic Laboratory for testing.

At a minimum, the following conformance tests will be performed on geotextiles:

1. Mass per unit area (ASTM D3776)
2. Grab strength (ASTM D4632)
3. Trapezoidal tear strength (ASTM D4533)
4. Burst strength (ASTM D4833)
5. Puncture strength (ASTM D4833)

All conformance test results will be reviewed and accepted or rejected by the SSQA Technician and CE prior to the deployment of the geotextile. The CE and SSQA Technician will examine all results from laboratory conformance testing. The CE and SSQA Technician will be responsible for checking that all test results meet or exceed the property values listed for the project.

If a test result is in nonconformance, all material from the lot represented by the failing test should be considered out-of-specification and rejected. Additional conformance test samples may be taken to "bracket" the portion of the lot not meeting project specifications. To isolate the out-of-specification material, additional samples must be taken from rolls that have roll numbers immediately adjacent to the roll that was sampled and failed. If both additional tests pass, the roll that represents the initial failed test and the roll manufactured immediately after that roll (next larger roll number) will be rejected. If one of the additional tests fail, then the entire lot will be rejected or the procedure repeated with two additional tests that bracket greater number of rolls within the lot.

7.4 GEOTEXTILE DEPLOYMENT

During shipment and storage, the geotextile will be protected from ultraviolet light exposure, moisture, mud, dirt, dust, puncture, cutting, or any other damaging or deleterious conditions. Geotextile rolls will be shipped and stored in relatively opaque and watertight wrappings. Wrappings will not be removed until shortly before deployment.

The SSQA Technician will observe rolls upon delivery at the site.

The Installer will ensure that geotextiles are not damaged during handling. The geotextile will be deployed as described below:

1. On slopes, the geotextiles will be securely anchored and then rolled down the slope in such a manner as to continually keep the geotextile sheet in tension.
2. In the presence of wind, all geotextiles will be weighted with sandbags or the equivalent. Such sand bags will be installed during deployment and will remain until replaced with cover material.
3. Geotextiles will be cut using a geotextile cutter (hook blade) only. If in place, special care will be taken to protect other materials from damage which could be caused by the cutting of the geotextiles.

4. The Installer will take any necessary precautions to prevent damage to underlying layers during placement of the geotextile.
5. During placement of geotextiles, care will be taken not to entrap, in or beneath the geotextile, stones, excessive dust, or moisture that could damage the geomembrane, cause clogging of drains or filters, or hamper subsequent seaming.
6. A visual examination of the geotextile will be carried out over the entire surface, after installation, to ensure that no potentially harmful foreign objects, such as needles, are present.

Conditions differing from the above will be brought to the attention of the Installer.

7.5 SEAMING PROCEDURES

Geotextiles will be overlapped a minimum of 3 in (75 mm) prior to seaming. In general, no horizontal seams will be allowed on sideslopes (seams along, not across, the slope) except as part of a patch. When horizontal seams are necessary, adjacent seams will be staggered horizontally.

On slopes steeper than 10:1 (horizontal:vertical), all geotextiles will be continuously sewn. Spot sewing is not allowed. On bottoms and slopes shallower than 10:1, geotextiles will be continually sewn or thermally bonded with the written approval of the Designer.

Any sewing will be done using polymeric thread with chemical and ultraviolet light resistance properties equal to or exceeding those of the geotextile. The color of the sewing thread will contrast the background color of the geotextile. Sewing will be done using machinery and stitch types agreed upon by the Installer, SSQA Technician and CE.

7.6 DEFECTS AND REPAIRS

7.6.1 Identification

If a defect is identified in the geotextile, the SSQA Technician will determine the extent and nature of the defect. If the defect is indicated by unsatisfactory test result, the SSQA Technician and CE will determine the extent of the deficient area by additional tests, observations, a review of records and other means that the SSQA Technician deems appropriate.

7.6.2 Notification

After determining the extent and nature of the defect, the SSQA Technician will promptly notify the CE, Installer and Project Manager. A work deficiency meeting will be held as required between the Installer, CE or SSQA Technician, Designer, and Project Manager to assess the problem, review alternative solutions, and implement an action plan.

7.6.3 Repair Procedures

The final decision as to the appropriate repair will be agreed upon between the Project Manager, Installer, Designer, and CE.

Any holes or tears in the geotextile will be repaired using the following two procedures.

On sideslopes, a patch made from the same geotextile will be thermally bonded or sewn into place in accordance with the project specifications. Should any tear exceed 10% of the width of the roll, that roll will be removed from the slope and replaced.

On non-sideslope areas, a patch made from the same geotextile will be thermally bonded or sewn into place with a minimum of 12-inch overlap in all directions. Care will be taken to remove any soil or other material which may have penetrated the torn geotextile.

The SSQA Technician will observe any repair.

7.7 GEOTEXTILE PROTECTIONS

All soil materials located on top of a geotextile will be deployed in such a manner as to ensure:

1. The geotextile and underlying lining materials are not damaged.
2. Minimal slippage of the geotextile on underlying layers occurs.
3. No excess tensile stresses occur in the geotextile.

8.0 GEONETS

8.1 DESCRIPTION

Geonets are geosynthetic nets used as a drainage medium in lining systems.

8.2 QUALITY CONTROL DOCUMENTATION

Prior to the installation of any geotextile, the Manufacturer or Installer will provide the Project Manager with the following information:

1. The origin (supplier's name and production plant) and identification (brand name and number) of the resin.
2. Copies of dated quality control certificates issued by the resin supplier.
3. Results of tests conducted by the Manufacturer to verify that resin used to manufacture the geonet meets the project specifications.
4. A statement indicating that the amount of reclaimed polymer added to the resin

during manufacturing was done with appropriate cleanliness and for geonet used for leachate collection applications.

5. A list of the materials which comprise the geonet, expressed in the following categories as percent by weight: polyethylene, carbon black, other additives.
6. A specification for the geonet which includes all contained in the project specifications measured using the appropriate test methods.
7. Written certification that minimum values given in the specification are guaranteed by the Manufacturer.
9. Quality control certificates, signed by a responsible party employed by the Manufacturer. The quality control certificates will include roll identification numbers, sampling procedures and results of quality control tests. At a minimum, results will be given for:

    a. Density (ASTM D1505)
    b. Mass per unit area (ASTM D3776)
    c. Thickness (ASTM D751)
    d. Carbon black content (ASTM D1603)

    Quality control tests will be performed in accordance with the test methods for every 40,000 ft^2 (4,000 m^2) of geonet produced.

The Manufacturer will identify all rolls of geonets with the following:

1. Manufacturer's name
2. Product identification
3. Roll number
4. Roll dimensions

The CQAPM and CE will review these documents and will report any discrepancies. The CQAPM and CE will verify that:

1. Property values certified by the Manufacturer meet all of its guaranteed specifications.
2. Measurements of properties by the Manufacturer are properly documented and that the test methods used are acceptable.
3. Quality control certificates have been provided at the specified frequency for all rolls, and that each certificate identifies the rolls related to it.
4. Roll packages are appropriately labeled.
5. Certified minimum roll properties meet the project specifications.

8.3 CONFORMANCE TESTING

Upon delivery of the rolls of geonet, the SSQA Technician will ensure that conformance test samples are obtained for the geonet. The rolls to be sampled will be selected by the

SSQA Technician. Samples will be taken from any portion of a roll which has not been deemed damaged by the SSQA Technician. Unless otherwise specified, samples will be 3 ft (1 m) long by the roll width. The SSQA Technician will mark the machine direction on the samples with an arrow.

A lot will be defined as a group of consecutively numbered rolls from the same manufacturing line. Alternatively, a lot may be designated by the SSQA Technician based on a review of all roll information including quality control documentation and manufacturing records.

Samples will be taken at a rate of one per lot and not less than one per 100,000 ft^2 (10,000 m^2) of geonet. These samples will then be forwarded to the Geosynthetic Laboratory for testing.

At a minimum, the following conformance tests will be performed:

1. Density (ASTM D1505)
2. Mass per unit area (ASTM D3776)
3. Thickness (ASTM D751)

All conformance test results will be reviewed and accepted or rejected by the SSQA Technician and CE prior to the deployment of the geonet. The CE and SSQA Technician will examine all results from laboratory conformance testing. The CE and SSQA Technician will be responsible for checking that all test results meet or exceed the property values listed for the project.

If a test result is in nonconformance, all material from the lot represented by the failing test should be considered out-of-specification and rejected. Additional conformance test samples may be taken to "bracket" the portion of the lot not meeting project specifications. To isolate the out-of-specification material, additional samples must be taken from rolls that have roll numbers immediately adjacent to the roll that was sampled and failed. If both additional tests pass, the (next larger roll number) will be rejected. If one of the additional tests fail, then the entire lot will be rejected or the procedure repeated with two additional tests that bracket a greater number of rolls within the lot.

8.4 GEONET DEPLOYMENT

The SSQA Technician will examine rolls upon delivery.

The geonet rolls should be protected against dust and dirt during shipment and storage since geonet cleanliness is essential to its performance. The geonet rolls will be delivered wrapped in plastic to protect the geonet from contamination. The SSQA Technician will verify that the geonet is free of dirt and dust prior to installation. The SSQA Technician will report any rolls judged dirty to the Installer. The Installer will clean geonet prior to

installation. Cleaning operations will be observed by the SSQA Technician.

The Installer will handle all geonet in such a manner as to ensure that it is not damaged in any way, and the following will be complied with:

1. On slopes, the geonet will be secured and rolled down the slope in such a manner as to continually keep the geonet sheet in tension. If necessary, the geonet will be positioned by hand being unrolled to minimize wrinkles.
2. In the presence of wind, all geonet will be weighted with sandbags or the equivalent. Such sand bags will be installed during deployment and will remain until replaced with cover material.
3. Unless otherwise specified, geonet will not be welded to geomembrane.
4. Geonet will be cut using scissors or other cutting tools approved by the Project Manager that will not damage the underlying geosynthetics. Care will be taken not to leave tools in the geonet.
5. The Installer will take any necessary precautions to prevent damage to underlying layers during placement of the geonet.
6. During placement of geonet, care will be taken not to entrap dirt, excessive dust, or fugitive bentonite clay in the geonet that could cause clogging of the drainage system, and/or stones that could damage the adjacent geomembrane. If dirt or excessive dust is entrapped in the geonet, it should be cleaned prior to placement of the next material on top of it. In this regard, care will be taken with the handling of sandbags, to prevent puncturing the sand bag.

Conditions differing from the above will be brought to the attention of the Installer.

8.5 SEAMING AND OVERLAPS

At a minimum, the following requirements for joining the adjacent geonet will be met:

1. Adjacent rolls will be overlapped by at least 4 in (100 mm).
2. The geonet overlaps will be tied with plastic fasteners. Tying devices will be white or yellow for easy inspection. Metallic devices are not allowed.
3. Tying will be every 5 ft (1.5 m) along the length at the adjacent rolls, every 6 in (0.15 m) in the anchor trench and every 6 in (0.15 m) along end-to-end seams.
4. In general, no horizontal seams will be allowed on sideslopes.
5. In the corners of the sideslopes of rectangular landfills, where overlaps between perpendicular geonet strips are required, an extra layer of geonet will be unrolled along the slope, on top of the previously installed geonet, from top to bottom of the slope.
6. When more than one layer of geonet is installed, joints will be staggered.
7. When several layers of geonet are stacked, rolls will be deployed in the same direction to prevent strands of one layer from penetrating the channels of the

adjacent layer.

8.6 DEFECTS AND REPAIRS

8.6.1 Identification

If a defect is identified in the geonet, the SSQA Technician will determine the extent and nature of the defect. If the defect is indicated by unsatisfactory test result, the SSQA Technician will determine the extent of the deficient area by additional tests, observations, a review of records and other means that the SSQA Technician deems appropriate.

8.6.2 Notification

After determining the extent and nature of the defect, the SSQA Technician will promptly notify the CE, Installer and Project Manager. A work deficiency meeting will be held as required between the Installer, CE or SSQA Technician, Designer, and Project Manager to assess the problem, review alternative solutions, and implement an action plan.

8.6.3 Repair Procedures

The final decision as to the appropriate repair will be agreed upon between the Project Manager, Installer, Designer, and CE.

If the hole or tear width is less than 50% of the width of the roll, the damaged area will be repaired as follows: procedures.

1. A patch will be placed extending 1 ft (0.3 m) beyond the edges of the hole or tear.
2. The patch will be secured to the original geonet by tying every 6 in (0.15 m). Tying devices will be as indicated in Section 8.6.

If the hole or tear width across the roll is equal to or more than 50% of the width of the roll, the damaged area will be repaired as follows:

1. On the base of the landfill, the damaged area will be cut out and the two portions of the geonet will be joined as indicated in Section 8.6.

The SSQA Technician will observe any repair.

8.7 GEONET PROTECTIONS

Soil should never be placed in direct contact with geonet. Soil materials near the geonet will be placed in such a manner as to ensure:

1. The geonet and underlying lining materials are not damaged.
2. Minimal slippage of the geonet on underlying layers occurs.
3. No excess tensile stresses occur in the geonet.

9.0 GEOTEXTILE/GEONET COMPOSITE

9.1 DEFINITION AND APPLICABILITY

Geotextile/geonet composites are geocomposites used as a filter and drainage media in lining systems. This Section is applicable to drainage geocomposites made of polyester or polypropylene nonwoven geotextiles and high density polyethylene (HDPE) geonet. The geotextiles may be bonded to one side or both sides of the geonet. This Section is not applicable to geocomposites made with other material or components. The specific type of geocomposite shall be specified in the project specifications.

9.2 MANUFACTURING PLANT INSPECTION

The Owner or appropriate representative will conduct a periodic inspection of the geocomposite Manufacturer's plant. In addition, the Project Manager or his designated representative, may visit the manufacturing plant for a project-specific inspection if deemed necessary. If possible, the project-specific inspection shall be prior to or during the manufacturing of the geotextile/geonet composite rolls for that particular project. The purpose of the plant inspection is to review the manufacturing process and quality control procedures.

The manufacturing plant inspection shall include:

1. Verification that the proper quality control documentation has been received by the Manufacturer from the component manufacturers.
2. Verification that properties guaranteed by the Manufacturer are met and meet all project specifications.
3. Verification that the measurement of properties by the Manufacturer is properly documented and test methods used are acceptable.
4. Spot inspection of the rolls and verification that they are free of imperfections or contamination by foreign matter.
5. Review of packaging, handling, storage, and transportation procedures and verification that these procedures will not damage the geocomposite.
6. Verification that roll packages have a label indicating the name of the manufacturer, type of geocomposite, roll number, and roll dimensions.

A report describing the inspection will be retained by the Owner for periodic inspections and by the Project Manager for project-specific inspections.

9.3 QUALITY CONTROL DOCUMENTATION

Prior to the installation of any geocomposite, the geocomposite Manufacturer or Installer shall provide the Project Manager with the following information:

1. The origin (supplier's name and production plant) and identification (brand name and number) of the geotextile and geonet used to fabricate the geocomposite.
2. Copies of dated quality control certificates issued by the geotextile and geonet supplier. These certificates shall contain the results of the quality control tests performed on the geocomposite components.
3. A specification for the geocomposite which includes all properties published by the Manufacturer measured using the appropriate test methods.
4. Written certification that minimum values given in the specification are guaranteed by the Manufacturer.
5. Quality control certificates for the geocomposite, signed by a responsible party employed by the Manufacturer. The quality control certificates shall include roll identification numbers, testing procedures and results of quality control tests. At a minimum, results shall be given for:

    a. Mass per unit area (ASTM D3776)
    b. Thickness (ASTM D1777)
    c. Geotextile-geonet adhesion (ASTM D413)

    Quality control tests shall be performed in accordance with the test methods for at least every 40,000 ft^2 (4,000 m^2) of geocomposite produced.

The Manufacturer shall identify all rolls of geocomposite with the following:

1. Manufacturer's name
2. Product identification
3. Roll number
4. Roll dimensions

The SSQA Technician shall review these documents and shall report any discrepancies with the above requirements to the Project Manager. The SSQA Technician shall verify that:

1. Property values certified by the Manufacturer meet all of its guaranteed specifications.
2. Measurements of properties by the Manufacturer are properly documented and that the test methods used are acceptable.
3. Quality control certificates have been provided at the specified frequency for all rolls, and that each certificate identifies the rolls related to it.

4. Roll packages are appropriately labeled.
5. Certified minimum roll properties meet the project specifications.
6. Project specifications and the CQA plan were submitted by the Project Manager to the Installer.

9.4 CONFORMANCE TESTING

9.4.1 Sampling Procedures

Upon delivery of the rolls of geocomposite, the SSQA Technician shall ensure that conformance test samples are obtained for the geocomposite.

The rolls to be sampled shall be selected by the SSQA Technician. Samples shall not be taken from any portion of a roll which has been damaged. Unless otherwise specified, samples shall be 3 ft (1 m) long by the roll width. The SSQA Technician shall mark the machine direction on the samples with an arrow. All lots of material and the particular test sample that represents each lot should be defined before the samples are taken.

A lot shall be defined as a group of consecutively numbered rolls from the same manufacturing line. Alternatively, a lot may be designated by the SSQA Technician based on a review of all roll information including quality control documentation and manufacturing records.

Unless otherwise specified, samples shall be taken at a rate of one per lot, not to be less than one per 100,000 ft^2 (10,000 m^2) of geocomposite. These samples shall then be forwarded to the SSQA Technician for testing to ensure conformance with the project specifications.

9.4.2 Conformance Tests

At a minimum, the following conformance tests shall be performed on the geocomposite as a unit:

1. Mass per unit area (ASTM D3776)
2. Geotextile-geonet adhesion (ASTM D413)

Additional conformance tests may be required by the project specifications.

9.4.3 Test Results

All conformance tests results shall be reviewed and accepted or rejected by the SSQA Technician prior to the deployment of the geocomposite. The SSQA Technician shall examine all results from laboratory conformance testing and shall report any nonconformance to the Project Manager. The SSQA Technician shall be responsible for

checking that all test results meet or exceed the property values listed in the project specifications.

If the Manufacturer has reason to believe that failing tests may be the result of the SSQA Technician incorrectly conducting the tests, the Manufacturer may request that the sample in question be retested by the SSQA Technician with a technical representative of the Manufacturer present during the testing. Alternatively, the Manufacturer may have the sample retested at two different Owner-approved labs at the expense of the Manufacturer. If both laboratories produce passing results, the material shall be accepted. If both laboratories do not produce passing results, then the original SSQA Technician's test results shall be accepted. The use of these procedures for dealing with failed test results is subject to the approval of the Project Manager.

If a test result is in noncomformance, all material from the lot represented by the failing test should be considered out-of-specification and rejected. Alternatively, at the option of the Project Manager, additional conformance test samples may be taken to "bracket" the portion of the lot not meeting specification (note that this procedure is valid only when all rolls in the lot are consecutively produced and numbered from one manufacturing line). To isolate the out-of-specification material, additional samples must be taken from rolls that have roll numbers immediately adjacent to the roll that was sampled and failed. If both additional tests pass, the roll that represents the initial failed test and the roll manufactured immediately after that roll (next larger roll number) shall be rejected. If one or both of the additional tests fail, then the entire lot shall be rejected or the procedure repeated with two additional tests that bracket a greater number of rolls within the lot.

9.5 GEOCOMPOSITE DEPLOYMENT

During shipment and storage, the geocomposite shall be protected from ultraviolet light exposure, moisture, mud, dirt, dust, puncture, cutting, or any other damaging conditions. Geocomposite rolls shall be shipped and stored in relatively opaque and watertight wrappings. The roll wrappings shall be removed shortly before deployment.

For one-sided geocomposite, the SSQA Technician shall verify that the geonet is free of dirt and dust prior to installation. The SSQA Technician shall identify any dirty rolls and report them to the Project Manager. If the geonet is judged to be dirty or dusty by the SSQA Technician, it shall be cleaned by the Installer prior to installation. Washing operation shall be observed by the SSQA Technician and improper washing operations shall be reported to the Project Manager.

The SSQA Technician shall observe rolls upon delivery at the site and any deviation from the above requirements shall be reported to the Project Manager.

The Installer shall handle all geocomposite in such a manner as to ensure they are not damaged and the following shall be compiled with:

1. On slopes, the geocomposite shall be securely anchored and then rolled down the slope in such a manner as to continually keep the geocomposite sheet in tension. If necessary, the geocomposite shall be positioned by hand after being unrolled to minimize wrinkles.
2. In the presence of wind, all geocomposites shall be weighted with sandbags of the equivalent. Sandbags shall be installed during deployment and shall remain until replaced with cover material.
3. Unless otherwise specified, single-sided geocomposite shall not be welded to the geomembrane.
4. Geocomposites shall be cut using a hook blade or other tool approved by the Project Manager. If in place, special care shall be taken to protect underlying geosynthetics from damage which could be caused by the cutting of the geocomposite. Care shall be taken not to leave the tools in the composite.
5. The Installer shall take any necessary precautions to prevent damage to underlying layers during placement of the geocomposite.
6. During placement of geocomposite, care shall be taken not to entrap in or beneath the geocomposite, stones, or dirt that could damage the geomembrane, cause clogging of drains or filters, or hamper subsequent seaming. If dirt or excess dust is entrapped in the geonet of single-sided geocomposite, it should be washed clean prior to placement of the next material on top of it. In this regard, care shall be taken with the handling of sandbags, to prevent puncturing the sandbag.
7. A visual examination of the geotextile component of the geocomposite shall be carried out over the entire surface, after installation to ensure that no potentially harmful foreign objects are present.

The SSQA Technician shall note any noncompliance and report it to the Project Manger.

9.6 SEAMING PROCEDURES

In general, no horizontal seams shall be allowed on sideslopes thus seams shall be along, not across, the slope, except as part of a patch. If horizontal seams are required, offset adjacent horizontal seams.

At a minimum, the following requirements shall be met:

1. Adjacent geocomposite shall be overlapped so that the geonet overlaps by at least 4 in (100 mm) and geotextile overlap by at least 3 in (75 mm).
2. If two sided geocomposite or the geotextile is on bottom, seam geotextile together.
3. The geonet overlaps shall be tied with plastic fasteners. Tying devices shall be white or yellow for easy inspection. Metallic devices are not allowed.
4. Tying shall be every 5 ft (1.5 m) along the slope, every 6 in (150 mm) in the anchor trench, and every 6 in (150 mm) along end-to-end seams on the base of the landfill.

5. In the corners of the sideslopes where overlaps between perpendicular strips are required, an extra layer shall be unrolled along the slope, on top of the previously installed geocomposite, from top to bottom of the slope.
6. When more than one layer of geocomposite is installed, joints shall be staggered.
7. Once geonet is tied, the geotextile of the geocomposite shall be seamed. On slopes steeper than 10:1 (horizontal:vertical), all geotextiles shall be continuously sewn. Spot sewing is not allowed. On bottoms and slopes shallower than 10:1, geotextiles shall be sewn (preferred), or thermally bonded with the written approval of the Project Manager. The Installer shall pay particular attention to seams to ensure that no earth cover material could be inadvertently inserted beneath the geotextile if applicable.
8. Any sewing shall be done using polymeric thread with chemical and ultraviolet light resistance properties equal to or exceeding those of the geotextile. Sewing shall be done using machinery and stitch types specified int he project specifications or as approved in writing by the Project Manager and the SSQA Technician.

The SSQA Technician shall note any noncompliance and report it to the Project Manager.

9.7 DEFECTS AND REPAIRS

9.7.1 Identification

If a defect is identified in the geotextile/geonet composite, the SSQA Technician shall determine the extent and nature of the defect. If the defect is indicated by unsatisfactory test result, the SSQA Technician shall determine the extent of the deficient area by additional tests, observations, a review of records and other means that the SSQA Technician deems appropriate.

9.7.2 Notification

After determining the extent and nature of the defect, the SSQA Technician shall promptly notify the Installer and Project Manager. A work deficiency meeting shall be held as required between the Installer, SSQA Technician, Project Manager and any other necessary parties to assess the problem, review alternative solutions, and implement an action plan.

9.7.3 Repair Procedures

The final decision as to the appropriate repair shall be agreed upon between the Project Manager, Installer, and SSQA Technician. Prior to acceptance of the geocomposite, the Installer shall locate and repair all damaged areas as directed by the SSQA Technician. Care shall be taken to remove any soil or other material which may have penetrated the

torn geotextile. The SSQA Technician shall observe any repair and report any noncompliance with the following requirements in writing to the Project Manager.

If in the SSQA Technician's judgement, the defect is determined to be small, typically smaller than 3 by 3 feet (1 m by 1 m), the geocomposite shall be repaired as follows:

1. If the geonet is judged to be undamaged but the geotextile is damaged, a patch of geotextile shall be placed. The geotextile patch shall be thermally bonded in place with a minimum of 12 inch (0.3 m) overlap in all directions.
2. If the geonet is judged to be damaged, the damaged geonet shall be removed. A section of geonet shall be cut to replace the removed section. The geonet shall be tied to the existing geonet using white plastic fasteners placed at least every 6 inches (150 mm) overlap. A geotextile patch shall be placed over the repaired geonet section. The geotextile patch shall be thermally bonded in place with a minimum of 12 inch (0.3 m) overlap in all directions.

If in the SSQA Technician's judgement, the defect is determined to be large, typically larger than 3 by 3 feet (1 m by 1 m), the geocomposite shall be replaced.

The SSQA Technician shall observe any repair and report any noncompliance with the above requirements in writing to the Project Manager.

9.7.4 Geocomposite Protection

For single-sided geocomposites, soils should never be placed in direct contact with geonet. All soil materials located on top of the geocomposite shall be deployed in such a manner as to ensure:

1. The geocomposite and underlying lining materials are not damaged.
2. Minimal slippage of the geocomposite on underlying layers occurs.
3. No excess tensile stresses occur in the geocomposite.

Any noncompliance with these guidelines or the project specifications shall be noted by the SSQA Technician and reported to the Project Manager.

10.0 LEACHATE COLLECTION SYSTEM

10.1 LEACHATE COLLECTION NETWORK

The leachate collection network is to be placed in the cell after the liner section has been installed and before the protective and drainage layer has been placed. The pipes will conform to all pertinent ASTM requirements and dimensions outlined in project plans and specifications. The pipes will be surrounded by non-carbonate stone which is to be

wrapped in geotextile drainage fabric as shown in the project drawings. The SSQA Technician will observe the process of placement to ensure that reasonable precautions are taken so as to avoid any damage to the geomembrane liner during the placement of the drainage layer. Prior to covering the system with the protective and drainage layer, the pipe diameter, length and slope of each lateral will be confirmed by the SSQA Technician. Any and all discrepancies will be immediately brought to the attention of the SSQA Technician and landfill manager. Resolution of the discrepancy must be obtained and corrections documented prior to placing the protective cover.

10.2 DRAINAGE LAYER/LINER PROTECTIVE COVER CONSTRUCTION

The liner protective cover, which is intended to also serve as a protective buffer between the waste and the geosynthetic base liner components, as well as a drainage layer for the leachate collection system, will be installed above the geomembrane liner and around the collection system after completion of the liner system. Placement technique will be submitted to and approved by CE or SSQA Technician prior to construction. In general, the protective cover will be placed in a single 2 foot lift to minimize possible liner damage.

10.3 QUALITY ASSURANCE TESTING

The SSQA Technician will collect representative samples of granular layer for every 3,000 yd^3 placed. Grain size distribution (through #200 sieve) test will be performed to confirm material compliance with project specifications. Testing to determine grain size distribution will be performed to allow certification of material compliance before the liner protective cover and drainage media is placed over the leachate collection system. Testing to determine permeability of granular layers will be made for every source of material. The CE or CQAPM will determine the appropriate sample density and confining pressure. Documentation of testing will be submitted with the certification as support data. Documentation will include comparison of grain size distribution with permeability test results.

11.0 DOCUMENTATION

11.1 DAILY FIELD REPORTS AND TEST RESULTS

The SSQA Technician will prepare daily reports which provide detailed descriptions of the construction operations for each day. The daily field reports will include but not be limited to the following:

a. Date, project name, location and other identifications and data on weather conditions.
b. Reports of any meeting(s) held and any pertinent results.

c. Description of construction operations, locations and equipment working on site during the time frame of the daily report.
d. Description of location of CQA testing including other testing operations, sampling locations, material used and quality verification documentation.
e. Decisions with regard to approval of units, material or work and/or corrective actions to be taken where substandard quality is identified.

The daily field reports should also include general comments and observations and will be signed by the SSQA Technician. A copy of the daily report will be kept on site and made available to the landfill manager, CQA personnel, Contractor, and ~~EPD~~ NCDEHNR personnel if so requested.

All field and laboratory test results will be reported on standard sheets and will, at a minimum, include the following:

a. Test title, sampling/test date, exact location of field test or sampling, personnel and any comments.
b. Type of testing activity and procedural references (standard methods when applicable).
c. Results of testing activity and comparison with specifications along with signature of performer and the SSQA Technician.

11.2 APPROVAL DOCUMENTATION

All corrective measures taken to bring unsuitable work up to design specifications must be documented. This documentation must describe what is in fault and the exact location, test designation that proves the work is unsuitable, the corrective measures agreed upon to bring it up to design specifications, the dates that corrective work was done, and the test designation that proves the work is now acceptable. All non-conformance reports will be brought to the attention of the Owner or Owner's representative by the SSQA Technician and will be documented in the CQA files. All work will be documented as to quality and attested to by the CE, including his signature of approval of "as-built" drawings.

The QA documentation will be organized and indexed to enable easy access and retrieval of original inspection and testing data sheets and all reports. During the construction period, originals of the documents will be maintained by the SSQA Technician and copies will be kept by the Owner's representative. At the completion of the project, a final certification report will be issued by the CE and transmitted to the ~~Georgia EPD~~ NCDEHNR and the Owner and Owner's representative. This document will include, at a minimum, the following information:

a. Scope of work, all daily field reports, laboratory and field test results.
b. Test methods and evaluation of test results with respect to project specifications.

c. Any non-conformance reports and corrective action reports.
d. Personnel involved with project and their qualifications.
e. As-built drawings and survey notes.
f. Certification of final construction as meeting or exceeding construction specifications. This certification should be signed and stamped by a registered professional geotechnical engineer (CE).

Once the construction quality has been certified by the CE and has been accepted by the Owner or Owner's representative, originals of the CQA documentation will be stored by the Owner and maintained.

To facilitate the review process by North Carolina DEHNR, the certification report may be issued as each phase of construction is completed. If this is done, it will be accomplished in such as way that when the last certification report is submitted North Carolina DEHNR will have a completed document, thus allowing sufficient time for review as well as insuring that the project is progressing in accordance with the permit.

Waste Management
regrounded on
Cover Seal - 40 mil
0.014 avg - for HDPE
.036 gm/m²-day

extruded onto
CoverSeal

LLDPE -
VLDPE - .036
HDPE .036

TABLE 4

NSC

40 mil *FRICTION SEAL CS* GEOMEMBRANE QUALITY CONTROL SPECIFICATIONS

FRICTION SEAL CS, National Seal Company's advanced textured polyethylene geomembrane is manufactured by attaching a friction surface to NSC's high quality *CoverSeal* geomembrane. The Friction surface is made from high molecular weight polyethylene resins compounded specifically for use in NSC geomembranes. The resins have been formulated to provide chemical and ultraviolet resistance for final cover applications. NSC produces *FRICTION SEAL CS* with a textured surface on one or both sides of the parent sheet.

The following properties, considered to be the most applicable for final cover applications, are tested every 100,000 ft² of geomembrane. Multi-axial tensile elongation is tested every 250,000 ft².

SHEET PROPERTIES	METHOD	UNITS	MINIMUM[1]
Thickness	ASTM D5199		
Average		mils	40.0
Individual		mils	36.0
Density[2]	ASTM D 1505	g/cm³	0.92 - 0.94
Carbon Black Content[2]	ASTM D 1603	percent	2.0 - 3.5
Tensile Properties[3]	ASTM D 638		
Stress at Break		psi	2300
Strain at Break	2.0" gage length	percent	300
	2.5" gage length (NSF)	percent	240
Multi-axial elongation	GRI, GM-4	percent	30

1 Except where noted, this value represents the minimum acceptable test value for a roll.

2 Testing performed on base sheet.

3 Stress and strength values are normalized to the nominal base sheet thickness. NSC certifies properties based on values calculated using nominal thickness only. Stress values calculated using actual product thickness is not guaranteed due to the lack of industry accepted thickness test procedures for friction sheet.

STANDARD ROLL DIMENSIONS

Width 15 feet Weight 3,000 lbs

This information contained herein has been compiled by National Seal Company and is, to the best of our knowledge, true and accurate. All suggestions and recommendations are offered without guarantee. Final determination of suitability for use based on any information provided, is the sole responsibility of the user. There is not implied or expressed warranty of merchantability of fitness of the product for the contemplated use.

NSC reserves the right to update the information contained herein in accordance with technological advances in the material properties.

? Coversear Friction

JUSTIFICATION FOR FINAL COVER AND CQA PLAN CHANGES

The following paragraphs correspond to the numbers indicated on the enclosed spreadsheet showing the changes in final cover geomembrane material and CQA Plan:

1. The PLFRC is presently permitted to use 40 mil coextruded very low density polyethylene (VLDPE) for their final cover geomembrane. As the name indicates, it is manufactured using VLDPE. In 1995, National Seal Corporation's (NSC) supplier of very low density polyethylene decided to cease the production of this material. In so making this decision, NSC was forced to no longer produce any geosynthetics using VLDPE. Desiring to continue to use NSC's products, the PLFRC desires to use another geomembrane in its place. This is a textured, polyethylene geomembrane named *FrictionSeal*™. Its properties are indicated in **Table 4** of the included, revised CQA Plan. It is friction type sheet of NSC's *CoverSeal*™ , and as you can see from **Table 4**, FrictionSeal is a *blend* of geomembrane-grade resins. The word "blend" is emphasized because *FrictionSeal*™ is manufactured by regrinding/ remanufacturing polyethylene sheets that do not meet specifications after completion of production, or waste sheet from other projects. These off-spec or waste sheets are mostly linear low or very low density polyethylene with some high density polyethylene.

Comparing some of the specifications between the coextruded VLDPE and *FrictionSeal*™ will be impossible because *FrictionSeal*™ is a blend of several different types of polyethylenes, the percentages of which is variable, and therefore strict specifications cannot be determined. However, it can be stated that comparing the known specifications, *FrictionSeal*™ is more than adequate to serve as the final cover geomembrane for the PLFRC.

---

2. The manufacturing of geomembranes have come a long way since the early 1980s. Manufacturing techniques are now well established with less off-spec material being produced. Because of this situation, it reduces the need for frequent quality assurance testing. Also, another reason for the reduction in the pre-installation QA of this geomembrane is its intended use. The PLFRC will not be constructing a base liner with this material. It will be used for final cover and if by some manufacturing error any off-spec sheet does slip by the QA testing, the worst case scenario would be that more rainfall may pass into the waste generating more leachate to treat -- a scenario that is not likely to take place.

---

3. See paragraph **2.** above. Again, it has been the PLFRC's experience that geomembrane manufacturing has become routine, whereby the owner (in this case the PLFRC) is now able to rely upon certifications and guarantees supplied by the manufacturer. Tests will be performed, but they will be performed by the manufacturer and certified within specifications to the owner. In our opinion, this is sufficient for final cover geomembrane.

---

4. This function will be performed, except that it will be required by the earthwork contractor and certified to the owner (in this case the PLFRC). The earthwork contractor will be performing this function anyway and therefore it is our opinion that it is redundant to perform it again by the owner's CQA personnel.

---

5. The responsibility of properly deploying the geomembrane will be the installer's (as it stands now, NSC will be the installer). They will certify through there own QC personnel that deployment will be in accordance with specifications. This will include proper seaming procedures and seam testing. In our opinion, it is sufficient for the owner's CQA personnel to periodically visually observe these procedures on final cover, review the installer's certifications and produce a report documenting adherence to the CQA Plan.

---

6. Due to the easily achievable specification of at least 1 X 10^{-5} cm/sec for the final cover soil layer's permeability, we believe a test pad is an unnecessary requirement. The earthwork contractor may construct a test pad but we wish to make it an option, and not a requirement.

---

7. The requirement in the existing approved CQA Plan was written with a base liner in mind. The requirements for base liners are and should be more stringent than final cover. We will be using on-site soil for use in our final cover, and have performed many tests upon these soils. There is no need to perform these tests further.

---

8. See paragraph number **7.** above. Again, these tests were written for liners. The only specifications that should be required for the soil final cover is thickness and permeability.

DIFFERENCES IN FINAL COVER AND CQA

ITEM	APPROVED PLAN	PROPOSED PLAN	JUSTIFICATION PARAGRAPH NUMBER
GEOMEMBRANE			
a.) Geomembrane material	40 mil Co-extruded	40 mil FrictionSeal	1
b.) Pre-Installation testing frequency by manufacturer	1 per 50,000 sf for various tests	1 per 100,000 sf; No Puncture Resistance; No Stress Crack Resistance	2
c.) Conformance testing and frequency by Owner's CQA personnel	1 per lot or 1/100,000 sf if less than 100,000 sf in project; various tests	Certifications and guarantees to be supplied by manufacturer	3
d.) Grade verification prior to deployment of geomembrane	To be verified by Owner's CQA representative	Responsibility of Earthwork Contractor	4
e.) Deployment testing and frequency	Owner's CQA personnel to verify various specifications during deployment	Owner's CQA personnel to visually monitor sheet quality and seaming procedures	5
SOIL			
a.) Pre-construction	Test Pad Required	No Test Pad necessary	6
b.) Pre-construction testing frequency	Various tests; Typically 1 per 3,000 cyds	Same Tests; 1 per source	7
c.) Conformance testing and frequency by Owner's CQA personnel	Various tests; Typically 1 per acre per lift	Thickness and permeability only; @ 1 per acre (or 1 per 2,420 cyds)	8

14

Forsyth Co

3406 1996

State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Waste Management

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
William L. Meyer, Director

DEHNR

34-06

December 19, 1996

Mr. William R. Lewis
Piedmont Landfill and Recycling Center
9900 Freeman Road
Kernersville, North Carolina 27284

RE: Final Contours, Module 1, Phase II
Piedmont Landfill and Recycling Center
Permit No. 36-04

Dear Mr. Lewis:

The Solid Waste Section has considered your request of December 6, 1996, to modify the final contours on the north side of Module 1, Phase II area. Your request and the attached drawings will be added to the list of approved documents for the facility. Please indicate the modifications on as-built drawings to be forwarded with Final Cover CQA documentation.

If you require additional information, please contact Sherri Coghill at (919) 733-0692, ext. 259.

Sincerely,

James C. Coffey

James C. Coffey, Supervisor
Permitting Branch
Solid Waste Section

cc: Julian Foscue
Brent Rockett

P.O. Box 27687,
Raleigh, North Carolina 27611-7687
Voice 919-733-4996

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Piedmont Landfill
and Recycling Center
9900 Freeman Road
Kernersville, North Carolina 27284
910/595-6677
FAX: 910/595-9735

A Waste Management Company

December 6, 1996

FAX

Ms. Sherri Coghill
North Carolina Dept. of Environment, Health, and Natural Resources
Solid Waste Section (SWS)
401 Oberlin Road
Raleigh, NC 27611

Re: Final Cover, First Phase, at the Piedmont Landfill & Recycling Center (PLFRC), Kernersville, NC. Permit Number 34-06

Dear Ms. Coghill:

As you know, we are presently constructing the first phase of final cover at the PLFRC. During this construction we noticed that the existing conditions on the north side of Module 1, Phase II, will not allow us to construct the final contours as per the permitted plans. Please consider this as a request to revise the final contours as per the attached Plan. Let me explain.

On the attached Plan View showing the permitted final contours and the proposed changes, you will notice that the changes are in red and are located on the perimeter of the landfill. The changes are minor in nature and the reason for this proposed change can be best explained by the attached cross-section. On this cross-section, the black lines indicate design/permitted criteria, while the red lines indicate both actual construction and the proposed changes. As you can see, the actual base liner is constructed higher than the design grade (approximately 2 feet higher). Because of this condition, we are unable to construct the final cover per the permitted contours and maintain the 24 inches of protective soil as per the permitted profile. Our proposed solution is to achieve the 24 inches of protective soil but this would mean raising the contours.

Please understand that the above solution does not increase the amount of waste in the landfill. In fact, because of how this cell was constructed, there is a loss of airspace. To be more specific, the permitted design indicated the limit of waste to be 6 feet from the inside, top of berm. Actual construction in this affected area shows that the inside, top of berm is located at the permitted limit of waste line, thereby creating a loss of airspace.

Ms. Coghill, we would appreciate your expedient response in this matter since we are in the middle of construction and need immediate direction. If you have any questions please do not hesitate to call either myself or Ed Gibson @ (910) 595-6677.

Sincerely,

William R. Lewis, P.E.
Division President and General Manager

cc: Ed Gibson, Mark Taylor, Peter Walls, Jay Lynch

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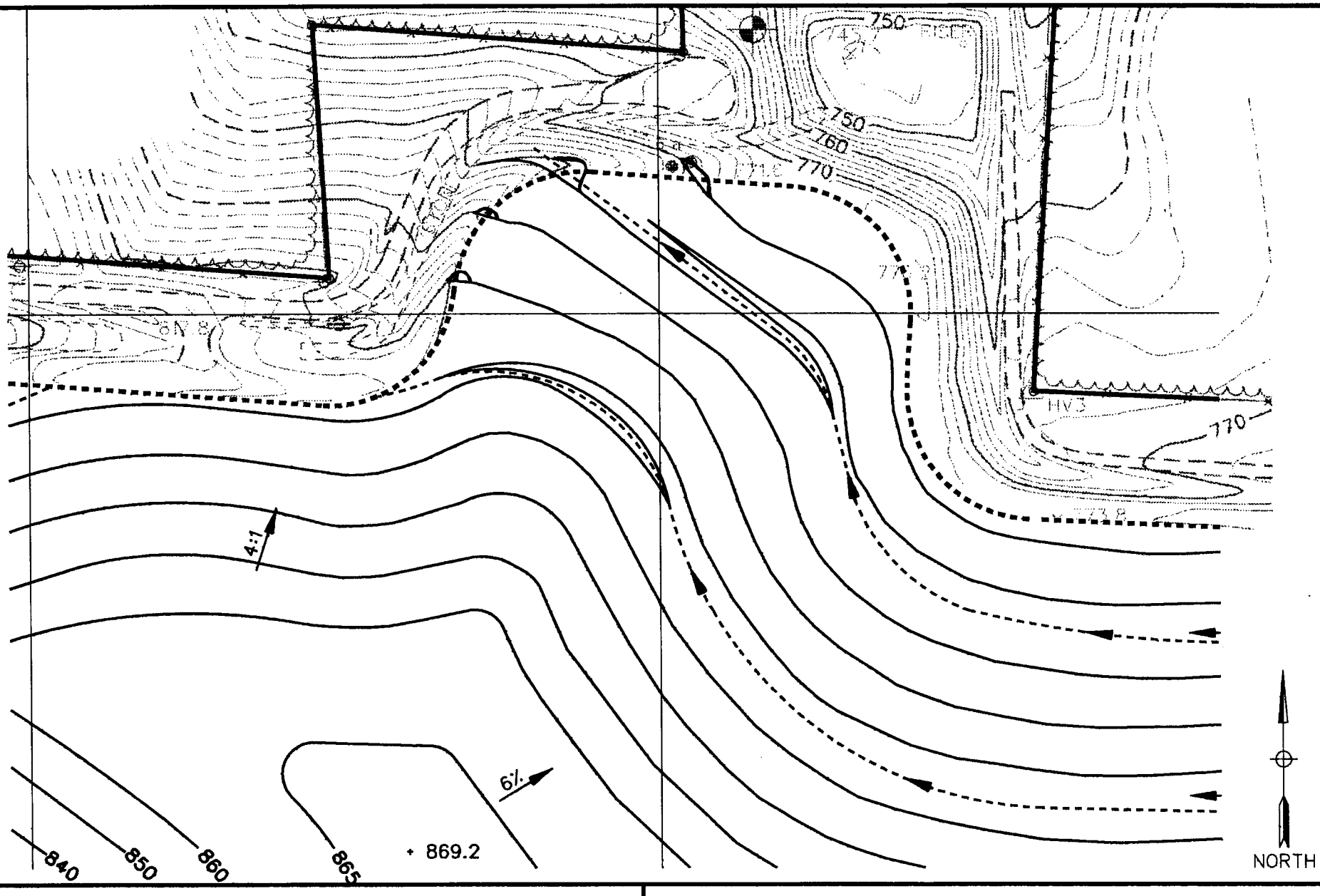
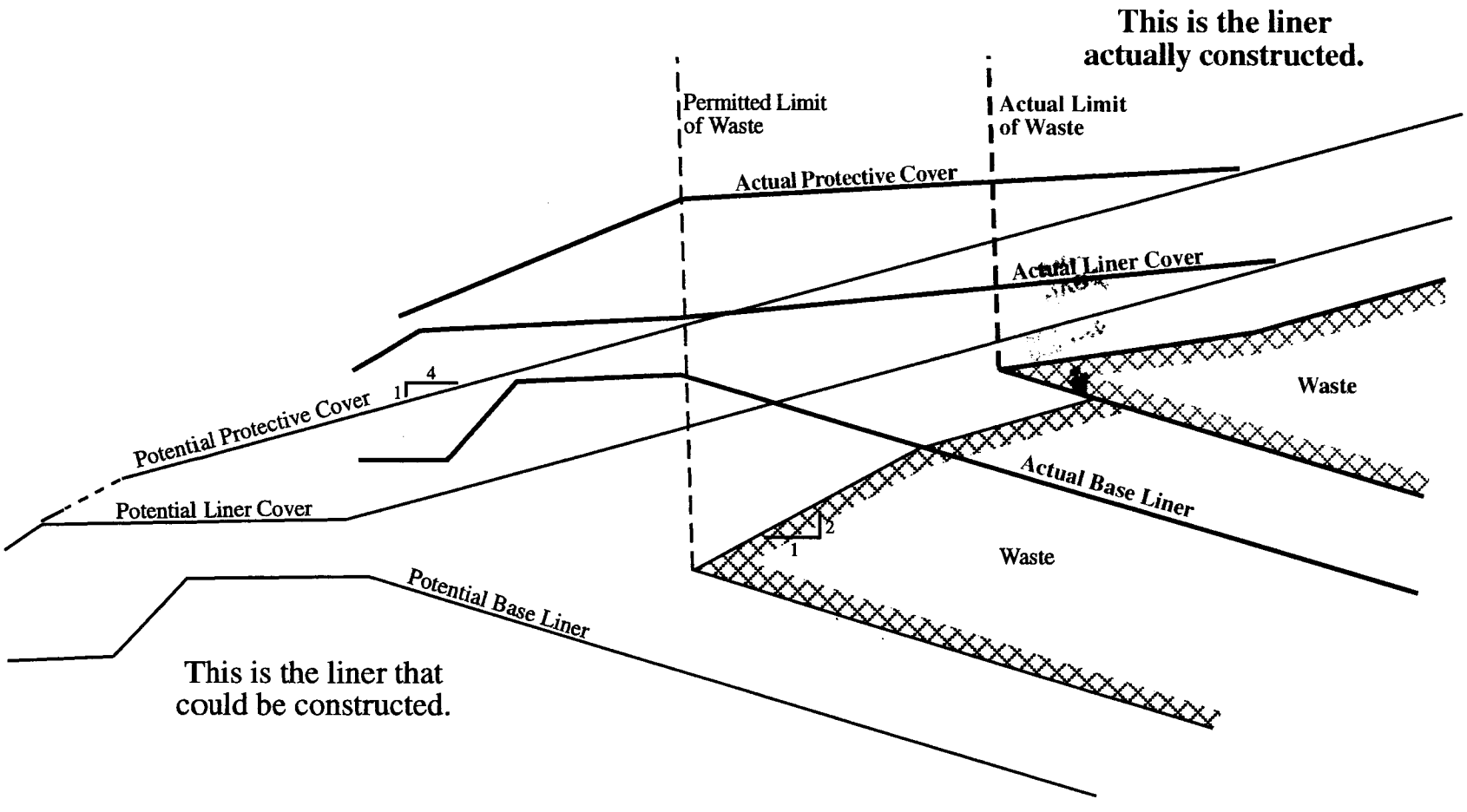


RUST ENVIRONMENT & INFRASTRUCTURE

PLAN VIEW OF FINAL COVER
IMPACT OF RETROFIT IN RED

RETROFIT FINAL COVER FOR AS-BUILT



State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Waste Management

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
William L. Meyer, Director

DEHNR

November 13, 1996

Mr. William R. Lewis
Piedmont Landfill and Recycling Center
9900 Freeman Road
Kernersville, North Carolina 27284

RE: Service Area
Piedmont Landfill and Recycling Center
Permit No. 36-04

Dear Mr. Lewis:

The Solid Waste Section has considered your request of November 6, 1996, to modify the approved plan to reflect the actual service area for the referenced landfill. Though the approved plan reflects a six-state service area, it is our understanding that only wastes from North Carolina and Virginia are actually accepted at the facility. Based on this information, the Solid Waste Section hereby approves your request to reduce the permitted service area for the Piedmont Landfill and Recycling Center to North Carolina and Virginia. Your request and this approval will be added to the list of approved documents for Permit No. 36-04.

If you have any questions or comments regarding this correspondence, please contact me at (919)733-0692, ext. 255.

Sincerely,

James C. Coffey

James C. Coffey, Supervisor
Permitting Branch
Solid Waste Section

cc: Julian Foscue
Brent Rockett

P.O. Box 27687,
Raleigh, North Carolina 27611-7687
Voice 919-733-4996

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State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Waste Management

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
William L. Meyer, Director

DEHNR

November 7, 1996

Thomas M. Yanoschak, P.E.
RUST
P. O. Box 24000
Greenville, SC 29618

Re: Modification to Anchor Trench
Piedmont Landfill and Recycling Center
Permit No. 34-06

Dear Mr. Yanoschak:

The Solid Waste Section hereby approves your request of November 6, 1996, to modify the permitted anchor trench detail for the referenced landfill. Please reference this modification in CQA documentation for the facility.

If you have any questions or require additional information, please contact Sherri Coghill at (919) 733-0692, ext. 259.

Sincerely,

James C Coffey

James C. Coffey, Supervisor
Permitting Branch
Solid Waste Section

cc: ~~Bill Lewis, PLFRC~~
Brent Rockett
Julian Foscue

P.O. Box 27687,
Raleigh, North Carolina 27611-7687
Voice 919-733-4996

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Piedmont Landfill
and Recycling Center
9900 Freeman Road
Kernersville, North Carolina 27284
910/595-6677
FAX: 910/595-9735

A Waste Management Company

November 6, 1996

Mr. James C. Coffey
North Carolina Department of Environment, Health, and Natural Resources
Solid Waste Section
401 Oberlin Road
Raleigh, NC 27611

Re: Piedmont Landfill & Recycling Center
Permit No. 34-06

Dear Mr. Coffey:

This correspondence is forwarded to request a change in the above referenced Permit #34-06, Condition Number "**Operation (O) 1. a**" [service area].

The currently specified service area includes North Carolina, South Carolina, Virginia, Kentucky, Tennessee and West Virginia. Piedmont Landfill & Recycling Center hereby requests that the area be reduced to North Carolina and Virginia.

During the original Landfill permitting process, the inclusion of every state from which sanitary waste could potentially come appeared to be proper. It is obvious, however, that since the inception of the Landfill, the waste stream has been from North Carolina and Virginia.. Piedmont Landfill & Recycling Center therefore feels it appropriate to request this change in the service area..

If you have any questions, please contact me or Ed Gibson at (910) 595-6677. We look forward to receiving the appropriate documentation reflecting this change.

Sincerely,

William R. Lewis, P. E.
Division President & General Manager

cc: Ed Gibson

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RUST Rust Environment & Infrastructure Inc.

A Rust International Company
15 Brendan Way
Greenville, SC 29615
P.O. Box 24000
Greenville, SC 29616

Phone 864.234.3000
Fax 864.234.3059

November 6, 1996

Ms. Sheri Coghill
NCDEHNR
P.O. Box 27687
Raleigh, NC 27611-7687

Re: Construction Detail Change
Piedmont Landfill & Recycling Center
Kernersville, North Carolina

Dear Ms. Coghill:

The purpose of this letter is to request approval of a minor change in the permitted anchor trench detail for the Piedmont Landfill & Recycling Center final cover construction.

As shown on the attached detail, we are requesting that a small piece of final cover geomembrane be deleted from the anchor trench detail. Deletion of this element will in no way inhibit the performance of the final cover system.

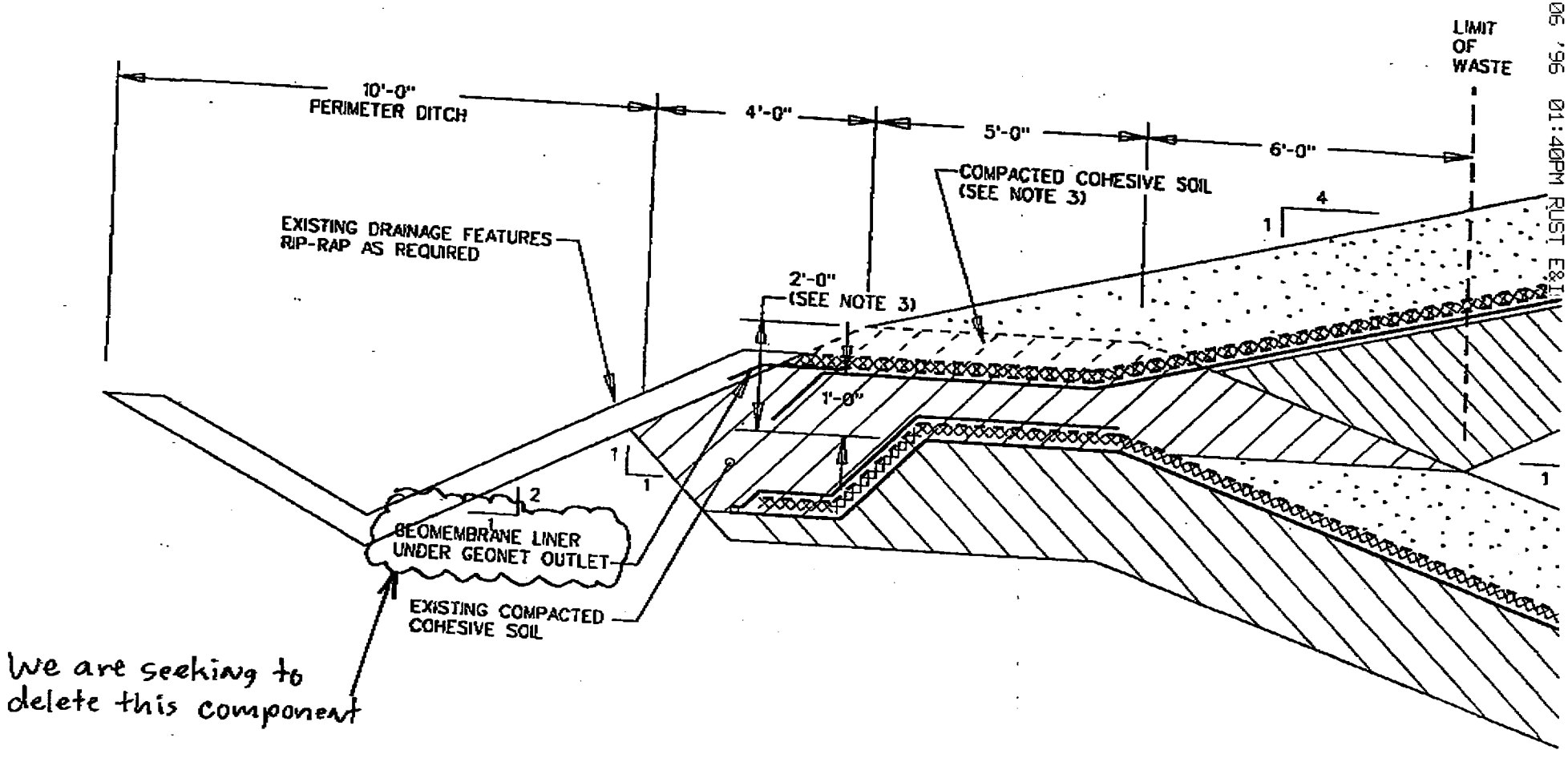
Please review the proposed change and let me know if you concur. The Contractor is on site and will need an answer very soon. Please call me at (864) 234-3042 once you have made a decision or if you need any additional information.

Sincerely,

Thomas M. Yanoschak

Thomas M. Yanoschak, P.E.
Certifying Engineer

cc: Ed Gibson - Piedmont Landfill



4/3 ANCHOR TRENCH / PERIMETER BERM

34-06

-Booklet-

Record Documentation
Phase I Landfill Gas Management System
for
Piedmont Landfill and Recycling Center

Nov. 1996

WASTE ENERGY TECHNOLOGY, INCORPORATED

11 Tupelo Avenue, S.E. • Fort Walton Beach, Florida 32548-5414
FAX (904) 243-0077 • TEL (904) 243-0033

RECORD DOCUMENTATION
PHASE 1 LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

November, 1996

Prepared for:

Waste Management of Carolinas, Inc.
9900 Freeman Road
Kernersville, North Carolina
(910) 595-6677

Prepared by:

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE
Fort Walton Beach, Florida 32548
(904) 243-0033

WET Project No: 96339

PHASE 1 LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

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GAS COLLECTION HEADER SYSTEM

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PHASE 1 LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

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   - J. Graded Bentonite
   - K. Thermometer
   - L. Trench Warning Ribbon

BLOWER/FLARE SKID ASSEMBLY

10. LFG BLOWER/FLARE SKID
   - A. O & M Manual
   - B. Ball Valves

PROJECT DOCUMENTATION

11. PHOTOGRAPHS

PROJECT OVERVIEW

PHASE 1 LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

PROJECT SUMMARY

On December 29, 1995, Waste Management of Carolinas, Inc. contracted Waste Energy Technology, Inc. (WET) to complete the Phase 1 Landfill Gas Management System Construction at the Piedmont Landfill and Recycling Center located in Kernersville, North Carolina.

This Landfill Gas Management System project consisted of the following:

- Installation of twenty-four (24) landfill gas extraction wells totaling 1224 feet of 36" diameter borehole and twenty-four (24) gas extraction well completions
- Installation of 6403 feet of 4" through 14" HDPE SDR 17 gas collection header and laterals
- Installation of two (2) 8" PVC underground isolation control valves with stem extensions
- Installation of two (2) condensate driplegs with clean out risers and drain tie-ins to the existing leachate collection system
- Installation of one (1) skid mounted blower/flare station rated at 1100 CFM capacity complete with temporary tie-in into the gas collection header, 2" HDPE condensate drain to the leachate collection system, and electrical service

During construction of one of the condensate dripleg tie-ins to the existing leachate system, the 60 mil HDPE liner was accidentally hit causing an approximate 3' x 5' tear. The documentation of the repair of this area is included in Section 8 of this document. There were also two (2) sections of the gas collection header damaged during the final cover construction. These sections were repaired by WET during blower/flare installation and also documented herein.

Final system inspection, start-up, and acceptance by the owner was completed on October 11, 1996.

PHASE 1 LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

PROJECT CONTACT LIST

LANDFILL MANAGER:

Mr. Bill Lewis
Piedmont Landfill and Recycling Center
9900 Freeman Road
Kernersville, North Carolina 27284-9765
(910) 595-6677

PROJECT MANAGER:

Mr. Edward L. Gibson, P.E.
Piedmont Landfill and Recycling Center
9900 Freeman Road
Kernersville, North Carolina 27284
(910) 595-6677

CONSTRUCTION MANAGER:

Mr. Mark Taylor, P.E.
Ecologic Associates, P.C.
2007 Yanceyville St.
Suite 223
Greensboro, North Carolina 27405-5004
(910) 271-3093

GENERAL CONTRACTOR:

Michael W. Rodgers - Project Manager
Rick Rodgers - Project Supervisor
James A. Getting, P.E. - Project Engineer
Rhea Baker - Collection Header Surveyor
Tommy Weder - Drilling Supervisor
Waste Energy Technology, Inc.
11 Tupelo Avenue, SE
Fort Walton Beach, Florida 32548
(904) 243-0033

PHASE 1 LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

SUB-CONTRACTOR AND VENDOR LIST

SUB-CONTRACTOR

A.C. Electric of Kernersville
P.O. Box 1625
Kernersville, North Carolina 27285
(910) 996-5446

Ground Safe, Inc.
2901 Clary Connector
Eastanolee, Georgia 30538
(706) 779-3313

I-Corp International
6072 North Ocean Boulevard
Ocean Ridge, Florida 33435
(561) 369-0795

VENDORS

Fasteners:

The Monarch Group, Ltd.
P.O. Box 611
Kernersville, North Carolina 27285
(919) 996-7618

Sand:

Larco Construction
4130 Glenn Avenue
Winston Salem, North Carolina 27115-6279
(910) 767-3500

Quality Sand Company
P.O. Box 1835
Statesville, North Carolina 28687
(919) 998-9487

Aggregate:

Vulcan Materials Company
P. O. Box 709
Stokesdale, North Carolina 27357
(901) 643-7770

For other material vendors see respective vendor or product literature enclosed herewith.

GAS EXTRACTION WELLS

GAS COLLECTION HEADER ROUTE SURVEY DATA - WELL SCHEDULE
LANDFILL GAS MANAGEMENT SYSTEM
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

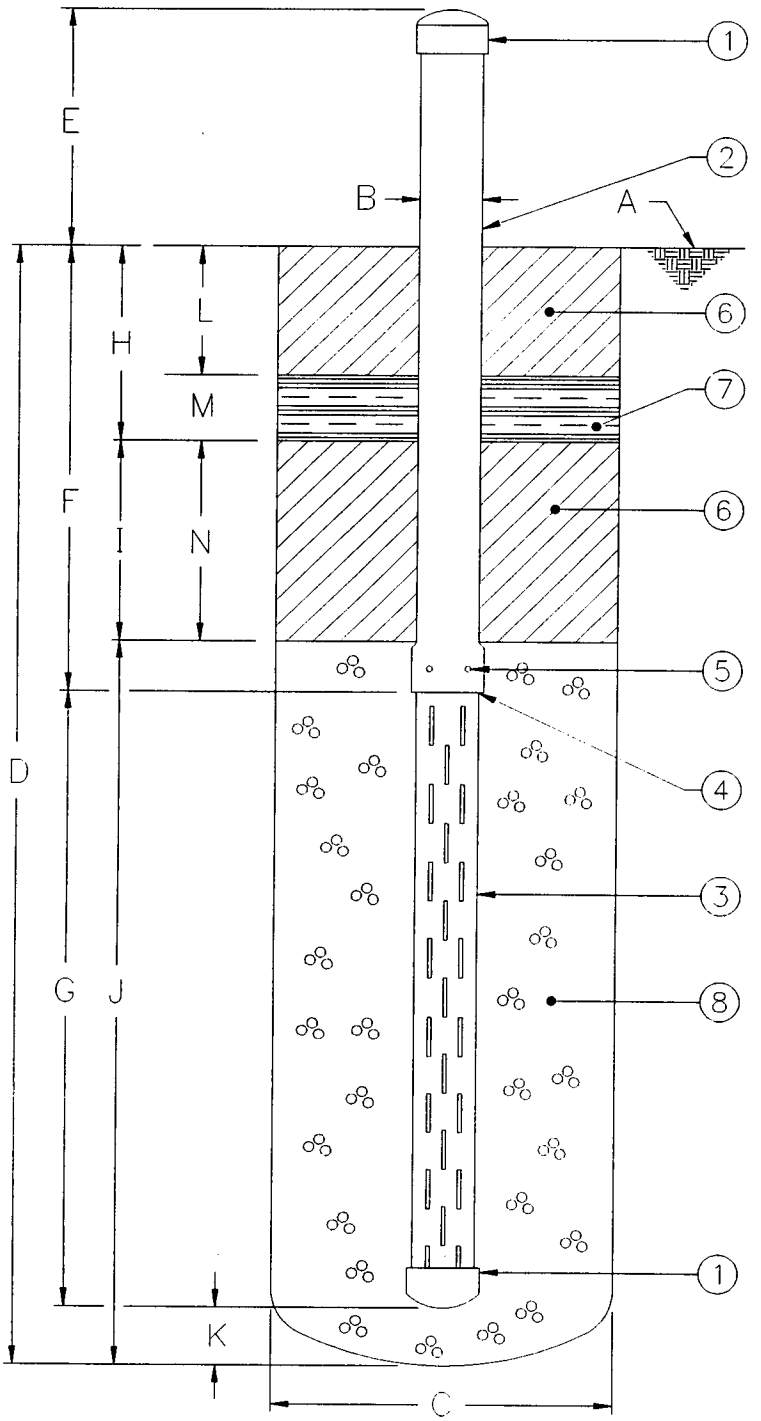
WELL ID	GRID COORDINATES (north)	(east)	GROUND ELEV. (ft)	BOTTOM OF WELL ELEV. (ft)	WELL DEPTH (ft)	SOLID PIPE (ft)	SLOTTED PIPE (ft)
GAS EXTRACTION WELLS							
W-1	892210	1691174	814.3	767.3	47	24	23
W-2	892306	1691319	827.1	771.1	56	28	28
W-3	892308	1691519	845.6	776.6	69	35	34
W-4	892308	1691720	846.1	782.1	64	32	32
W-5	892307	1691913	837.7	775.7	62	31	31
W-6	892451	1692012	804.5	768.5	36	20	16
W-7	892311	1692117	800.2	771.2	29	20	9
W-8	892213	1692278	799.9	771.9	28	20	8
W-9	892190	16924477	803.9	771.9	32	20	12
W-10	892220	1692680	797.6	770.6	27	20	7
W-11	892127	1691335	824.7	769.7	55	28	27
W-12	892104	1961530	846.6	767.6	79	40	39
W-13	892110	1691718	857.7	774.7	83	44	39
W-14	892113	1691914	855.2	773.2	82	41	41
W-15	892101	1692116	832.9	775.9	57	29	28
W-18	891929	1691419	799.5	765.5	34	20	14
W-19	891934	1691621	834.0	768.0	66	33	33
W-20	891928	1691793	855.8	774.8	81	41	40
W-20A	---------	----------	855.7	825.7	30	N/A	N/A
W-24	891760	1691515	800.9	764.9	36	20	16
W-25	891755	1691715	823.0	772.0	51	26	25
W-29	891620	1691837	793.2	764.2	29	20	9
W-32	892187	1692878	806.9	775.9	31	20	11
W-33	892180	1693078	807.6	778.6	29	20	9
W-34	892181	1693280	805.9	774.9	31	20	11
				TOTALS	**1224**	**652**	**542**

WELL CONSTRUCTION AND BORING LOGS

WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/22/96
WET PROJECT NO: 96339

WELL NUMBER: W-1
WELL LOCATION: N: 892210
E: 1691174



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	814.3 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	47 FT.
E	SOLID PIPE ABOVE GROUND:	11 FT.
F	SOLID PIPE BELOW GROUND:	24 FT.
G	SLOTTED PIPE LENGTH:	23 FT.
H	COVER DEPTH:	2 FT.
I	REFUSE DEPTH TO AGGREGATE:	20 FT.
J	AGGREGATE PACK:	25 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	19 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	45 FT.
	REFUSE TEMP RANGE (DEG F):	90-100

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
L:\PROJECT\PIEDM339\339WELL1.WPD

WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/22/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-1

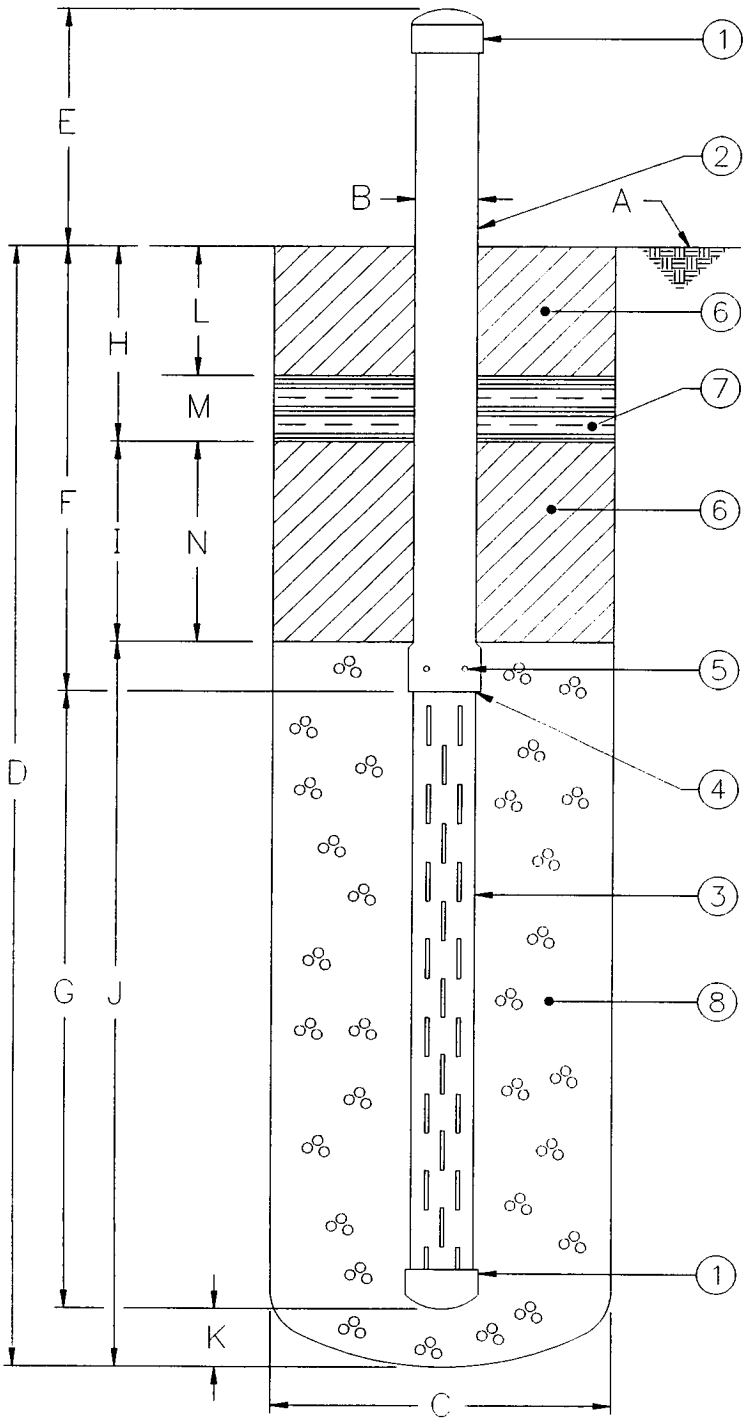
DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	SOIL COVER	N/A				
2' - 4'	PAPER, PLASTIC	MODERATE	DRY			
4' - 6'	PAPER, PLASTIC	MODERATE	DRY		1992	
6' - 8'	PAPER, PLASTIC	MODERATE	DRY	90 °		
8' - 10'	PAPER, PLASTIC	MODERATE	DRY			
10' - 15'	PAPER, PLASTIC	MODERATE	DRY			
15' - 20'	PAPER, PLASTIC	MODERATE	DRY	96 °		
20' - 25'	PAPER, PLASTIC	MODERATE-HEAVY	DRY			
25' - 30'	PAPER, PLASTIC	MODERATE-HEAVY	DRY	98 °		
30' - 35'	PAPER, PLASTIC	MODERATE-HEAVY	DRY			
35' - 40'	PAPER, PLASTIC	MODERATE-HEAVY	DRY			
40' - 45'	DAILY COVER	MODERATE-HEAVY	DRY		1991	
45' - 47'	PAPER, PLASTIC	MODERATE-HEAVY	DRY	100 °		

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
(904) 243-0033 WET Project No. 96339

WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/22/96
WET PROJECT NO: 96339

WELL NUMBER: W-2
WELL LOCATION: N: 892306
E: 1691319



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	827.1 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	56 FT.
E	SOLID PIPE ABOVE GROUND:	9 FT.
F	SOLID PIPE BELOW GROUND:	28 FT.
G	SLOTTED PIPE LENGTH:	28 FT.
H	COVER DEPTH:	2 FT.
I	REFUSE DEPTH TO AGGREGATE:	24 FT.
J	AGGREGATE PACK:	30 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	23 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	54 FT.
	REFUSE TEMP RANGE (DEG F):	85-110

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/22/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER:W-2

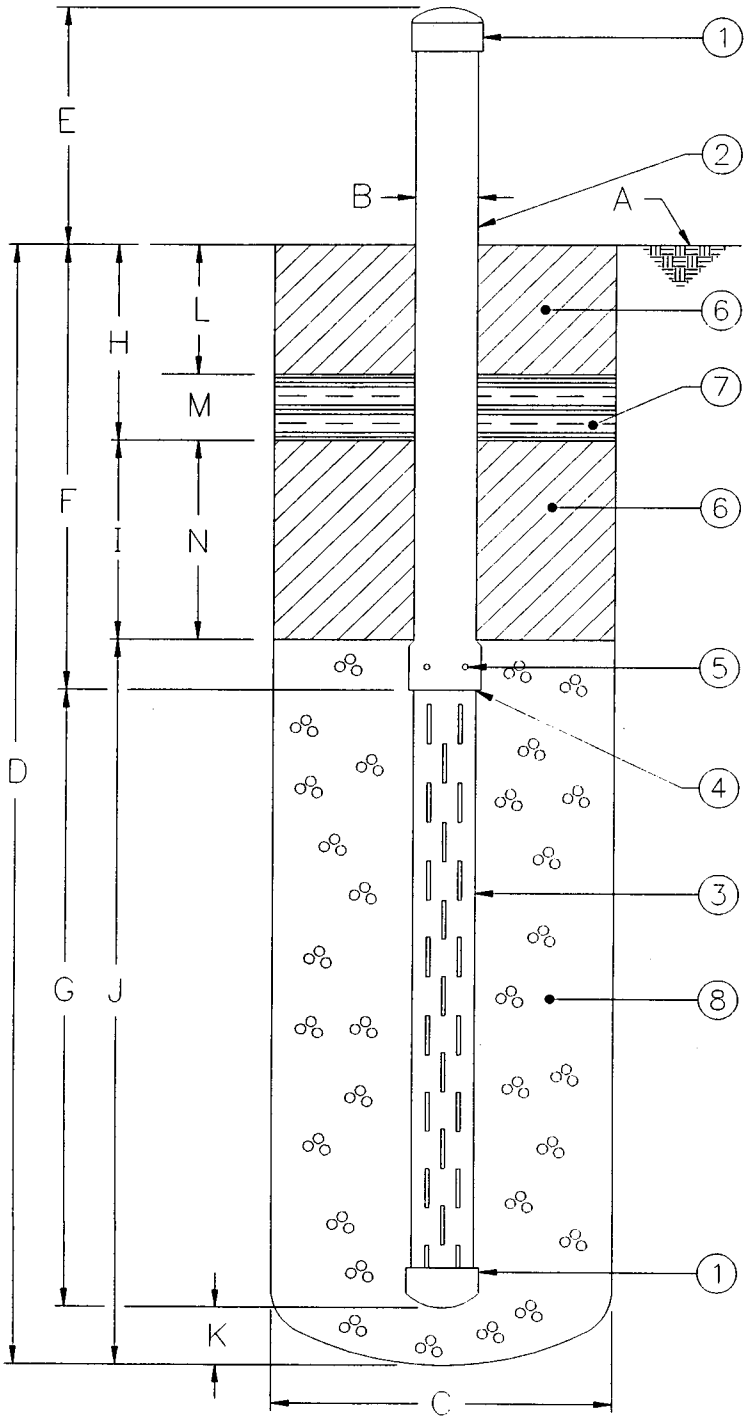
DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	SOIL COVER	N/A				
2' - 4'	PAPER, PLASTIC, WOOD	MODERATE	MOIST			
4' - 6'	PAPER, PLASTIC, GLASS	MODERATE	MOIST	85 °		
6' - 8'	PAPER, PLASTIC, METAL	MODERATE	MOIST		1994	
8' - 10'	PAPER, PLASTIC	MODERATE	MOIST	90 °		
10' - 15'	PAPER, PLASTIC, RUBBER	MODERATE	MOIST			
15' - 20'	PAPER, PLASTIC	MODERATE	MOIST			
20' - 25'	PAPER, PLASTIC	MODERATE	MOIST	100 °		
25' - 30'	PAPER, PLASTIC, TIRES	MODERATE	MOIST			
30' - 35'	PAPER, PLASTIC	HEAVY	MOIST			
35' - 40'	PAPER, PLASTIC	HEAVY	MOIST	110 °		
40' - 45'	PAPER, PLASTIC, RUBBER	HEAVY	MOIST		1991	
45' - 50'	PAPER, PLASTIC, RUBBER	HEAVY	MOIST			
50' - 55'	PAPER, PLASTIC, GLASS	HEAVY	MOIST	100 °		
55' - 56'	PAPER, PLASTIC, RUBBER	HEAVY	MOIST			

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
(904) 243-0033 WET Project No. 96339

WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/25/96
WET PROJECT NO: 96339

WELL NUMBER: W-3
WELL LOCATION: N: 892308
E: 1691519



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	845.6 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	69 FT.
E	SOLID PIPE ABOVE GROUND:	11 FT.
F	SOLID PIPE BELOW GROUND:	35 FT.
G	SLOTTED PIPE LENGTH:	34 FT.
H	COVER DEPTH:	2 FT.
I	REFUSE DEPTH TO AGGREGATE:	31 FT.
J	AGGREGATE PACK:	36 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	30 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	67 FT.
	REFUSE TEMP RANGE (DEG F):	90-97

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/25/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-3

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	SOIL COVER	N/A				
2' - 4'	PAPER, PLASTIC	MODERATE	DRY			
4' - 6'	PAPER, PLASTIC	MODERATE	DRY			
6' - 8'	PAPER, PLASTIC	MODERATE	DRY			
8' - 10'	PAPER, PLASTIC	MODERATE	DRY	90 °		
10' - 15'	PAPER, PLASTIC	MODERATE	DRY			
15' - 20'	PAPER, PLASTIC	MODERATE	DRY			
20' - 25'	PAPER, PLASTIC	MODERATE	DRY	90 °		
25' - 30'	PAPER, PLASTIC	MODERATE	DRY		1992	
30' - 35'	PAPER, PLASTIC	HEAVY	DRY			
35' - 40'	PAPER, PLASTIC	HEAVY	DRY	93 °		
40' - 45'	PAPER, PLASTIC	HEAVY	DRY		1991	
45' - 50'	PAPER, PLASTIC	HEAVY	DRY			
50' - 55'	PAPER, PLASTIC	HEAVY	DRY	95 °		
55' - 60'	PAPER, PLASTIC	HEAVY	DRY			
60' - 65'	PAPER, PLASTIC	HEAVY	DRY			
65' - 69'	PAPER, PLASTIC	HEAVY	DRY	97 °		

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
(904) 243-0033 WET Project No. 96339
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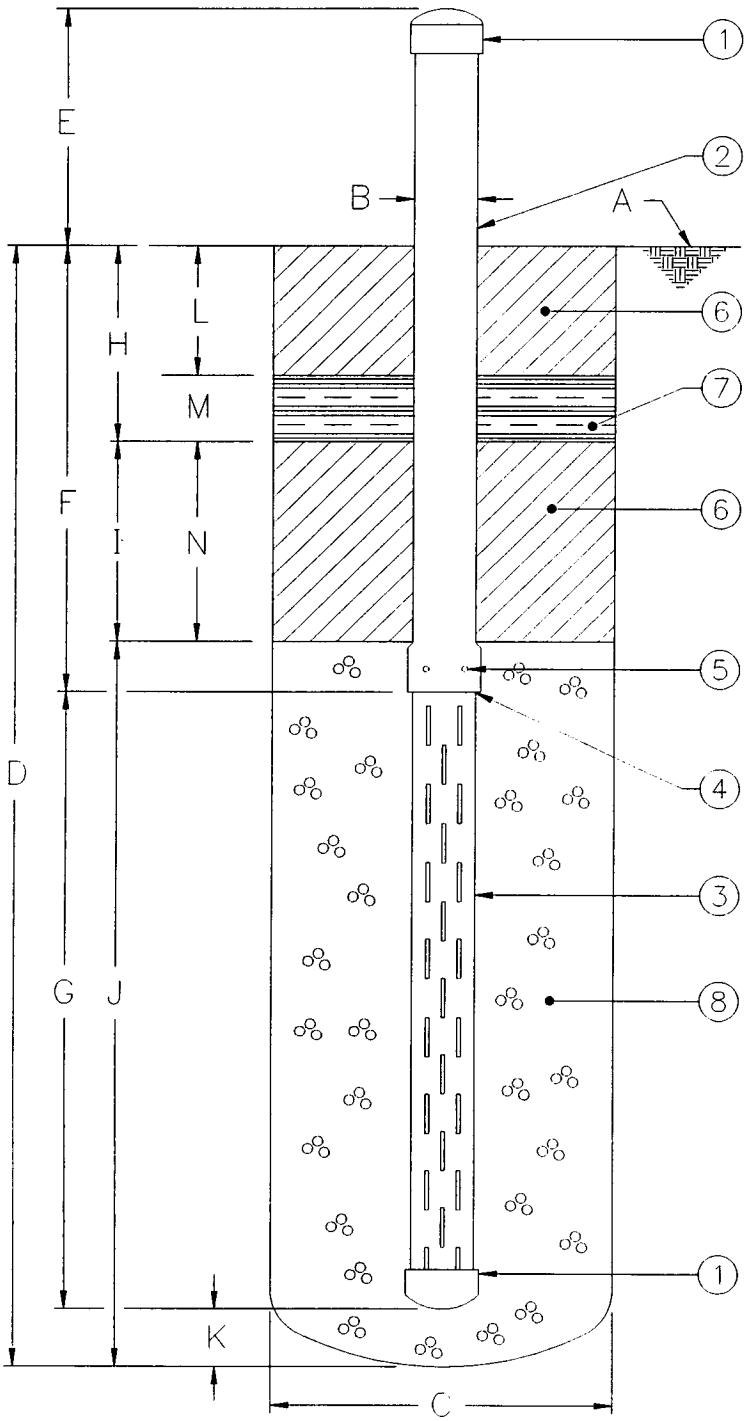
WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/22/96
WET PROJECT NO: 96339

WELL NUMBER: W-4
WELL LOCATION: N: 892308
E: 1691720



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	846.1 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	64 FT.
E	SOLID PIPE ABOVE GROUND:	6 FT.
F	SOLID PIPE BELOW GROUND:	32 FT.
G	SLOTTED PIPE LENGTH:	32 FT.
H	COVER DEPTH:	2 FT.
I	REFUSE DEPTH TO AGGREGATE:	28 FT.
J	AGGREGATE PACK:	34 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	27 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	62 FT.
	REFUSE TEMP RANGE (DEG F):	90-110

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/22/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-4

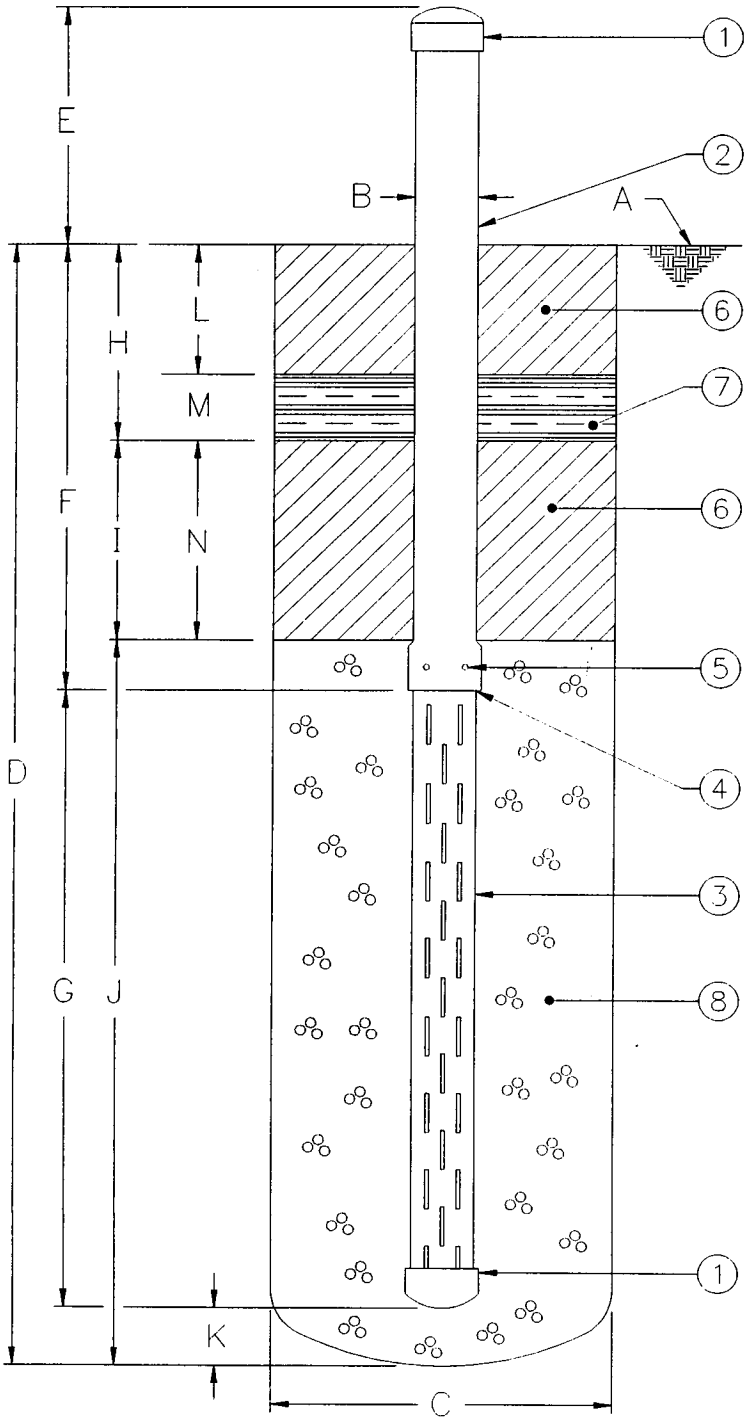
DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	COVER	N/A				
2' - 4'	PAPER, PLASTIC, WIRE, WOOD	HEAVY-MODERATE	MOIST			
4' - 6'	PAPER, PLASTIC, GLASS, WOOD	HEAVY-MODERATE	MOIST			
6' - 8'	PAPER, PLASTIC, GLASS, WOOD	HEAVY-MODERATE	MOIST			
8' - 10'	PAPER, PLASTIC, GLASS, WOOD	HEAVY-MODERATE	MOIST	90 °		
10' - 15'	PAPER, PLASTIC, CLOTH, WOOD	HEAVY-MODERATE	MOIST		1995	
15' - 20'	PAPER, PLASTIC, GLASS, WOOD	HEAVY-MODERATE	MOIST	90 °		
20' - 25'	PAPER, PLASTIC, CLOTH, WOOD	HEAVY-MODERATE	MOIST		1995	
25' - 30'	PAPER, PLASTIC, CLOTH, WOOD	HEAVY-MODERATE	MOIST	95 °		
30' - 35'	PAPER, METAL, PLASTIC, WOOD	HEAVY-MODERATE	MOIST			
35' - 40'	PAPER, PLASTIC, WOOD	HEAVY-MODERATE	MOIST	100 °		
40' - 45'	PAPER, PLASTIC, WOOD, TIRES	HEAVY-MODERATE	MOIST		1993	
45' - 50'	PAPER, WOOD, PLASTIC, RUBBER	HEAVY-MODERATE	MOIST	110 °		
50' - 55'	PAPER, PLASTIC, WOOD, RUBBER	HEAVY-MODERATE	MOIST			
55' - 60'	PAPER, PLASTIC, GRASS	HEAVY-MODERATE	MOIST	110 °	1993	
60' - 64'	PAPER, PLASTIC, LEAVES	HEAVY-MODERATE	MOIST			

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
(904) 243-0033 WET Project No. 96339

WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/24/96
WET PROJECT NO: 96339

WELL NUMBER: W-5
WELL LOCATION: N: 892307
E: 1691913



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	837.7 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	62 FT.
E	SOLID PIPE ABOVE GROUND:	11 FT.
F	SOLID PIPE BELOW GROUND:	31 FT.
G	SLOTTED PIPE LENGTH:	31 FT.
H	COVER DEPTH:	2 FT.
I	REFUSE DEPTH TO AGGREGATE:	27 FT.
J	AGGREGATE PACK:	33 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	26 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	60 FT.
	REFUSE TEMP RANGE (DEG F):	90-110

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/24/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-5

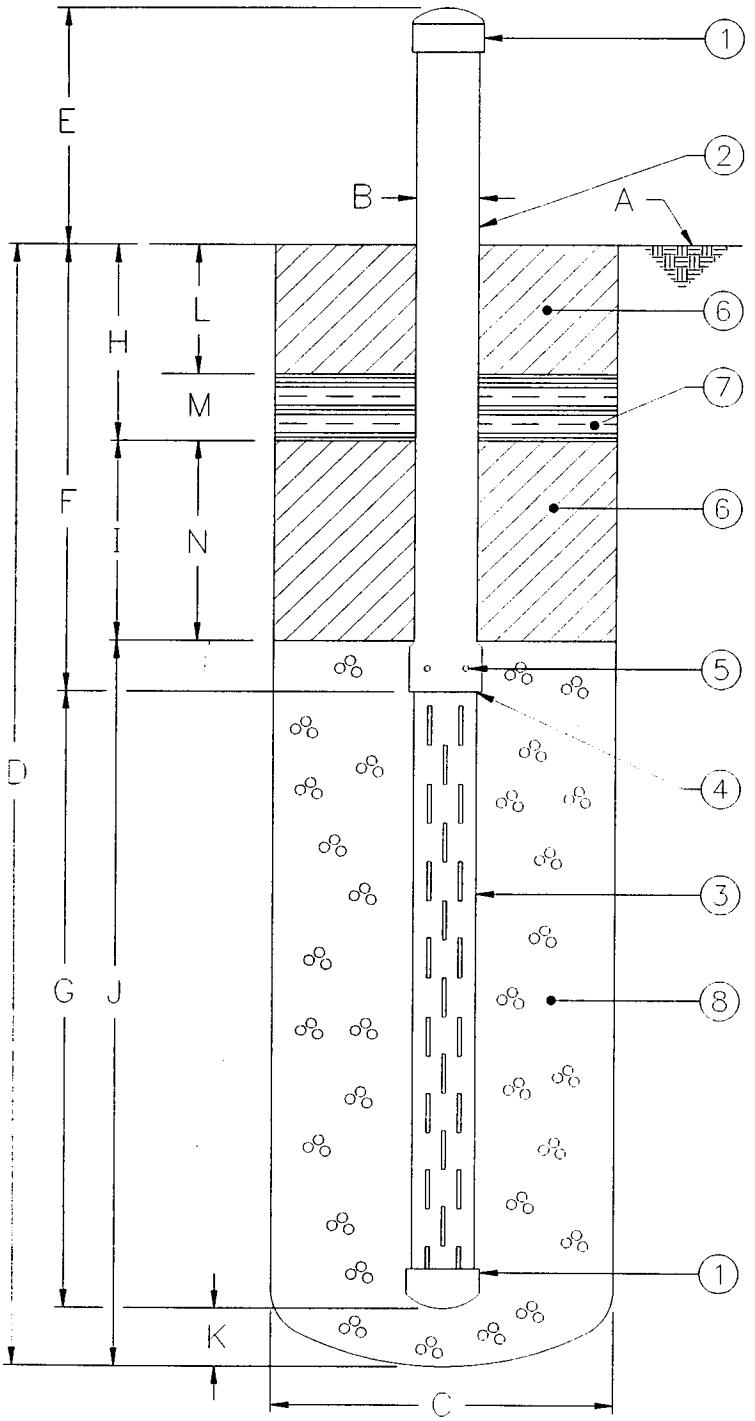
DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	COVER	N/A				
2' - 4'	PAPER, PLASTIC, WOOD	MODERATE-HEAVY	MOIST			
4' - 6'	PAPER, PLASTIC, WOOD	MODERATE-HEAVY	MOIST			
6' - 8'	PAPER, PLASTIC, WOOD	MODERATE-HEAVY	MOIST			
8' - 10'	PAPER, PLASTIC, TIRES	MODERATE-HEAVY	MOIST	90 °		
10' - 15'	PAPER, PLASTIC, TIRES	MODERATE-HEAVY	MOIST			
15' - 20'	PAPER, PLASTIC, TIRES	MODERATE-HEAVY	MOIST	95 °	1995	
20' - 25'	PAPER, PLASTIC, WIRE	MODERATE-HEAVY	MOIST	98 °		
25' - 30'	PAPER, PLASTIC, WIRE	MODERATE-HEAVY	MOIST			
30' - 35'	PAPER, PLASTIC, RUBBER	MODERATE-HEAVY	MOIST	100 °		
35' - 40'	PAPER, PLASTIC, WIRE	MODERATE-HEAVY	MOIST			
40' - 45'	PAPER, PLASTIC, GRASS	MODERATE-HEAVY	MOIST	110 °	1994	
45' - 50'	PAPER, PLASTIC, METAL	MODERATE-HEAVY	MOIST			
50' - 55'	PAPER, PLASTIC, GRASS	MODERATE-HEAVY	MOIST	110 °		
55' - 60'	PAPER, PLASTIC, WOOD	MODERATE-HEAVY	MOIST			
60' - 62'	PAPER, PLASTIC, WOOD	MODERATE-HEAVY	MOIST	100 °		

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
(904) 243-0033 WET Project No. 96339

WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/21/96
WET PROJECT NO: 96339

WELL NUMBER: W-6
WELL LOCATION: N: 892451
E: 1692012



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	804.5 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	36 FT.
E	SOLID PIPE ABOVE GROUND:	8 FT.
F	SOLID PIPE BELOW GROUND:	20 FT.
G	SLOTTED PIPE LENGTH:	16 FT.
H	COVER DEPTH:	2 FT.
I	REFUSE DEPTH TO AGGREGATE:	16 FT.
J	AGGREGATE PACK:	18 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	15 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	34 FT.
	REFUSE TEMP RANGE (DEG F):	82-95

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/21/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-6

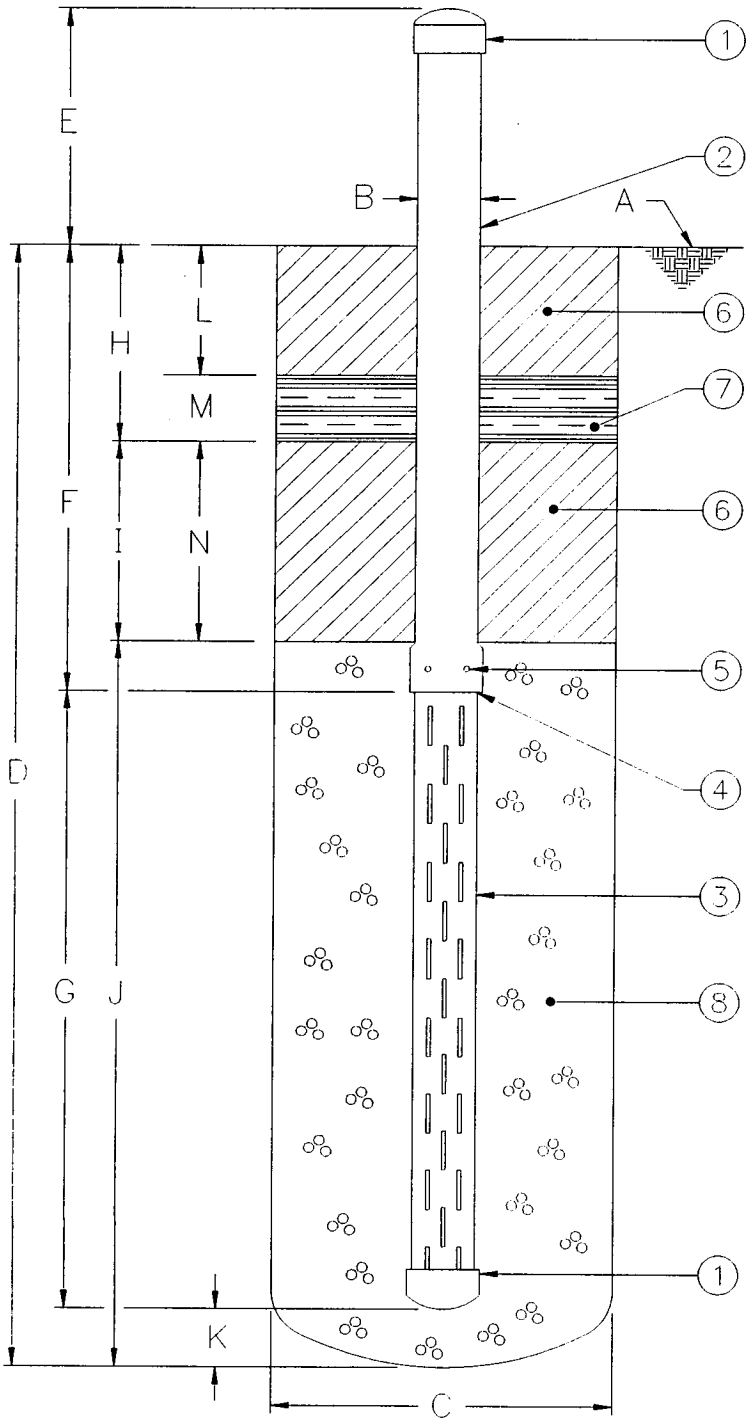
DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	COVER	N/A				
2' - 4'	PAPER, PLASTIC	MODERATE	DRY			
4' - 6'	PAPER, PLASTIC	MODERATE	DRY			
6' - 8'	PAPER, PLASTIC, WOOD	MODERATE	DRY			
8' - 10'	PAPER, PLASTIC, WOOD	MODERATE	DRY			
10' - 15'	PAPER, PLASTIC, CLOTH	MODERATE	DRY	82 °		
15' - 20'	PAPER, PLASTIC, CLOTH	MODERATE	DRY			
20' - 25'	PAPER, PLASTIC, WOOD	MODERATE	DRY	85 °		
25' - 30'	PAPER, PLASTIC	HEAVY	DRY			
30' - 35'	PAPER, PLASTIC	HEAVY	DRY	95 °		
35' - 36'	PAPER, PLASTIC	HEAVY	DRY			

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
(904) 243-0033 WET Project No. 96339

WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/21/96
WET PROJECT NO: 96339

WELL NUMBER: W-7
WELL LOCATION: N: 892311
E: 1692117



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	800.2 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	29 FT.
E	SOLID PIPE ABOVE GROUND:	11 FT.
F	SOLID PIPE BELOW GROUND:	20 FT.
G	SLOTTED PIPE LENGTH:	9 FT.
H	COVER DEPTH:	2 FT.
I	REFUSE DEPTH TO AGGREGATE:	16 FT.
J	AGGREGATE PACK:	11 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	15 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	27 FT.
	REFUSE TEMP RANGE (DEG F):	85-90

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/21/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-7

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	SOIL COVER	N/A				
2' - 4'	PAPER, PLASTIC	HEAVY	MOIST			
4' - 6'	PAPER, PLASTIC	HEAVY	MOIST			
6' - 8'	GLASS, TIRES	MODERATE	MOIST	85 °		
8' - 10'	CARPET, PAPER	MODERATE	MOIST			
10' - 15'	METAL, WOOD	MODERATE	MOIST	90 °		
15' - 20'	PAPER, PLASTIC	HEAVY	MOIST			
20' - 25'	RUBBER, PLASTIC	HEAVY	MOIST			
25' - 29'	PAPER, PLASTIC, WOOD	HEAVY	MOIST	90 °		

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
(904) 243-0033 WET Project No. 96339
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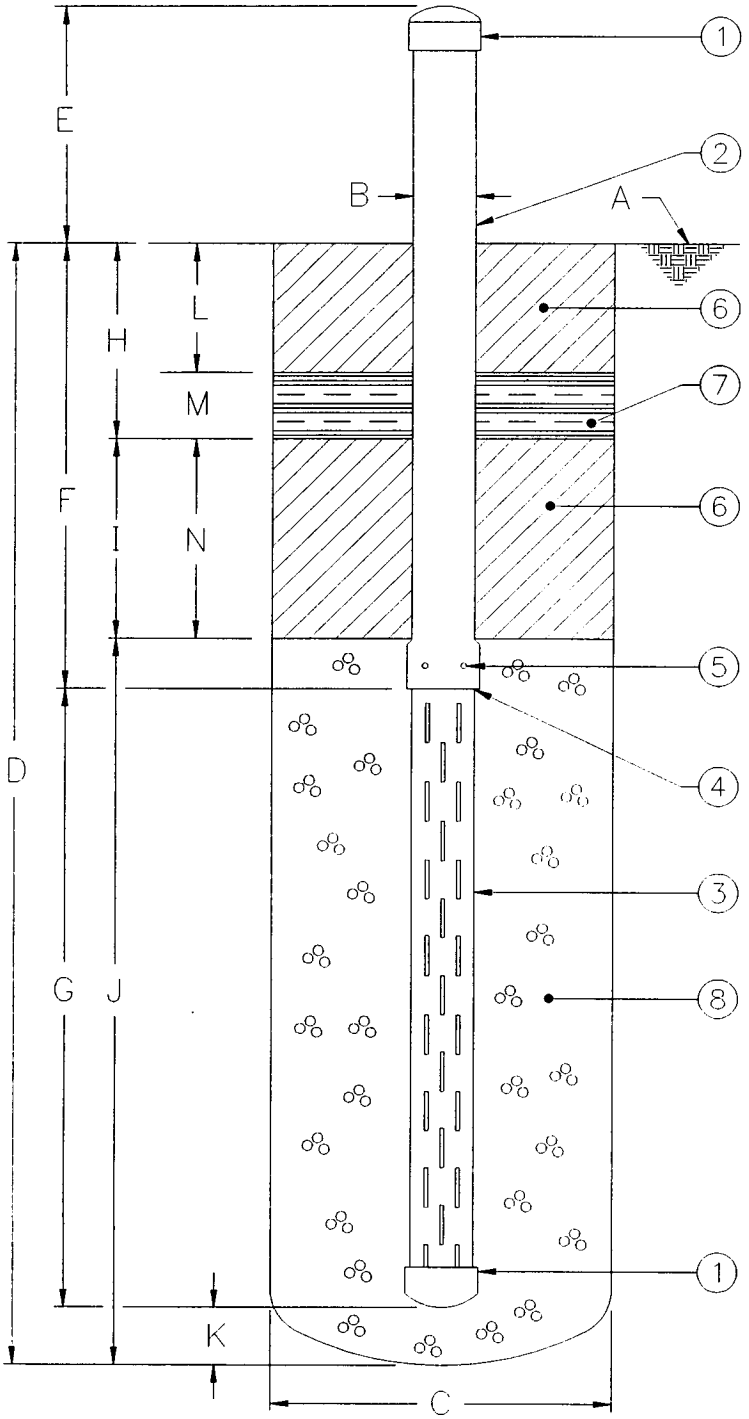
WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/21/96
WET PROJECT NO: 96339

WELL NUMBER: W-8
WELL LOCATION: N: 892213
E: 1692278



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	799.9 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	28 FT.
E	SOLID PIPE ABOVE GROUND:	8 FT.
F	SOLID PIPE BELOW GROUND:	20 FT.
G	SLOTTED PIPE LENGTH:	8 FT.
H	COVER DEPTH:	2 FT.
I	REFUSE DEPTH TO AGGREGATE:	16 FT.
J	AGGREGATE PACK:	10 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	15 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	26 FT.
	REFUSE TEMP RANGE (DEG F):	80-85

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/21/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-8

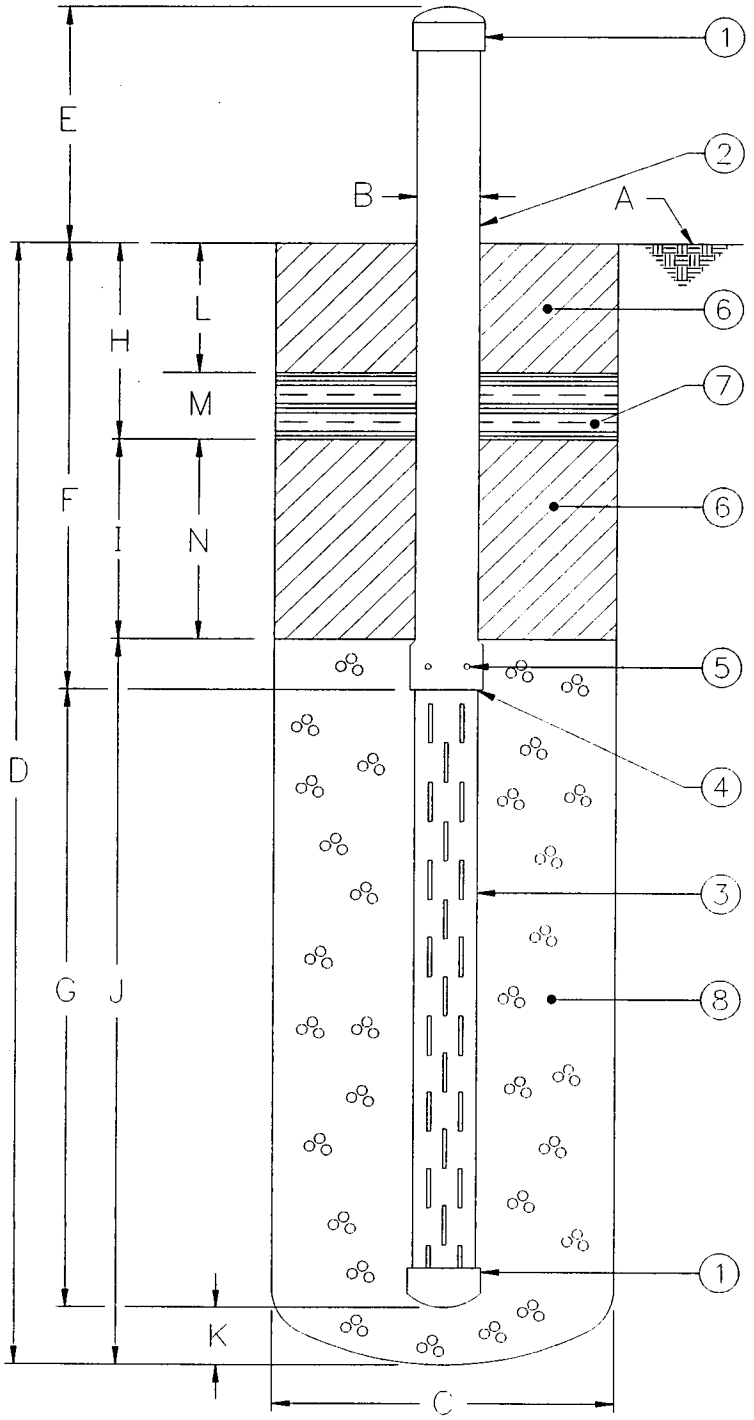
DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	COVER	N/A				
2' - 4'	PAPER, PLASTIC, WOOD	MODERATE	MOIST			
4' - 6'	PAPER, GLASS, WOOD	MODERATE	MOIST	80 °		
6' - 8'	PAPER, PLASTIC, WOOD	MODERATE	MOIST			
8' - 10'	PAPER, PLASTIC, WOOD	MODERATE	MOIST			
10' - 15'	CARPET, TIRES	MODERATE	MOIST	85 °		
15' - 20'	PAPER, PLASTIC, METAL	MODERATE	MOIST			
20' - 25'	PAPER, PLASTIC, WOOD	MODERATE	MOIST			
25' - 28'	CARPET, PLASTIC, PAPER	HEAVY	MOIST	85 °		

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
(904) 243-0033 WET Project No. 96339

WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/21/96
WET PROJECT NO: 96339

WELL NUMBER: W-9
WELL LOCATION: N: 892190
E: 16924477



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	803.9 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	32 FT.
E	SOLID PIPE ABOVE GROUND:	7 FT.
F	SOLID PIPE BELOW GROUND:	20 FT.
G	SLOTTED PIPE LENGTH:	12 FT.
H	COVER DEPTH:	2 FT.
I	REFUSE DEPTH TO AGGREGATE:	16 FT.
J	AGGREGATE PACK:	14 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	15 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	30 FT.
	REFUSE TEMP RANGE (DEG F):	85-95

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/21/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-9

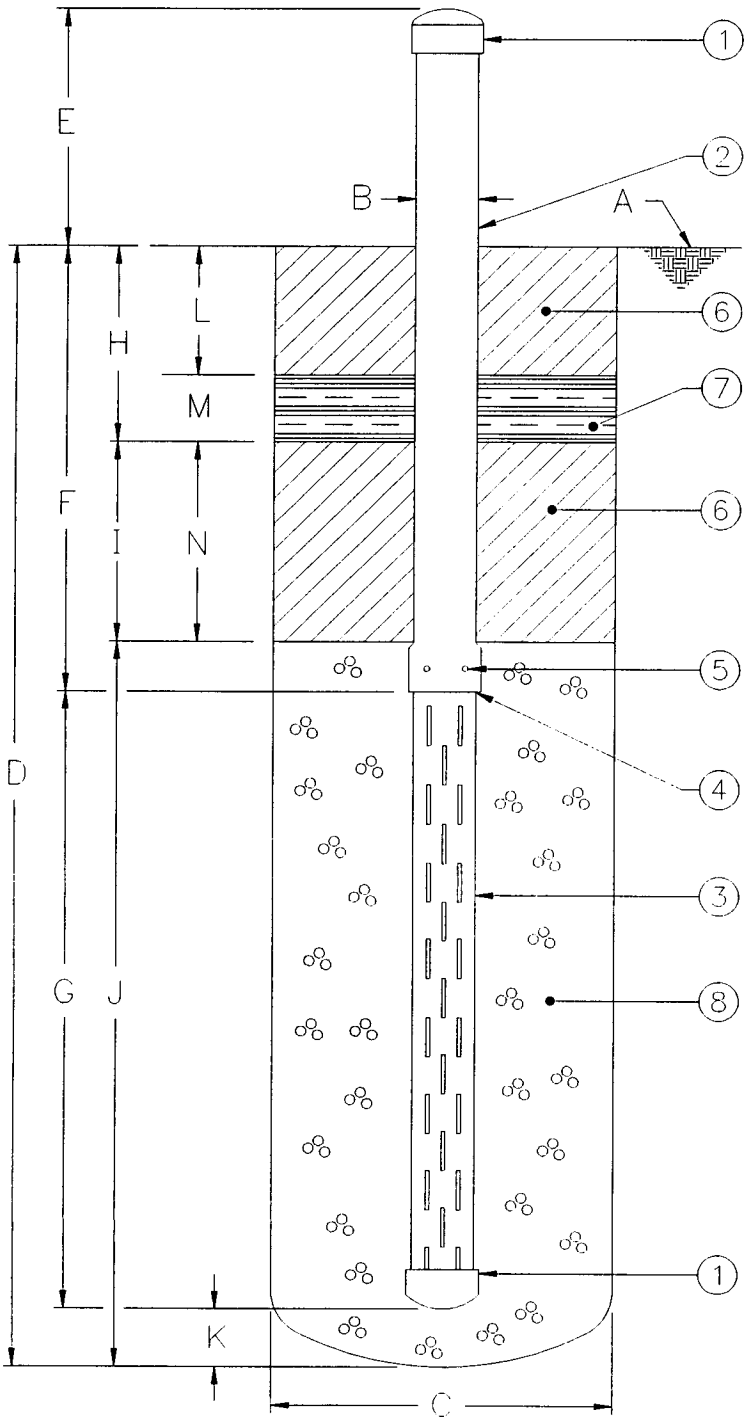
DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	COVER	N/A				
2' - 4'	PAPER, PLASTIC	HEAVY				
4' - 6'	PAPER, PLASTIC	MODERATE	MOIST			
6' - 8'	PAPER, PLASTIC	MODERATE	MOIST	85 °		
8' - 10'	PAPER, PLASTIC, WOOD	MODERATE	MOIST			
10' - 15'	PAPER, PLASTIC	MODERATE	MOIST			
15' - 20'	PAPER, PLASTIC	MODERATE	MOIST			
20' - 25'	PAPER, CARPET, PLASTIC	MODERATE	MOIST	85 °		
25' - 30'	PAPER, WOOD, METAL	MODERATE	MOIST			
30' - 32'	PAPER, WOOD, GLASS	MODERATE	MOIST	95 °		

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
(904) 243-0033 WET Project No. 96339

WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/21/96
WET PROJECT NO: 96339

WELL NUMBER: W-10
WELL LOCATION: N: 892220
E: 1692680



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	797.6 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	27 FT.
E	SOLID PIPE ABOVE GROUND:	8 FT.
F	SOLID PIPE BELOW GROUND:	20 FT.
G	SLOTTED PIPE LENGTH:	7 FT.
H	COVER DEPTH:	2 FT.
I	REFUSE DEPTH TO AGGREGATE:	16 FT.
J	AGGREGATE PACK:	9 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	15 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	25 FT.
	REFUSE TEMP RANGE (DEG F):	80-85

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/21/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-10

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	SOIL COVER	N/A	MOIST			
2' - 4'	PAPER, PLASTIC	HEAVY	MOIST			
4' - 6'	PAPER, PLASTIC	HEAVY	MOIST			
6' - 8'	PAPER, WOOD, PLASTIC	HEAVY	MOIST			
8' - 10'	PAPER, WOOD, PLASTIC	HEAVY	MOIST	80 °		
10' - 15'	PAPER, CARPET	HEAVY	MOIST			
15' - 20'	PAPER, PLASTIC	HEAVY	MOIST	84 °		
20' - 25'	PAPER, PLASTIC	HEAVY	MOIST	85 °		
25' - 27'	PAPER, WOOD, PLASTIC	HEAVY	MOIST	80 °		

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
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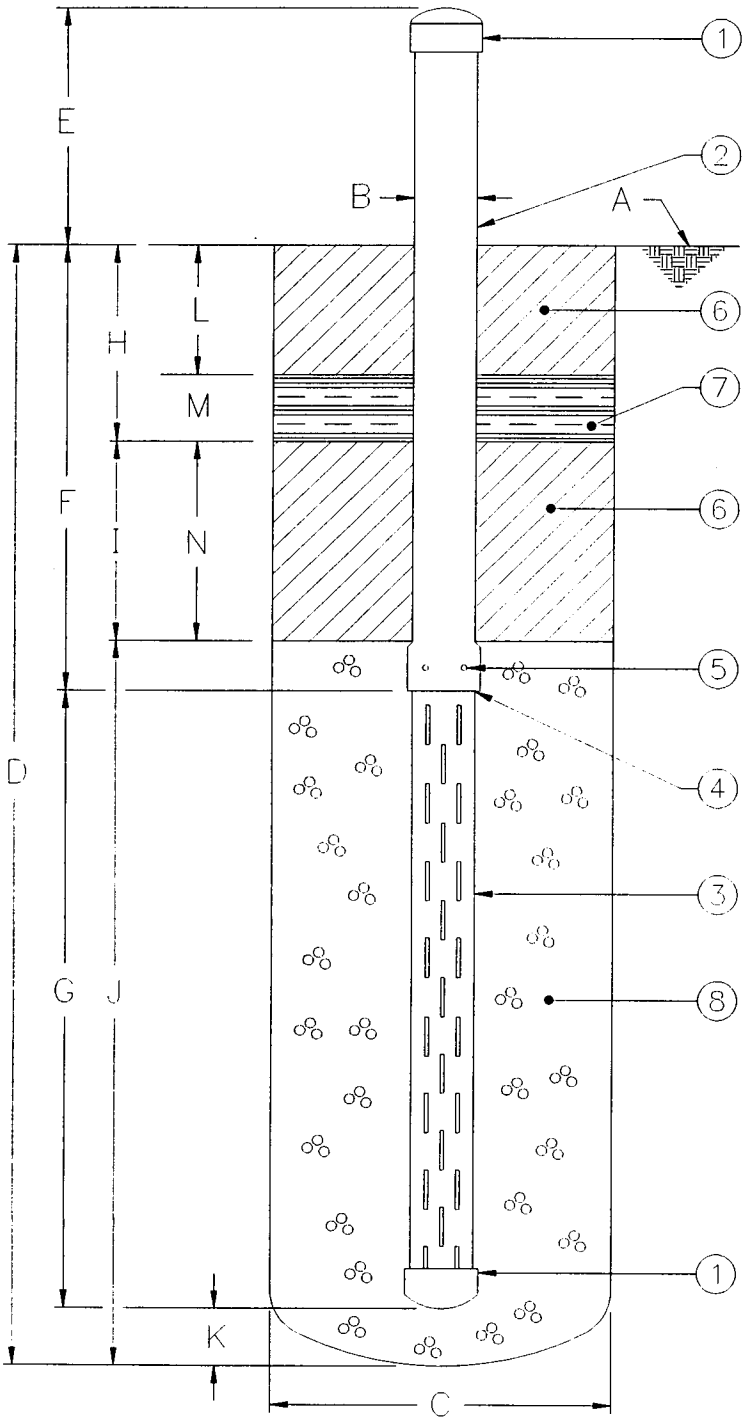
WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/24/96
WET PROJECT NO: 96339

WELL NUMBER: W-11
WELL LOCATION: N: 892127
E: 1691335



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	824.7 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	55 FT.
E	SOLID PIPE ABOVE GROUND:	6 FT.
F	SOLID PIPE BELOW GROUND:	28 FT.
G	SLOTTED PIPE LENGTH:	27 FT.
H	COVER DEPTH:	2 FT.
I	REFUSE DEPTH TO AGGREGATE:	24 FT.
J	AGGREGATE PACK:	29 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	23 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	53 FT.
	REFUSE TEMP RANGE (DEG F):	90

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/24/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-11

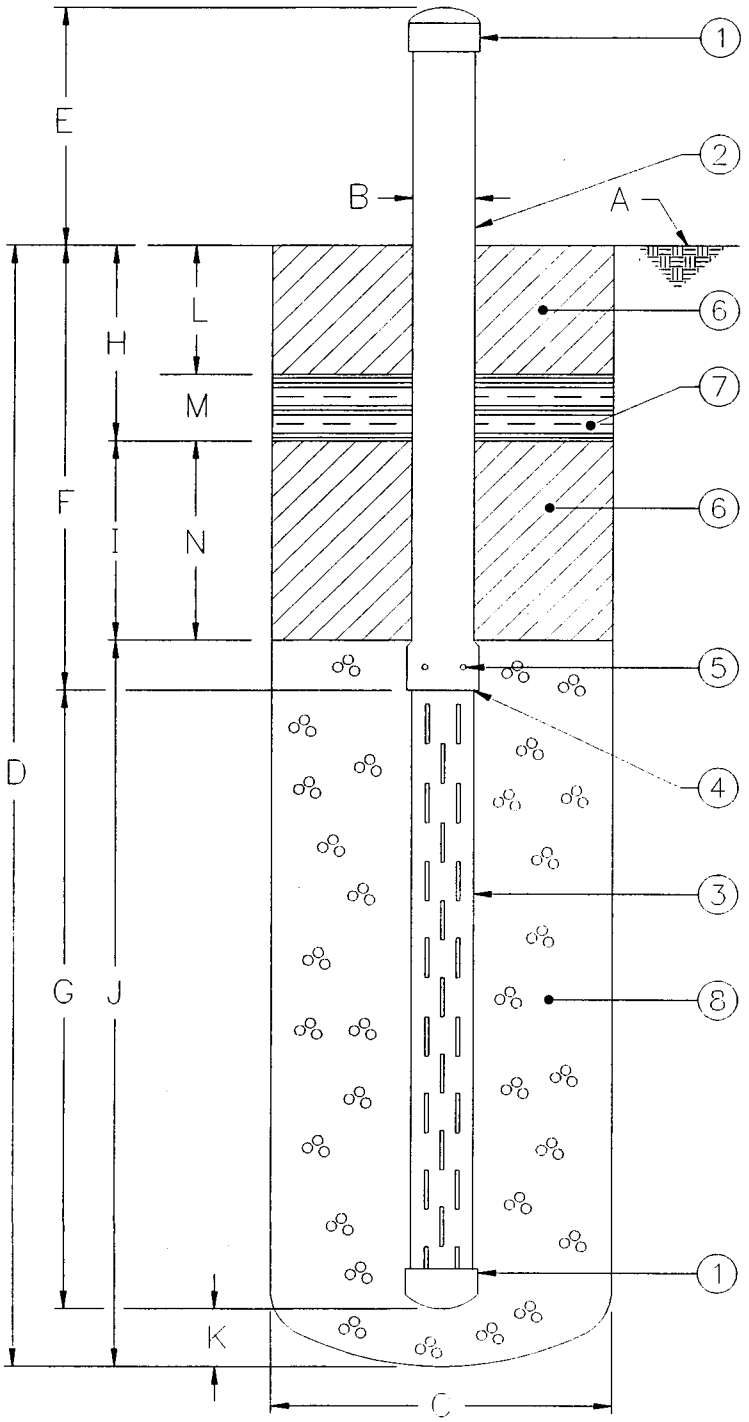
DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	SOIL COVER	N/A				
2' - 4'	PAPER, PLASTIC, WOOD	MEDIUM	DRY			
4' - 6'	PAPER, PLASTIC, GLASS	MEDIUM	DRY			
6' - 8'	PAPER, PLASTIC	MEDIUM	DRY			
8' - 10'	PAPER, PLASTIC	MEDIUM	DRY			
10' - 15'	PAPER, PLASTIC	MEDIUM	DRY	90 °		
15' - 20'	PAPER, PLASTIC	MEDIUM	DRY			
20' - 25'	PAPER, PLASTIC	MEDIUM	DRY	90 °		
25' - 30'	PAPER, PLASTIC	MEDIUM	DRY			
30' - 35'	PAPER, PLASTIC	MEDIUM	DRY			
35' - 40'	PAPER, PLASTIC	MEDIUM	DRY	90 °		
40' - 45'	PAPER, PLASTIC	MEDIUM-HEAVY	DRY		12/91	
45' - 50'	PAPER, PLASTIC	MEDIUM-HEAVY	DRY			
50' - 55'	PAPER, PLASTIC	MEDIUM-HEAVY	DRY			

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
(904) 243-0033 WET Project No. 96339

WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/21/96
WET PROJECT NO: 96339

WELL NUMBER: W-12
WELL LOCATION: N: 892104
E: 1961530



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	846.6 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	79 FT.
E	SOLID PIPE ABOVE GROUND:	9 FT.
F	SOLID PIPE BELOW GROUND:	40 FT.
G	SLOTTED PIPE LENGTH:	39 FT.
H	COVER DEPTH:	4 FT.
I	REFUSE DEPTH TO AGGREGATE:	34 FT.
J	AGGREGATE PACK:	41 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	35 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	75 FT.
	REFUSE TEMP RANGE (DEG F):	85-103

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/21/96
DRILLING CONTRACTOR: WASTE ENERGY TECHOLOGY, INC.

WELL NUMBER: W-12

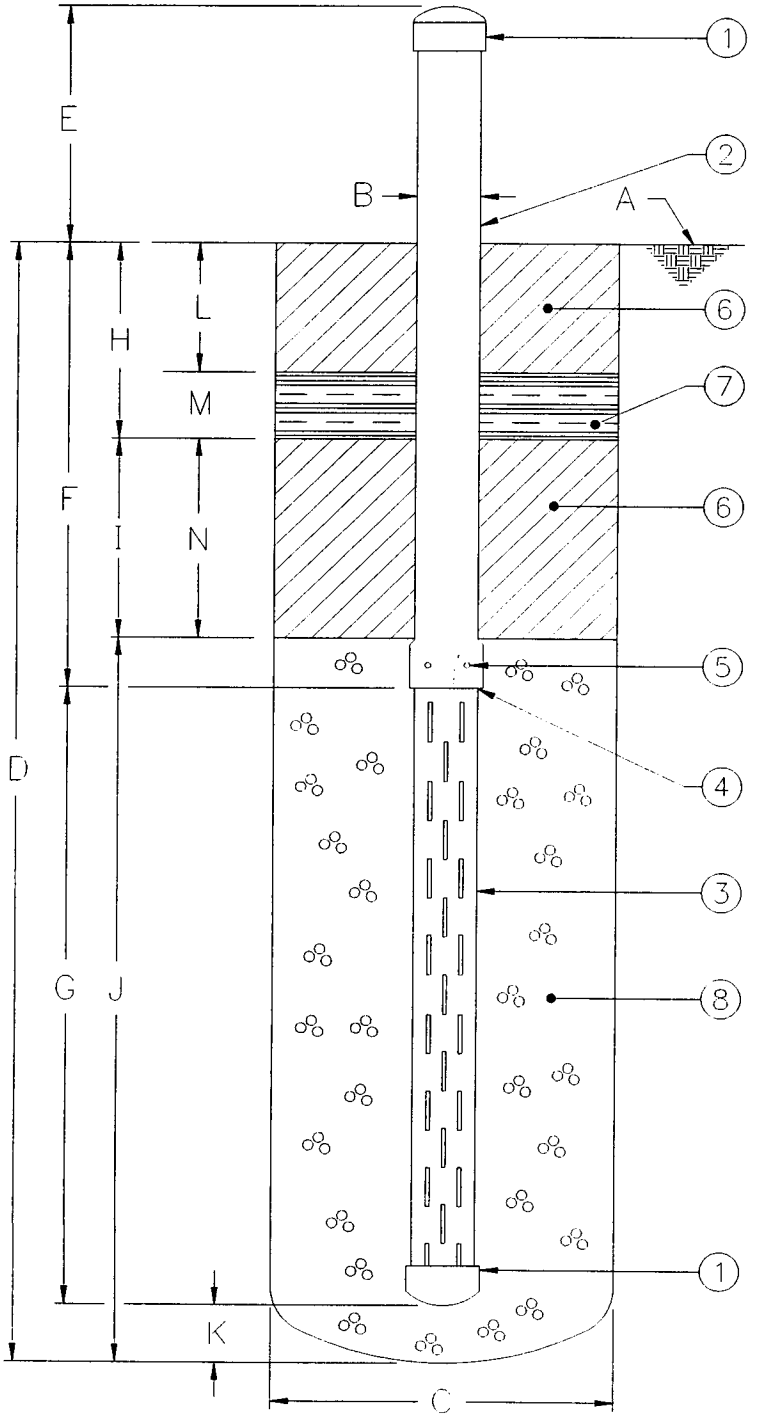
DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	SOIL COVER	N/A				
2' - 4'	SOIL COVER	N/A				
4' - 6'	PAPER, PLASTIC	HEAVY	MOIST			
6' - 8'	PAPER, PLASTIC, WOOD	HEAVY	MOIST			
8' - 10'	PAPER, PLASTIC	HEAVY	MOIST			
10' - 15'	PAPER, PLASTIC	HEAVY	MOIST			
15' - 20'	PAPER, PLASTIC	HEAVY	MOIST			
20' - 25'	PAPER, PLASTIC	HEAVY	MOIST	85 °		
25' - 30'	PAPER, PLASTIC	HEAVY	MOIST			
30' - 35'	PAPER, PLASTIC	HEAVY	MOIST			
35' - 40'	PAPER, PLASTIC, CLOTH	HEAVY	MOIST			
40' - 45'	PAPER, PLASTIC	HEAVY	MOIST			
45' - 50'	PAPER, PLASTIC	HEAVY	MOIST			
50' - 55'	PAPER, PLASTIC, CLOTH, DIRT	HEAVY	MOIST			
55' - 60'	PAPER, PLASTIC, WOOD	HEAVY	MOIST	100 °		
60' - 65'	PAPER, PLASTIC	HEAVY	MOIST			
65' - 70'	PAPER, PLASTIC	HEAVY	MOIST			
70' - 75'	PAPER, PLASTIC, WOOD	HEAVY	MOIST	103 °		
75' - 79'	PAPER, PLASTIC, WOOD	HEAVY	MOIST			

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
(904) 243-0033 WET Project No. 96339

WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/19/96
WET PROJECT NO: 96339

WELL NUMBER: W-13
WELL LOCATION: N: 892110
E: 1691718



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	857.7 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	83 FT.
E	SOLID PIPE ABOVE GROUND:	11 FT.
F	SOLID PIPE BELOW GROUND:	44 FT.
G	SLOTTED PIPE LENGTH:	39 FT.
H	COVER DEPTH:	2 FT.
I	REFUSE DEPTH TO AGGREGATE:	40 FT.
J	AGGREGATE PACK:	41 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	39 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	81 FT.
	REFUSE TEMP RANGE (DEG F):	80-100

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/19/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-13

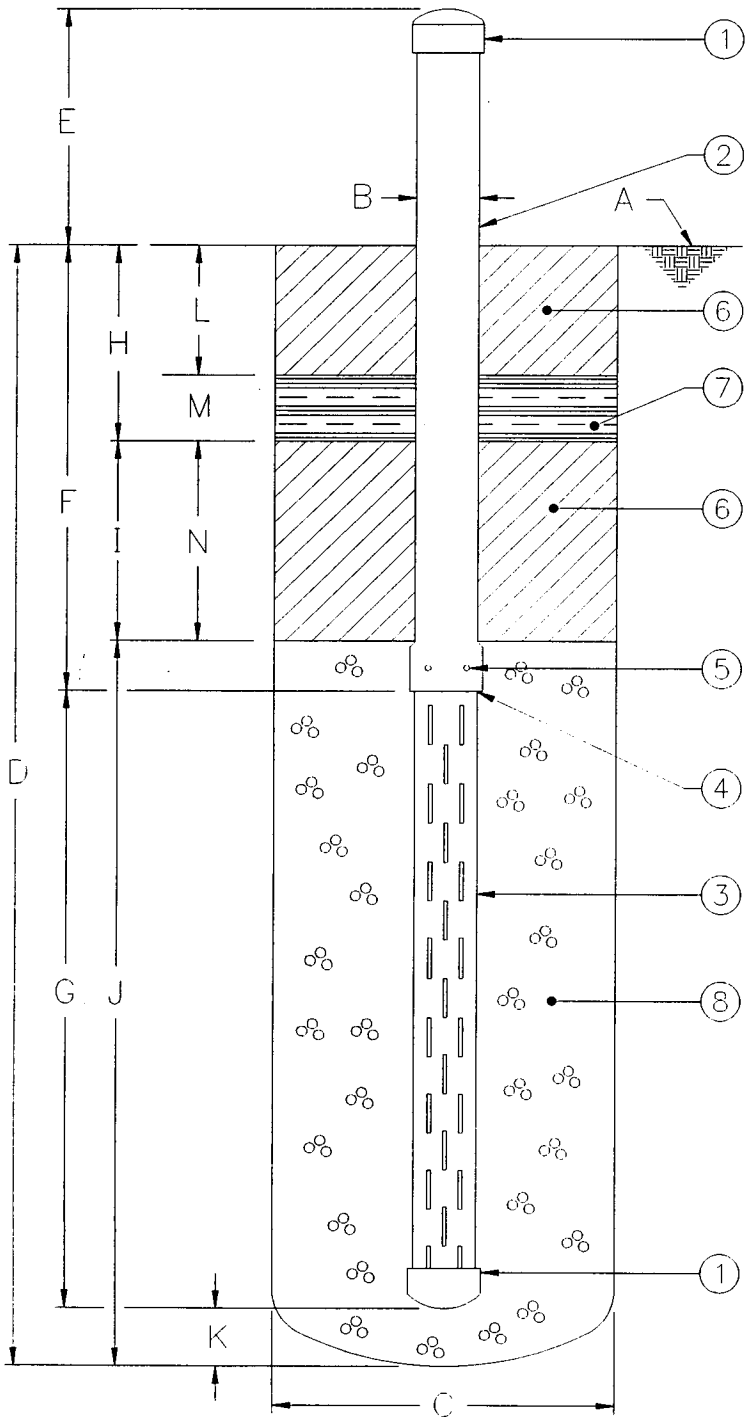
DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	SOIL COVER	N/A				
2' - 4'	PAPER, PLASTIC	MODERATE	DRY			
4' - 6'	PAPER, PLASTIC	MODERATE	DRY			
6' - 8'	PAPER, PLASTIC	MODERATE	DRY	85 °		
8' - 10'	PAPER, PLASTIC	MODERATE	DRY			
10' - 15'	PAPER, PLASTIC	MODERATE	DRY			
15' - 20'	PAPER, PLASTIC	MODERATE	DRY			
20' - 25'	PAPER, PLASTIC, WOOD	MODERATE	DRY	88 °		
25' - 30'	PAPER, PLASTIC, WOOD	MODERATE	DRY			
30' - 35'	PAPER, PLASTIC	MODERATE	DRY			
35' - 40'	PAPER, PLASTIC, WOOD	MODERATE	DRY	87 °	1995	
40' - 45'	PAPER, PLASTIC, WOOD	MODERATE	DRY			
45' - 50'	PAPER, PLASTIC	MODERATE	DRY	80 °		
50' - 55'	PAPER, PLASTIC	MODERATE	DRY	92 °		
55' - 60'	PAPER, PLASTIC	MODERATE	DRY			
60' - 65'	PAPER, PLASTIC	MODERATE	DRY	93 °		
65' - 70'	PAPER, PLASTIC	MODERATE	DRY			
70' - 75'	PAPER, PLASTIC	MODERATE	DRY	96 °		
75' - 80'	PAPER, DAILY COVER	MODERATE	DRY			
80' - 83'	PAPER, PLASTIC, WOOD	MODERATE	DRY	100 °		

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
(904) 243-0033 WET Project No. 96339

WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/26/96
WET PROJECT NO: 96339

WELL NUMBER: W-14
WELL LOCATION: N: 892113
E: 1691914



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	855.2 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	82 FT.
E	SOLID PIPE ABOVE GROUND:	12 FT.
F	SOLID PIPE BELOW GROUND:	41 FT.
G	SLOTTED PIPE LENGTH:	41 FT.
H	COVER DEPTH:	2.5 FT.
I	REFUSE DEPTH TO AGGREGATE:	36.5 FT.
J	AGGREGATE PACK:	43 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	36 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	79.5 FT.
	REFUSE TEMP RANGE (DEG F):	85-95

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/26/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-14

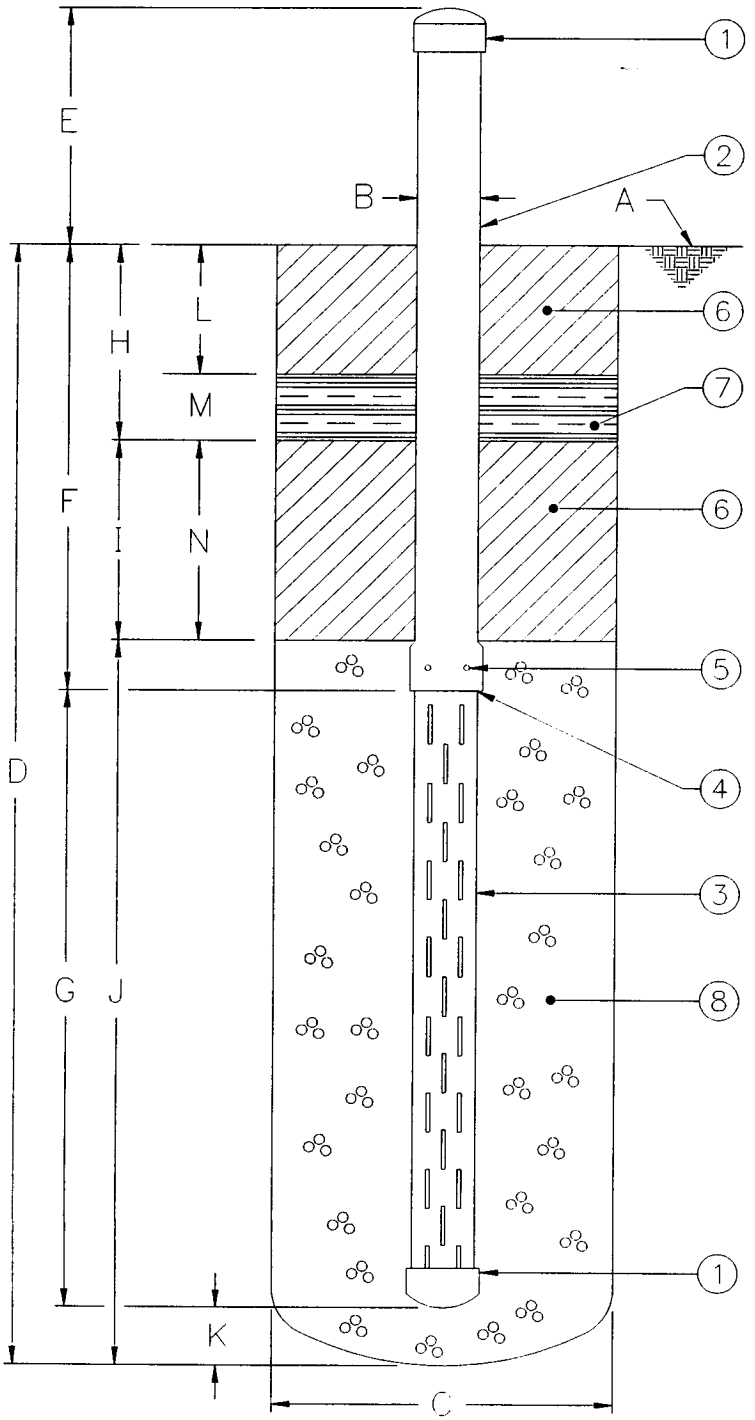
DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2.5'	SOIL COVER	N/A				
2.5' - 4'	PAPER	MODERATE	DRY			
4' - 6'	PAPER, PLASTIC	MODERATE	DRY			
6' - 8'	CLOTH, WOOD	MODERATE	DRY	85 °		
8' - 10'	WIRE, METAL	MODERATE	DRY			
10' - 15'	INSULATION, PAPER	MODERATE	DRY			
15' - 20'	PLASTIC, METAL	MODERATE	DRY			
20' - 25'	WOOD, PLASTIC	MODERATE	DRY			
25' - 30'	PAPER, PLASTIC	MODERATE	DRY	95 °		
30' - 35'	PAPER, PLASTIC	MODERATE	DRY			
35' - 40'	CLOTH, ALUMINUM	MODERATE	DRY			
40' - 45'	METAL, CLOTH	MODERATE	DRY			
45' - 50'	PAPER, PLASTIC	MODERATE	DRY			
50' - 55'	PAPER, PLASTIC	MODERATE	DRY			
55' - 60'	PAPER, PLASTIC	MODERATE	DRY			
60' - 65'	PAPER, PLASTIC	MODERATE	DRY	95 °		
65' - 70'	WOOD, SAWDUST	MODERATE	DRY			
70' - 75'	WOOD, PAPER	MODERATE	DRY			
75' - 80'	WOOD, PAPER	MODERATE	DRY			
80' - 82'	WOOD, PAPER	MODERATE	DRY			

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
(904) 243-0033 WET Project No. 96339

WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/25/96
WET PROJECT NO: 96339

WELL NUMBER: W-15
WELL LOCATION: N: 892101
E: 1692116



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	832.9 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	57 FT.
E	SOLID PIPE ABOVE GROUND:	10 FT.
F	SOLID PIPE BELOW GROUND:	29 FT.
G	SLOTTED PIPE LENGTH:	28 FT.
H	COVER DEPTH:	2 FT.
I	REFUSE DEPTH TO AGGREGATE:	25 FT.
J	AGGREGATE PACK:	30 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	24 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	55 FT.
	REFUSE TEMP RANGE (DEG F):	80-85

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/25/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-15

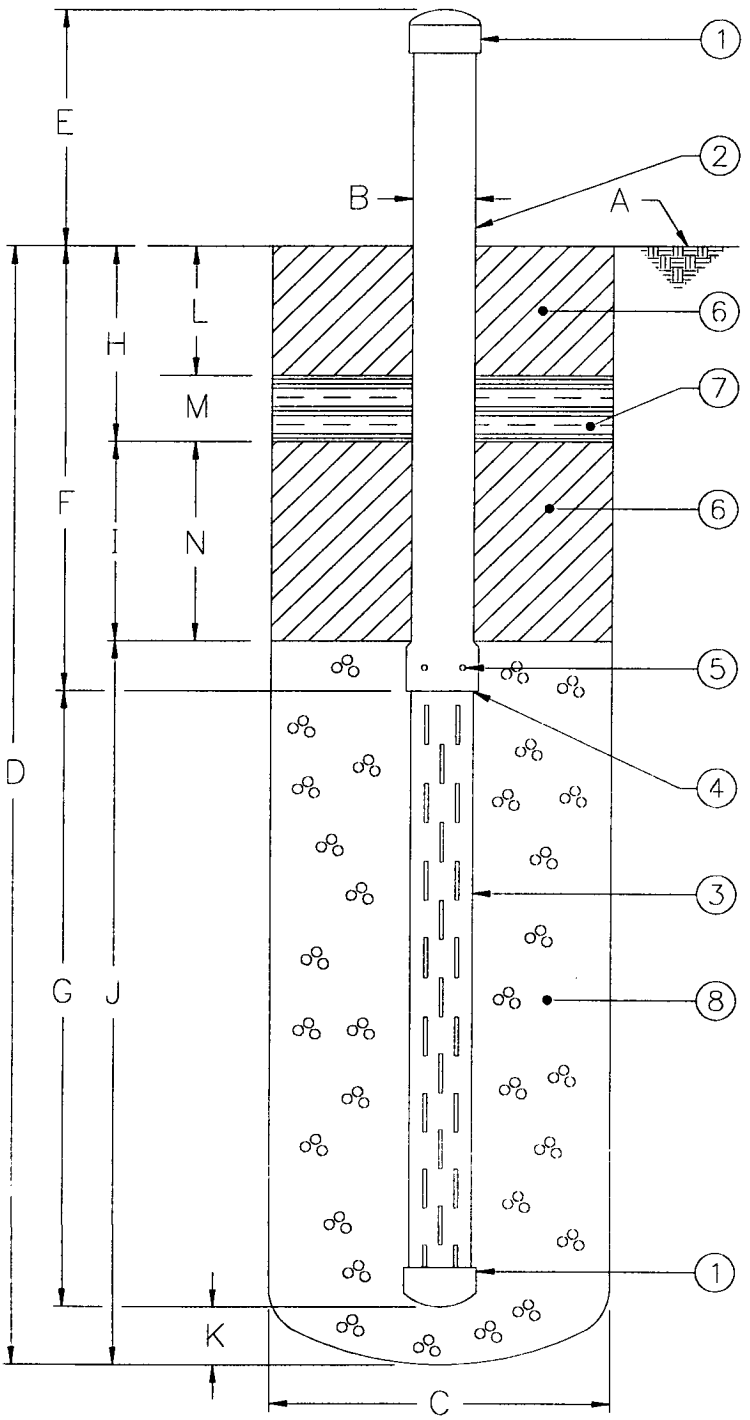
DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	SOIL COVER	N/A				
2' - 4'	PAPER, PLASTIC, CLOTH	HEAVY-MODERATE	MOIST			
4' - 6'	PAPER, PLASTIC, TIRES	HEAVY-MODERATE	MOIST			
6' - 8'	PAPER, PLASTIC, CLOTH	HEAVY-MODERATE	MOIST			
8' - 10'	PAPER, PLASTIC, WOOD	HEAVY-MODERATE	MOIST	80 °		
10' - 15'	PAPER, PLASTIC, WOOD	HEAVY-MODERATE	MOIST		1992	
15' - 20'	PAPER, PLASTIC, WIRE	HEAVY-MODERATE	MOIST	85 °		
20' - 25'	PAPER, PLASTIC, TIRES	HEAVY-MODERATE	MOIST			
25' - 30'	PAPER, PLASTIC, WOOD	HEAVY-MODERATE	MOIST	85 °		
30' - 35'	PAPER, PLASTIC, CLOTH	HEAVY-MODERATE	MOIST			
35' - 40'	PAPER, PLASTIC, CLOTH	HEAVY-MODERATE	MOIST	80 °		
40' - 45'	PAPER, PLASTIC, WOOD	HEAVY-MODERATE	MOIST			
45' - 50'	PAPER, PLASTIC, WOOD	HEAVY-MODERATE	MOIST	85 °		
50' - 55'	PAPER, PLASTIC, WIRE	HEAVY-MODERATE	MOIST			
55' - 57'	PAPER, PLASTIC, WIRE	HEAVY-MODERATE	MOIST			

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
(904) 243-0033 WET Project No. 96339

WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/24/96
WET PROJECT NO: 96339

WELL NUMBER: W-18
WELL LOCATION: N: 891929
E: 1691419



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	799.5 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	34 FT.
E	SOLID PIPE ABOVE GROUND:	5 FT.
F	SOLID PIPE BELOW GROUND:	20 FT.
G	SLOTTED PIPE LENGTH:	14 FT.
H	COVER DEPTH:	2 FT.
I	REFUSE DEPTH TO AGGREGATE:	12 FT.
J	AGGREGATE PACK:	20 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	11 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	32 FT.
	REFUSE TEMP RANGE (DEG F):	90-92

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/24/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-18

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	SOIL COVER	N/A				
2' - 4'	PAPER, PLASTIC, TIRES	HEAVY-MODERATE	MOIST			
4' - 6'	PAPER, PLASTIC, TIRES	HEAVY-MODERATE	MOIST			
6' - 8'	PAPER, PLASTIC, TIRES	HEAVY-MODERATE	MOIST		1994	
8' - 10'	PAPER, PLASTIC, CARPET	HEAVY-MODERATE	MOIST	90 °		
10' - 15'	PAPER, PLASTIC, GLASS	HEAVY-MODERATE	MOIST			
15' - 20'	PAPER, PLASTIC, WOOD	HEAVY-MODERATE	MOIST	90 °		
20' - 25'	PAPER, PLASTIC, CLOTH	HEAVY-MODERATE	MOIST	92 °		
25' - 30'	PAPER, PLASTIC, TIRES	HEAVY-MODERATE	MOIST	92 °		
30' - 34'	PAPER, PLASTIC, METAL	HEAVY-MODERATE	MOIST			

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
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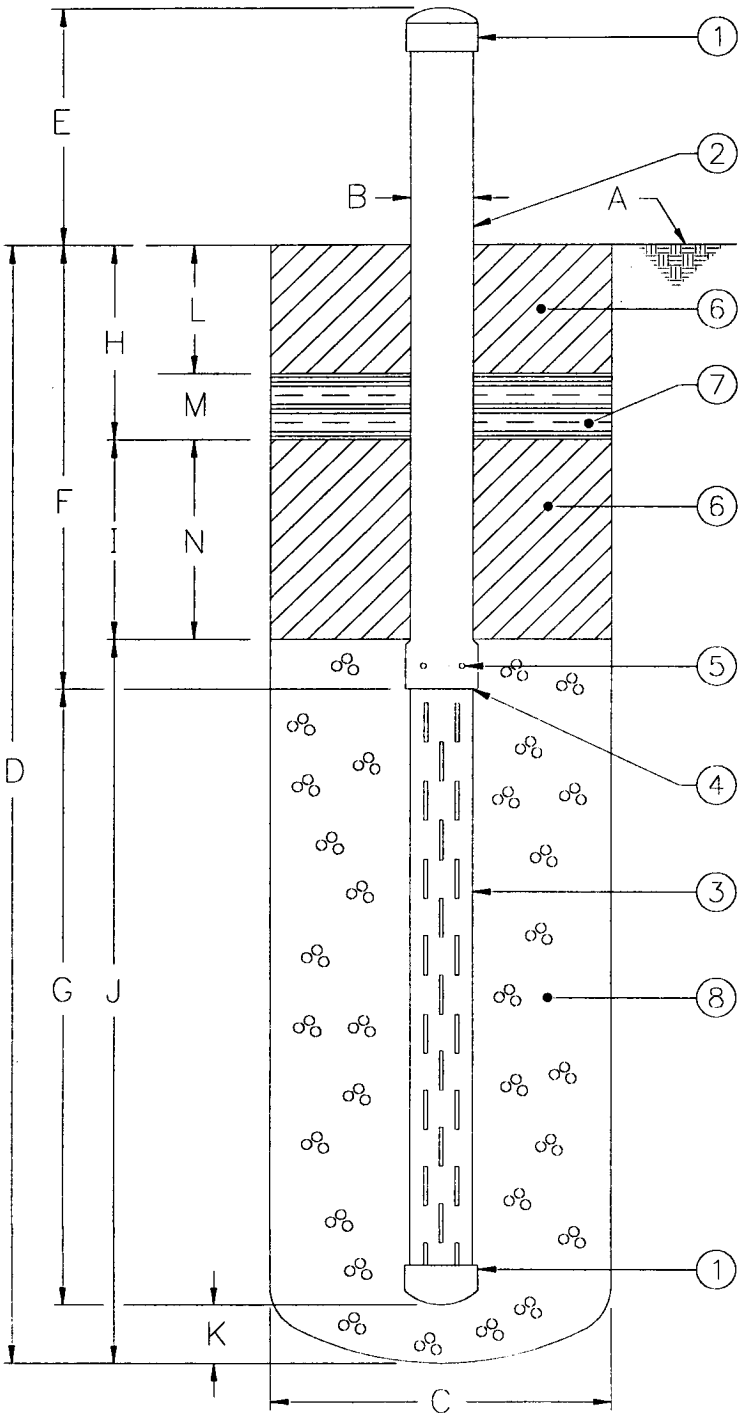
WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/25/96
WET PROJECT NO: 96339

WELL NUMBER: W-19
WELL LOCATION: N: 891934
E: 1691621



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	834.0 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	66 FT.
E	SOLID PIPE ABOVE GROUND:	10 FT.
F	SOLID PIPE BELOW GROUND:	33 FT.
G	SLOTTED PIPE LENGTH:	33 FT.
H	COVER DEPTH:	2 FT.
I	REFUSE DEPTH TO AGGREGATE:	29 FT.
J	AGGREGATE PACK:	35 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	28 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	64 FT.
	REFUSE TEMP RANGE (DEG F):	90-95

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/25/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-19

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	SOIL COVER	N/A				
2' - 4'	PAPER, PLASTIC	MODERATE	DRY			
4' - 6'	PAPER, PLASTIC	MODERATE	DRY			
6' - 8'	PAPER, PLASTIC	MODERATE	DRY			
8' - 10'	PAPER, PLASTIC	MODERATE	DRY			
10' - 15'	PAPER, PLASTIC	MODERATE	DRY	90 °		
15' - 20'	PAPER, PLASTIC	MODERATE	DRY			
20' - 25'	PAPER, PLASTIC	MODERATE	DRY	90 °	1994	
25' - 30'	PAPER, PLASTIC	MODERATE	DRY			
30' - 35'	PAPER, PLASTIC	MODERATE	DRY			
35' - 40'	PAPER, PLASTIC	MODERATE-HEAVY	DRY	92 °		
40' - 45'	PAPER, PLASTIC	MODERATE-HEAVY	DRY			
45' - 50'	PAPER, PLASTIC	MODERATE-HEAVY	DRY			
50' - 55'	PAPER, PLASTIC	MODERATE-HEAVY	DRY	93 °		
55' - 60'	PAPER, PLASTIC	MODERATE-HEAVY	DRY			
60' - 65'	PAPER, PLASTIC	MODERATE-HEAVY	DRY			
65' - 66'	PAPER, PLASTIC	MODERATE-HEAVY	DRY	95 °		

Waste Energy Technology, Inc.
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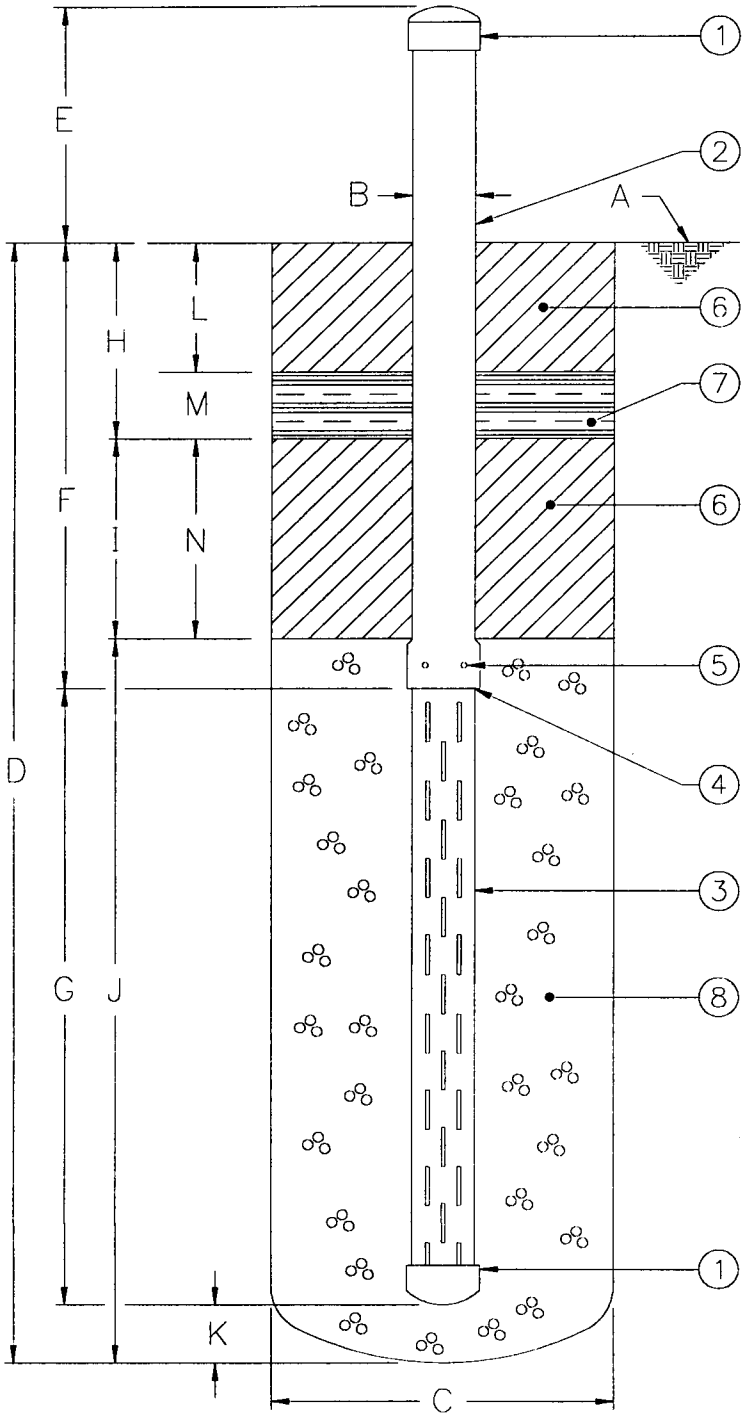
WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/19/96
WET PROJECT NO: 96339

WELL NUMBER: W-20
WELL LOCATION: N: 891928
E: 1691793



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	855.8 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	81 FT.
E	SOLID PIPE ABOVE GROUND:	8 FT.
F	SOLID PIPE BELOW GROUND:	41 FT.
G	SLOTTED PIPE LENGTH:	40 FT.
H	COVER DEPTH:	2 FT.
I	REFUSE DEPTH TO AGGREGATE:	37 FT.
J	AGGREGATE PACK:	42 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	36 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	79 FT.
	REFUSE TEMP RANGE (DEG F):	86-100

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/19/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-20

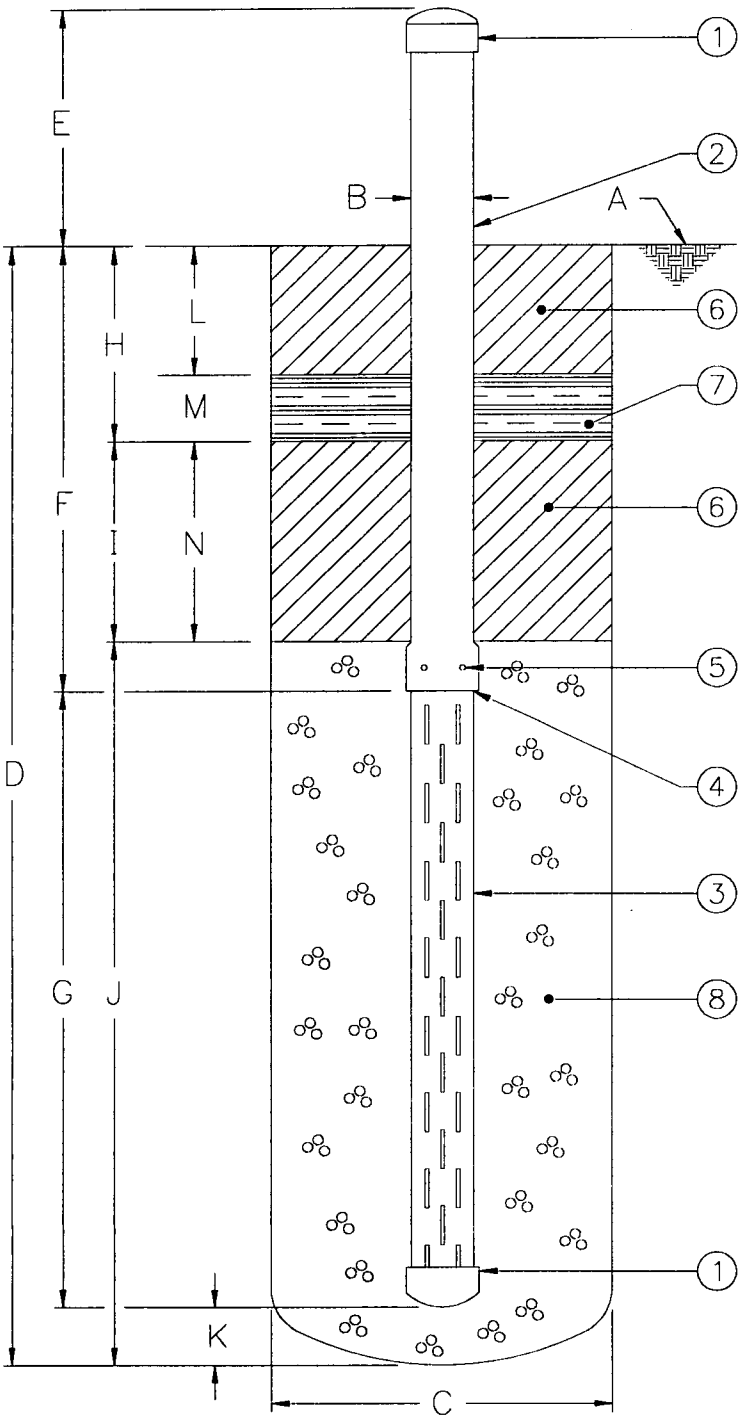
DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	SOIL COVER	N/A				
2' - 4'	PAPER, PLASTIC	MODERATE	DRY			
4' - 6'	PAPER, PLASTIC	MODERATE	DRY	86 °		
6' - 8'	PAPER, PLASTIC	MODERATE	DRY			
8' - 10'	PAPER, PLASTIC	MODERATE	DRY	86 °		
10' - 15'	PAPER, PLASTIC	MODERATE	DRY			
15' - 20'	PAPER, PLASTIC	MODERATE	DRY			
20' - 25'	PAPER, PLASTIC	MODERATE	DRY	95 °	1994	
25' - 30'	PAPER, PLASTIC	MODERATE	DRY			
30' - 35'	PAPER, PLASTIC	MODERATE	DRY	94 °		
35' - 40'	PAPER, PLASTIC	MODERATE	DRY			
40' - 45'	PAPER, PLASTIC	MODERATE	DRY	90 °		
45' - 50'	PAPER, PLASTIC	MODERATE	DRY	93 °		
50' - 55'	PAPER, PLASTIC	MODERATE	DRY	94 °		
55' - 60'	PAPER, PLASTIC	MODERATE	DRY			
60' - 65'	PAPER, DAILY COVER	MODERATE	DRY	98 °		
65' - 70'	PAPER, PLASTIC	MODERATE	DRY			
70' - 75'	PAPER, PLASTIC	MODERATE	DRY	100 °		
75' - 80'	PAPER, PLASTIC	MODERATE	DRY			
80' - 81'	PAPER, PLASTIC	MODERATE	DRY	100 °		

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
(904) 243-0033 WET Project No. 96339

WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/19/96
WET PROJECT NO: 96339

WELL NUMBER: W-20A
WELL LOCATION: N: 0
E: 0



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	855.7 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	30 FT.
E	SOLID PIPE ABOVE GROUND:	FT.
F	SOLID PIPE BELOW GROUND:	FT.
G	SLOTTED PIPE LENGTH:	FT.
H	COVER DEPTH:	FT.
I	REFUSE DEPTH TO AGGREGATE:	FT.
J	AGGREGATE PACK:	FT.
K	AGGREGATE BASE:	FT.
L	SOIL BACKFILL:	FT.
M	BENTONITE LAYER:	FT.
N	SOIL BACKFILL:	FT.
	REFUSE DEPTH:	FT.
	REFUSE TEMP RANGE (DEG F):	

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/19/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-20A

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	SOIL COVER	N/A				
2' - 4'	PAPER, PLASTIC	MODERATE	DRY			
4' - 6'	PAPER, PLASTIC, CLOTH	MODERATE	DRY	83 °		
6' - 8'	PAPER, PLASTIC, CLOTH	MODERATE	DRY			
8' - 10'	PAPER, PLASTIC	MODERATE	DRY			
10' - 15'	PAPER, PLASTIC	MODERATE	DRY	85 °		
15' - 20'	PAPER, PLASTIC	MODERATE	DRY			
20' - 25'	PAPER, PLASTIC, CLOTH	MODERATE	DRY	86 °		
25' - 30'	PAPER, PLASTIC, CLOTH	MODERATE	DRY			ABANDONED @ 30'

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
(904) 243-0033 WET Project No. 96339
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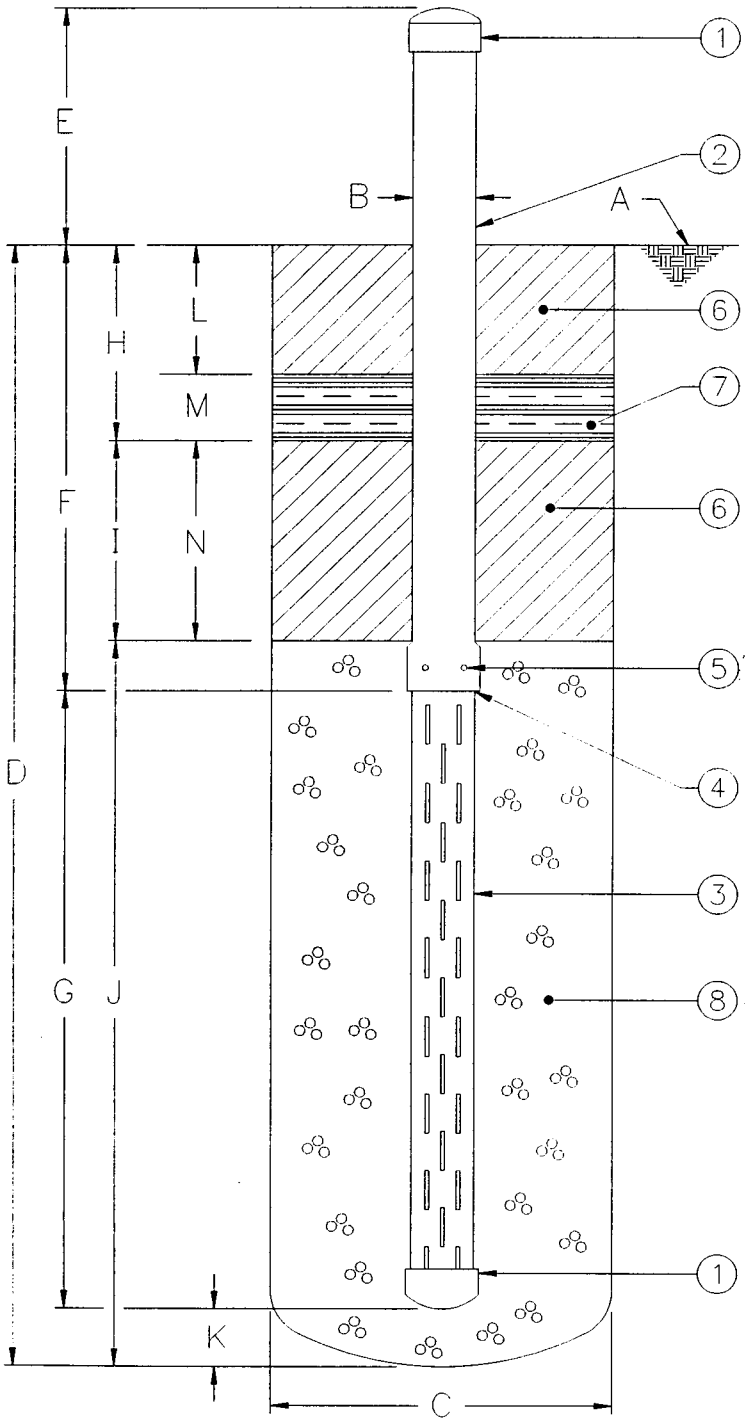
WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/25/96
WET PROJECT NO: 96339

WELL NUMBER: W-24
WELL LOCATION: N: 891760
E: 1691515



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	800.9 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	36 FT.
E	SOLID PIPE ABOVE GROUND:	8 FT.
F	SOLID PIPE BELOW GROUND:	20 FT.
G	SLOTTED PIPE LENGTH:	16 FT.
H	COVER DEPTH:	2 FT.
I	REFUSE DEPTH TO AGGREGATE:	16 FT.
J	AGGREGATE PACK:	18 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	15 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	34 FT.
	REFUSE TEMP RANGE (DEG F):	80-85

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/25/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-24

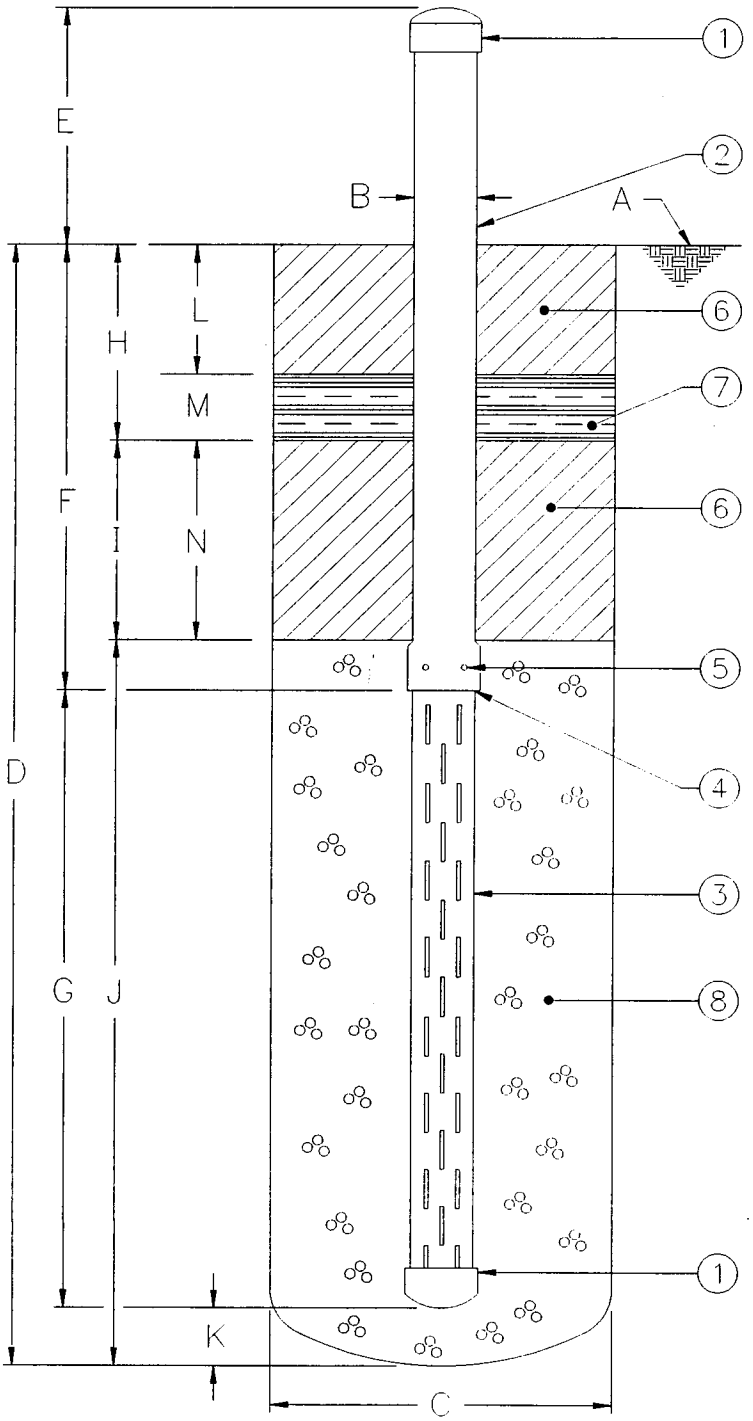
DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	SOIL COVER	N/A				
2' - 4'	PAPER, PLASTIC, CLOTH	MODERATE-HEAVY	MOIST			
4' - 6'	PAPER, RUBBER	MODERATE-HEAVY	MOIST			
6' - 8'	PLASTIC, RUBBER	MODERATE-HEAVY	MOIST			
8' - 10'	PLASTIC, RUBBER	MODERATE-HEAVY	MOIST	80 °		
10' - 15'	PAPER	MODERATE-HEAVY	MOIST		1992	
15' - 20'	PAPER, PLASTIC	MODERATE-HEAVY	MOIST	85 °		
20' - 25'	YARD LEAVES	MODERATE-HEAVY	MOIST			
25' - 30'	PAPER, GRASS	MODERATE-HEAVY	MOIST			
30' - 35'	PAPER, SHINGLES	MODERATE-HEAVY	MOIST	85 °		
35' - 36'	PAPER, SHINGLES	MODERATE-HEAVY	MOIST		1990	

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
(904) 243-0033 WET Project No. 96339

WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/25/96
WET PROJECT NO: 96339

WELL NUMBER: W-25
WELL LOCATION: N: 891755
E: 1691715



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	823.0 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	51 FT.
E	SOLID PIPE ABOVE GROUND:	5 FT.
F	SOLID PIPE BELOW GROUND:	26 FT.
G	SLOTTED PIPE LENGTH:	25 FT.
H	COVER DEPTH:	4 FT.
I	REFUSE DEPTH TO AGGREGATE:	20 FT.
J	AGGREGATE PACK:	27 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	21 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	47 FT.
	REFUSE TEMP RANGE (DEG F):	

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/25/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-25

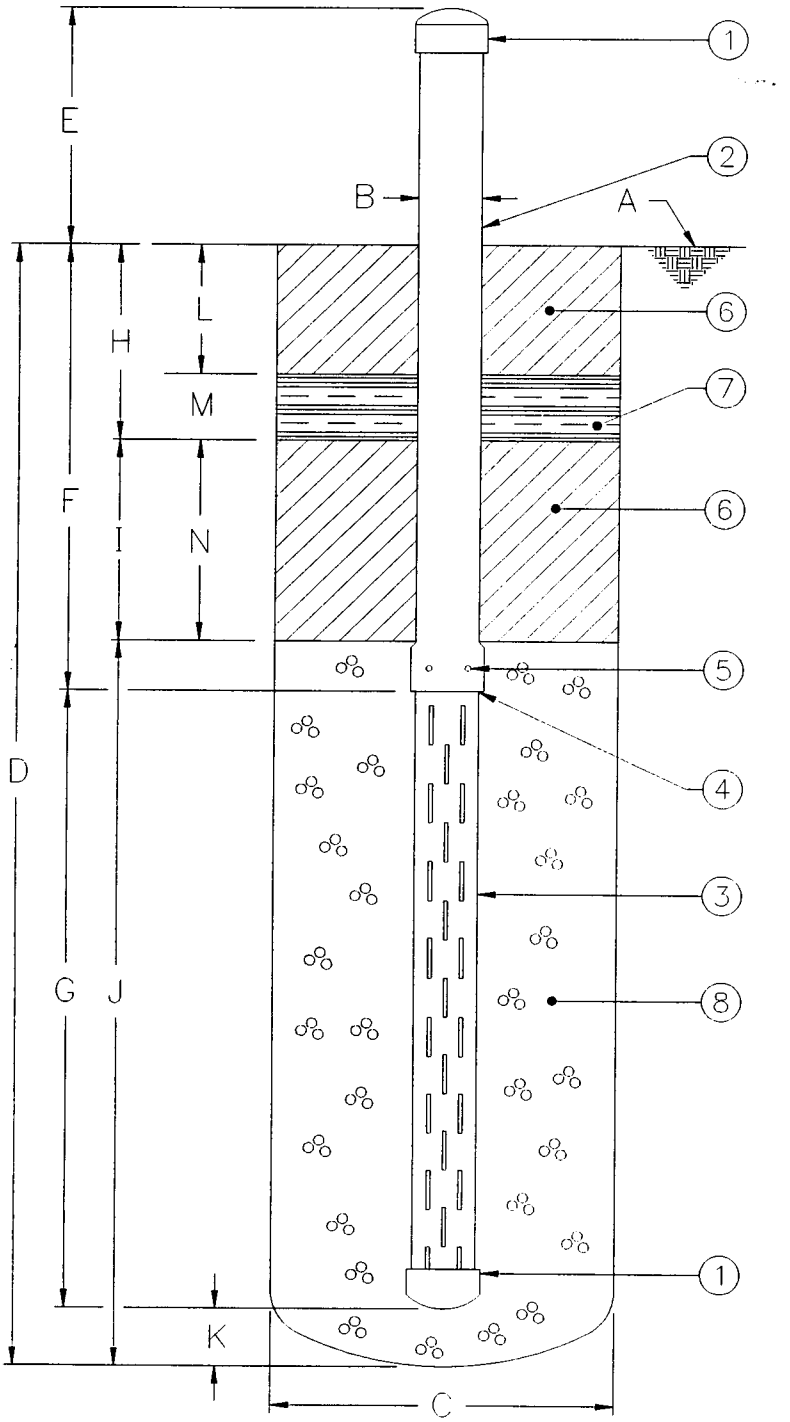
DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 4'	SOIL COVER	N/A				
4' - 6'	PLASTIC, PAPER, TIRES	HEAVY-MODERATE	MOIST			
6' - 8'	PLASTIC, CARDBOARD	HEAVY-MODERATE	MOIST			
8' - 10'	PLASTIC, CARPET	HEAVY-MODERATE	MOIST			
10' - 15'	PAPER, METAL	HEAVY-MODERATE	MOIST			
15' - 20'	PAPER, RUBBER	HEAVY-MODERATE	MOIST			
20' - 25'	PAPER, RUBBER	HEAVY-MODERATE	MOIST			
25' - 30'	PAPER, RUBBER	HEAVY-MODERATE	MOIST			
30' - 35'	PAPER, CARPET	HEAVY-MODERATE	MOIST			
35' - 40'	PAPER, CARPET	HEAVY-MODERATE	MOIST			
40' - 45'	PAPER, INSULATION	HEAVY-MODERATE	MOIST			
45' - 50'	PAPER, SHINGLES	HEAVY-MODERATE	MOIST			
50' - 51'	PAPER, SHINGLES	HEAVY-MODERATE	MOIST			

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
(904) 243-0033 WET Project No. 96339

WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/25/96
WET PROJECT NO: 96339

WELL NUMBER: W-29
WELL LOCATION: N: 89120
E: 1691837



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	793.2 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	29 FT.
E	SOLID PIPE ABOVE GROUND:	7 FT.
F	SOLID PIPE BELOW GROUND:	20 FT.
G	SLOTTED PIPE LENGTH:	9 FT.
H	COVER DEPTH:	2 FT.
I	REFUSE DEPTH TO AGGREGATE:	16 FT.
J	AGGREGATE PACK:	11 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	15 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	27 FT.
	REFUSE TEMP RANGE (DEG F):	80-85

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: BIGFOOT RUN LANDFILL
DRILLING DATE: 06/25/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-29

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	SOIL COVER	N/A				
2' - 4'	PAPER, PLASTIC, PIPE	MODERATE-HEAVY	MOIST			
4' - 6'	PAPER, PLASTIC	MODERATE-HEAVY	MOIST			
6' - 8'	PAPER, PLASTIC	MODERATE-HEAVY	MOIST			
8' - 10'	PAPER, PLASTIC	MODERATE-HEAVY	MOIST	80 °		
10' - 15'	PAPER, WIRE	MODERATE-HEAVY	MOIST			
15' - 20'	PAPER, PLASTIC, CLOTH	MODERATE-HEAVY	MOIST	80 °		
20' - 25'	PAPER, CARDBOARD	MODERATE-HEAVY	MOIST		1990	
25' - 29'	PAPER, INSULATION	MODERATE-HEAVY	MOIST	85 °		

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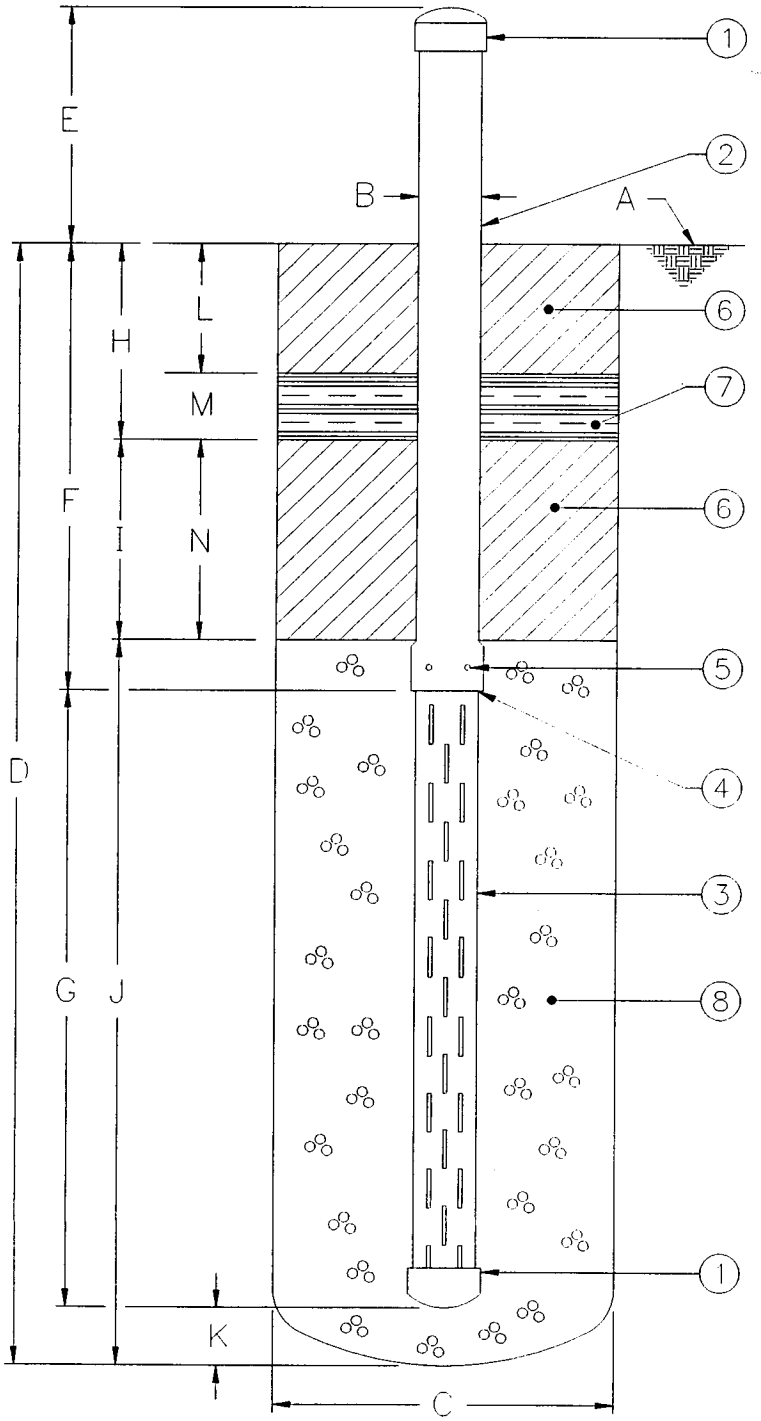
WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/20/96
WET PROJECT NO: 96339

WELL NUMBER: W-32
WELL LOCATION: N: 892187
E: 1692878



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	806.9 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	31 FT.
E	SOLID PIPE ABOVE GROUND:	6 FT.
F	SOLID PIPE BELOW GROUND:	20 FT.
G	SLOTTED PIPE LENGTH:	11 FT.
H	COVER DEPTH:	2 FT.
I	REFUSE DEPTH TO AGGREGATE:	16 FT.
J	AGGREGATE PACK:	13 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	15 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	29 FT.
	REFUSE TEMP RANGE (DEG F):	85

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/20/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-32

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	SOIL COVER	N/A				
2' - 4'	PAPER, PLASTIC, WOOD	MODERATE	DRY			
4' - 6'	PAPER, PLASTIC, WOOD	MODERATE	DRY			
6' - 8'	PAPER, PLASTIC, WOOD	MODERATE	DRY			
8' - 10'	PAPER, PLASTIC, WOOD	MODERATE	DRY			
10' - 15'	PAPER, PLASTIC, WOOD	MODERATE	DRY	85 °		
15' - 20'	PAPER, PLASTIC, WOOD	MODERATE	DRY			
20' - 25'	PAPER, PLASTIC, WOOD	MODERATE	DRY	85 °		
25' - 30'	PAPER, PLASTIC, WOOD	MODERATE	DRY			
30' - 31'	PAPER, PLASTIC, WOOD	MODERATE	DRY	85 °		

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
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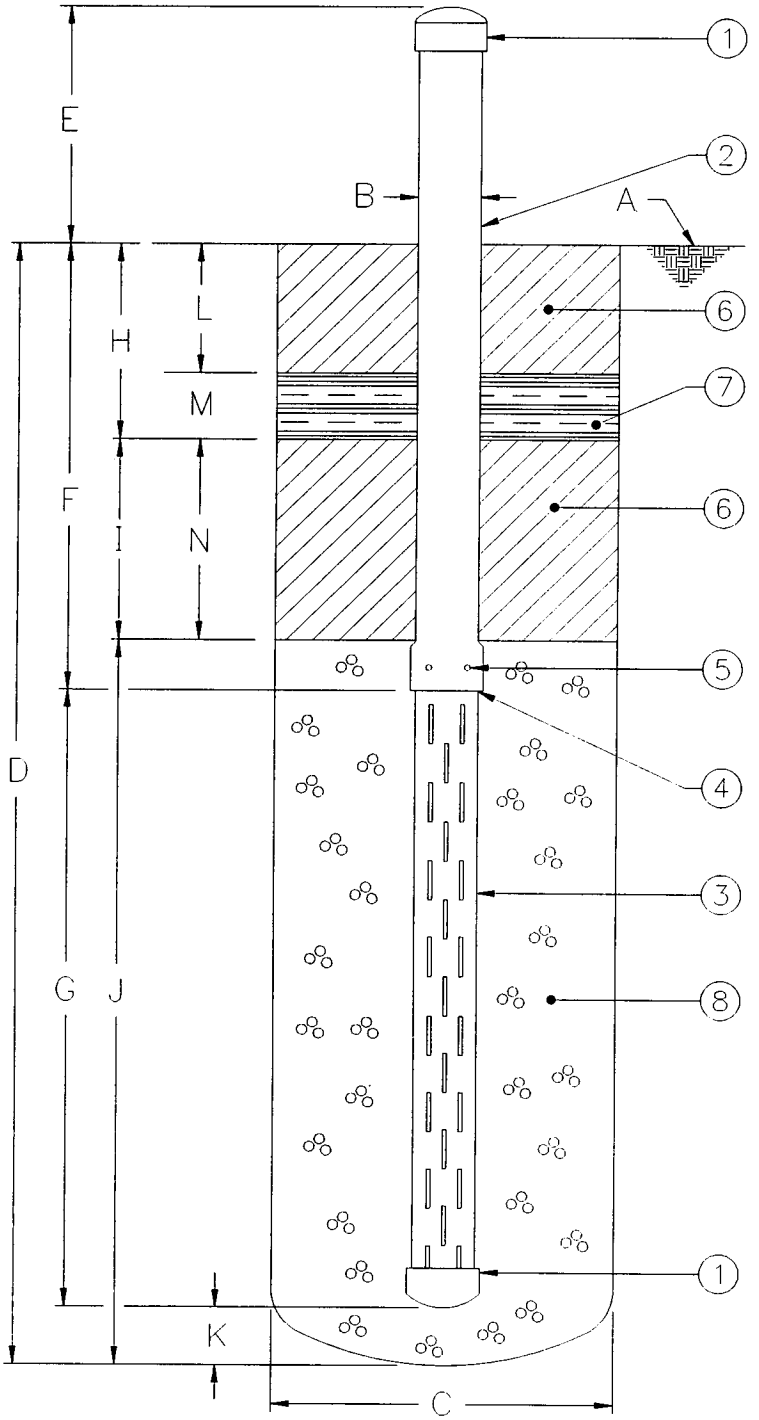
WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/19/96
WET PROJECT NO: 96339

WELL NUMBER: W-33
WELL LOCATION: N: 892180
E: 1693078



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	807.6 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	29 FT.
E	SOLID PIPE ABOVE GROUND:	6 FT.
F	SOLID PIPE BELOW GROUND:	20 FT.
G	SLOTTED PIPE LENGTH:	9 FT.
H	COVER DEPTH:	2 FT.
I	REFUSE DEPTH TO AGGREGATE:	16 FT.
J	AGGREGATE PACK:	11 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	15 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	27 FT.
	REFUSE TEMP RANGE (DEG F):	80-85

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/19/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-33

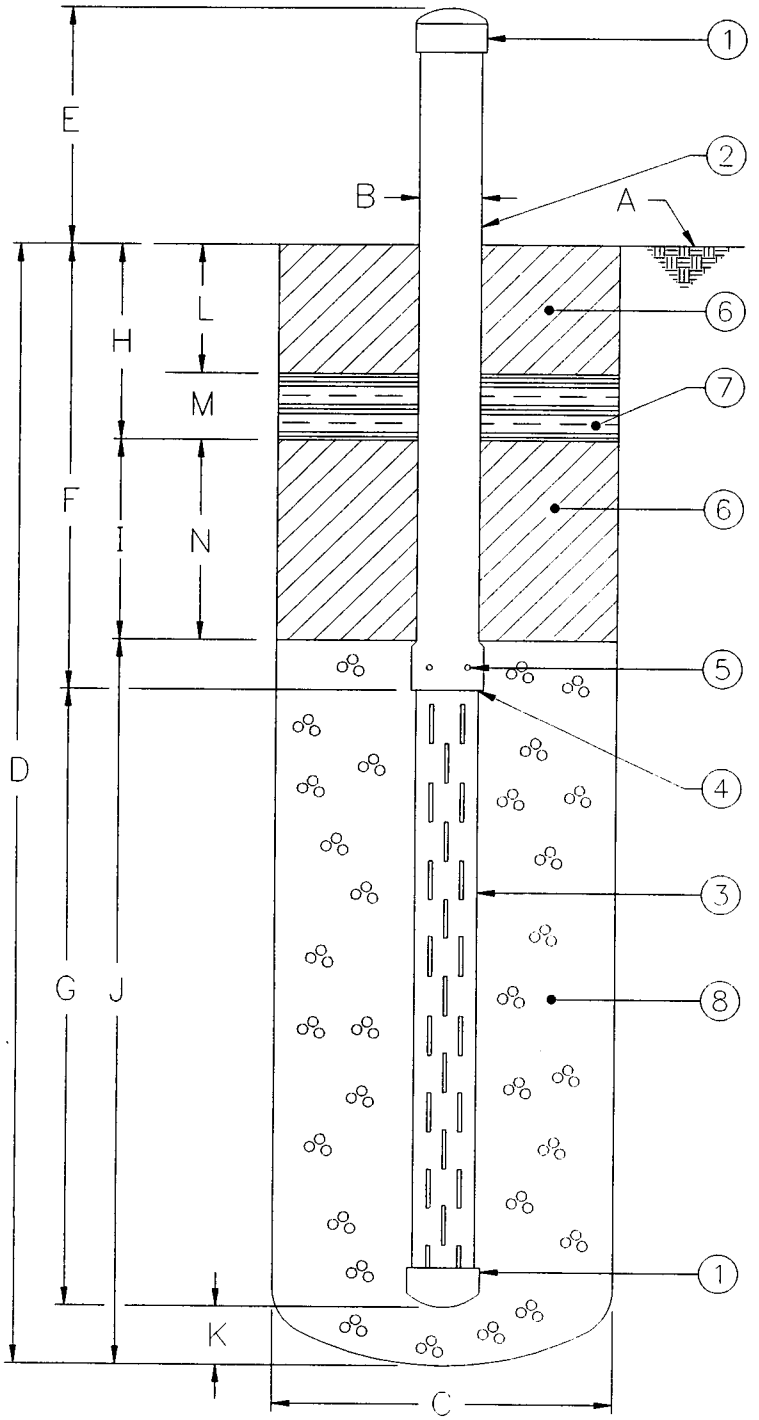
DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	SOIL COVER	N/A				
2' - 4'	PAPER, PLASTIC, WOOD	MODERATE	DRY			
4' - 6'	PAPER, PLASTIC, WOOD	MODERATE	DRY			
6' - 8'	PAPER, PLASTIC, WOOD	MODERATE	DRY			
8' - 10'	PAPER, PLASTIC, WOOD	MODERATE	DRY			
10' - 15'	PAPER, PLASTIC, WOOD	MODERATE	DRY	80 °		
15' - 20'	PAPER, PLASTIC, WOOD	MODERATE	DRY			
20' - 25'	PAPER, PLASTIC, WOOD	MODERATE	DRY			
25' - 29'	PAPER, PLASTIC, WOOD	MODERATE	DRY	85 °		

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
(904) 243-0033 WET Project No. 96339

WELL CONSTRUCTION LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/18/96
WET PROJECT NO: 96339

WELL NUMBER: W-34
WELL LOCATION: N: 892181
E: 1693280



MATERIAL LIST

1	CAP:	8" SCH 80 PVC
2	PIPE:	8" SCH 80 PVC
3	SLOTTED PIPE:	8" SCH 80 PVC
4	CONNECTION:	BELL COUPLING
5	LAG BOLTS:	1 1/4"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	BENSEAL
8	AGGREGATE:	1 1/2" STONE

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	805.9 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	31 FT.
E	SOLID PIPE ABOVE GROUND:	5 FT.
F	SOLID PIPE BELOW GROUND:	20 FT.
G	SLOTTED PIPE LENGTH:	11 FT.
H	COVER DEPTH:	2 FT.
I	REFUSE DEPTH TO AGGREGATE:	16 FT.
J	AGGREGATE PACK:	13 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	15 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	1 FT.
	REFUSE DEPTH:	29 FT.
	REFUSE TEMP RANGE (DEG F):	88-85

NOTES

DRILLING CONTRACTOR

JR'S DRILLING, A WET COMPANY
11 TUPELO AVE. S. E.
FT. WALTON BEACH FL 32548
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WASTE ENERGY TECHNOLOGY, INCORPORATED
ENVIRONMENTAL MANAGEMENT ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: PIEDMONT LANDFILL AND RECYCLING CENTER
DRILLING DATE: 06/18/96
DRILLING CONTRACTOR: WASTE ENERGY TECHNOLOGY, INC.

WELL NUMBER: W-34

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	SOIL COVER	N/A				
2' - 4'	PAPER, PLASTIC, WOOD	MODERATE	DRY			
4' - 6'	PAPER, PLASTIC, WOOD	MODERATE	DRY			
6' - 8'	PAPER, PLASTIC, WOOD	MODERATE	DRY			
8' - 10'	PAPER, PLASTIC, WOOD	MODERATE	DRY			
10' - 15'	PAPER, PLASTIC, WOOD	MODERATE	DRY	88 °		
15' - 20'	PAPER, PLASTIC, WOOD	MODERATE	DRY			
20' - 25'	PAPER, PLASTIC, WOOD	MODERATE	DRY	85 °		
25' - 30'	PAPER, PLASTIC, WOOD	MODERATE	DRY			
30' - 31'	DAILY COVER	MODERATE	DRY	85 °		

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Ft. Walton Beach, FL 32548
(904) 243-0033 WET Project No. 96339

RECORD CONSTRUCTION
HEADER ROUTE SURVEY

GAS COLLECTION HEADER ROUTE SURVEY DATA - PIPE SUMMARY
LANDFILL GAS MANAGEMENT SYSTEM
PIEDMONT RECYCLING AND DISPOSAL FACILITY
KERNERSVILLE, NORTH CAROLINA

PIPE FOOTAGE SUMMARY

GAS LINE	PIPE FOOTAGE (FT)				
	6"	8"	10"	14"	TOTAL
A-A'		633			633
B-B'		689			689
C-C'		1640			1640
D-D'	208				208
E-E'	209				209
F-F'		140			140
H-H'			1349	50	1399
I-I'		54			54
J-J'	73				73
K-K'	94				94
L-L'	123				123
M-M'		120			120
N-N'	90				90
LATERALS	767	164			931
TOTAL	1564	3440	1349	50	6403

TOTAL PIPE FOOTAGE 6403 FT

GAS COLLECTION HEADER ROUTE SURVEY DATA
LANDFILL GAS MANAGEMENT SYSTEM
PIEDMONT RECYCLING AND DISPOSAL FACILITY
KERNERSVILLE, NORTH CAROLINA

STATION (ft)	GRID COORDINATES (north)	(east)	HEADER INVERT ELEV. (ft)	GROUND ELEV. (ft)	HEADER DEPTH (ft)	HEADER SLOPE (%)	CONSTRUCTION NOTES	PIPE INFORMATION
LINE A-A'								
0+00	892220	1691492	850.9	854.7	3.8	-9.30%	STA 0+00 LINE B-B'	
							8" VALVE	
							8" FLANGES	
0+50	892270	1691493	846.3	850.1	3.8	-17.90%	STA 0+00 LINE C-C'	
							8"TEE	
1+00	892316	1691508	837.4	841.1	3.8	-3.66%	STA 0+00 LAT TO WELL W-3	
							8" TEE	
2+00	892351	1691602	833.7	837.5	3.8	-3.04%		
2+99	892354	1691702	830.7	834.4	3.8	-5.76%		
3+20	892355	1691723	829.5	833.2	3.8	-8.95%	STA 0+00 LAT TO WELL W-4	
							8" TEE	
3+63	892358	1691765	825.6	829.4	3.8	-3.73%		START OF REPAIRED
3+80	892366	1691781	825.0	828.8	3.8	-3.73%		AREA
4+01	892373	1691801	824.2	827.9	3.8	-32.11%		
4+08	892381	1691801	821.8	825.5	3.8	-13.63%	8" FLANGE	
4+28	892393	1691817	819.1	822.8	3.8	-11.03%		
4+66	892417	1691845	814.9	818.6	3.8	-5.07%		END OF REPAIRED AREA
5+01	892442	1691873	813.0	816.7	3.8	-9.26%		
5+88	892462	1691958	804.9	808.7	3.8	-7.45%		
6+33	892451	1692001	801.6	805.3	3.8		STA 0+00 LINE H-H'	
							10" x 8" REDUCER	
LINE B-B'								
0+00	892220	1691492	850.9	854.7	3.8	-5.74%	STA 0+00 LINE A-A'	
0+50	892170	1691494	848.1	851.8	3.8	-10.38%		
1+25	892101	1691522	840.3	844.0	3.8	-7.20%	STA 0+00 LAT TO WELL W-12	
							8" TEE	
1+36	892091	1691526	839.5	843.2	3.7	-11.96%		START OF REPAIRED
1+51	892077	1691532	837.7	841.4	3.7	-7.43%		AREA
1+63	892066	1691538	836.8	840.5	3.7	-7.84%	8" FLANGES	
1+76	892055	1691544	835.8	839.5	3.7	-6.91%		
1+93	892040	1691552	834.6	838.3	3.7	-7.60%		
2+00	892035	1691557	834.0	837.8	3.7	-12.69%		END OF REPAIRED AREA
2+11	892025	1691561	832.6	836.3	3.7	-5.41%		
2+23	892015	1691567	832.0	835.7	3.7	-7.49%		
2+75	891970	1691593	828.1	831.8	3.8	-3.00%		
3+09	891939	1691608	827.1	831.9	4.8		STA 0+00 LINE D-D'	
							8" TEE	
3+75	891877	1691630	825.1	830.7	5.6	-3.70%		
4+49	891813	1691667	822.4	826.1	3.8	-10.38%		
5+36	891740	1691713	813.3	817.1	3.8	-4.31%	STA 0+00 LINE E-E'	
							8" TEE	
5+99	891722	1691774	810.6	814.4	3.8	-8.41%		

GAS COLLECTION HEADER ROUTE SURVEY DATA
LANDFILL GAS MANAGEMENT SYSTEM
PIEDMONT RECYCLING AND DISPOSAL FACILITY
KERNERSVILLE, NORTH CAROLINA

STATION (ft)	GRID COORDINATES (north)	(east)	HEADER INVERT ELEV. (ft)	GROUND ELEV. (ft)	HEADER DEPTH (ft)	HEADER SLOPE (%)	CONSTRUCTION NOTES	PIPE INFORMATION
6+59	891706	1691831	805.6	809.3	3.8	-12.17%		
6+84	891699	1691855	802.5	806.3	3.8		STA 0+00 LINE F-F'	
							8" TEE	
6+89	891698	1691860	801.9	805.7	3.8		8" BLIND FLANGE	
LINE C-C'								
0+00	892270	1691493	846.3	850.1	3.8	-12.94%	STA 0+50 LINE A-A'	250 FT OF 8" DIA PE AT CONTOUR
0+20	892275	1691474	843.7	847.5	3.8	-15.16%	8" VALVE	
							8" FLANGES	
1+00	892295	1691397	831.6	835.3	3.8	-13.73%		
1+81	892315	1691320	820.5	824.2	3.8	-5.94%	STA 0+00 LAT TO WELL W-2	
							8" TEE	
2+50	892306	1691252	816.4	820.1	3.8	-3.31%		49 FT OF 8" DIA PE AT 3.31%
2+99	892273	1691214	814.7	818.5	3.8	-8.17%		40 FT OF 8" DIA PE AT CONTOUR
3+39	892237	1691197	811.5	815.2	3.8	-4.41%		60 FT OF 8" DIA PE AT 4.41%
3+68	892211	1691185	810.2	814.8	4.6		STA 0+00 LAT TO WELL W-1	
							8" TEE	
3+99	892182	1691192	808.8	812.6	3.8	-3.08%		299 FT OF 8" DIA PE AT 3.08%
4+99	892105	1691257	805.8	809.7	4.0			
5+44	892076	1691291	804.4	809.0	4.7		STA 0+00 LAT TO WELL W-11	
							8" TEE	
5+99	892039	1691332	802.7	806.5	3.8			
6+98	891969	1691402	799.6	803.4	3.8	-8.43%		43 FT OF 8" DIA PE AT CONTOUR
7+41	891933	1691425	796.0	800 9	4.9	-3.67%	STA 0+00 LAT TO WELL W-18	57 FT OF 8" DIA PE AT 3.67%
							8" TEE	
7+98	891885	1691457	793.9	797.7	3.8	-3.14%		200 FT OF 8" DIA PE AT 3.14%
8+98	891786	1691471	790.8	794.6	3.9			
9+33	891752	1691475	789.7	794.5	4.8		STA 0+00 LAT TO WELL W-24	
							8" TEE	
9+48	891737	1691477	789.2	793.6	4.4			
9+98	891694	1691501	787.6	791.4	3.8	-3.07%		199 FT OF 8" DIA PE AT 3.07%
10+97	891638	1691584	784.6	788.3	3.7			
11+97	891608	1691679	781.5	785.3	3.8	-5.26%		99 FT OF 8" DIA PE AT CONTOUR
12+96	891580	1691773	776.3	780.1	3.8	-4.31%		100 FT OF 8" DIA PE AT 4.31%
13+61	891564	1691836	773.5	777.5	4.0		STA 1+40 LINE F-F'	
							8" TEE	
13+96	891556	1691870	772.0	775.8	3.8	-3.04%		200 FT OF 8" DIA PE AT 3.04%
14+95	891543	1691969	769.0	772.8	3.8			
15+45	891525	1692015	767.5	771.2	3.7			
15+96	891496	1692057	765.9	769.7	3.8	-11.93%		44 FT OF 8" DIA PE AT CONTOUR
16+40	891452	1692059	760.7	764.4	3.8		CONDENSATE DRIPLEG #2	
LINE D-D'								
0+00	891939	1691608	827.2	831.9	4.7	21.60%	STA 3+09 LINE B-B'	125 FT OF 6" DIA PE AT CONTOUR
							8" x 6" REDUCER	

GAS COLLECTION HEADER ROUTE SURVEY DATA
LANDFILL GAS MANAGEMENT SYSTEM
PIEDMONT RECYCLING AND DISPOSAL FACILITY
KERNERSVILLE, NORTH CAROLINA

STATION (ft)	GRID COORDINATES (north)	(east)	HEADER INVERT ELEV. (ft)	GROUND ELEV. (ft)	HEADER DEPTH (ft)	HEADER SLOPE (%)	CONSTRUCTION NOTES	PIPE INFORMATION
0+08	891943	1691615	828.9	833.6	4.7		STA 0+00 LAT TO WELL W-19	
							6" TEE	
1+00	892018	1691664	848.8	852.3	3.5	11.61%		
1+25	892039	1691677	851.7	856.2	4.5	3.04%		83 FT OF 6" DIA PE AT 3.04%
2+08	892111	1691718	854.2	857.7	3.5		WELL W-13	
LINE E-E'								
0+00	891740	1691713	813.4	817.1	3.6	22.92%	STA 5+36 LINE B-B'	209 FT OF 6" DIA PE AT CONTOUR
							8" x 6" REDUCER	
0+13	891748	1691722	816.4	819.9	3.5	18.25%	STA 0+00 LAT TO WELL W-25	
							6" TEE	
0+44	891778	1691733	822.1	825.6	3.5	17.23%		
1+00	891828	1691754	831.7	835.2	3.5	18.85%		
2+09	891928	1691793	852.3	855.8	3.5		WELL W-20	
LINE F-F'								
0+00	891699	1691855	802.5	806.3	3.8	-10.82%	STA 6+84 LINE B-B'	140 FT OF 8" DIA PE AT CONTOUR
0+50	891650	1691846	797.1	800.9	3.8	-26.55%		
0+83	891618	1691847	788.3	792.1	3.8	-26.03%	STA 0+00 LAT TO WELL W-29	
							8" TEE	
1+40	891564	1691836	773.5	777.5	4.0		STA 13+61 LINE C-C'	
LINE H-H'								
0+00	892451	1692001	801.1	805.3	4.3	-6.01%	STA 6+32 LINE A-A'	8 FT OF 10" DIA PE AT CONTOUR
0+08	892445	1692006	800.6	805.5	4.9	-2.36%	STA 0+00 LAT TO WELL W-6	172 FT OF 10" DIA PE AT 2.36%
							10" x 6" REDUCING TEE	
0+40	892422	1692029	799.8	806.1	6.3		STA 0+00 LAT TO WELL W-5	
							10" x 6" REDUCING TEE	
0+80	892393	1692056	798.9	804.3	5.4			
1+80	892307	1692108	796.5	801.2	4.7	-2.00%	STA 0+00 LAT TO WELL W-7	107 FT OF 10" DIA PE AT 2.00%
							10" x 6" REDUCING TEE	
1+97	892294	1692118	796.2	800.1	3.9		STA 0+00 LAT TO WELL W-14	
							10" x 6" REDUCING TEE	
2+87	892243	1692192	794.4	799.0	4.6	-2.02%	STA 0+00 LAT TO WELL W-15	215 FT OF 10" DIA PE AT 2.02%
							10" TEE	
3+02	892238	1692206	794.1	798.7	4.7			
3+79	892225	1692282	792.5	796.5	4.0		STA 0+00 LAT TO WELL W-8	
							10" x 6" REDUCING TEE	
4+01	892221	1692304	792.1	796.4	4.4			
5+02	892229	1692404	790.0	794.5	4.5	-2.03%		199 FT OF 10" DIA PE AT 2.03%
5+56	892242	1692458	788.9	793.2	4.3		STA 0+00 LINE N-N'	
							10" x 6" REDUCING TEE	
6+01	892251	1692501	788.0	792.0	4.0			
7+01	892268	1692600	786.0	790.0	4.0	-2.06%		100 FT OF 10" DIA PE AT 2.06%
7+68	892274	1692666	784.6	788.5	3.9		STA 0+00 LINE M-M'	

GAS COLLECTION HEADER ROUTE SURVEY DATA
LANDFILL GAS MANAGEMENT SYSTEM
PIEDMONT RECYCLING AND DISPOSAL FACILITY
KERNERSVILLE, NORTH CAROLINA

STATION (ft)	GRID COORDINATES (north)	(east)	HEADER INVERT ELEV. (ft)	GROUND ELEV. (ft)	HEADER DEPTH (ft)	HEADER SLOPE (%)	CONSTRUCTION NOTES	PIPE INFORMATION
							10" TEE	
							10" x 8" REDUCER	
8+01	892277	1692699	783.9	788.1	4.2	-4.19%		100 FT OF 10" DIA PE AT 4.19%
8+51	892284	1692749	781.9	786.9	5.0			
9+01	892284	1692799	779.8	786.6	6.8		STA 0+00 LINE I-I'	
							CONDENSATE DRIPLEG #1	
9+01	892284	1692799	779.8	788.1	8.4	-15.68	STA 0+00 LINE I-I'	50 FT OF 10" DIA PE AT 2.58%
							CONDENSATE DRIPLEG #1	
9+51	892284	1692848	779.8	787.4	7.7	3.07%		99 FT OF 10" DIA PE AT 3.07%
9+85	892278	1692883	780.8	788.8	8.0		STA 0+00 LINE L-L'	
							10" x 6" REDUCING TEE	
10+50	892270	1692947	782.8	790.7	7.9	3.00%		300 FT OF 10" DIA PE AT 3.00%
11+50	892251	1693045	785.8	793.7	7.9			
11+90	892244	1693084	787.0	794.9	7.9		STA 0+00 LINE K-K'	
							10" x 6" REDUCING TEE	
12+50	892231	1693143	788.8	796.8	8.0			
13+50	892213	1693241	791.8	799.8	8.0	3.84%	14" x 10" REDUCER	49 FT OF 14" DIA PE AT 3.84%
13+85	892206	1693275	793.2	801.3	8.2		STA 0+00 LINE J-J'	
							14" x 6" REDUCING TEE	
13+99	892203	1693289	793.7	801.7	8.0		14" BLIND FLANGE	
LINE I-I'								
0+00	892284	1692799	0.0	786.6	786.6		STA 9+01 LINE H-H'	86 FT OF 8" DIA PE ABOVE GROUN
							CONDENSATE DRIPLEG #1	
0+54	892337	1692803	0.0	779.7	779.7		BLOWER INLET	
							END OF SKID	
0+86	892336	1692834	0.0	779.6	779.6		FLARE	
							END OF SKID	
LINE J-J'								
0+00	892206	1693275	797.3	801.3	4.0	18.94%	STA 13+85 LINE H-H'	73 FT OF 6" DIA PE AT CONTOUR
0+22	892184	1693270	801.4	804.9	3.5	18.51%	STA 0+00 LAT TO WELL W-34	
							6" TEE	
0+73	892140	1693248	810.9	814.4	3.5		6" BLIND FLANGE	
LINE K-K'								
0+00	892244	1693084	791.0	794.9	3.9	20.09%	STA 11+90 LINE H-H'	94 FT OF 6" DIA PE AT CONTOUR
0+64	892183	1693069	803.8	807.3	3.5	20.58%	STA 0+00 LAT TO WELL W-33	
							6" TEE	
0+94	892155	1693058	810.0	813.5	3.5		6" BLIND FLANGE	
LINE L-L'								
0+00	892278	1692883	784.8	788.8	4.0	20.23%	STA 9+85 LINE H-H'	123 FT OF 6" DIA PE AT CONTOUR
0+49	892231	1692875	794.7	798.2	3.5	18.32%		
0+91	892190	1692869	802.4	805.9	3.5	17.85%	STA 0+00 LAT TO WELL W-32	

GAS COLLECTION HEADER ROUTE SURVEY DATA
LANDFILL GAS MANAGEMENT SYSTEM
PIEDMONT RECYCLING AND DISPOSAL FACILITY
KERNERSVILLE, NORTH CAROLINA

STATION (ft)	GRID COORDINATES (north)	(east)	HEADER INVERT ELEV. (ft)	GROUND ELEV. (ft)	HEADER DEPTH (ft)	HEADER SLOPE (%)	CONSTRUCTION NOTES	PIPE INFORMATION
							6" TEE	
1+23	892161	1692856	808.1	811.6	3.5		6" BLIND FLANGE	
LINE M-M'								
0+00	892274	1692666	784.7	788.5	3.9	16.62%	STA 7+68 LINE H-H'	120 FT OF 8" DIA PE AT CONTOUR
							10" x 8" REDUCER	
0+55	892220	1692671	793.8	798.1	4.3	21.20%	STA 0+00 LAT TO WELL W-10	
							8" TEE	
1+20	892161	1692645	807.6	811.3	3.8		8" BLIND FLANGE	
LINE N-N'								
0+00	892242	1692458	789.1	793.2	4.1	19.98%	STA 5+56 LINE H-H'	90 FT OF 6" DIA PE AT CONTOUR
0+55	892189	1692468	800.1	804.0	3.9	25.86%	STA 0+00 LAT TO WELL W-9	
							6" TEE	
0+90	892156	1692458	809.2	812.7	3.5		6" BLIND FLANGE	
LATERAL TO WELL W-1								
0+00	892211	1691185	810.2	814.8	4.6	6.19%	STA 3+68 LINE C-C'	10 FT OF 6" DIA PE AT CONTOUR
							8" x 6" REDUCER	
0+10	892211	1691175	810.8	814.3	3.5		WELL W-1	
LATERAL TO WELL W-2								
0+00	892315	1691320	820.5	824.2	3.7	10.00%	STA 1+81 LINE C-C'	9 FT OF 6" DIA PE AT CONTOUR
							8" x 6" REDUCER	
0+09	892306	1691319	821.4	827.1	5.7		WELL W-2	
LATERAL TO WELL W-3								
0+00	892316	1691508	837.4	841.1	3.8	11.43%	STA 1+00 LINE A-A'	14 FT OF 6" DIA PE AT CONTOUR
							8" x 6" REDUCER	
0+14	892309	1691520	839.0	845.6	6.6		WELL W-3	
LATERAL TO WELL W-4								
0+00	892355	1691723	829.5	833.2	3.8	27.30%	STA 3+20 LINE A-A'	48 FT OF 6" DIA PE AT CONTOUR
							8" x 6" REDUCER	
0+48	892309	1691721	842.6	846.1	3.5		WELL W-4	
LATERAL TO WELL W-5								
0+00	892422	1692029	800.6	806.1	5.4	20.08%	STA 0+40 LINE H-H'	166 FT OF 6" DIA PE AT CONTOUR
1+66	892307	1691914	834.0	837.7	3.8		WELL W-5	
LATERAL TO WELL W-6								
0+00	892445	1692006	800.8	805.5	4.7	3.06%	STA 0+08 LINE H-H'	9 FT OF 6" DIA PE AT 3.06%
0+09	892452	1692012	801.1	804.5	3.5		WELL W-6	
LATERAL TO WELL W-7								

GAS COLLECTION HEADER ROUTE SURVEY DATA
LANDFILL GAS MANAGEMENT SYSTEM
PIEDMONT RECYCLING AND DISPOSAL FACILITY
KERNERSVILLE, NORTH CAROLINA

STATION (ft)	GRID COORDINATES (north)	(east)	HEADER INVERT ELEV. (ft)	GROUND ELEV. (ft)	HEADER DEPTH (ft)	HEADER SLOPE (%)	CONSTRUCTION NOTES	PIPE INFORMATION
0+00	892307	1692108	796.7	801.2	4.5	3.06%	STA 1+80 LINE H-H'	10 FT OF 6" DIA PE AT 3.06%
0+10	892311	1692117	797.0	800.2	3.1		WELL W-7	
LATERAL TO WELL W-8								
0+00	892225	1692282	792.7	796.5	3.8	10.00%	STA 3+79 LINE H-H'	13 FT OF 6" DIA PE AT CONTOUR
0+13	892214	1692279	794.0	799.9	5.9		WELL W-8	
LATERAL TO WELL W-9								
0+00	892189	1692468	800.1	804.0	3.9	3.01%	STA 0+55 LINE N-N'	10 FT OF 6" DIA PE AT 3.01%
0+10	892190	1692478	800.4	803.9	3.5		WELL W-9	
LATERAL TO WELL W-10								
0+00	892220	1692671	793.8	798.1	4.3	3.03%	STA 0+55 LINE M-M'	10 FT OF 6" DIA PE AT 3.03%
0+10	892220	1692681	794.1	797.6	3.5		WELL W-10	
LATERAL TO WELL W-11								
0+00	892076	1691291	804.4	809.0	4.7	23.65%	STA 5+44 LINE C-C'	71 FT OF 6" DIA PE AT CONTOUR
							8" x 6" REDUCER	
0+71	892128	1691336	821.2	824.7	3.5		WELL W-11	
LATERAL TO WELL W-12								
0+00	892101	1691522	840.3	844.0	3.7	10.00%	STA 1+25 LINE B-B'	9 FT OF 6" DIA PE AT CONTOUR
							8" x 6" REDUCER	
0+09	892104	1691531	841.2	846.6	5.4		WELL W-12	
LATERAL TO WELL W-14								
0+00	892294	1692118	796.4	800.1	3.7	25.01%	STA 1+97 LINE H-H'	279 FT OF 6" DIA PE AT CONTOUR
0+69	892250	1692068	813.6	817.1	3.5	17.06%		
1+05	892226	1692041	819.8	823.3	3.5	23.55%		
2+20	892152	1691958	846.9	850.4	3.5	5.11%		
2+65	892122	1691925	849.2	852.7	3.5	18.15%		
2+79	892113	1691915	851.7	855.2	3.5		WELL W-14	
LATERAL TO WELL W-15								
0+00	892243	1692192	794.6	799.0	4.4	22.96%	STA 2+87 LINE H-H'	164 FT OF 8" DIA PE AT CONTOUR
							10" x 8" REDUCER	
1+00	892157	1692146	817.5	821.0	3.5	18.56%		
1+64	892102	1692116	829.4	832.9	3.5		WELL W-15	
LATERAL TO WELL W-18								
0+00	891933	1691425	796.0	800.9	4.9	3.16%	STA 7+41 LINE C-C'	7 FT OF 6" DIA PE AT 3.16%
							8" x 6" REDUCER	
0+07	891929	1691419	796.2	799.5	3.3		WELL W-18	
LATERAL TO WELL W-19								

GAS COLLECTION HEADER ROUTE SURVEY DATA
LANDFILL GAS MANAGEMENT SYSTEM
PIEDMONT RECYCLING AND DISPOSAL FACILITY
KERNERSVILLE, NORTH CAROLINA

STATION (ft)	GRID COORDINATES (north)	(east)	HEADER INVERT ELEV. (ft)	GROUND ELEV. (ft)	HEADER DEPTH (ft)	HEADER SLOPE (%)	CONSTRUCTION NOTES	PIPE INFORMATION
0+00	891943	1691615	828.9	833.6	4.7	10.29%	STA 0+08 LINE D-D'	11 FT OF 6" DIA PE AT CONTOUR
0+11	891935	1691622	830.1	834.0	3.9		WELL W-19	
LATERAL TO WELL W-24								
0+00	891752	1691475	789.7	794.5	4.8	18.32%	STA 9+33 LINE C-C'	42 FT OF 6" DIA PE AT CONTOUR
							8" x 6" REDUCER	
0+42	891761	1691515	797.4	800.9	3.5		WELL W-24	
LATERAL TO WELL W-25								
0+00	891748	1691722	816.4	819.9	3.5	10.00%	STA 0+13 LINE E-E'	10 FT OF 6" DIA PE AT CONTOUR
0+10	891756	1691715	817.4	823.0	5.6		WELL W-25	
LATERAL TO WELL W-29								
0+00	891618	1691847	788.4	792.1	3.7	10.00%	STA 0+83 LINE F-F'	10 FT OF 6" DIA PE AT CONTOUR
							8" x 6" REDUCER	
0+10	891620	1691838	789.4	793.2	3.8		WELL W-29	
LATERAL TO WELL W-32								
0+00	892190	1692869	802.4	805.9	3.5	10.95%	STA 0+91 LINE L-L'	9 FT OF 6" DIA PE AT CONTOUR
0+09	892188	1692878	803.4	806.9	3.5		WELL W-32	
LATERAL TO WELL W-33								
0+00	892183	1693069	803.8	807.3	3.5	3.00%	STA 0+64 LINE K-K'	10 FT OF 6" DIA PE AT 3.00%
0+10	892181	1693079	804.1	807.6	3.4		WELL W-33	
LATERAL TO WELL W-34								
0+00	892184	1693270	801.4	804.9	3.5	9.80%	STA 0+22 LINE J-J'	10 FT OF 6" DIA PE AT CONTOUR
0+10	892181	1693280	802.4	805.9	3.5		WELL W-34	

DAILY WORK REPORTS

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

DAILY WORK REPORTS

WEEK BEGINNING: 06/17/96 WEEK ENDING: 06/23/96

DATE		DESCRIPTION OF WORK PERFORMED
MON	06/17	Pre-construction meeting.
TUE	06/18	Slotted PVC pipe.
WED	06/19	Drilled, installed and backfilled Well W-34. Drilled, installed and backfilled Well W-13. Rain.
THUR	06/20	Drilled, installed and backfilled Well W-33. Drilled, installed and backfilled Well W-20. Rain.
FRI	06/21	Drilled, installed and backfilled Well W-32. Drilled, installed and backfilled Well W-12. Drilled, installed and backfilled Wells W-6 through W-10.
SAT	06/22	Drilled, installed and backfilled Well W-1 and W-2. Drilled, installed and backfilled Well W-4.
SUN	06/23	

Rick Rogers
WET Supervisor

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

DAILY WORK REPORTS

WEEK BEGINNING: 06/24/96 WEEK ENDING: 06/30/96

DATE		DESCRIPTION OF WORK PERFORMED
MON	06/24	Drilled, installed and backfilled Wells W-4 and W-5. Drilled, installed and backfilled Well W-11. Drilled, installed and backfilled Well W-18.
TUE	06/25	Drilled, installed and backfilled Well W-3. Drilled, installed and backfilled Well W-15. Drilled, installed and backfilled Wells W-24 and W-25. Drilled, installed and backfilled Well W-29.
WED	06/26	Drilled, installed and backfilled Well W-14.
THUR	06/27	Cleaned up site.
FRI	06/28	Surveyed. Traveled.
SAT	06/29	
SUN	06/30	

Rick Rogers
WET Supervisor

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

DAILY WORK REPORTS

WEEK BEGINNING: 07/08/96 WEEK ENDING: 07/08/96

DATE		DESCRIPTION OF WORK PERFORMED
MON	07/08	Welded pipe. Hauled dirt.
TUE	07/09	Welded pipe. Hauled dirt.
WED	07/10	Installed and backfilled 350' of 8" PE pipe (C-C' 0+00-3+50). Installed and backfilled 9' of 6" PE pipe Lateral to Well W-2 (0+00-0+10).
THUR	07/11	Installed and backfilled 350' of 8" PE pipe (C-C' 3+50-7+00). Installed and backfilled 10' of 6" PE pipe Lateral to Well W-1 (0+00-0+10). Installed and backfilled 91' of 6" PE pipe Lateral to Well W-11 (0+00-0+91).
FRI	07/12	Rain.

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

DAILY WORK REPORTS
cont.

WEEK BEGINNING: 07/08/96 WEEK ENDING: 07/08/96

SAT	07/13	Installed and backfilled 233' of 8" PE pipe (C-C' 7+00-9+33). Installed and backfilled 7' of 6" PE pipe Lateral to Well W-18 (0+00-0+07). Installed and backfilled 42' of 6" PE pipe Lateral to Well W-24 (0+00-0+24).
SUN	07/14	

Rick Rogers
WET Supervisor

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

DAILY WORK REPORTS

WEEK BEGINNING: 07/15/96 WEEK ENDING: 7/21/96

DATE		DESCRIPTION OF WORK PERFORMED
MON	07/15	Installed and backfilled 407' of 8" PE pipe (C-C' 9+33-13+40).
TUE	07/16	Installed and backfilled 225' of 8" PE pipe (C-C' 13+40-15+65). Installed and backfilled 100' of 8" PE pipe (F-F' 1+40-4+00). Installed and backfilled 10' of 6" PE pipe Lateral to Well W-29 (0+00-0+10). Drilled, installed and backfilled Well W-29.
WED	07/17	Installed and backfilled 40' of 8" PE pipe (F-F' 0+40-0+00). Installed and backfilled 203' of 8" PE pipe (B-B' 6+89-4+86). Installed and backfilled 209' of 6" PE pipe (E-E' 2+09-0+00). Installed and backfilled 10' of 6" PE pipe Lateral to Well W-25 (0+00-0+10).

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

DAILY WORK REPORTS
cont.

WEEK BEGINNING: 07/15/96 WEEK ENDING: 7/21/96

THUR	07/18	Installed and backfilled 211' of 8" PE pipe (B-B' 4+86 - 2+75). Installed and backfilled 208' of 6" PE pipe (D-D' 0+00-2+08). Installed and backfilled 11' of 6" PE pipe Lateral to Well W-19 (0+00-0+11).
FRI	07/19	Installed and backfilled 275' of 8" PE pipe (B-B' 2+75-0+00). Installed and backfilled 200' of 8" PE pipe (A-A' 0+00-2+00). Installed and backfilled 9' of 6" PE pipe Lateral to Well W-12 (0+00-0+09). Installed and backfilled 14' of 6" PE pipe Lateral to Well W-3 (0+00-0+14).
SAT	07/20	Installed and backfilled 199' of 8" PE pipe (A-A' 2+00-3+99) Installed and backfilled 48' of 6" PE pipe Lateral to Well W-4 (0+00-0+48)
SUN	07/21	

Rick Rogers
WET Supervisor

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

DAILY WORK REPORTS

WEEK BEGINNING: 07/22/96 WEEK ENDING: 07/28/96

DATE		DESCRIPTION OF WORK PERFORMED
MON	07/22	Installed and backfilled 279' of 6" PE pipe (0+00-2+79 Lateral to Well W-14) Installed and backfilled 164' of 6" PE pipe (0+00-1+64 Lateral to Well W-15).
TUE	07/23	Installed and backfilled 75' of 8" PE pipe (C-C' 15+65 - 16+40). Installed and backfilled 234' of 8" PE pipe (A-A' 3+99-6+33). Excavation on Condensate Drip Leg CDL-2.
WED	07/24	Worked on Condensate Drip Leg CDL-2. Hauled dirt. Rain.
THUR	07/25	Welded pipe. Hauled dirt.
FRI	07/26	Installed and backfilled 130' of 10" PE pipe (H-H' 0+00-1+30). Installed and backfilled 166' of 8" PE pipe (0+00-1+66 Lateral to Well W-5). Installed and backfilled 9' of 8" PE pipe (0+00-0+09 Lateral to Well W-6).

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

DAILY WORK REPORTS
cont.

WEEK BEGINNING: 07/22/96 WEEK ENDING: 07/28/96

DATE		DESCRIPTION OF WORK PERFORMED
SAT	07/22	Installed and backfilled 130' of 10" PE pipe (H-H' 0+00-1+30). Installed and backfilled 166' of 8" PE pipe (0+00-1+66 Lateral to Well W-5). Installed and backfilled 9' of 8" PE pipe (0+00-0+09 Lateral to Well W-6).
SUN	07/23	

Rick Rogers
WET Supervisor

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

DAILY WORK REPORTS

WEEK BEGINNING: 07/29/96 WEEK ENDING: 08/04/96

DATE		DESCRIPTION OF WORK PERFORMED
MON	07/29	Rain. Installed and backfilled 157' of 10" PE pipe (H-H' 1+30-2+87). Installed and backfilled 10' of 6" PE pipe (0+00-0+10 Lateral to Well W-7).
TUE	07/30	Installed and backfilled 481' of 10" PE pipe (H-H' 2+87-7+68) Installed and backfilled 13' of 6" PE pipe (0+00-0+13 Lateral to Well W-8). Installed and backfilled 90' of 6" PE pipe (N-N' 0+00-0+90) Installed and backfilled 10' of 6" PE pipe (0+00-0+10 Lateral to Well W-9).
WED	07/31	Installed and backfilled 132' of 10" PE pipe (H-H' 7+68-9+00). Installed and backfilled 120' of 8" PE pipe (0+00-0+120 Lateral to Well W-10). Worked on sump area.
THUR	08/01	Cleaned up sump area.
FRI	08/02	Cleaned up sump area.

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

DAILY WORK REPORTS
cont.

WEEK BEGINNING: 07/29/96 WEEK ENDING: 08/04/96

DATE		DESCRIPTION OF WORK PERFORMED
SAT	08/03	Repaired liner.
SUN	08/04	

Rick Rogers
WET Supervisor

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

DAILY WORK REPORTS

WEEK BEGINNING: 08/05/96 WEEK ENDING: 08/11/96

DATE		DESCRIPTION OF WORK PERFORMED
MON	08/05	Traveled.
TUE	08/06	Installed and backfilled 200' of 10" PE pipe (H-H' 9+00-11+00) Installed and backfilled 123' of 6" PE pipe (9+00-0+09 Lateral to Well W-32).
WED	08/07	Rain.
THUR	08/08	Installed and backfilled 299' of 10" PE pipe (H-H' 19+00-13+99). Installed and backfilled 94' of 6" PE pipe (K-K' 0+00-0+94) Installed and backfilled 10' of 6" PE pipe (0+00-0+10 Lateral to Well W-33) Installed and backfilled 10' of 6" PE pipe (0+00-0+10 Lateral to Well W-34)
FRI	08/09	Completed backfilling and dressing up site. Started flare pad and fabricated knockout.
SAT	08/10	
SUN	08/11	

Rick Rogers
WET Supervisor

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

DAILY WORK REPORTS

WEEK BEGINNING: 08/12/96 WEEK ENDING: 08/18/96

DATE		DESCRIPTION OF WORK PERFORMED
MON	08/12	Fabricated wellheads. Rain.
TUE	08/13	Cleaned out valves (ditches). Installed two 8" valves. Tested line segments for leaks (passed).
WED	08/14	Started cleaning of sump area.
THUR	08/15	Completed clean-up of sump area. Installed rock - GSI sewed Geotextile back.
FRI	08/16	Installed dripleg. Installed riser over 18". Tested system up to knockout test (passed).
SAT	08/17	
SUN	06/30	Dug on North sump.

Rick Rogers
WET Supervisor

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

DAILY WORK REPORTS

WEEK BEGINNING: 08/19/96 WEEK ENDING: 08/25/96

DATE		DESCRIPTION OF WORK PERFORMED
MON	08/19	Installed North sump dripleg. Installed 6/18 branch saddle with clean-out riser. Installed 40' 6" drain line.
TUE	08/20	Air tested Sta. 900-1399 Line H-H'; passed. Cleaned up site. Completed wellhead fabrication.
WED	08/21	Installed 2" drain line from flare. Installed 4" branch saddle on knockout. Walk-through performed with Ed Gibson and Mark Taylor. Stockpiled all wellheads and needed PE parts. Moved dirt to South sump area (as requested by Mr. Gibson). Left site.
THUR	08/22	
FRI	08/23	
SAT	08/24	
SUN	08/25	

Rick Rogers
WET Supervisor

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

DAILY WORK REPORTS

WEEK BEGINNING: 09/23/96 WEEK ENDING: 09/29/96

DATE		DESCRIPTION OF WORK PERFORMED
MON	09/23	
TUE	09/24	Build pipe and paint support stands.
WED	09/25	Review project, contact vendors and site personnel. Package parts and materials for shipping.
THUR	09/26	
FRI	09/27	Review project, contact vendors and site personnel.
SAT	09/28	
SUN	09/29	Prepare for Piedmont flare installation. Travel to Kernersville, NC. Excavate pad for flare. Unload flare and set off-side of the road on the road on the North side of the site. Discuss liner/flare location situation.

Keith Rowecamp
WET Supervisor

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

DAILY WORK REPORTS

WEEK BEGINNING: 09/30/96 WEEK ENDING: 10/06/96

DATE	DESCRIPTION OF WORK PERFORMED
MON 09/30	Build wellheads. Review line damage. Survey and mark lines on South side of site.
TUE 10/01	Rained out. Met with Ed Gibson and Mark Taylor - make decision on flare location. Plan flare installation - purchase parts.
WED 10/02	Met with Ed Gibson - Purchase miscellaneous parts. Rained out.
THUR 10/03	Build wellheads. Build flare pad. Install geotextile fabric on flare pad. Set flare on pad and raise stack with crane.
FRI 10/04	Unload pickup, set knockout, on flare skid. Excavate approximately 125' - expose damaged line. Replace 30' of 8" HDPE pipe and install two (2) 8" HDPE flanges - North side used site backhoe and dump truck. Install steel 8" line, manual valve and pneumatic valve from blower to knockout pot. Place sand and line in ditch. Make flanged connection - North side. Excavate approximately 100' - expose damaged line - South side.
SAT 10/05	Survey top of pipe, undercoat flanges, backfill ditch - North side. Excavate line, haul dirt for backfill - South side. Excavate branch saddle at knockout, assemble stands, install propane line - 1/4" hose, install nitrogen line - 3/8" OD poly tubing with 3/8" compression x 1/4" MNPT brass fittings each end, install area light. Install geotextile fabric and secure, place dirt on edges, install thermometer and pressure gauge.

(Continued Next Page)

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

DAILY WORK REPORTS

WEEK BEGINNING: 09/30/96 WEEK ENDING: 10/06/96

DATE		DESCRIPTION OF WORK PERFORMED
SAT	10/05	Survey line location - mark line and depth of pipe. Construction notes - paperwork.
SUN	10/06	Install site knockout pot sight glass, excavate branch saddle on knockout and cut 2" HDPE. Install 4" HDPE cap. Replace 20' of 8" HDPE pipe and install two (2) 8" HDPE flanges. Place sand and line in ditch. Make flanged connection, survey top of pipe, undercoat flanges, backfill ditch - South side. Assemble air test plumbing, install plumbers balloons in knockout and leachate riser and inflate to 40 psi. Replace 18" air test. Bring system to 4 psi, hold for 9 minute bleeding slowly back to 0 psi. Site electrical conduit diagram and electrican instructions.

Keith Rowecamp
WET Supervisor

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

DAILY WORK REPORTS

WEEK BEGINNING: 10/07/96 WEEK ENDING: 10/13/96

DATE	DESCRIPTION OF WORK PERFORMED
MON 10/07	Survey well elevations, cut off 8" PVC well casing and install wellheads (not cemented). Locate air leaks in risers and seal off, air test to 9.5 psi, pressure bled back to 0 psi rapidly (balloon at South leachate riser moved past tee - location unknown).
TUE 10/08	Locate plumbers balloon, fish out of riser, reset balloon. Prepare for air test - South leachate riser. Set plumbers balloon, replace 18" blind, remove 6" blind. Air test to 5 psi for 1 hour (lost 1.9 psi). Construction notes.
WED 10/09	Complete air test, fill drip legs with water, air test to 5 psi for 1.25 hours - lost 2.5 psi - no leak at North dripleg - could not see down South dripleg. Repair valve stem - Outer stem was bent. Fabricate 8" HDPE flare inlet line.
THUR 10/10	Install 16 wellheads with test ports, excavate ditch for drain line, install 2" HDPE branch saddle, 2" x 4" HDPE reducer, 2" HDPE drain line, 2" PVC drain line, backfill ditches.
FRI 10/11	Start flare with LFG representative, training. Clean up site, load trailer and equipment. Install 8 wellheads with test ports, 8" HDPE flare inlet line, 2" HDPE flare drain, nitrogen needle valve, inlet line stands, valve actuator. Survey flare skid, pad and wells. Remove plumbers balloons and replace blind flanges on leachate driplegs. Construction notes.
SAT 10/12	
SUN 10/13	

Keith Rowecamp
WET Supervisor

PE PIPE PRESSURE TEST REPORTS

PROJECT NAME: PIEDMONT LANDFILL & RECYCLING CTR.
PROJECT #: 96339

PE PIPE PRESSURE TEST REPORT

FORM II

CONTRACTOR:	WASTE ENERGY TECHNOLOGY, INC.	DATE: 8-14-96
PERSON PERFORMING TEST:	Rick Rogers	TIME: 4:50 P.M.
DESCRIPTION/LOCATION OF TEST SEGMENT:	(Pipe, Diameter, Length, & SDR's)	AA Line - 633' 8" BB Line - 689' 8" CC Line - 1640' 8" HH Line - 900' 10" includes all Laterals to we Line DD - 208' 6" Line EE - 209' 6" Line FF - 140' 8" Line NN 90' 6" Line MM - 120' 8" includes Drop Legs 2

T_i = Initial temperature in $_oC$ - _____ $_oC$

P_i = Initial test pressure in psig - _____ psig

P_c = Initial pressure in psig corrected for temperature (T_i) at time 't'

t = Time in minutes from initiation of test

T_t = Temperature in $_oC$ at time 't'

P_t = Test pressure in psig at time 't'

$$P_c = \frac{(P_i + 14.7)(T_t + 273)}{(T_i - 273)} - 14.7$$

$$\text{Percent Pressure Drop} = \frac{(P_c - P_t)}{(P_c)} \times 100$$

NOTE: $_oC = \frac{(_oF - 32)}{1.8}$

TIME (min.)	T_t TEMP READING ($_oC$)	P_t GAUGE READING (psig)	P_c CORRECT PRESSURE (psig)	PERCENT PRESSURE DROP (%)
0 4:50 Pm	28.9	19	19	
20 5:10				
30 5:20				
40 5:30				
50 5:40				
60 5:50 P.m		19	19	<1%

Pass/Failure: Pass Retest (yes/no): _____

Description: Nature of Leaks and Repairs of retest segment: _____

OK [illegible] 8-16-96

WASTE ENERGY TECHNOLOGY, INC.
11 TUPELO AVENUE S.E., FT. WALTON BEACH, FL 32548 904/243-0033; FAX: 904/243-0077

PROJECT NAME:
PROJECT #:

PE PIPE PRESSURE TEST REPORT

FORM II

CONTRACTOR:	WASTE ENERGY TECHNOLOGY, INC.	DATE: 8-19-96
PERSON PERFORMING TEST:		TIME: 2:10 PM.
DESCRIPTION/LOCATION OF TEST SEGMENT:	(Pipe, Diameter, Length, & SDR's)	450' 10" (HH-9100-1399)

Line LL 123' 6"
Line JJ - 73' 6"
Line KK 94' 6"
49' 14" (HH 1350 - 1399
Lat - Well 32 - 9' 6"
Lat Well 33 - 10' 6"
Lat Well 34 - 10' 6"

T_i = Initial temperature in $_oC$ - _____ $_oC$

P_i = Initial test pressure in psig - 12 psig

P_c = Initial pressure in psig corrected for temperature (T_i) at time 't'

t = Time in minutes from initiation of test

T_t = Temperature in $_oC$ at time 't'

P_t = Test pressure in psig at time 't'

$$P_c = \frac{(P_i + 14.7)(T_t + 273)}{(T_i - 273)} - 14.7$$

$$\text{Percent Pressure Drop} = \frac{(P_c - P_t)}{(P_c)} \times 100$$

NOTE: $_oC = \frac{(_oF - 32)}{1.8}$

TIME (min.)	T_t TEMP READING ($_oC$)	P_t GAUGE READING (psig)	P_c CORRECT PRESSURE (psig)	PERCENT PRESSURE DROP (%)
0 2:10	78°	12		—
20 2:30	78°	12		—
30 2:40	78°	12		—
40 2:50	78°	12		—
50 3:00	78°	12		—
60 3:10	78°	12		<1%

Pass/Failure: Pass Retest (yes/no): _____

Description: Nature of Leaks and Repairs of retest segment: _____

OK [illegible] 8-19-96

WASTE ENERGY TECHNOLOGY, INC.
11 TUPELO AVENUE S.E., FT. WALTON BEACH, FL 32548 904/243-0033; FAX: 904/243-0077

PROJECT NAME: PIEDMONT LANDFILL & RECYCLING CTR.
PROJECT #: 96339

PE PIPE PRESSURE TEST REPORT

FORM II

CONTRACTOR:	WASTE ENERGY TECHNOLOGY, INC.	DATE: 8-14-96
PERSON PERFORMING TEST:	Rick Rogers	TIME: 4:50 P.M.
DESCRIPTION/LOCATION OF TEST SEGMENT:	(Pipe, Diameter, Length, & SDR's)	AA Line - 633' 8" BB Line - 689' 8" CC Line - 1640' 8" HH Line - 900' 10" includes all Laterals to well. Line DD - 208' 6" Line EE - 209' 6" Line FF - 140' 8" Line NN 90' 6" Line MM - 120' 8" includes Drop Legs 2

T_i = Initial temperature in $_oC$ - _____ $_oC$

P_i = Initial test pressure in psig - _____ psig

P_c = Initial pressure in psig corrected for temperature (T_i) at time 't'

t = Time in minutes from initiation of test

T_t = Temperature in $_oC$ at time 't'

P_t = Test pressure in psig at time 't'

$$P_c = \frac{(P_i + 14.7)(T_t + 273)}{(T_i - 273)} - 14.7$$

$$\text{Percent Pressure Drop} = \frac{(P_c - P_t)}{(P_c)} \times 100$$

NOTE: $_oC = \frac{(_oF - 32)}{1.8}$

TIME (min.)	T_t TEMP READING ($_oC$)	P_t GAUGE READING (psig)	P_c CORRECT PRESSURE (psig)	PERCENT PRESSURE DROP (%)
0 4:50 Pm	28.9	19	19	
20 5:10				
30 5:20				
40 5:30				
50 5:40				
60 5:50 P.m		19	19	<1%

Pass/Failure: Pass Retest (yes/no): _____

Description: Nature of Leaks and Repairs of retest segment: _____

OK [illegible] 8-16-96

WASTE ENERGY TECHNOLOGY, INC.
11 TUPELO AVENUE S.E., FT. WALTON BEACH, FL 32548 904/243-0033; FAX: 904/243-0077

PROJECT NAME:
PROJECT #:

PE PIPE PRESSURE TEST REPORT

FORM II

CONTRACTOR:	WASTE ENERGY TECHNOLOGY, INC.	DATE: 8-19-96
PERSON PERFORMING TEST:		TIME: 2:10 PM.
DESCRIPTION/LOCATION OF TEST SEGMENT:	(Pipe, Diameter, Length, & SDR's)	450' 10" (HH-9ra-1399)

Line LL 123' 6"
Line JJ - 73' 6"
Line KK 94' 6"
49' 14" (HH 1350 - 1399)
Lat - Well 32 - 9' 6"
Lat Well 33 - 10' 6"
Lat Well 34 - 10' 6"

T_i = Initial temperature in $_oC$ - _____ $_oC$

P_i = Initial test pressure in psig - 12 psig

P_c = Initial pressure in psig corrected for temperature (T_i) at time 't'

t = Time in minutes from initiation of test

T_t = Temperature in $_oC$ at time 't'

P_t = Test pressure in psig at time 't'

$$P_c = \frac{(P_i + 14.7)(T_t + 273)}{(T_i - 273)} - 14.7$$

$$\text{Percent Pressure Drop} = \frac{(P_c - P_t)}{(P_c)} \times 100$$

NOTE: $_oC = \frac{(_oF - 32)}{1.8}$

TIME (min.)	T_t TEMP READING ($_oC$)	P_t GAUGE READING (psig)	P_c CORRECT PRESSURE (psig)	PERCENT PRESSURE DROP (%)
0 2:10	78°	12		—
20 2:30	78°	12		—
30 2:40	78°	12		—
40 2:50	78°	12		—
50 3:00	78°	12		—
60 3:10	78°	12		<1%

Pass/Failure: Pass Retest (yes/no): _____

Description: Nature of Leaks and Repairs of retest segment: _____

OK Mark Taylor 8-19-96

WASTE ENERGY TECHNOLOGY, INC.
11 TUPELO AVENUE S.E., FT. WALTON BEACH, FL 32548 904/243-0033; FAX: 904/243-0077

PROJECT NAME: PIEDMONT LANDFILL & RECYCLING CTR.
PROJECT #: 96339

PE PIPE PRESSURE TEST REPORT

FORM II

CONTRACTOR:	WASTE ENERGY TECHNOLOGY, INC.	DATE: 10/6/96
PERSON PERFORMING TEST:	KEITH ROWECAMP	TIME: 10:00 AM
DESCRIPTION/LOCATION OF TEST SEGMENT:	(Pipe, Diameter, Length, & SDR's)	

Assemble Air Test Plumbing, Install Plumbers Balloons in Knockout and Leachate Riser and Inflate to 40 psi, Replace 18" and 8" PVC Blind Flanges, and Bolts.

Air Test Bring System to 4 psi, Hold for 9 Minute Bleeding Slowly Back to 0 psi.

Pass/Failure: Fail Retest (yes/no): _____

Description: Nature of Leaks and Repairs of retest segment: _____

WASTE ENERGY TECHNOLOGY, INC.
11 TUPELO AVENUE S.E., FT. WALTON BEACH, FL 32548 904/243-0033; FAX: 904/243-0077

PROJECT NAME: PIEDMONT LANDFILL & RECYCLING CTR.
PROJECT #: 96339

PE PIPE PRESSURE TEST REPORT

FORM II

CONTRACTOR:	WASTE ENERGY TECHNOLOGY, INC.	DATE: 10/7/96
PERSON PERFORMING TEST:	KEITH ROWECAMP	TIME: 12:00 PM
DESCRIPTION/LOCATION OF TEST SEGMENT:	(Pipe, Diameter, Length, & SDR's)	

Locate Air Leaks in Risers and Seal Off, Air Test to 9.5 psi, Pressure Bled Back to 0 psi Rapidly (Balloon at South Leachate Riser Moved Past Tee - Location Unknown).

Pass/Failure: Fail Retest (yes/no): _____

Description: Nature of Leaks and Repairs of retest segment: _____

WASTE ENERGY TECHNOLOGY, INC.
11 TUPELO AVENUE S.E., FT. WALTON BEACH, FL 32548 904/243-0033; FAX: 904/243-0077

PROJECT NAME: PIEDMONT LANDFILL & RECYCLING CTR.
PROJECT #: 96339

PE PIPE PRESSURE TEST REPORT

FORM II

CONTRACTOR:	WASTE ENERGY TECHNOLOGY, INC.	DATE: 10/8/96
PERSON PERFORMING TEST:	KEITH ROWECAMP	TIME: 8:00 AM
DESCRIPTION/LOCATION OF TEST SEGMENT:	(Pipe, Diameter, Length, & SDR's)	

Locate Plumbers Balloon, Fish Out of Riser, Reset Baloon, Prepare for Air Test - South Leachate Riser.

Set Plumbers Balloon, Replace 18" Blind, Remove 6" Blind, Air Test to 5 psi for 1 Hour (lost 1.9 psi).

Pass/Failure: Pass Retest (yes/no): _____

Description: Nature of Leaks and Repairs of retest segment: _____

WASTE ENERGY TECHNOLOGY, INC.
11 TUPELO AVENUE S.E., FT. WALTON BEACH, FL 32548 904/243-0033; FAX: 904/243-0077

PROJECT NAME: PIEDMONT LANDFILL & RECYCLING CTR.
PROJECT #: 96339

PE PIPE PRESSURE TEST REPORT

FORM II

CONTRACTOR:	WASTE ENERGY TECHNOLOGY, INC.	DATE: 10/9/96
PERSON PERFORMING TEST:	KEITH ROWECAMP	TIME: 7:00 AM
DESCRIPTION/LOCATION OF TEST SEGMENT:	(Pipe, Diameter, Length, & SDR's)	

Complete Air Test, Fill Drip Legs with Water, Air Test to 5 psi for 1.25 Hours - Lost 2.5 psi - No Leak at North Drip Leg - Could Not See Down South Drip Leg.

Pass/Failure: Pass Retest (yes/no): _____

Description: Nature of Leaks and Repairs of retest segment: _____

WASTE ENERGY TECHNOLOGY, INC.
11 TUPELO AVENUE S.E., FT. WALTON BEACH, FL 32548 904/243-0033; FAX: 904/243-0077

MATERIAL TEST REPORTS

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

GRAVEL

1 1/2"	1"	3/4"	1/2"	3/8"
100	90-100	26-55	0-10	0-5

SCREEN #	1	2	3	4	5	6	7	8	9	10	11	12
AVERAGE	100.0	94.3	39.0	4.5	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STANDARD DEVIATION	0.0	0.9	4.7	0.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
# SAMPLES	2											

VULCAN MATERIALS COMPANY
STOKESDALE QUARRY
N.C. # 5

DATE	TIME	CODE	SIZE	1 1/2" 100	1" 90-100	3/4" 26-55	1/2" 0-10	3/8" 0-5
041696	1600	9	105	100.0	94.9	42.3	3.9	3.0
040495	1200	9	105	100.0	93.6	35.7	5.1	3.2

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

SAND

For Info Only !!!

K & T Form 300-A
6-2-94

STATE OF NORTH CAROLINA
DEPT. OF TRAN
MATERIALS AND
RALEIGH, NORTH C

ACCREGATE GRADE

Post-it® Fax Note 7671	Date 8-8-96	# of pages ▶ 1
To Kevin Nixon	From MJT	
Co./Dept. MJT	Co. CRUSHER	
Phone #	Phone # 704-876-1321	
Fax # 910-761-2075	Fax #	

Lab Inspection
8-6-96

Project No. 9956
County Rowan
Resident Engineer
Contractor
Furnished By Quality Sand
Source Hanover Ferry Rd & Yadkin River
Sampled By K D Wilson
Laboratory Statesville

	S.P. #1		S.P. #2			
MATERIAL	2.5 Sand	2.5 Sand	2.5 Sand	2.5 Sand		
Lab No.	S-96-2651	S-96-2652	S-96-2653	S-96-2654		
Sample No.	2.5	2.5	2.5	2.5		
Date Sampled	8-6-96					
Date Received	8-8-96					
Sampled From	Pit					
Quantity	500 Tons					
Proposed Use						
SIEVE SIZE	PERCENT PASSING					
2"						
1½"						
1"						
¾"						
½"						
⅜"	100	100	100	100		
#4	99	100	100	100		
#8	97	97	95	97		
#16						
#30						
#50	90	93	93	91		
#100	70	77	75	70		
#200	16	24	17	17		
0.05	6	7	5	4		
0.02	4	4	3	3.5		
0.005	3	3	3	3		
Fineness Modulus	2.37	2.63	2.58	2.56		

Remarks

S#1, 3, 4 - Meets Specs
S#2 - Does not meet Specs

Signed Statesville Lab

LINER REPAIR

REPAIR REPORT

PHASE 1 LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

HDPE LINER REPAIR

On Wednesday, July 31, 1996, while excavating to make the CDL #2 tie-in into the leachate sump riser, Waste Energy Technology, Inc. (WET) accidentally hit the 60 mil HDPE base liner and underlaying clay liner with the backhoe. A section about 3' X 5' was believed to have been damaged. The Project Manager and Construction Manager were notified of the problem and immediate action was taken to pack-off the damaged area with a bentonite seal. A bentonite berm was also installed around the damaged area to prevent any water migration into the area.

The area around the damaged liner was stripped back and cleaned to allow for a detailed inspection of the damage. This inspection showed that the backhoe had cut and ripped back an approximate 3' X 7' area and also had damaged the top 12"- 18" of the 30"-36" clay base under the liner at that location.

After inspection, the damaged area was repacked with bentonite, covered with a temporary sheet of HDPE liner, and the bentonite berm was re-established to prevent any water migration into the damaged area. Because of impending rainy weather, the WET construction crew manned the damaged area throughout the night to ensure water run-off did not penetrate into the damaged area. Ground Safe, Inc. (GSI), a liner installation contractor, was contacted and mobilized on site the following day to perform the repair. GSI arrived on site the afternoon of August 1, 1996 and completed repairs and testing. A report of the GSI repair, methods used, QA/QC procedures and test results are included in this section.

Due to both the conditions and location of the repaired area, a follow-up geoelectric test was performed. This test was performed by I-Corp International, Inc. on Saturday, August 3, 1996. This test indicated three (3) small problem areas. A report of the methods and results of the geoelectric test are included in this section.

The three (3) problem areas determined by the geoelectric test were repaired by GSI on August 3, 1996. A repair report and additional tests for these repairs are included in this section.

Upon completion of liner repairs, the area was cleaned, the liner protective geotextile repaired, the area was backfilled with clean gravel, and the top geotextile was repaired.

The following related documents pertaining to the liner repair are included in this section:

- GSI repair - August 1, 1996
- I-Corp Geoelectric Test
- GSI Repair - August 3, 1996
- WMI QA Plan
- GSI QC Plan
- Photo Documentation

GSI LINER REPAIR
AUGUST 1, 1996

GSI Ground Safe, Inc.

Page _____ of _____

TRIAL WELD INFORMATION

PROJECT NAME: Piedmont Landfill PROJECT NUMBER: NC-159-7-96 MATERIAL DESCRIPTION: 60 mil

DATE/ TIME	AMBIENT TEMP	Q.C. INITIALS	MACHINE NUMBER	SEAMER INITIALS	EXTRUSION WELDS				FUSION WELDS				PEEL VALUES LBS / INCH			PASS/ FAIL	COMMENTS
					BARREL TEMP		PREHEAT TEMP		WEDGE TEMP		MEASURED SPEED FT / MIN	SPEED SETTING					
					SET	PYRO	SET	PYRO	SET	PYRO							
00 pm -1	76°	KH	246	KH	220		4.5					P S	98 142	114 134		P	

Ground Safe, Inc.

REPAIR REPORT

PAGE _____ OF _____

PROJECT NAME: Piedmont Landfill PROJECT NUMBER: NC-159-7-96 MATERIAL DESCRIPTION: 60 ml

FIELD SEAM #	PANEL NO.	REPAIR DATE	REPAIR CREW	MACHINE NUMBER	TEST DATE	VBOX TEST CREW	TEST P/F	LOCATION / COMMENTS
/	Sump	8-1	KH	246	8-1	BJ/KH	P	8'x4.5' patch in sump
	↓	↓	↓	↓	/	/	/	9x5' patch in sump

[redacted]Y T[redacted]INPUT WORK SHEET

FORM 1002
SHEET __ OF __

REPORTED BY:	NAME K. Hiar
JOB NAME:	JOB W.E.T.
JOB NUMBER:	NO. NC-159-7-96
DATE:	
SUPERVISOR:	NAME
PROJECT MANAGER:	NAME

What Type of project?	
	< Single lined
	< Double lined
	< CAP

A: Repair liner
B:
C:
D:
E:
F:
G:

H:
I:
J: SET-UP
K: TRAVEL
L: WEATHER
M: T & M
N: STAND-BY

EQUIP. QTY.
EXTRUDER
MICR
GENERATOR
TRUCK
MISC.

TYPE OF DAY	
TRAVEL	
WORK	
WEATHER	
STANDBY	
WEEKEND	

COMMENTS: Repaired 5'x9' patch in sump VB & added second patch of same on next layer

NAME	POS.	A	B	C	D	E	F	G	H	I	SET UP J	TRAVEL K	WEATHER L	T & M M	STAND BY N	TOTAL
KENNY HIAR		8.5										9				17.5
Brian Bowman		8.5										9				17.5
TOTAL		17										18				35

I-CORP GEOELECTRIC LEAK SURVEY REPORT

FINAL REPORT

LEAK SURVEY IN THE SUMP OF SUBCELL 1, CELL 2, PHASE 3 AT PIEDMONT SANITARY LANDFILL, NC

Prepared by

I-CORP INTERNATIONAL, Inc.
Ocean Ridge, FL

Prepared for

Waste Environment Technologies
Fort Walton Beach, FL

6 August 1996

LEAK SURVEY IN THE SUMP OF SUBCELL 1, CELL 2, PHASE 3 AT PIEDMONT SANITARY LANDFILL, NC

1. INTRODUCTION

This report has been prepared for Mr. Michael Rodgers of Waste Environment Technologies (WET), Fort Walton Beach, FL by Dr. Ian D. Peggs of I-CORP INTERNATIONAL Inc. (I-CORP), Ocean Ridge, FL.

On 2 August 1996 WET requested that I-CORP perform a geoelectric leak location survey on repair seams in the primary geomembrane liner in the sump of Subcell 1, Cell 2, Phase 3 of the Piedmont Sanitary Landfill, near Kernersville, NC. It is understood that repairs had been made to the geomembrane but that the Construction Manager was not satisfied with the effectiveness of vacuum box testing used to confirm the integrity of the seams.

The survey was performed by Dr. Ian D. Peggs on 3 August 1996 with the support of Mr. Rick Rodgers of WET and Mr. Mark Taylor of EcoLogic Associates, the Construction Manager.

2. TECHNOLOGY

Electrical methods of locating liner leaks rely on the geomembrane being an electrical insulator. A potential of about 24 VDC is applied across the geomembrane, from an injector (positive) electrode in the soil/leachate above the geomembrane, and a negative (ground) electrode in the soil or leaking liquid under the geomembrane. If the two soils are electrically isolated from each other current will only flow through holes in the geomembrane. If the geomembrane is covered by leachate a probe is traversed through the liquid to measure the potential gradients in the liquid, which are quite uniform except at a hole. The high current density at a hole produces high potential gradients that are identified. The electrodes of the probe can be placed directly on the point of highest potential gradient to exactly pinpoint the hole.

The difficulty in this project is that the soil on top of the single composite liner is not electrically isolated from the soil under the geomembrane; they are in contact at the edge of the cell. This would significantly reduce the effectiveness of the survey since much of the applied current would flow through the cover soil and not through holes in the geomembrane. To minimize this effect, the ground electrode was placed in the ditch at the side of the public road to the south of the sump; the elevation of this ditch is similar to that of the base of the sump. Thus, the current

would be encouraged to flow directly to the underside of the geomembrane rather than through the surface soil up the outside and over the top of the berm then down into the sump. The injector electrode was placed in a soil layer placed over the drainage stone on the north side of the sump. Thus the current would have to flow past any hole in the sump liner to reach the ground electrode.

3. OBSERVATIONS

The equipment was calibrated against a 0.040 in. diameter hole in a calibration cell. This confirmed that current was successfully being injected into the leachate above the geomembrane. A rub sheet was removed from on top of the primary geomembrane and the sump was filled with a minimum of 3 in. of water above the repair seam. Due to the confined space the survey was performed with the search probe electrodes about 1 ft apart. Under these conditions the survey was performed at something less than the normal sensitivity.

A leak was indicated in the seam on the east side of the patch just to the north of the center. By feeling through the leachate, a large sideways squeeze-out on the edge of the seam could be felt and could be pulled away from the geomembrane.

The sump was pumped out and the defect examined. The distance along which the extruded bead was disbonded from the geomembrane was found to be about 8 in. The extruded bead had never been bonded to the geomembrane. This was at a location where leachate was rapidly flowing into the sump, and just underneath an elbow in a clean out pipe about 18 in. above the geomembrane. While investigating this feature another lack of bond (about 2 in. long) was found about 2 ft south of the first indication. A third lack of bond, about 1 in. long was found on the west side of the patch.

All of these disbond sections were cut out and retained by Mr. Mark Taylor (Construction Manager). Repairs were made by Ground Safe, Inc.

The sump was refilled with water and another geoelectric leak survey performed, only this time the search probe was used at several electrode separation distances to maximize sensitivity. A small signal was obtained at the southernmost edge of the patch over the first identified lack of bonding, where the repair bead crossed the original repair seam. This was the most difficult part of the seam to weld since it is directly under the angled clean out pipe; it was not possible to hold the extrusion welding machine vertical at this location.

The repair at this location was made after I-CORP left the site.

It is worth noting that electrofusion patches are available for making repairs in awkward locations such as experienced in this project. A patch, with electrofusion weld bead already bonded to it, is placed on the geomembrane, and weighted. A current source is attached to the two terminals and welding takes place in about 8 seconds. It is claimed that such welding can also be done underwater and in dirty environments.

4. CONCLUSIONS

The geoelectric leak survey identified one leak on the original repair patch seam, and lead directly to the location of two additional, but smaller leaks. Subsequently, an additional leak was located in the seam made to repair the first identified leak.

* * * * *

f:\reports\WETrept.doc

GSI REPAIRS MADE IN CONJUNCTION WITH I-CORP SURVEY

GST Ground Safe, Inc.

TRIAL WELD INFORMATION

PROJECT NAME: Piedmont Landfill PROJECT NUMBER: NC-159-7-96 MATERIAL DESCRIPTION: 60 ml

DATE/ TIME	AMBIENT TEMP	Q.C. INITIALS	MACHINE NUMBER	SEAMER INITIALS	EXTRUSION WELDS				FUSION WELDS				PEEL VALUES LBS / INCH			PASS/ FAIL	COMMENTS
					BARREL TEMP		PREHEAT TEMP		WEDGE TEMP		MEASURED SPEED FT / MIN	SPEED SETTING					
					SET	PYRO	SET	PYRO	SET	PYRO							
1:00 pm 8-1	76°	KH	246	KH	220		4.5					P	98	114		P	
												S	142	134			
2:00 pm 8-3		KH	246	KH	220		4.5					P	91	88	97	P	
												S	125	121			

[redacted] Gro[redacted]d S[redacted]e, [redacted].

REPAIR REPORT

PAGE _____ OF _____

PROJECT NAME: Piedmont Landfill PROJECT NUMBER: NC-159-7-96 MATERIAL DESCRIPTION: 60 ml

FIELD SEAM #	PANEL NO.	REPAIR DATE	REPAIR CREW	MACHINE NUMBER	TEST DATE	VBOX TEST CREW	TEST P/F	LOCATION / COMMENTS
/	Sump	8-1	KH	246	8-1	BJ/KH	P	8'x5.5' patch in sump
	↓	↓	↓	↓	/	/	/	9x5' patch in sump
/	Sump	8-3	KH	246	8-3	KH	P	3 1x1 patch in sump
	↓	↓	↓	↓	/	/	/	10'x6' patch in sump

Ground Safe, Inc.

PROJECT NO.: NC-159-7-96

WEEK ENDING, SUNDAY: 8-4-96

EMPLOYEE NAME	MON.	TUES.	WED.	THUR.	FRI.	SAT.	SUN.	TOTAL	SIGNATURE
Kenny Hiar				9.0 / 8.5				9.0 / 8.5	
Brian Bowman				9.0 / 8.5				9.0 / 8.5	

WASTE MANAGEMENT QA PLAN

panels, or portions of panels, should be rejected, 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 the Geosynthetic QAC. Repairs shall be made using procedures described in Section 4.9.

4.5.6 Writing on the Liner

To avoid confusion, the Installer and the Geosynthetic QAC shall each use different colored markers that are readily visible for writing on the geomembrane. The markers used must be semi-permanent and compatible with the geomembrane. The Installer shall use a white marker to write on the geomembrane. The Geosynthetic QAC shall use a yellow marker.

4.6 FIELD SEAMING

4.6.1 Seam Layout

Before installation begins, the Installer must provide the Project Manager and the Geosynthetic QAC with a panel layout drawing, i.e., a drawing of the facility to be lined showing all expected seams. The Geosynthetic QAE shall review the panel layout drawing and verify that it is consistent with accepted state-of-practice. No panels may be seamed without the written approval of the panel layout drawing by the Project Manager. In addition, panels not specifically shown on the panel layout drawing may not be used without the Project Manager's prior 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 ft (1.5 m) from the toe of the slope, or areas of potential stress concentrations, unless otherwise authorized by the Project Manager.

A seam numbering system compatible with the panel numbering system shall be used by the Geosynthetic QAC.

4.6.2 Accepted Seaming Methods

Approved processes for field seaming are extrusion welding and fusion welding. Proposed alternate processes shall be documented and submitted by the Installer to the Project Manager for approval. Only apparatus which have been specifically approved by make and model shall be used. The Project Manager shall submit all documentation regarding seaming methods to be used to the Geosynthetic QAC for review.

4.6.2.1 Extrusion Process

The Geosynthetic QAC shall log ambient, seaming apparatus, and geomembrane surface temperatures at appropriate intervals and report any noncompliances to the Project Manager.

The Geosynthetic QAC shall verify that:

1. The Installer maintains on-site the number of spare operable seaming apparatus decided upon at the pre-construction meeting.
2. Equipment used for seaming is not likely to damage the geomembrane.
3. Prior to beginning a seam, the extruder is purged until all heat-degraded extrudate has been removed from the barrel.
4. Clean and dry welding rods or extrudate pellets are used.
5. The electric generator is placed on a smooth base such that no damage occurs to the geomembrane.
6. Grinding shall be completed no more than 1 hour prior to seaming.
7. A smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage.
8. The geomembrane is protected from damage in heavily trafficked areas.
9. Exposed grinding marks adjacent to an extrusion weld shall be minimized. In no instance shall exposed grinding marks extend more than 1/4" from the seamed area.
10. In general, the geomembrane panels are aligned to have a nominal overlap of 3 in (75 mm) for extrusion welding. In any event, the final overlap shall be sufficient to allow peel tests to be performed on the seam.
11. No solvent or adhesive is used unless the product is approved in writing by the Project Manager prior to use (samples shall be submitted to the Project Manager for testing and evaluation).
12. The procedure used to temporarily bond adjacent panels together does not damage the geomembrane; in particular, the temperature of hot air at the nozzle of any temporary welding apparatus is controlled such that the geomembrane is not damaged or degraded.

4.6.2.2 Fusion Process

The Geosynthetic QAC shall log ambient, seaming apparatus, and geomembrane surface temperatures at appropriate intervals and report any noncompliances to the Project Manager.

The Geosynthetic QAC shall also verify that:

1. The Installer maintains on-site the number of spare operable seaming apparatus decided upon at the pre-construction meeting.
2. Equipment used for seaming is not likely to damage the geomembrane.
3. For cross seams, the edge of the cross seam is ground to an incline prior to welding.

4. The electric generator is placed on a smooth base such that no damage occurs to the geomembrane.
5. A smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage.
6. The geomembrane is protected from damage in heavily trafficked areas.
7. A movable protective layer is used as required by the Installer directly below each overlap of geomembrane that is to be seamed to prevent buildup of moisture between the sheets and prevent debris from collecting around the pressure rollers.
8. In general, the geomembrane panels are aligned to have a nominal overlap of 5 in (125 mm) for fusion welding. In any event, the final overlap shall be sufficient to allow peel tests to be performed on the seam.
9. No solvent or adhesive is used unless the product is approved in writing by the Project Manager prior to use (samples shall be submitted to the Project Manager for testing and evaluation).

4.6.3 Seam Preparation

The Geosynthetic QAC shall verify that prior to seaming, the seam area is clean and free of moisture, dust, dirt, debris or foreign material of any kind. If seam overlap grinding is required, the Geosynthetic QAC must ensure that the process is completed according to the Manufacturer's instructions within one hour of the seaming operation, and in a way that does not damage the geomembrane. The Geosynthetic QAC shall also verify that seams are aligned with the fewest possible number of wrinkles and "fishmouths".

4.6.4 Trial Seams

Trial seams shall be made on fragment pieces of geomembrane liner to verify that conditions are adequate for production seaming. Such trial seams shall be made at the beginning of each seaming period, and at least once each five hours, for each production seaming apparatus used that day. Each seamer shall make at least one trial seam each day. Trial seams shall be made under the same conditions as actual seams.

The trial seam sample shall be at least 5 ft (1.0 m) long by 1 ft (0.3 m) wide (after seaming) with the seam centered lengthwise. Seam overlap shall be as indicated in Section 4.6.2.

Two specimens shall be cut from the sample with a 1 in (25 mm) wide die. The specimens shall be cut by the Installer at locations selected randomly along the trial seam sample by the Geosynthetic QAC. The specimens shall be tested in peel using a field tensiometer. The tensiometer shall be capable of maintaining a constant jaw separation rate of two inches per minute. They should not fail in the seam as described in Section 4.8.5. If a 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 trial welds are achieved. The Geosynthetic QAC shall observe all trial seam procedures.

The remainder of the successful trial seam sample shall be cut into three pieces, one to be retained in the Project Manager's archives, one to be given to the Installer, and one to be retained by the Geosynthetic QAC for possible laboratory testing. Each portion of the sample shall be assigned a number and marked accordingly by the Geosynthetic QAC, who shall also log the date, hour, ambient temperature, number of seaming unit, name of seamer, and pass or fail description.

If agreed upon between the Project Manager and the Geosynthetic QAE, and documented by the Geosynthetic QAE in his daily report, the remaining portion of the trial seam sample can be subjected to destructive testing as indicated in Section 4.8.6. If a trial seam sample fails a test conducted by the Geosynthetic QAL, then a destructive seam test sample shall be taken from each of the seams completed by the seamer during the shift related to the considered trial seam. These samples shall be forwarded to the Geosynthetic QAL and, if they fail the tests, the procedure indicated in Section 4.8.7 shall apply. The conditions of this paragraph shall be considered satisfied for a given seam if a destructive seam test sample has already been taken.

4.6.5 General Seaming Procedures

During general seaming, the Geosynthetic QAC shall be cognizant of the following:

1. For fusion welding, it may be necessary to place a movable protective layer of plastic directly below each overlap of geomembrane that is to be seamed. This is to prevent any moisture buildup between the sheets to be welded and prevent debris from collecting around the pressure rollers.
2. If required, a firm substrate shall be provided by using a flat board, a conveyor belt, or similar hard surface directly under the seam overlap to achieve proper support.
3. 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 in (150 mm) beyond the cut in all directions.
4. If seaming operations are carried out at night, adequate illumination shall be provided.
5. Seaming shall extend to the outside edge of panels placed in the anchor trench.
6. All cross seam tees should be extrusion welded to a minimum distance of 4 in on each side of the tee.
7. No field seaming shall take place without the Master Seamer being present.

The Geosynthetic QAC shall verify that the above seaming procedures (or any other procedures agreed upon and indicated in the project QAP) are followed, and shall inform the Project Manager of any nonconformance.

4.6.6 Seaming Weather Conditions

4.6.6.1 Normal Weather Conditions

The normal required weather conditions for seaming are as follows:

1. Ambient temperature between 32°F (0°C) and 104°F (40°C).
2. Dry conditions, i.e. no precipitation or other excessive moisture, such as fog or dew.
3. No excessive winds.

The Geosynthetic QAE shall verify that these weather conditions are fulfilled and notify the Project Manager in writing if they are not. Ambient temperature shall be measured by the Geosynthetic QAC in the area in which the panels are to be placed. The Project Manager will then decide if the installation is to be stopped or special procedures used.

4.6.6.2 Cold Weather Conditions

To ensure a quality installation, if seaming is conducted when the ambient temperature is below 32°F (0°C), the following conditions must be met:

1. Geomembrane surface temperatures shall be determined by the Geosynthetic QAC at intervals of at least once per 100 foot of seam length to determine if preheating is required. For extrusion welding, preheating is required if the surface temperature of the geomembrane is below 32°F (0°C).
2. Preheating may be waived by the Project Manager based on a recommendation from the Geosynthetic QAE, if the Installer demonstrates to the Geosynthetic QAE's satisfaction that welds of equivalent quality may be obtained without preheating at the expected temperature of installation.
3. If preheating is required, the Geosynthetic QAC shall inspect all areas of geomembrane that have been preheated by a hot air device prior to seaming, to ensure that they have not been overheated.
4. Care shall be taken to confirm that the surface temperatures are not lowered below the minimum surface temperatures specified for welding due to winds or other adverse conditions. It may be necessary to provide wind protection for the seam area.
5. All preheating devices shall be approved prior to use by the Project Manager.
6. Additional destructive tests (as described in Section 4.8) shall be taken at an interval between 500 feet and 250 feet of seam length, at the discretion of the Geosynthetic QAE.
7. Sheet grinding may be performed before preheating, if applicable.
8. Trial seaming, as described in Section 4.6.4, shall be conducted under the same ambient temperature and preheating conditions as the actual seams. Under cold weather conditions, new trial seams shall be conducted if the ambient temperature drops by more than 5°F from the initial trial seam test conditions.

4.6.6.3 Warm Weather Conditions

At ambient temperatures above 104 °F, no seaming of the geomembrane shall be permitted unless the Installer can demonstrate to the satisfaction of the Project Manager that geomembrane seam quality is not compromised.

Trial seaming, as described in Section 4.6.4, shall be conducted under the same ambient temperature conditions as the actual seams.

At the option of the Geosynthetic QAC, additional destructive tests (as described in Section 4.8) may be required for any suspect areas.

4.7 NONDESTRUCTIVE SEAM TESTING

4.7.1 Concept

The Installer shall nondestructively test all field seams over their full length using a vacuum test unit, air pressure test (for double fusion seams only), or other approved method. Vacuum testing and air pressure testing are described in Sections 4.7.2 and 4.7.3 respectively. The purpose of nondestructive tests is to check the continuity of seams. It does not provide quantitative information on seam strength. Nondestructive testing shall be carried out as the seaming work progresses, not at the completion of all field seaming.

For all seams, the Geosynthetic QAC shall:

1. Observe nondestructive testing procedures.
2. Record location, data, test unit number, name of tester, and outcome of all testing.
3. Inform the Installer and Project Manager of any required repairs.

Any seams that cannot be nondestructively tested shall be cap-stripped with the same geomembrane. The cap-stripping operations shall be observed by the Geosynthetic QAC and Installer for uniformity and completeness.

4.7.2 Vacuum Testing

The following procedures are applicable to vacuum testing.

1. The equipment shall consist of the following:

   a. A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, a porthole or valve assembly, and a vacuum gauge.
   b. A pump assembly equipped with a pressure controller and pipe connections.
   c. A rubber pressure/vacuum hose with fittings and connections.

d. A soapy solution.
e. A bucket and wide paint brush, or other means of applying the soapy solution.

2. The following procedures shall be followed:

a. Energize the vacuum pump and reduce the tank pressure to approximately 5 psi (10 in of Hg) (35 kPa) gauge.
b. Wet a strip of geomembrane approximately 12 in x 48 in (0.3 m x 1.2 m) with the soapy solution.
c. Place the box over the wetted area.
d. Close the bleed valve and open the vacuum valve.
e. Ensure that a leak-tight seal is created.
f. For a period of not less than 10 seconds, apply vacuum and examine the geomembrane through the viewing window for the presence of soap bubbles.
g. If no bubble appears after 10 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3 in (75 mm) overlap, and repeat the process.
h. All areas where soap bubbles appear shall be marked and repaired in accordance with Section 4.9.3.

4.7.3 Air Pressure Testing

The following procedures are applicable to double fusion welding which produces a double seam with an enclosed space.

1. The equipment shall consist of the following:
   a. 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) and mounted on a cushion to protect the geomembrane.
   b. A rubber hose with fittings and connections.
   c. A sharp hollow needle, or other approved pressure feed device.

2. The following procedures shall be followed:

   a. Seal both ends of the seam to be tested.
   b. Insert needle or other approved pressure feed device into the air channel created by the fusion weld.
   c. Insert a protective cushion between the air pump and the geomembrane.
   d. Energize the air pump to a pressure between 25 and 30 psi (160 and 200 kPa), close valve, allow 2 minutes for pressure to stabilize, and sustain pressure for at least 5 minutes.
   e. If loss of pressure exceeds 4 psi (30 kPa) or does not stabilize, locate faulty area and repair in accordance with Section 4.9.3.

GSI QC PLAN

GROUND SAFE, INC.

CONSTRUCTION QUALITY CONTROL MANUAL

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GROUND SAFE, INC.
CONSTRUCTION QUALITY CONTROL MANUAL

1. INTRODUCTION

1.1 This manual addresses the Quality Control Program developed and utilized by Ground Safe, Inc. Installation Personnel to assure the quality of workmanship and the installation integrity of geomembranes and other geosynthetic products.

1.2 All geosynthetic components of lining systems will be addressed in this manual, including geomembranes, geotextiles, geonets, and bentonite mats. Ground Safe, Inc. recognizes that careful and specific documentation of the installation is required to substantiate this Quality Control Program.

2. MATERIAL DELIVERY

2.1 A Third Party QA Respresentative should be present, whenever possible, to observe and assist in material delivery and unloading on site. The Third Party QA Representative is to note any materials received in a damaged state and note any material damaged during unloading. Upon mobilization to site, a Ground Safe, Inc. Representative shall:

- Verify the equipment used on site is adequate and does not risk damage to the geomembrane or other materials.
- Mark rolls or portions of rolls which appear damaged.
- Verify the storage of materials ensures adequate protection against dirt, theft, vandalism, and passage of vehicle.
- Ensure that rolls are properly labeled and that labeling corresponds with Quality Control documentation and Shipping Bills of Lading.
- Assist Third Party QA Respresentative, if present, with material sampling or record keepint.
- Complete roll numbers, date, bill of lading number, roll size, and any damage noted will be logged on the Ground Safe, Inc. Material Delivery Checklist. (See Appendix A).

3. GEOMEMBRANE INSTALLATION

3.1 Earth Work

3.1.1 The General and/or Earthwork Contractor shall be responsible for preparing and maintaining the subgrade in a condition suitable for installation of the liner unless specifically agreed otherwise.

3.1.2 In cases where no site specific earthwork quality control guidelines exist, the following genreal minimum guidelines shall be followed.

3.1.2.1 Surfaces to be lined shall be smooth and free of debris, roots, and angular or sharp rocks. All fill shall consist of well-graded material, free of organics, trash, clayballs, or other deleterious material that may cause damage to the geomembrane. The upper six inches (6") of the finished upgrade shall not contain stones or debris larger than one-half inch (1/2"). The subgrade shall be compacted in accordance with design specifications, but in no event less than is required to provide a firm, unyielding foundation sufficient to permit the movement of vehicles and welding equipment over the subgrade without causing rutting or other deleterious effects. The subgrade shall have no sudden sharp or abrupt changes in grade.

3.1.2.2 The Earthwork Contractor shall project the subgrade from desiccation, flooding, and freezing. Protection, if required, many consist of a thin plastic protective cover (or other material as approved by the engineer) installed over the completed subgrade until such time as the placement of geomembrane liner begins. Subgrades found to have desiccation cracks greater than one-half inch (1/2") in width or depth, or which exhibit swelling, heaving, or other similar conditions shall be replaced or reworked by the General and/or Earthwork Contractor to remove these defects.

3.1.2.3 Surface Acceptance. Upon request, Ground Safe, Inc.'s Site Supervisor will provide the Owner's and/or Contractor's Representatives with a written acceptance of the surface to be lined. This acceptance will be limited to the amount of area that Ground Safe, Inc. is capable of lining during a particular work shift. Direction and control of any subsequent repairs to the subgrade, including the subgrade surface, shall remain the responsibility of the Earthwork Contractor. An example of Ground Safe Inc.'s Subgrade Surface Acceptance Form is included in Appendix A.

3.2 Crest Anchorage Systems

3.2.1 The anchor trech shall be excavated by the General and/or the Earthwork Contractor to the lines and widths shown on the design drawings prior to geomembrane placement.

3.2.2 Anchor trenches excavated in clay soils susceptible to desiccation cracks should be excavated only the distance required for that days liner placement to minimize the potential of desiccation cracking of the clay soils.

3.2.3 Corners in the anchor trench shall be slightly rounded where the geomembranes adjoins the trench to minimize sharp bends in the geomembrane.

3.3 Preparation for Geomembrane Deployment

3.3.1 Panel Layout

Prior to commencement of liner deployment, layout drawings shall be produced to indicate the panel configuration and general location of field seams for the project.

3.3.2 Identification

Each panel used for the installation shall be given a numeric or alpha-numeric identifier. This panel identification number shall be related on the Ground Safe, Inc. Panel Placement Form to a manufacturing roll number that identifies the resin type, batch number, and date of manufacture.

3.4 Field Panel Placement

3.4.1 Weather Conditions

Geomembrane deployment will generally not be done during any precipitation, in the presence of excessive moisture (i.e. fog, dew), in an area of standing water, or during high winds.

3.4.2 Location

Ground Safe, Inc. intends to install field panels as indicated on the layout drawing. If the panels are deployed in a location other than that indicated on the layout drawings, the revised locations shall be noted in the field on a record "as-built" draawing which will be modified at the completion of the project to reflect actual panel locations. Record drawings will be maintained and submitted by Ground Safe, Inc. and/or the Third Party QA Representative as required by the project specification and contract documents.

3.4.3 Documentation of Panel Placement

Information relating to geomembrane panel placement including date, time, panel number, and panel dimensions will be maintained on the Panel Placement Form as presented in Appendix A.

3.4.3.1 If a portion of a a roll is set aside to be used at another time, the roll number will be written on the remainder of the roll in several places.

3.4.4 Method of Deployment

3.4.4.1 The method and equipment used to deploy the panels must not damage the geomembrane or the supporting subgrade surface.

3.4.4.2 No personnel working on the geomembrane will wear shoes that can damage the geomembrane or engage in actions which could result in damage to the geomembrane.

3.4.4.3 Adequate temporary loading and/or anchoring, (i.e. sandbags, tires), which will not damage the geomembrane, will be placed to prevent uplift of the geomembrane by wind.

3.4.4 The geomembrane will be deployed in a manner to minimize wrinkles.

3.4.5 Any area of a panel seriously damaged (torn, twisted, or crimped) will be marked and repaired in accordance with Paragraph 5.3 of this document.

3.5 Geomembrane Field Seaming

3.5.1 General Requirements

3.5.1.1 Layout

In general, seams shall be oriented parallel to the slope, i.e., oriented along, not across the slope. Whenever possible, horizontal seams should be located on the base of the cell, not less than five feet (5') from the toe of the slope. Each seam made in the field shall be numbered and indicated on the record drawings. Seaming information to include seam number, welder ID, machine number, temperature setting, and weather conditions will be maintained on Ground Safe, Inc. Panel Seaming Form as presented in Appendix A.

3.5.1.2 Personnel

All personnel performing seaming operations shall be trained in the operation of the specific seaming equipment being used and will qualify by successfully welding a test seam as described in Paragraph 3.5.3. The project Foreman will provide direct supervision of the seaming operations.

3.5.1.3 Equipment

3.5.1.3.1 Fusion Welding

Fusion Welding consists of placing a heated wedge, mounted on a self propelled vehicular unit, between (2) two over-lapped sheets such that the surface of both sheets are heated above the polyethylene's melting point. After being heated by the wedge, the overlapped panels pass through a set of pre-set pressure wheels which compress the (2) two panels together to form the weld. The fusion welder is equipped with a device which continuously monitors the temperature of the wedge.

3.5.1.3.2 Extrusion Fillet Welding

Extrusion fillet welding consists of introducing a ribbon of molten resin along the edge of the overlap of the (2) two geomembrane sheets to be welded. A hot-air preheat and the addition of molten polymer causes dome of the material of each sheet to be liquified resulting in a homogeneous bond between the molten weld bead and the surfaces of the overlapped sheets. The extrusion welder is equipped with gauges giving the temperature in the apparatus and a numerical setting for the pre-heating unit.

3.5.1.4 Weather Conditions

Ground Safe, Inc. relies on the experience of the Project Superintendent and the results of test seams to determine whether seaming is restricted by weather conditions. Many factors, such as, the geomembrane temperature, humidity, wind, precipitation, etc., can effect the integrity of field seams and must be taken into account when deciding whether or not seaming should proceed. Test seams, as described in Paragraph 3.5.3, are required prior to daily production seaming to determine if the weather conditions will effect Ground Safe, Inc.'s ability to produce quality seams. Additional non-destructive and destructive testing of production seams substantiate the decision made by the Project Superintendent to seam on any given day.

3.5.2 Seam Preparation

3.5.2.1 Fusion Welding

3.5.2.1.1 Overlap the panels of Geomembrane approximately (4") four to (6") inches prior to welding.

3.5.2.1.2 Clean the seam area prior to seaming to assure the area is clean and free of moisture, dust, dirt, or debris of any kind. No grinding is required for fusion welding.

3.5.2.1.3 Adjust the panels so that seams are aligned with the fewest possible number of wrinkles and "fishmouths".

3.5.2.1.4 A movable protective layer may be used, at the discretion of the Ground Safe, Inc. Project Superintendent, directly below the overlap of geomembrane that is to be seamed to prevent build-up of dirt or moisture between the panels.

3.5.2.2 Extrusion Fillet Welding

3.5.2.2.1 Whenever possible, extrusion welded seams will be pre-beveled prior to heat-tacking into place.

3.5.2.2.2 Overlap the panels of geomembrane a minimum of (3") three inches.

3.5.2.2.3 Using a hot-air device, temporarily bond the panels of geomembrane to be welded, taking care not to damage the geomembrane.

3.5.2.2.4 Clean the seam area prior to seaming to assure the area is clean and free of moisture, dust, dirt, and debris of any kind.

3.5.2.2.5 Grind seam overlap prior to welding within (1) one hour of the welding operation in a manner that does not damage the geomembrane. Grind marks should be covered with extrudate whenever possible. In all cases (1/4") one-quarter inch past the edge of the area covered by the extrudate during welding.

3.5.2.2.6 Purge the extruder prior to beginning the seam to remove all heat-degraded extrudate from the barrel. The purged extrudate will be place on scrap material so as to prevent contact with installed geomembrane.

3.5.2.2.7 Keep welding rod clean and dry.

3.5.3 Trial Welds

Trial welds shall be conducted by Welding Technicians prior to each seaming period, ever (5) five hours, as weather conditions dictate, or as requested by Ground Safe, Inc. CQC personnel if welding problems are suspected. All trial welds will be conducted under the same conditions as will be encountered during actual seaming. Once qualified by a passing trial weld, Welding Technician will not change parameters (temperature, speed, etc.) without performing another trial weld.

3.5.3.1 Trial Weld Length

The trial weld shall be made by joining (2) two pieces of geomembrane at least (6") six inches in width. Trial welds for fusion welds will be (15') 15 feet long and extrusion weld trial seams will be a minimum of (4') four feet long.

3.5.3.2 Sample Procedure

3.5.3.2.1 Visually inspect the seam for squeeze out, footprint,pressure, and general appearance.

3.5.3.2.2 Cut (3) three (1") one inch wide specimens, (1) one from the middle of the seam and (1') one foot from each end of the test seam. Specimens shall be obtained using a (1") one inch die cutter. The specimens shall then be tested in peel using a field tensiometer.

3.5.3.2.3 In order for a trial weld to be considered acceptable, all (3) three specimens must meet the following criteria:

1. Exhibit Film Tearing Bond (FTB).

2. Meet or exceed the minimum peel strength values listed in Ground Safe, Inc.'s Material Specification Sheet. If any specimens are in non-conformance, the entire procedure shall be repeated. In the case of double track fusion welded seams, both welds must pass in order to be considered acceptable.

3.5.3.2.4 If repeat tests utilizing reasonable sets of welding parameters also fail, the seaming apparatus shall not be used for seaming until the deficiencies are corrected and a passing test seam is achieved.

3.5.3.3 Trial Weld Documentation

3.5.3.3.1 CQC Coordinator and/or Assistant will be present during peel testing and will record date, time, operator, machine number, ambient and operating temperatures, speed setting, peel values, and pass/fail designation.

3.5.3.3.2 All trial weld records shall be maintained on Ground Safe, Inc.'s Trial Weld Form as exhibited in Appendix A.

3.5.3.3.3 The Ground Safe, Inc. CQC Coordinator will give final approval to proceed with welding after observing trial welds.

3.5.4 General Seaming Procedures

3.5.4.1 Seaming shall extend to the outside edge of panels to be placed on the trench.

3.5.4.2 While welding a seam, monitor and maintain the proper overlap.

3.5.4.3 Inspect seam area to assure it is clean and free of moisture, dust, dirt and debris of any kind.

3.5.4.4 Welding Technicians will periodically check machine operating temperature and speed, and will mark this information.

3.5.4.5 Align wrinlkes at the seam overlap to allow welding through the wrinkle.

3.5.4.6 "Fishmouths" or wrinkles at seam overlaps, which cannot be welded through, shall be cut along the ridge in order to achieve a flat overlap . The cut "fishmouth" or wrinkle shall be heat-tacked flat and extruded or patched with an oval or round patch of the same geomembrane extending a minimum of (3") three inches beyond the cut in all directions.

3.5.4.7 All cross/butt seams between (2) two rows of seamed panels shall be welded during the coolest time of the day to allow for contraction of the geomembrane.

3.5.4.8 Prior to welding cross/butt seams, the top and bottom overlap of intersecting fusion welded seams will be trimmed (6") six inches. Intersecting extrusion fillet welder seams will be ground to flatten the extrusion bead prior to welding butt seams.

3.5.4.9 All "T" joints produced as a result of cross/butt seams shall be extrusion fillet welded. The overlap on each "leg" of the "T" joint will be trimmed back (6") six inches. Then grind (3") three inches minimum on each of the (3) three legs of the "T" and weld all of the area prepared for grinding.

3.5.4.10 Whenever possible, Welding Technicians will cut a (1") one inch peel specimen at the end of every seam. Prior to welding the next seam, the specimen will be tested for peel. The CQC Coordinator may request additional trial welds, based on observations of peel test specimens.

3.5.4.11 In the event non-complying seam test strips are encountered, the welding machine will be taken out of service until a passing trial weld is obtained, and additional peel specimens will be taken to localize the flaw.

3.5.4.12 Results of field seam test strips will be maintained in the destructive test column on the Panel Seaming Form as shown in Appendix A.

3.5.4.13 The CQC Coordinator may, after consulting with Ground Safe, Inc.'s Site Superintendent, take destructive samples from any seam, if defects are suspected.

3.5.5 Seaming Documentation

3.5.5.1 All seaming operations will be documented by the CQC Coordinator or a designated Assistant. Welding Technicians will mark on the liner with Mean Streak permanent markers at the start of all seams information regarding date, time, Welding Technician ID, machine number, and machine operating temperature and speed. CQC Coordinator or Assistant will record date, time, seam number, Technician ID, machine ID, set temperature, speed, and weather conditions on the Ground Safe, Inc. Panel Seaming Form (See Appendix A).

3.5.5.2 Welding Technicians will periodically check operating temperature and speed and mark the information along the seam.

3.5.5.3 CQC Coordinator will make periodic checks on welding operations to verify overlap, cleanliness, etc.

4. Seam Testing - Geomembrane

4.1 Concept

The welded seam created by Ground Safe, Inc.'s fusion welding process is composed of a primary seam and a secondary track that creates an unwelded channel. The presence of an unwelded channel permits Ground Safe, Inc.'s fusion seams to be tested by inflating the sealed channel with air to a predetermined pressure and observing the stability of the pressurized channel over time.

Ground Safe, Inc. performs non-destructive air-pressure testing in accordance with the following procedures, developed by Ground Safe, Inc., and adopted by the Geosynthetic Research Institute as Test Method GM-6.

4.2 Air Pressure Testing

4.2.1 Equipment for Air Testing

4.2.1.1 An air pump (manual or motor driven) capable of generating and sustaining a pressure between 20 to 60 psi.

4.2.1.2 A rubber hose with fittings and connections.

4.2.1.3 A sharp hollow needle, or other approved pressure feed device with a pressure gauge capable of reading and sustaining a pressure between 0 and 60 psi.

4.2.2 Procedure for Air Testing

4.2.2.1 Seal both ends of the seam to be tested.

4.2.2.2 Insert needle or other approved pressure feed device into the sealed channel created by the fusion weld.

4.2.2.3 Inflate the test channel to a pressure of approximately 30 psi, and maintain the pressure within the range listed in the Initial Pressure Schedule. Close valve, observe and record the initial pressure.

INITIAL PRESSURE SCHEDULE *

MATERIAL (mils)	MINIMUM (psi)	MAXIMUM (psi)
40	24	30
60	27	35
80	30	35
100	30	35

*Initial pressure settings are recorded after an optional (2) two minute stabizization period. The purpose of this "relaxing period" is to permit the air temperature and pressure to stabilize. The initial pressure reading may be recorded once stabilization has taken place.

4.2.2.4 Observe and record the air pressure (5) five minutes after the initial pressure setting is recorded. If loss of pressure exceeds the following or if the pressure does not stabilize, locate the suspect area and repair in accordance with Section 4.2.3.

MAXIMUM PERMISSIBLE PRESSURE DIFFERENTIAL AFTER 5 MINUTES - HDPE

MATERIAL (MIL)	PRESSURE DIFF.
40	4 psi
60	3 psi
80	2 psi
100	2 psi

4.2.2.5 At the conclusion of all pressure tests, the end of the air-channel opposite the pressure gauge is cut. A decrease in gauge pressure must be observed or the air-channel will be considered "blocked" and the test will have to be repeated from the point of blockage. If the point of blockage cannot be found, cut the air-channel in the middle of the seam and treat each half as a separate test.

4.2.2.6 Remove the pressure feed needle and seal the resulting hole by extrusion welding.

4.2.3 In the event of a Non-Complying Air Pressure Test, the following procedure shall be followed:

4.2.3.1 Check seam end seals and retest seam.

4.2.3.2 If a seam will not maintain the specified pressure, the seam should be visually inspected to localize the flaw. If this method is unsuccessful, cut (1") one inch samples from each end of the seam.

4.2.3.3 Perform destructive peel tests on the samples using the field tensiometer.

4.2.3.4 If all samples pass destructive testing remove the overlap left by the wedge welder and vacuum test the entire length of seam in accordance with Paragraph 4.3.

4.2.3.4.1 If a leak is located by the vacuum test, repair by extrusion fillet welding. Test the repair by vacuum testing.

4.2.3.4.2 If no leak is discovered by vacuum testing, the seams will be considered to have passed non-destructive testing.

4.2.3.5 If one or more peel specimens are in non-compliance, additional samples will be taken in accordance with Paragraph 4.4.3.

4.2.3.5.1 When (2) two passing samples are located, the length of seam bounded by the (2) two passing test locations will be considered non-complying. The overlap left by the wedge welder will be heat tacked in place along the entire length of seam and the non-complying portion of seam will be extrusion fillet welded.

4.2.3.5.1 Test the entire length of the repaired seam by vacuum testing in accordance with Paragraph 4.3.

4.2.4 General Air Testing Procedures

4.2.4.1 The opposite end of the air-channel will in all cases be pierced to assure that no blockages of the air-channel have occurred.

4.2.4.2 Whenever possible, seams should be air-tested prior to completing butt seams to avoid having to cut into liner. All cuts through the liner as a result of testing will be repaired with an extrusion bead.

4.2.5 Air Pressure Testing Documentation

All information regarding air-pressure testing, (date, initial time and pressure, final time and pressure, pass/fail designation, and Technicians initials) will be written at both ends of the seam, or portion of seam tested. All of the above information will also be logged by the CQC Coordinator on the Ground Safe, Inc. Non-Destructive Testing Form as exhibited in Appendix A.

4.3 Vacuum Testing

This test is used on extrusion welds, or when the geometry of a fusion weld makes air pressure testing impossible or impractical, or when attempting to locate the precise location of a defect believed to exist after air pressure testing.

4.3.1 Equipment for Vacuum Testing

4.3.1.1 Vacuum box assembly consisting of a rigid housing with a soft neoprene gasket attached to the bottom, a transparent viewing window, port hole or port assembly, and a vacuum gauge.

4.3.1.2 Vacuum pump assembly equipped with a pressure controller and pipe connection.

4.3.1.3 A rubber pressure/vacuum hose with fittings and connections.

4.3.1.4 A bucket and means to apply s soapy solution.

4.3.1.5 A soapy solution.

4.3.2 Procedure for Vacuum Testing

4.3.2.1 Trim excess overlap from the seam, if any.

4.3.2.2 Turn on the vacuum pump to reduce the vacuum box to approximately (10") ten inches of mercury, i.e., (5) five psi gauge.

4.3.2.3 Apply a generous amount of a strong solution of liquid detergent and water to the are to be tested.

4.3.2.4 Place the vacuum box over the area to be tested and apply sufficient downward pressure to "seat" the seal strip against the liner.

4.3.2.5 Close the bleed valve and open the vacuum valve.

4.3.2.6 Apply a minimum of (5) five psi vacuum to the area as indicated by the gauge on the vacuum box.

4.3.2.7 Ensure that a leak tight seal is created.

4.3.2.8 For a period of approximately (10) ten to (15) fifteen seconds, examine the geomembrane through the viewing window for the presence of soap bubbles.

4.3.2.9 If no bubbles appear after (15) fifteen seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum (3") three inch overlap, and repeat the process.

4.3.3 Procedure for Non-Complying Test

4.3.3.1 Mark all areas where soap bubbles appear and repair the marked areas in accordance with Paragraph 5.3.

4.3.3.2 Retest repaired areas.

4.3.4 General Vacuum Testing Procedures

4.3.4.1 Vacuum box testing will be performed by qualified construction personnel with frequent supervision by the CQC Coordinator.

4.3.4.2 Overlap must be trimmed prior to vacuum boxing all seams.

4.3.4.3 Special attention shall be exercised when vacuum testing "T" seams or patch intersections with seams.

4.3.5 Vacuum Testing Documentation

4.3.5.1 Vacuum testing crew will use permanent markers to write on liner indicating tester's initials, date, and pass/fail designation on all areas tested.

4.3.5.2 Records of vacuum testing will be maintained by the CQC Coordinator or testing crew on the Ground Safe, Inc. Non-Destructive Testing Form or Ground Safe, Inc. Repair Report Form as exhibited in Appendix A.

4.4 Destructive Testing

4.4.1 Concept

The purpose of destructive testing is to determine and evaluate seam strength. These tests require sampling and thus subsequent patching. Therefore, destructive testing should be held to a minimum to reduce the amount of repairs to the geomembrane.

4.4.2 Procedure for Destructive Testing

4.4.2.1 Destructive test samples shall be marked and cut out randomly at a minimum average frequency of (1) one test location every (500') five hundred feet of seam length.

4.4.2.2 Location of destructive samples will be selected by CQC Coordinator (or the Third Party QA Representative), with samples cut by Ground Safe, Inc. Construction Personnel.

4.4.2.3 Destructive samples should be taken and tested as soon as possible after the seams are welded (the same day), in order ot receive test results in a timely manner.

4.4.2.4 CQC Coordinator will observe all destructive testing and record date, time, seam number, location, and test results on the Ground Safe, Inc. Destructive Testing Form as contained in Appendix A.

4.4.2.5 All destructive test locations with pass/fail designation will be marked on liner with permanent Mean Streak markers.

4.4.2.6 Sample Size

4.4.2.6.1 The sample should be (12") twelve inches wide with a seam (16") sixteen inches long centered lengthwise in the sample. The sample may be increased in size to accomodate independent laboratory testing by the Owner, at the Owner's request, or by specific project specifications.

4.4.2.6.2 A (1") one inch specimen shall be cut from each end of the test seam for field testing.

4.4.2.6.3 The (2) two (1") one inch wide specimens shall be tested on a field tensiometer for peel strength. If either field speciment does not pass, it will be assumed the sample would also not pass laboratory destructive testing.

The procedure outlined in Paragraph 4.4.3 shall be followed to locate passing samples to send to the laboratory.

4.4.3 Procedure for Non-Complying Destructive Testing

4.4.3.1 Cut additional field samples for peel testing. In the case of a field productoion seam, the sample must lie approximately (10') ten feet in each direction from the location of the initial sample. Perform a field tes for peel

strength. If these field samples pass, the laboratory samples can be cut and forwarded to the laboratory for full testing.

4.4.3.1.1 If the laboratory samples pass, then reconstruct the seam between the (2) two passing sample locations according to procedures detailed in Section 5.3.

4.4.3.1.2 If either of the samples are stil in non-compliance, then additional samples are taken in accordance with the above procedure until (2) two passing samples are found to establish the zone in which the seam should be reconstructed.

4.4.3.2 All passing seams must be bounded by (2) two locations from which samples passing laboratory destructive tests have been taken.

4.4.3.3 In cases of reconstructed seams exceeding 150 feet, a sample must be taken and pass destructive testing from within the zone in which the seam has been reconstructed.

4.4.3.4 All destructive seam samples shall be numbered and recorded on Ground Safe, Inc.'s Destructive Test Form as exhibited in Appendix A.

4.5 Laboratory Testing of Destructive Seam Samples

4.5.1 Destructive Seam Testing Laboratory

Seam destructive samples will be sent to Ground Safe, Inc.'s laboratory when required by a site specific quality control plan or in the event that third party laboratory destructive testing is not being performed.

4.5.2 Acceptance Criteria

Destructive samples will be tested for "Shear Strength" and "Peel Adhesion" (ASTM D4437 as modified by NSF). (5) five specimens shall be tested for each test method. (4) four out of

(5) five specimens must exhibit FTB (as defined by NSF Standary Number 54-1991) for each round of peel and shear testing. In addition, (4) four of the (5) five individual specimesn and the average of the (5) peel and shear tests must meet or exceed the strength requirements as listed in Ground Safe, Inc.'s Material Specification Sheet in order for the seam to pass the destructive test.

5. Defects and Repairs

5.1 Ground Safe, Inc.'s CQC Coordinator and Project Superintendent shall conduct a detailed walk through and visually check all seams and non-seam areas of the geomembrane for defects, holes, blisters, and signs of damage during installation.

5.2 All other Ground Safe, Inc. installation personnel shall, at all times, be on the lookout for any damaged area. Damaged area shall be marked and repaired.

5.3 Repair Procedure

Any portion of the geomembrane or geomembrane seam showing a flaw, or have a destructive or non-destructive test in non-compliance shall be repaired. Several procedures exist for repair and the decision as the appropriate repair procedure shall be made by Ground Safe, Inc.'s Project Superintendent.

Procedures available for repair include the following:

5.3.1 Patching - used to repair large holes, tears, and destructive sample locations. All patches shall extend at least (3") three inches beyond the edges of the defect and all corners of patches shall be rounded.

5.3.2 Grinding and Welding - used to repair sections of extruded fillet seams.

5.3.3 Spot Welding and Seaming - used to repair small tears, pinholes, or other minor localized flaws.

5.3.4 Capping - used to repair lengths of extrusion or fusion welded seams.

5.3.5 Extruding the exposed overlap along the length of fusion welded seams.

5.3.6 Removal of a suspect seam and replacement with a strip of new material seamed into place.

5.4 Verification of Repairs

Every repair shall be non-destructively tested using the methods set out in Paragraph 4.4. Repairs which pass the non-destructive test shall be deemed acceptable. Repairs in excess of 150 feet require a destructive test. Non-destructive testing of repairs shall be logged on a Ground Safe, Inc. Repair Report Form as exhibited in Appendix A. The repair location shall be recorded on the record drawing.

6. Geotextiles

6.1 Handling and Placement

All geotextiles shall be handled in a manner to ensure they are not damaged. The following special handling requirements shall be adhered to:

6.1.1 On slopes, the geotextiles shall be secured in the anchor trench and then rolled down the slope in such a manner as to continually keep the geotextile sheet in sufficient tension to preclude folds and wrinkles.

6.1.2 In the presence of wind, all geotextiles shall be weighted with sandbags or the equivalent.

6.1.3 Geotextiles shall be cut using an approved cutter. If the material is being cut in place, special care must be taken to protect other geosynthetic materials from damage.

6.1.4 Care shall be taken not to entrap stones or excessive dust that could damage the geomembrane, or generate clogging of drains or filters.

6.2 Seams and Overlaps

Geotextiles may be seamed by thermal bonding or by sewing. No horizontal seams shall be allowed on side slopes.

6.2.1 On slopes steeper than (10) ten horizontal to (1) one vertical, it is recommended that geotextiles be continously sewn along the entire length of the seam. Geotextiles shall be overlapped a minimum of (4") four inches prior to sewing.

6.2.2 On bottoms and slopes shallower than (10) ten horizontal to (1) one veritcal, geotextiles can be either sewn as indicated above or thermally bonded. If thermally bonded the geotextile shall be overlapped a minimum of (8") eight inches prior to seaming.

6.3 Repairs

Any holes or tears in the geotextile shall be repaired as follows:

6.3.1 On Slopes - A patch made from the same geotextile shall be seamed into place. Should any tear exceed (10%) ten per cent of the width of the roll, that roll shall be removed from the slope and replaced.

6.3.2 Horizontal Areas - A patch made from the same geotextile shall be spot-seamed in place with a minimum of (12") twelve inches overlap in all directions.

7. Geonets

7.1 Handling and Placement

The geonets shall be handled in such a manner as to ensure that the geonets are not damaged in any way.

7.1.1 On slopes, the geonets shall be secured in the anchor trench and then rolled down the slope in such a manner as to continually keep the geonet sheet in tension. If necessary, the geonet shall be positioned by hand after being unrolled to minimize wrinkles. Geonets can be placed in the horizontal direction (across the slope) in some special locations (e.g. at the toe of a slope, or where an extra layer of geonet is required).

Such locations shall be identified by the Design Engineer in the proper drawings.

7.1.2 Geonets shall not be welded to geomembrane with extrusion welders. Geonets shall be cut using approved cutters, i.e. hook blade, scissors, etc. Care should be taken to prevent damage to underlying layers.

7.1.3 Care must be taken not to entrap dirt in the geonet that could cause clogging of the drainage system, and/or stones that could damage the adjacent geomembrane.

7.2 Layering and Tying of Geonet

When several layers of geonet are installed, care should be taken to prevent the strands of one layer from penetrating the channels of the next layer, thereby significantly reducing the transmissivity. Layered geonets must be placed in the same direction and never laid perpendicular to the underlying geonet. Adjacent geonets shall be joined according to the following requirements.

7.2.1 Adjacent rolls shall be overlapped by at least (4") four inches and securely tied.

7.2.2 Tying can be achieved by plastic fasteners. Tying devices shall be white or yellow for easy inspection. Metallic devices are not allowed.

7.2.3 Tying shall be every (5') five feet along the slope, (2') two feet across the slope and (6") six inches in the anchor trench.

7.2.4 In the corners of the side slope where overlaps between perpendicular geonet strips are required, an extra layer of geonet shall be unrolled along the slope, on top of the previously installed geonets, from top to bottom of the slope.

7.2.5 When more than one layer of geonet is installed, overlaps must be staggered and layers tied together.

7.3 Repairs

Any holes or tears in the geonet shall be repaired by placing a patch extending (2') two feet beyond edges of the hole or tear. The patch shall be secured to the original geonet by trying every (6") six inches. If the

hole of tear width across the roll is more than (50%) fifty per cent the width of the roll, the damaged area shall be cut out and the (2) two portions of the geonet shall be joined.

8. Bentonite Mat

8.1 Storage

8.1.1 Bentonite mat rolls must always be stored in a location where they will not be exposed to dirt or moisture.

8.2 Handling and Placement

8.2.1 On slopes, bentonite mat should be placed with overlap oriented parrallel to the maximum slope (i.e. down the slope, not across the slope).

8.2.2 Adjoining panels of bentonite mat should be overlapped a minimum of (6") six inches.

8.2.3 Bentonite mat should never be installed in standing water or while rain is falling.

8.2.4 Bentonite mat should always be installed with the marked side up.

8.2.5 Rolls should be pulled tight to smooth out any creases or irregularities.

8.2.6 Precautions should be taken to avoid damage to any underlying geosynthetic materials while placing bentonite mats.

8.2.7 Cover bentonite mats with geomembrane after placement to avoid damage from precipitation.

8.3 Repairs

8.3.1 Repairs to cuts or tears in installed rolls should extend a minium of (6") six inches beyond the area in need of repair. Repair pieces should be held in place until cover material has been placed.

The procdures described herein are those in effect as of August 1, 1991. Ground Safe, Inc. reserves the right to deviate from these procedures in order to keep abreast of changes in technology.

APPENDIX A

FORMS

GSI

Ground Safe, Inc.

Route 2, Box 161
Eastanollee, Georgia 30538
Phone (706) 779-3313
Fax (706) 779-3882

ACCEPTANCE FOR WORK AS COMPLETED

FOR

_____

DATE _____ JOB NO. _____

The undersigned, as owner or authorized agent for owner, states that he has inspected the above listed project and found it complete in accordance with the Engineering Design.

NAME OF OWNER _____

AUTHORIZED AGENT _____

JOB ADDRESS _____

BUSINESS ADDRESS _____

SIGNATURE OF OWNER
OR AUTHORIZED AGENT _____

NATIONAL SEAL COMPANY

by _____

MATERIAL DELIVERY/INVENTORY CHECKLIST

Page_____ of_____

Date_____ Truck #_____ Bill of Lading #_____ QC ID_____

Project Number_____ Project Name_____

Location_____ Material Type_____

	Complete Roll Number	Batch Number	Roll Size	Damage / Remarks
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				

Ground Safe, Inc.

CERTIFICATE OF ACCEPTANCE OF SOIL SUBGRADE SURFACE

PROJECT NAME: _____

PROJECT NUMBER: _____

OWNER: _____

LOCATION: _____

I, the undersigned, a duly appointed representative of , have visually observed the soil subgrade surface described below, and found it to be an acceptable surface on which to install geomembrane.

This certification is based on observations of the the surface of the subgrade only. No subterranean inspections or tests have been performed by and makes no representations or warranties regarding conditions which may exist below the surface of the subgrade. National Seal Company accepts no responsibility for conformance of the subgrade to this project's specifications.

Area Being Accepted: _____

_____

_____

Ground Safe, Inc.

Date: _____

Signature: _____

Name: _____

Title: _____

OWNERS REPRESENTATIVE:

Date: _____

Signature: _____

Name: _____

Title: _____

Company: _____

GSI

PAGE _____ OF _____

PANEL PLACEMENT FORM

PROJECT NAME: _____ PROJECT NUMBER: _____ MATERIAL DESCRIPTION: _____

DATE/ TIME	PANEL NUMBER	ROLL NUMBER	PANEL LENGTH	PANEL WIDTH	COMMENTS/ PANEL LOCATION

GSI Ground Safe, Inc.

TRIAL WELD INFORMATION

PROJECT NAME: _____ PROJECT NUMBER: _____ MATERIAL DESCRIPTION: _____

DATE/ TIME	AMBIENT TEMP	Q.C. INITIALS	MACHINE NUMBER	SEAMER INITIALS	EXTRUSION WELDS				FUSION WELDS				PEEL VALUES LBS / INCH			PASS/ FAIL	COMMENTS
					BARREL TEMP		PREHEAT TEMP		WEDGE TEMP		MEASURED SPEED FT / MIN	SPEED SETTING					
					SET	PYRO	SET	PYRO	SET	PYRO							

GSI Ground Safe, Inc.

PAGE _____ OF _____

PANEL SEAMING FORM

PROJECT NAME: _____ PROJECT NUMBER: _____ MATERIAL DESCRIPTION: _____

DATE/ TIME	SEAM NUMBER	PANEL NUMBERS	SEAM LENGTH	SEAMER INITIALS	MACHINE NUMBER	TEMP SETTING	WEATHER	WINDS	AMBIENT TEMP	DES TEST P/F	COMMENTS

G S I Ground Safe, Inc.

NON-DESTRUCTIVE TESTING FORM

PAGE ______ OF ______

PROJECT NAME: ______________ PROJECT NUMBER: ______________ MATERIAL DESCRIPTION: ______________

DATE/ TIME	SEAM NO.	TESTER INITIAL	AIR TESTING						VBOX P/F	LOCATION / COMMENTS
			PRESSURE			TIME				
			START	END	+/-	START	END	P/F		

GSI Ground Safe, Inc.

PAGE _____ OF _____

DESTRUCTIVE TEST LOG

PROJECT NAME: _____ PROJECT NUMBER: _____ MATERIAL DESCRIPTION: _____

DATE	SAMPLE I.D.	SEAM NO.	MACH NO.	SEAMER INITIALS	PEEL VALUES LBS. / INCH						PASS / FAIL	DATE TO LAB PKG. SLIP NO.	LAB PASS / FAIL	LOCATION / COMMENTS

GSI Ground Safe, Inc.

REPAIR REPORT

PAGE _____ OF _____

PROJECT NAME: _____ PROJECT NUMBER: _____ MATERIAL DESCRIPTION: _____

FIELD SEAM #	PANEL NO.	REPAIR DATE	REPAIR CREW	MACHINE NUMBER	TEST DATE	TEST CREW	TEST P/F	LOCATION / COMMENTS

DAILY TIME INPUT WORK SHEET

FORM #1008

SHEET__OF__

REPORTED BY:	NAME
JOB NAME:	JOB
JOB NUMBER :	NO.
DATE:	
SUPERVISOR:	NAME
PROJECT MANAGER :	NAME

What Type of project ?	
	< Single lined
	< Double lined
	< CAP

TYPE OF DAY	
TRAVEL	
WORK	
WEATHER	
STANDBY	
WEEKEND	

A: ______

B: ______

C: ______

D: ______

E: ______

F: ______

G: ______

H: ______

I: ______

J: SET-UP ______ EXTRUDER

K: TRAVEL ______ MICE

L: WEATHER ______ GENERATOR

M: T & M ______ TRUCK

N: STAND-BY ______ MISC.

EQUIP. QTY.

COMMENTS: ______

NAME	POS.	A	B	C	D	E	F	G	H	I	SET UP J	TRAVEL K	WEATHER L	T & M M	STAND BY N	TOTAL
TOTAL																

AGGREGATE SPECIFICATIONS

Supplying Vendor:

Vulcan Materials Company
P.O. Box 709
Stokesdale, North Carolina 27357
(901) 643-7770

1 1/2"	1"	3/4"	1/2"	3/8"
100	90-100	26-55	0-10	0-5

SCREEN #	1	2	3	4	5	6	7	8	9	10	11	12
AVERAGE	100.0	94.3	39.0	4.5	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STANDARD DEVIATION	0.0	0.9	4.7	0.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
# SAMPLES	2											

VULCAN MATERIALS COMPANY
STOKESDALE QUARRY
N.C. # 5

DATE	TIME	CODE	SIZE	1 1/2" 100	1" 90-100	3/4" 26-55	1/2" 0-10	3/8" 0-5
061696	1600	9	105	100.0	94.9	42.3	3.9	3.0
060496	1200	9	105	100.0	93.6	35.7	5.1	3.2

PHOTOGRAPH DOCUMENTATION

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

PHOTOGRAPHS

TOP TO BOTTOM

Liner Repair Area

- Bentonite Seal Below Damaged Liner
- PE Liner Welded Over Damaged Area

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

PHOTOGRAPHS

TOP TO BOTTOM

Liner Repair Area

- Vacuum Testing Welds in Repair Area
- Geoelectric Leak Detecting Equipment

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

PHOTOGRAPHS

TOP TO BOTTOM

Liner Repair Area

- Geoelectrically Testing Welds in Repair Area
- Geoelectric Leak Survey Repair Area I

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

PHOTOGRAPHS

TOP TO BOTTOM

Liner Repair Area

- Geoelectric Leak Survey Repair Area 2
- Geoelectric Leak Survey Repair Area 3

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

PHOTOGRAPHS

TOP TO BOTTOM

Liner Repair Area

- Repaired Area 1
- Repaired Area 2

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

PHOTOGRAPHS

TOP TO BOTTOM

Liner Repair Area

- Repaired Area 3
- Sewing Geotextile above Repaired Liner

PVC PIPE SPECIFICATIONS

Manufacturer:	Various
Model:	PVC Type 1, Grade 1
Size:	8" Slotted, 4" Sch. 80
Wall Thickness:	Schedule 80 pipe and fittings
Supplying Vendor:	Irrigation Supply Company, Inc. 926 Baxter Avenue Louisville, Kentucky 40204 (502) 583-6591

ESLON PIPING PRODUCTS

ESLON THERMOPLASTICS

Physical Properties of PVC and CPVC

Poly(Vinyl Chloride) PVC

This thermoplastic material is the largest volume member of the vinyl family. It is the most widely used material for plastic pipe, valves, and fittings.

PVC has many advantages over conventional piping materials. Just a few are:

Corrosion Resistance - outstanding chemical resistance to nearly all acids, alkalis, alcohols, halogens and many other corrosive materials.

Fluid Friction - less friction loss as compared to metallics. Lower pressure drop = smaller pumps = less electricity.

Thermal - lower thermal conductivity than for metallics. Less moisture condensation, reduced heat loss, and more uniform fluid temperature. (Insulation is usually not required.)

Electrical - a non-conductor of electricity. Eliminates galvanic or electrolytic corrosion that causes expensive repairs.

Other - weather resistant, high strength-to-weight ratio, dent resistant, non-toxic, maintains properties over long periods of time, easy to install, maintenance-free.

Chlorinated Poly(Vinyl Chloride) CPVC

An industrial thermoplastic piping material which can be used for higher temperature applications. It is a specialty polymer with a higher glass transition point, which means advantages over regular PVC pipe and fittings while retaining the excellent chemical resistant properties of PVC.

CPVC retains its mechanical strength at higher temperatures.

CPVC = 200°F Max.
PVC = 140°F Max.

Eslon PVC and CPVC pipe and fittings compounds are blended according to strict industry guidelines. Specifications and requirements are set forth by agencies such as the American Society for Testing and Materials (ASTM) and the National Sanitation Foundation (NSF). Compliance with these standards assures the customer that they are receiving products manufactured from materials that will perform the tasks for which they are designed.

BASIC MATERIAL DATA

	PVC	CPVC
• Base Resin	Poly(vinyl chloride) Homopolymer	Chlorinated Poly(vinyl chloride)
• Commercial Classification of Rigid Compound *	Type I, Grade 1 PVC 1120	Type IV, Grade 1 CPVC 4120
• Class Designation	12454-B	23447

* Rigid Material is also known as Un-Plasticized (U-PVC)

ESLON PIPING PRODUCTS

ESLON THERMOPLASTICS

Specific Material Data

MECHANICAL

Properties	Unit	PVC	CPVC	Remarks	ASTM Test
Tensile Strength @ 73°F	PSI	7,280	8,000	Same in Circumferential Direction	D-638
Modulus of Elasticity in Tension @ 73°F	PSI	420,000	360,000	Ratio of Stress to Elongation (Young's Modulus)	D-638
Compressive Strength @ 73°F	PSI	9,600	10,920		D-695
Flexural Strength @ 73°F	PSI	12,700	15,100	Tensile Stress on Bent Sample at Failure	D-790
Izod Impact @ 73°F	Ft-Lbs/In of Notch	1.6	1.5	Impact Resistance of a Notched Sample to a Sharp Blow	D-256
Relative Hardness @ 73°F	Durometer "D" Rockwell "R"	80 ± 3 110-120	— 119	Equivalent to Aluminum —	D-2240 D-785

THERMODYNAMICS

Properties	Unit	PVC	CPVC	Remarks	ASTM Test
Coefficient of Thermal Linear Expansion per °F	in/in/°F	2.8×10^{-5}	3.8×10^{-5}		D-696
Thermal Conductivity	BTU/hr/ft²/°F/in	1.3	0.95	Average Specific Heat of 0-100°C	
Specific Heat	CAL/g/°C	0.20-0.28		Ratio of Thermal Capacity to that of Water at 15°C	
Maximum Operating Temperature	°F	140	200	Pressure Rating is Directly Related to Temperature	
Heat Deflection Temperature @ 264 PSI	°F	165	217	Thermal Vibration and Softening Occurs	D-648
Decomposition Point	°F	400+	400+	Scorching by Carbonization and Dehydrochloration	

ELECTRICAL

Properties	Unit	PVC	CPVC	Remarks	ASTM Test
Dielectric Strength	VOLTS/MIL	1,400	1,250	Electric Insulator and Non-Magnetic	D-147
Dielectric Constant 60 Hz @ 30°F		3.70	3.25 @ 1,000 Hz		D-150
Power Factor 60 Hz @ 30°F	%	1.255	.007 @ 1,000 Hz		D-150
Specific Volume Resistivity @ 73°F	Ohm/CM	$3\text{-}5 \times 10^{15}$	3.4×10^{15}		D-257

OTHER

Properties	Unit	PVC	CPVC	Remarks	ASTM Test
Specific Gravity	g/cc	1.38	1.55	Relative Density	D-792
Water Absorption	%	+0.05%	+0.03 @ 73°F +0.55 @ 180°F	Weight Gain in 24 Hrs.	D-570
Poisson's Ratio @ 73°F		0.38	0.27		
Cell Designation		12454-B	23447		D-1784

UNDERGROUND CONTROL VALVE SPECIFICATIONS

Manufacturer:	Asahi/America 425 Riverside Avenue Medford, MA 02155 (617) 391-2353
Model:	Type 75 Butterfly Valve
Size:	8"
Operator:	Gear
Body:	PVC
Discs:	PP
Seats:	EPDM
Seals:	Same as Seating Material
Actuators:	N/A

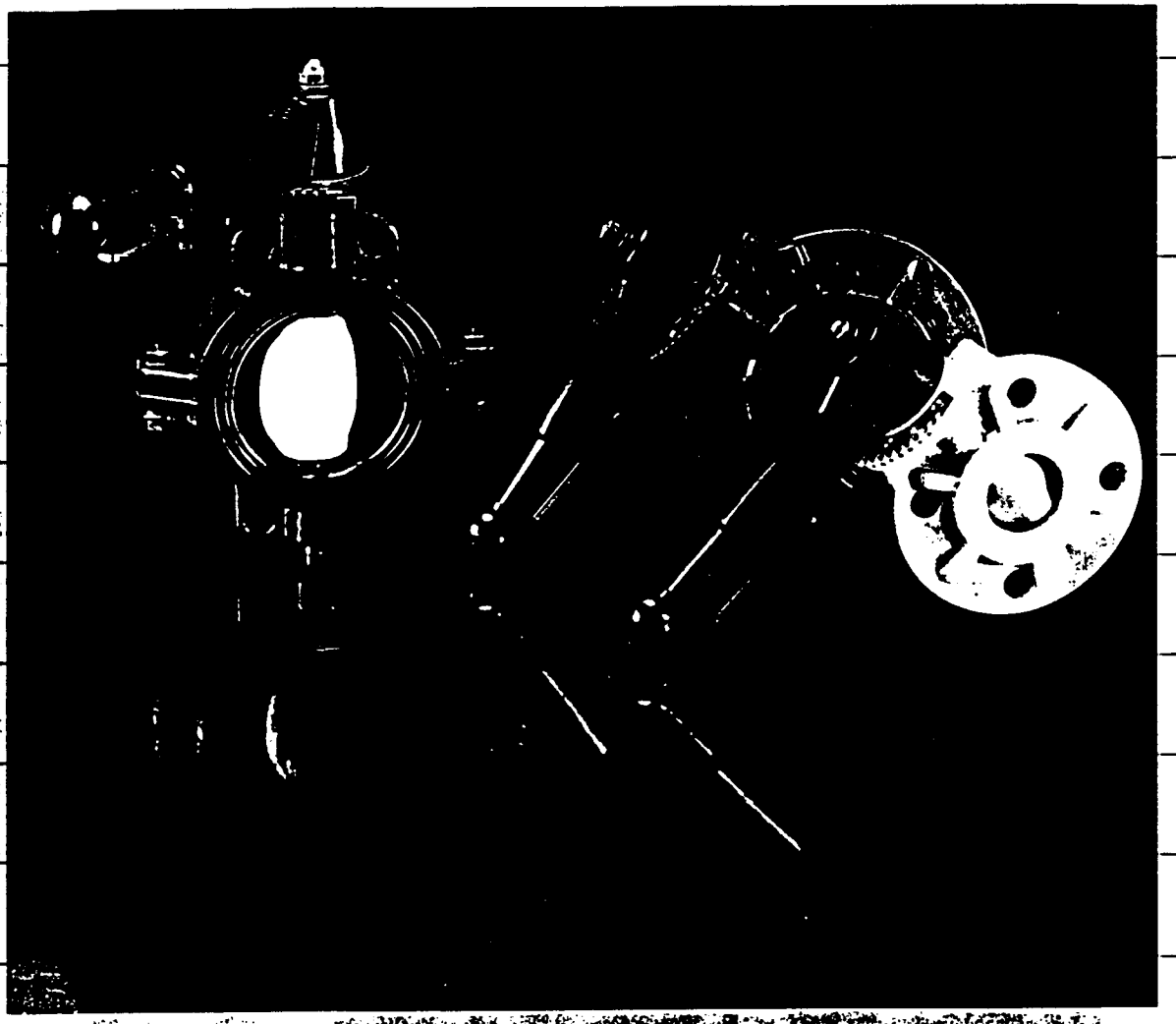
OPTIONS

- Wafer Style
- Carbon Steel Stem Extension

Supplying Vendor: Irrigation Supply Company, Inc.
926 Baxter Avenue
P. O. Box 4545
Louisville, Kentucky 40204
(502) 584-9713

ASAHI/AMERICA®

BUTTERFLY VALVES



425 Riverside Avenue, Medford, MA 02155, U.S.A., Fax: (617) 391-0210, Telex: 94-9411, Cable: VALVES MEDF
Tel (617) 391-2353

BUTTERFLY VALVES
INTRODUCTION

Introduction
Discussion
Warranty

Introduction

For over 15 years Asahi/America has been at the forefront of thermoplastic valve technology. The Asahi/America line is now the broadest in the industry in terms of size, range, valve types, materials, features, and options. Advanced molding techniques, rigid engineering standards, and a wide choice of corrosion resistant thermoplastic and elastomeric materials insure the highest level of reliability for all Asahi/America valves, even in the most severe corrosive applications.

The valves in this catalog represent one segment of the Asahi/America line. Other valves are grouped according to type or special function in separate catalogs. On the back cover of this brochure you will find a brief representation of the complete product line as an aid to requesting additional information.

If, however, you have a requirement for a valve with features not contained in any of our literature, please contact our engineering department to discuss our custom fabrication capability. Chances are we have already encountered a similar request and can accommodate your special needs with a minimum of effort.

Butterfly Valves: Discussion

The name of this valve comes from the wing-like action of the flow-controlling disc which operates at right angles to the flow. The disc has about the same diameter as the connecting pipe and the flow is straight-through with a low pressure drop. Maintenance is easy because of the minimum number of moving parts. The butterfly valve can be used either as an "ON/OFF" type of valve, wherein the seating of the disc against an elastomeric seal is important, or it can be used as a control valve, wherein seating materials are unnecessary.

Asahi/America butterfly valves with seats are self-gasketing, eliminating the need for flange gaskets. These valves can be operated manually, electrically or pneumatically.

Asahi/America thermoplastic valves provide a dependable and economical way to handle corrosive chemicals like sulfuric and hydrofluoric acid, nitric acid, and other oxidizing chemicals, as well as caustics, solvents, halogens and other problem materials, at temperatures to 250° F, pressures to 150 PSI and flows up to 18,500 gpm.

When we speak of corrosion resistance, we refer to the ability of a material to withstand physical and chemical deterioration when it reacts with its environment, and particularly with oxygen. Corrosion, itself, has become a term which applies mostly to metals because the process is primarily an electrochemical one. There is ionization or corrosion at the surface due to electrical potentials that are created between positive and negative poles formed when unlike metals are joined in the same electrically conductive medium or when fluids that surround the metals have different ionic concentrations. Because thermoplastics are dielectric, meaning that they cannot easily support a charge, they are practically immune from corrosion in the conventional sense. There are some chemicals that can cause thermoplastics to deteriorate. For this reason, we have a thermoplastic chemical resistance chart, which we will be happy to send you upon request.

To the best of our knowledge the information contained herein is accurate. However, neither Asahi/America, Inc. nor any of its affiliates assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of the suitablility of any information or material for the use contemplated, or the manner of use, is the sole responsibility of the user.

Due to our policy of continuous product improvement, we reserve the right to change or modify design without incurring any obligation to furnish or install such changes or modifications on products previously or subsequently sold.

Warranty and Liabilities

WARRANTY—THE SALE BY ASAHI/AMERICA, INC. OF ITS PRODUCTS IS EXPRESSLY CONDITIONED UPON AND SUBJECT TO ALL TERMS AND CONDITIONS SET FORTH ON THE BACK COVER OF THIS CATALOG.

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Thermoplastic Materials

PVC (POLYVINYL CHLORIDE) TYPE 1, GRADE 1 Asahi/America uses an unplasticized PVC polymer in all of its PVC valves. This material has excellent chemical resistance, strength, rigidity, and modulus of elasticity. It resists attack by most acids and strong alkalies, as well as gasoline, kerosine, aliphatic alcohols and hydrocarbons, and salt solutions. Aromatics, chlorinated organic compounds, and lacquer solvents do have effect upon PVC's chemical properties. Its temperature range is 140° F. PVC's low cost and overall balance of properties make it the material best suited to the widest number of corrosive applications.

PP (POLYPROPYLENE) TYPE 1 Polypropylene, a member of the polyolefin family, is one of the lightest plastics known. It is highly crystalline, thus is strong and hard. It possesses excellent chemical resistance to many acids, alkalies and organic solvents. PP is not recommended for use with chlorinated hydrocarbons and aromatics. Its upper temperature limit is slightly lower than that of CPVC.

PVDF-KYNAR®(POLYVINYLIDENE FLUORIDE) PVDF is a high molecular weight fluro-carbon that has superior abrasion resistance, chemical resistance, dielectric properties, and mechanical strength. The remarkable fact is that it maintains these characteristics over a temperature range of -40° F. to 250° F. PVDF is highly resistant to wet or dry chlorine, bromine and other halogens, most strong acids and bases, aliphatics, aromatics, alcohols, and chlorinated solvents. It is not, however, recommended for ketones or esters.

FRP (FIBERGLASS WRAPPED POLYESTER) Unsaturated polyester thermoset resins are manufactured from glycols, dibasic acids and monomers. Inhibitors are used to control gel and curing during the cross linking process. An initiator is added at the final fabrication process to achieve cure. Working temperature range is 210° F. Chemical and corrosion resistance is excellent for acids, bases and some organics.

Elastomeric Materials

NITRILE (BUNA N) Nitrile rubber is a copolymer of butadiene and acrylonitrile. In addition to its good elastomeric properties, it is resistant to aliphatic hydrocarbons and aromatic solvents.

BUTYL Butyl rubber is a copolymer of isobutylene and isoprene, vulcanized in the same manner as natural rubber. Butyl has good resistance to most acids.

HYPALON® Hypalon® is DuPont's name for its elastomer of chlorosulfonated polyethylene used for diaphragms and valve seals.

EPDM (ETHYLENE PROPYLENE TERPOLYMER) This elastomer is particularly suited for diaphragms, valve seals, and "O"-rings. It can stand up to a variety of acids, bases, alcohols, and oxidizing chemicals.

NEOPRENE Neoprene is a chlorinated synthetic rubber which is used primarily as a diaphragm or sealing material in Asahi/America valves. Its use should be limited to lower temperature applications.

NATURAL RUBBER Natural rubber is a high molecular weight polymer of isoprene derived from the Hevea tree. It is used as a diaphragm and sealing material because of its excellent elastomeric properties and resistance to abrasion.

Note

Caution: Asahi/America Butterfly Valves are not recommended for use in compressed gas services. When testing, only hydrostatic pressure testing is recommended, with a gradual increase in pressure.

Teflon®, Viton® and Hypalon® are registered trademarks of DuPont.
Kynar® is a registered trademark of Pennwalt.

TYPE 75 BUTTERFLY VALVES
LEVER AND GEAR

Features, Options
Sample Specification
Pressure Vs. Temperature
Vacuum Service
Cv Values

SPECIFICATIONS

SIZES: 1½"-24"
Lever: 1½"-8" Gear: 8"-24"
MODELS: Wafer style (for ANSI flanges)
OPERATORS: Lever, Gear
BODIES: PVC, PVDF
DISCS: PP, PVDF, PVC (optional)
SEATS: EPDM, VITON®, Nitrile (Buna N) Butyl, Hypalon, Natural Rubber, Neoprene, Chlorinated Polyethylene (CPE)
SEALS: Same as seating material
ACTUATORS: Electric, Pneumatic

FEATURES

- Standard model has PVC body and polypropylene disc for better chemical and abrasion resistance at temperatures higher than can be achieved with PVC.
- Can be fitted with a variety of elastomeric seat materials to provide bubble-tight seating for a wide range of chemicals.
- Stainless steel shaft has full engagement with disc and is a non-wetted part isolated from the media by double "O" ring seals on top and bottom trunnions of disc.
- EDPM and Viton® are standard seat materials. Others are available as options.
- Only disc and liner are wetted parts.

OPTIONS

- Stem Extensions
- Other seat materials available on special order.
- Gear operators for all sizes.
- Sprocket and chain wheel: all sizes.
- Teflon® or PVDF stem coatings.
- Handle locking devices.
- 2" square operating nut.
- Stem of any commercially available metal.
- Lug style butterfly valves.
- Lever handle on 8".
- Tandem arrangements (patented).
- Disc and/or body in PVDF for better temperature range or chemical resistance.

SAMPLE SPECIFICATION

All solid thermoplastic butterfly valves shall be of the lined body design and seal bubble tight with only the liner and disc as wetted parts. The disc shall have double "O" ring seals on top and bottom trunnions, of the same material as the valve liner. Liner shall be molded and formed around the body, functioning as a gasket on each side of valve. Stem shall be of stainless steel and have engagement over the full length of the disc. Butterfly valves shall be wafer style, as manufactured by Asahi/America, 425 Riverside Avenue, Medford, MA 02155.

PRESSURE VS. TEMPERATURE (PSI, WATER, NON-SHOCK)

	PVC Body With PP Disc and appropriate elastomer*				PVDF Body With PVDF Disc and appropriate elastomer*			
Size (Inches)	30°F 70°F	120°F	140°F	180°F	-5°F 140°F	141°F 175°F	176°F 210°F	211°F 250°F
1 1/2-3	150	100	70	30	150	100	85	70
4-6	150	100	45	30	150	100	85	70
8	150	100	40	20	150	85	70	60
10	150	100	30	15	150	85	70	60
12	100	60	30	15	100	60	40	20
14	100	60	30	7	100	40	30	15
16	85	60	30	7	85	40	30	15
18	70	30	20	7	70	40	30	15
20-24	50	30	20	7	50	30	20	15

*Maximum allowable temperature of Viton is 250° F All other elastomers have a limit of 210° F.

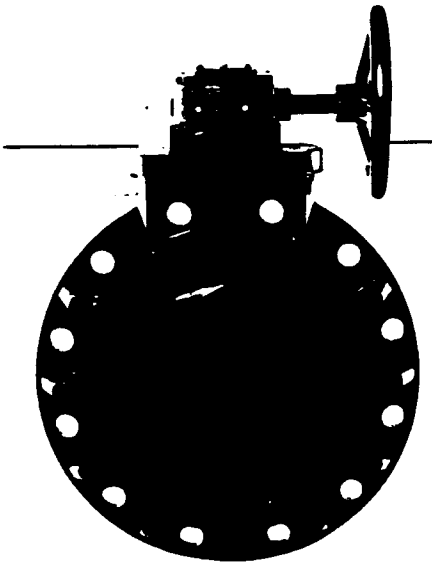
VACUUM SERVICE
(UNIT: INCHES OF MERCURY)

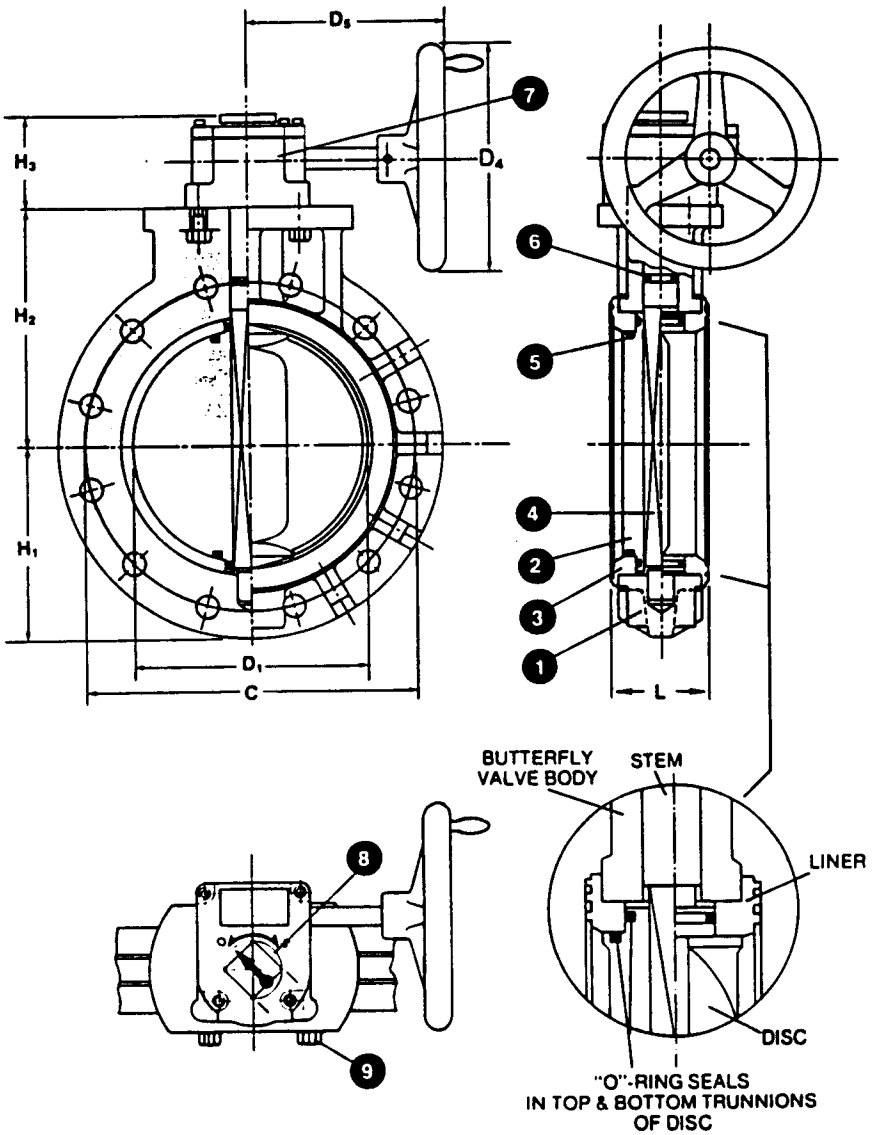
Size		Size	
1½"	-29.92	10"	-27.56
2"	-29.92	12"	-23.62
2½"	-29.92	14"	-23.62
3"	-29.92	16"	-23.62
4"	-29.92	18"	-19.69
5"	-29.92	20"	-19.69
6"	-27.56	24"	-19.69
8"	-27.56		

Cv VALUES

Size	10°	20°	30°	40°	50°	60°	70°	80°	90°
1½"	0	0.8	2.6	5.4	11.0	22.0	38.0	58.0	75.0
2"	0	1.9	5.2	9.5	25.0	46.8	79.0	91.0	102.0
2½"	0	4.0	9.0	18.2	35.7	59.7	166.0	239.0	260.0
3"	0	7.5	17.7	31.6	58.0	101.0	251.0	356.0	387.0
4"	0.7	10.5	25.3	45.3	85.8	156.2	328.0	465.0	504.0
5"	2.7	21.6	46.3	82.0	140.0	271.0	501.0	710.0	772.0
6"	15.3	42.6	80.5	142.0	220.0	462.0	794.0	1085.0	1183.0
8"	33.0	82.0	147.0	300.0	387.0	816.0	1390.0	1880.0	2040.0
10"	61.0	151.0	270.0	540.0	720.0	1476.0	2490.0	3320.0	3600.0
12"	88.0	233.0	408.0	776.0	1070.0	2140.0	3650.0	4760.0	5160.0
14"	129.0	328.0	535.0	1030.0	1609.0	2770.0	4580.0	5890.0	6440.0
16"	175.0	458.0	750.0	1416.0	2170.0	3760.0	6000.0	7660.0	8340.0
18"	252.0	622.0	1100.0	1960.0	2940.0	5020.0	7960.0	10020.0	10890.0
20"	337.0	845.0	1448.0	2673.0	3940.0	6620.0	10400.0	12920.0	14060.0
24"	463.0	1148.0	2130.0	3700.0	5550.0	9180.0	13900.0	17000.0	18500.0

TYPE 75 BUTTERFLY VALVES
GEAR





PARTS—GEAR 8"-24"

No.	Parts	Pcs.	Materials
1	Body	1	PVC, PP, PVDF
2	Disc	1	PP, PVDF
3	Seat	1	EPDM, Viton®, Nitrile (Buna N), Neoprene®, Hypalon® Butyl, Natural Rubber
4	Stem	1	Stainless Steel
5	Disc Seal "O" Ring	4	Same material as seat
6	Stem Seal "O" Ring	1	Same material as seat
7	Gearbox	1	Aluminum cast iron coated with epoxy
8	Position Indicator	1	
9	Travel Stops	2	

1. 16"-24" body material is PP

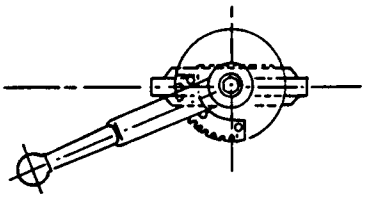
DIMENSIONS—GEAR (IN INCHES—BODY BOLT HOLES ANSI)

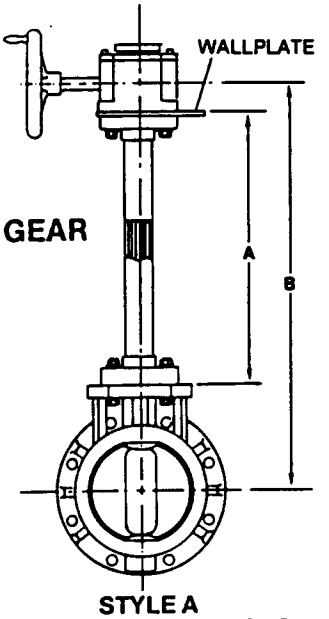
Size	Weight (lbs.)	D_1	C	L	H_1	H_2	H_3	D_4	D_5
8	33.60	7.99	11.75	3.43	6.69	8.27	3.23	7.87	6.89
10	41.10	10.04	14.25	4.33	7.99	9.45	3.23	7.87	6.89
12	77.40	12.24	17.00	5.20	9.53	11.69	4.02	9.84	8.74
14	85.80	14.09	18.75	5.20	10.24	11.81	4.02	9.84	8.74
16	112.70	15.69	21.25	6.73	11.81	13.78	4.02	9.84	8.74
18	151.60	17.74	22.75	7.13	12.40	14.57	4.13	12.40	12.99
20	172.40	19.70	25.00	7.60	13.78	15.75	4.13	12.40	12.99
24	258.00	23.66	29.50	8.39	16.02	18.31	4.13	12.40	12.99

OPTIONS FOR BUTTERFLY VALVES continued

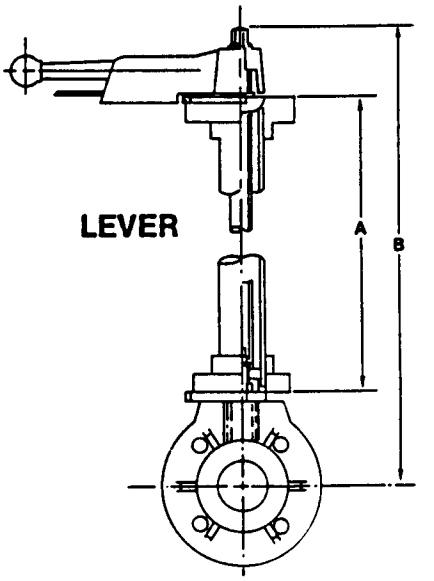
STEM EXTENSIONS

TWO PIECE STEM AND HOUSING
For submerged or buried applications. PVC housing protects stem extensions from aggressive environments, or functions as valve box.



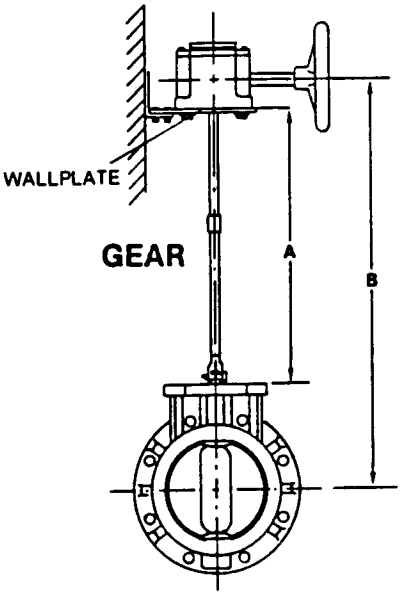


STYLE A
(TWO PIECE STEM & HOUSING)

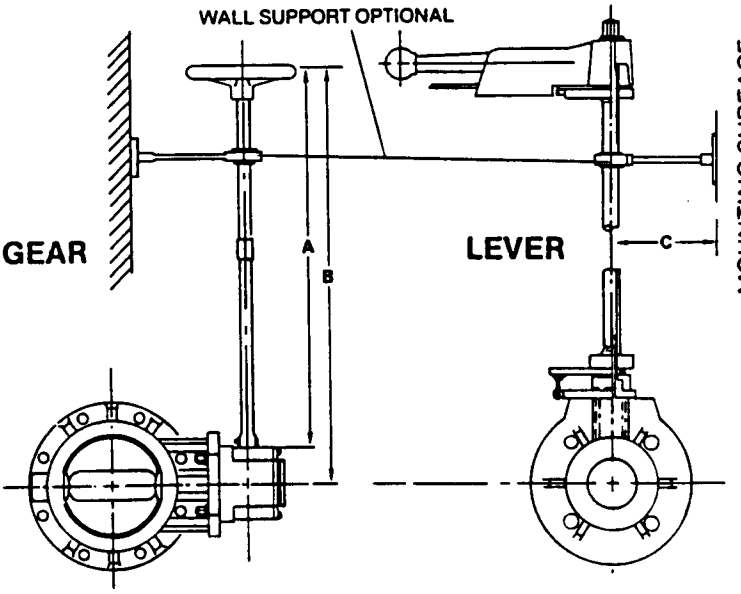


STYLE A
(TWO PIECE, STEM & HOUSING)

SINGLE STEM EXTENSIONS
Valve handle can be extented away from the valve for out-of-reach locations.



STYLE B
(ONE PIECE, NON-SUPPORTED)



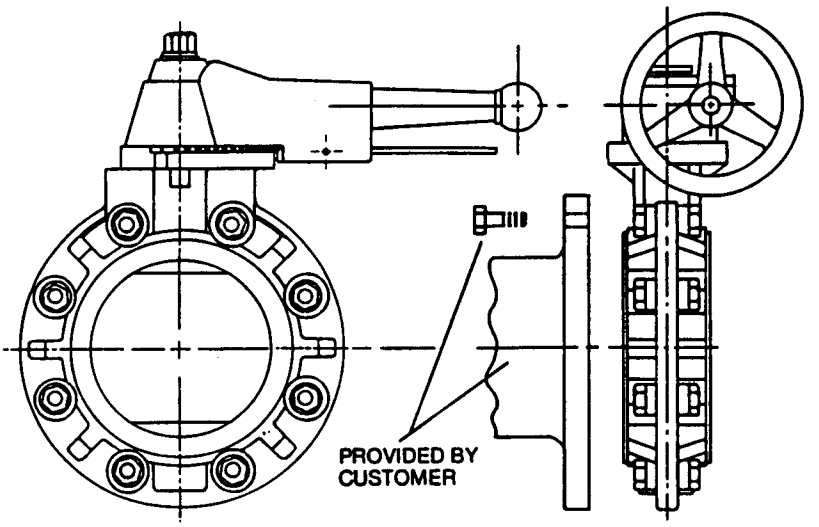
STYLE C
(ONE PIECE, NON-SUPPORTED)

STYLE B
(ONE PIECE, NON-SUPPORTED)

OPTIONS FOR BUTTERFLY VALVES continued

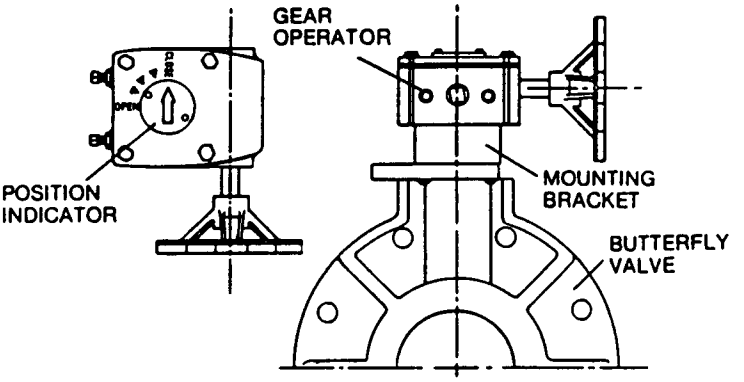
LUG STYLE

LUG STYLE VALVES
For valves used at the end of line applications, mounted with a single flange. Also used as a blocking valve where either side of the valve can be un-bolted, while still maintaining system pressure on the opposite side of the valve.



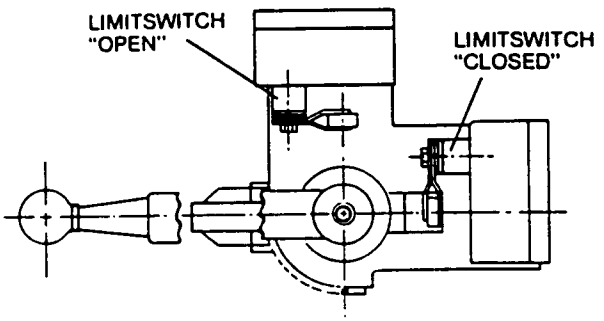
GEAR OPERATORS

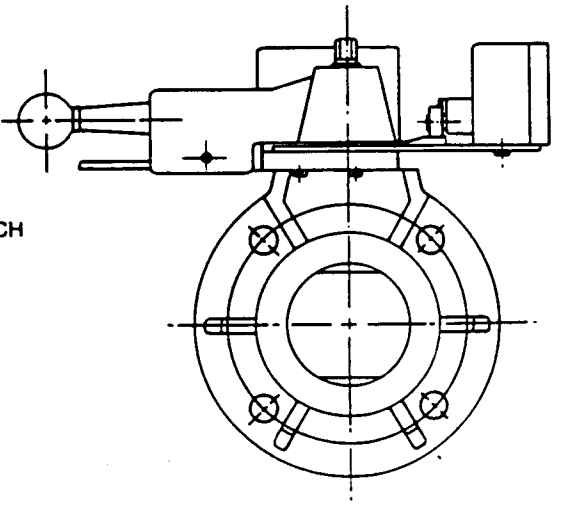
GEAR OPERATORS
1½"-6". For applications where a gear operator is required to replace the standard lever handle.



LIMIT SWITCHES

LIMIT SWITCHES
For remote position indication through lights, or for sequencing of other equipment.





WELLHEAD CONTROL VALVE SPECIFICATIONS

Manufacturer:	Asahi/America 425 Riverside Avenue Medford, MA 02155 (617) 391-2353
Model:	Type 75 Butterfly Valve
Size:	4"
Operator:	Gear
Body:	Polypropylene
Discs:	PVC
Seats:	EPDM
Seals:	Same as Seating Material
Actuators:	N/A

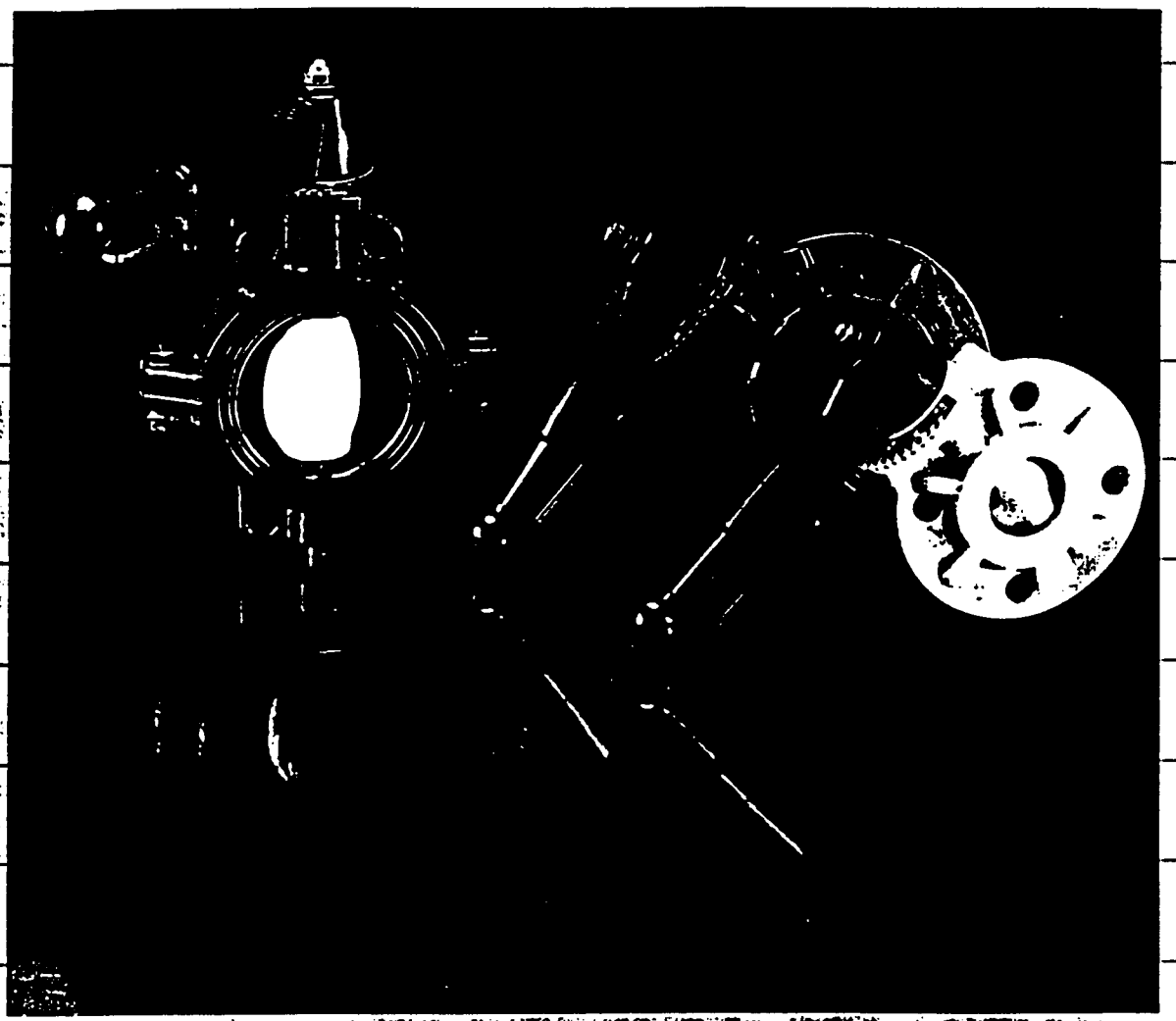
OPTIONS

- Wafer Style
- Stainless Steel Stem Extension

Supplying Vendor: Irrigation Supply Company, Inc.
926 Baxter Avenue
P.O. Box 4545
Louisville, Kentucky 40204
(502) 584-9713

ASAHI/AMERICA®

BUTTERFLY VALVES



425 Riverside Avenue, Medford, MA 02155, U.S.A., Fax: (617) 391-0210, Telex: 94-9411, Cable: VALVES MEDF
Tel (617) 391-2353

BUTTERFLY VALVES
INTRODUCTION

Introduction
Discussion
Warranty

Introduction

For over 15 years Asahi/America has been at the forefront of thermoplastic valve technology. The Asahi/America line is now the broadest in the industry in terms of size, range, valve types, materials, features, and options. Advanced molding techniques, rigid engineering standards, and a wide choice of corrosion resistant thermoplastic and elastomeric materials insure the highest level of reliability for all Asahi/America valves, even in the most severe corrosive applications.

The valves in this catalog represent one segment of the Asahi/America line. Other valves are grouped according to type or special function in separate catalogs. On the back cover of this brochure you will find a brief representation of the complete product line as an aid to requesting additional information.

If, however, you have a requirement for a valve with features not contained in any of our literature, please contact our engineering department to discuss our custom fabrication capability. Chances are we have already encountered a similar request and can accommodate your special needs with a minimum of effort.

Butterfly Valves: Discussion

The name of this valve comes from the wing-like action of the flow-controlling disc which operates at right angles to the flow. The disc has about the same diameter as the connecting pipe and the flow is straight-through with a low pressure drop. Maintenance is easy because of the minimum number of moving parts. The butterfly valve can be used either as an "ON/OFF" type of valve, wherein the seating of the disc against an elastomeric seal is important, or it can be used as a control valve, wherein seating materials are unnecessary.

Asahi/America butterfly valves with seats are self-gasketing, eliminating the need for flange gaskets. These valves can be operated manually, electrically or pneumatically.

Asahi/America thermoplastic valves provide a dependable and economical way to handle corrosive chemicals like sulfuric and hydrofluoric acid, nitric acid, and other oxidizing chemicals, as well as caustics, solvents, halogens and other problem materials, at temperatures to 250° F, pressures to 150 PSI and flows up to 18,500 gpm.

When we speak of corrosion resistance, we refer to the ability of a material to withstand physical and chemical deterioration when it reacts with its environment, and particularly with oxygen. Corrosion, itself, has become a term which applies mostly to metals because the process is primarily an electrochemical one. There is ionization or corrosion at the surface due to electrical potentials that are created between positive and negative poles formed when unlike metals are joined in the same electrically conductive medium or when fluids that surround the metals have different ionic concentrations. Because thermoplastics are dielectric, meaning that they cannot easily support a charge, they are practically immune from corrosion in the conventional sense. There are some chemicals that can cause thermoplastics to deteriorate. For this reason, we have a thermoplastic chemical resistance chart, which we will be happy to send you upon request.

To the best of our knowledge the information contained herein is accurate. However, neither Asahi/America, Inc. nor any of its affiliates assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of the suitablility of any information or material for the use contemplated, or the manner of use, is the sole responsibility of the user.

Due to our policy of continuous product improvement, we reserve the right to change or modify design without incurring any obligation to furnish or install such changes or modifications on products previously or subsequently sold.

Warranty and Liabilities

WARRANTY—THE SALE BY ASAHI/AMERICA, INC. OF ITS PRODUCTS IS EXPRESSLY CONDITIONED UPON AND SUBJECT TO ALL TERMS AND CONDITIONS SET FORTH ON THE BACK COVER OF THIS CATALOG.

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Thermoplastic Materials

PVC (POLYVINYL CHLORIDE) TYPE 1, GRADE 1 Asahi/America uses an unplasticized PVC polymer in all of its PVC valves. This material has excellent chemical resistance, strength, rigidity, and modulus of elasticity. It resists attack by most acids and strong alkalies, as well as gasoline, kerosine, aliphatic alcohols and hydrocarbons, and salt solutions. Aromatics, chlorinated organic compounds, and lacquer solvents do have effect upon PVC's chemical properties. Its temperature range is 140° F. PVC's low cost and overall balance of properties make it the material best suited to the widest number of corrosive applications.

PP (POLYPROPYLENE) TYPE 1 Polypropylene, a member of the polyolefin family, is one of the lightest plastics known. It is highly crystalline, thus is strong and hard. It possesses excellent chemical resistance to many acids, alkalies and organic solvents. PP is not recommended for use with chlorinated hydrocarbons and aromatics. Its upper temperature limit is slightly lower than that of CPVC.

PVDF-KYNAR®(POLYVINYLIDENE FLUORIDE) PVDF is a high molecular weight flurocarbon that has superior abrasion resistance, chemical resistance, dielectric properties, and mechanical strength. The remarkable fact is that it maintains these characteristics over a temperature range of -40° F. to 250° F. PVDF is highly resistant to wet or dry chlorine, bromine and other halogens, most strong acids and bases, aliphatics, aromatics, alcohols, and chlorinated solvents. It is not, however, recommended for ketones or esters.

FRP (FIBERGLASS WRAPPED POLYESTER) Unsaturated polyester thermoset resins are manufactured from glycols, dibasic acids and monomers. Inhibitors are used to control gel and curing during the cross linking process. An initiator is added at the final fabrication process to achieve cure. Working temperature range is 210° F. Chemical and corrosion resistance is excellent for acids, bases and some organics.

Elastomeric Materials

NITRILE (BUNA N) Nitrile rubber is a copolymer of butadiene and acrylonitrile. In addition to its good elastomeric properties, it is resistant to aliphatic hydrocarbons and aromatic solvents.

BUTYL Butyl rubber is a copolymer of isobutylene and isoprene, vulcanized in the same manner as natural rubber. Butyl has good resistance to most acids.

HYPALON® Hypalon® is DuPont's name for its elastomer of chlorosulfonated polyethylene used for diaphragms and valve seals.

EPDM (ETHYLENE PROPYLENE TERPOLYMER) This elastomer is particularly suited for diaphragms, valve seals, and "O"-rings. It can stand up to a variety of acids, bases, alcohols, and oxidizing chemicals.

NEOPRENE Neoprene is a chlorinated synthetic rubber which is used primarily as a diaphragm or sealing material in Asahi/America valves. Its use should be limited to lower temperature applications.

NATURAL RUBBER Natural rubber is a high molecular weight polymer of isoprene derived from the Hevea tree. It is used as a diaphragm and sealing material because of its excellent elastomeric properties and resistance to abrasion.

Note

Caution: Asahi/America Butterfly Valves are not recommended for use in compressed gas services. When testing, only hydrostatic pressure testing is recommended, with a gradual increase in pressure.

Teflon®, Viton® and Hypalon® are registered trademarks of DuPont.
Kynar® is a registered trademark of Pennwalt.

TYPE 75 BUTTERFLY VALVES
LEVER AND GEAR

Features, Options
Sample Specification
Pressure Vs. Temperature
Vacuum Service
Cv Values

SPECIFICATIONS

SIZES: 1½"-24"
Lever: 1½"-8" Gear: 8"-24"
MODELS: Wafer style (for ANSI flanges)
OPERATORS: Lever, Gear
BODIES: PVC, PVDF
DISCS: PP, PVDF, PVC (optional)
SEATS: EPDM, VITON®, Nitrile (Buna N) Butyl, Hypalon, Natural Rubber, Neoprene, Chlorinated Polyethylene (CPE)
SEALS: Same as seating material
ACTUATORS: Electric, Pneumatic

FEATURES

- Standard model has PVC body and polypropylene disc for better chemical and abrasion resistance at temperatures higher than can be achieved with PVC.
- Can be fitted with a variety of elastomeric seat materials to provide bubble-tight seating for a wide range of chemicals.
- Stainless steel shaft has full engagement with disc and is a non-wetted part isolated from the media by double "O" ring seals on top and bottom trunnions of disc.
- EDPM and Viton® are standard seat materials. Others are available as options.
- Only disc and liner are wetted parts.

OPTIONS

- Stem Extensions
- Other seat materials available on special order.
- Gear operators for all sizes.
- Sprocket and chain wheel: all sizes.
- Teflon® or PVDF stem coatings.
- Handle locking devices.
- 2" square operating nut.
- Stem of any commercially available metal.
- Lug style butterfly valves.
- Lever handle on 8".
- Tandem arrangements (patented).
- Disc and/or body in PVDF for better temperature range or chemical resistance.

SAMPLE SPECIFICATION

All solid thermoplastic butterfly valves shall be of the lined body design and seal bubble tight with only the liner and disc as wetted parts. The disc shall have double "O" ring seals on top and bottom trunnions, of the same material as the valve liner. Liner shall be molded and formed around the body, functioning as a gasket on each side of valve. Stem shall be of stainless steel and have engagement over the full length of the disc. Butterfly valves shall be wafer style, as manufactured by Asahi/America, 425 Riverside Avenue, Medford, MA 02155.

PRESSURE VS. TEMPERATURE (PSI, WATER, NON-SHOCK)

	PVC Body With PP Disc and appropriate elastomer*				PVDF Body With PVDF Disc and appropriate elastomer*			
Size (Inches)	30°F 70°F	120°F	140°F	180°F	-5°F 140°F	141°F 175°F	176°F 210°F	211°F 250°F
1 1/2–3	150	100	70	30	150	100	85	70
4–6	150	100	45	30	150	100	85	70
8	150	100	40	20	150	85	70	60
10	150	100	30	15	150	85	70	60
12	100	60	30	15	100	60	40	20
14	100	60	30	7	100	40	30	15
16	85	60	30	7	85	40	30	15
18	70	30	20	7	70	40	30	15
20–24	50	30	20	7	50	30	20	15

*Maximum allowable temperature of Viton is 250° F. All other elastomers have a limit of 210° F.

VACUUM SERVICE
(UNIT: INCHES OF MERCURY)

Size		Size	
1½"	-29.92	10"	-27.56
2"	-29.92	12"	-23.62
2½"	-29.92	14"	-23.62
3"	-29.92	16"	-23.62
4"	-29.92	18"	-19.69
5"	-29.92	20"	-19.69
6"	-27.56	24"	-19.69
8"	-27.56		

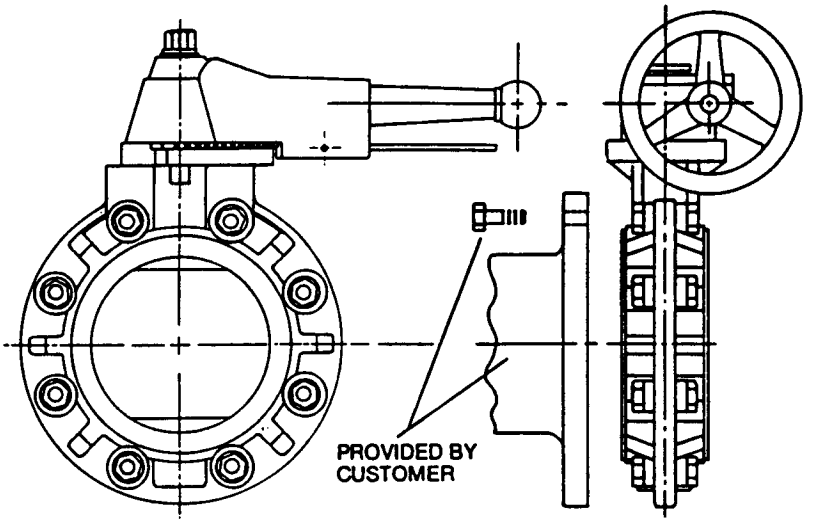
Cv VALUES

Size	10°	20°	30°	40°	50°	60°	70°	80°	90°
1½"	0	0.8	2.6	5.4	11.0	22.0	38.0	58.0	75.0
2"	0	1.9	5.2	9.5	25.0	46.8	79.0	91.0	102.0
2½"	0	4.0	9.0	18.2	35.7	59.7	166.0	239.0	260.0
3"	0	7.5	17.7	31.6	58.0	101.0	251.0	356.0	387.0
4"	0.7	10.5	25.3	45.3	85.8	156.2	328.0	465.0	504.0
5"	2.7	21.6	46.3	82.0	140.0	271.0	501.0	710.0	772.0
6"	15.3	42.6	80.5	142.0	220.0	462.0	794.0	1085.0	1183.0
8"	33.0	82.0	147.0	300.0	387.0	816.0	1390.0	1880.0	2040.0
10"	61.0	151.0	270.0	540.0	720.0	1476.0	2490.0	3320.0	3600.0
12"	88.0	233.0	408.0	776.0	1070.0	2140.0	3650.0	4760.0	5160.0
14"	129.0	328.0	535.0	1030.0	1609.0	2770.0	4580.0	5890.0	6440.0
16"	175.0	458.0	750.0	1416.0	2170.0	3760.0	6000.0	7660.0	8340.0
18"	252.0	622.0	1100.0	1960.0	2940.0	5020.0	7960.0	10020.0	10890.0
20"	337.0	845.0	1448.0	2673.0	3940.0	6620.0	10400.0	12920.0	14060.0
24"	463.0	1148.0	2130.0	3700.0	5550.0	9180.0	13900.0	17000.0	18500.0

OPTIONS FOR BUTTERFLY VALVES continued

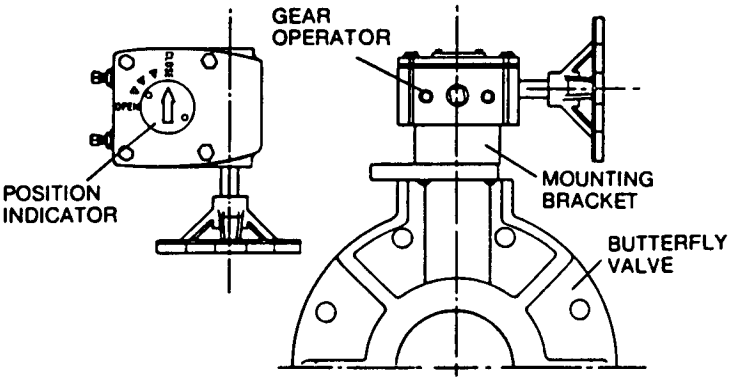
LUG STYLE

LUG STYLE VALVES
For valves used at the end of line applications, mounted with a single flange. Also used as a blocking valve where either side of the valve can be un-bolted, while still maintaining system pressure on the opposite side of the valve.



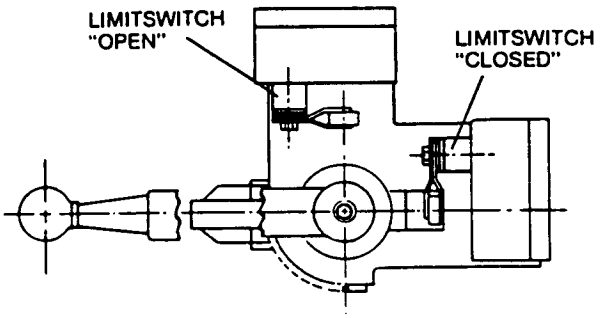
GEAR OPERATORS

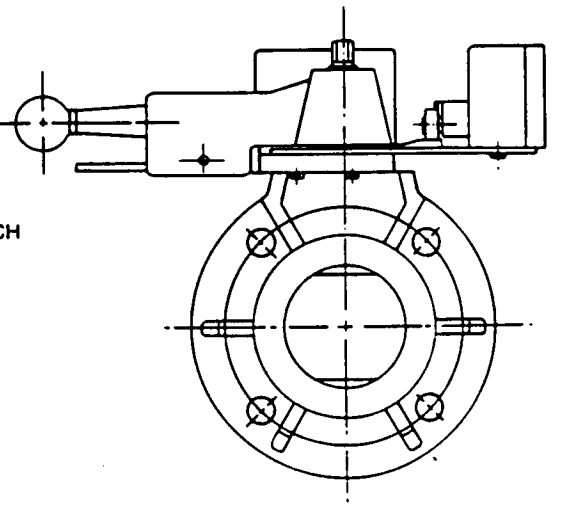
GEAR OPERATORS
1½"-6". For applications where a gear operator is required to replace the standard lever handle.



LIMIT SWITCHES

LIMIT SWITCHES
For remote position indication through lights, or for sequencing of other equipment.





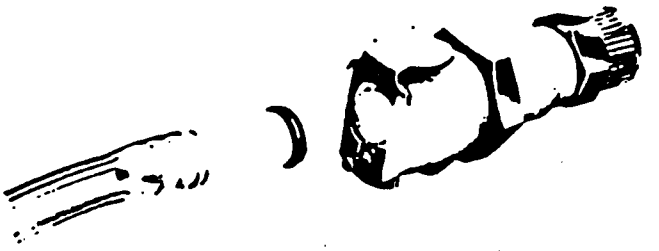
SAMPLE PORT SPECIFICATIONS

Manufacturer:	Colder Products Company 2459 University Avenue St. Paul, Minnesota 55114 (612) 645-0091
Model:	LC 220
Size:	1/4" MPT
Body:	Chrome-Plated Brass
Supplying Vendor:	Wilson Company 2317 East Loop 820 North Ft. Worth, Texas 76118 (817) 595-2244

PLASTIC QUICK DISCONNECT COUPLINGS (Continued)

PLC 220

¼" FLOW
PLASTIC SERIES



PMC 110 and PLC 220 ADVANTAGES

- **Chemical resistance** — can be used where brass is not desirable
- **Cost saving** — chemical resistance without the high cost of stainless steel
- **Attractive appearance** — Natural acetal color (white)
- **Lightweight** — applicable where small tubing and light materials are a must.

PMC 110 and PLC 220 SPECIFICATIONS

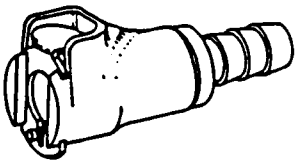
Materials: Bodies and valves; acetal plastic (Delrin® or Celcon®) stainless steel springs and latch, Buna-N-seals (special seal materials on request)

Color: Natural (White)

Maximum Operating Temperature: 180°F [82°C]

Working Pressure: 120 PSI

COUPLING BODIES

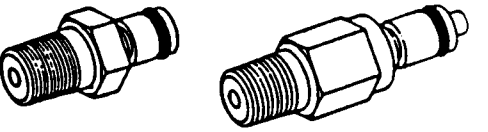


IN LINE

STRAIGHT THRU	TUBING	LENGTH	WITH SHUT-OFF
PLC 130-06	⅜" O.D. Poly	1.95	PLCD 130-06
PLC 170-04*	¼" I.D.	1.95	PLCD 170-04*
PLC 170-06*	⅜" I.D.	1.95	PLCD 170-06*

*Hose Barb

COUPLING INSERTS



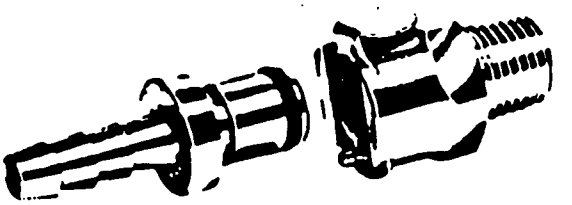
PIPE THREAD

STRAIGHT THRU	THREAD	WITH SHUT-OFF
PLC 240-04	¼" NPT	PLCD 240-04
PLC 240-06	⅜" NPT	PLCD 240-06

CHROME PLATED BRASS QUICK DISCONNECT COUPLINGS (Continued)

LC 220

¼" FLOW
BRASS SERIES



LC 220 QUICK COUPLINGS

LC 220 FEATURES — High flow small size couplings. Designed specifically for flexible tubing applications where higher flow rates and minimum coupling size are required. Available in ¼" and ⅜" sizes. Wide variety of flexible tube connections offered. Chrome plated brass, single and double end shut-off.

SPECIFICATIONS:

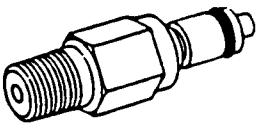
Materials: Chrome plated brass bodies, stainless steel springs and latch, Delrin® plastic valve poppet, Buna-N-Seals.

Maximum Operating Temperature: 180°F.

Maximum Working Pressure: 250 psi.

Pipe Thread

SHUT-OFF	THREAD
LCD 240-04	¼" MPT
LCD 240-06	⅜" MPT



CPC™

COLDER PRODUCTS COMPANY
2459 University Avenue, St. Paul, MN 55114
Phone 612/645-0091

Form No. 882

FLANGE GASKET SPECIFICATIONS

Manufacturer:	Boston Industrial Products P. O. Box 1000 Paragould, Arkansas 72451 (800) 643-0134
Sizes:	Varies to match flange size
Style No.:	1051
Material:	Neoprene
Thickness:	1/8 inch
Supplying Vendor:	Irrigation Supply Company, Inc. 926 Baxter Avenue Louisville, Kentucky 40204 (502) 583-6591

Boston's Style #363 Buna N Nitrile sheet meets the following specifications:

Elastomer Type:	Nitrile Base
Finish:	Plate - Finish
Durometer Hardness:	55-65
Tensile (Min.):	1000 PSI
Ultimate Elongation:	300% Min.
Avg. Wt. (lbs./sq.yd 1/16" thick):	4.1
Temperature Range	-30°Low +200°
Meets ASTM D2000 BF 610	

If we can be of further service, please feel free to contact our office.

Sincerely,

David Minick

David Minick
Plant Chemist/Product Engineer

WELLHEAD FLEXHOSE SPECIFICATIONS

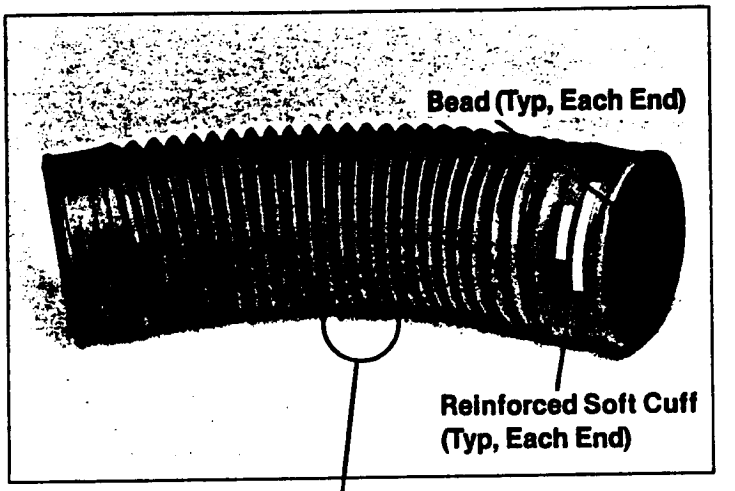
Manufacturer:	Industrial Tube Corporation 3091 Indian Avenue Perris, California 92571 (714) 657-2611
Model:	IT-6000 Flexible Coupling
Size:	4" Wellheads: 4" x 36"
Body:	Silicone Rubber / Polyester Fabric
Wire:	SS (Type 302)
Supplying Vendor:	Irrigation Supply Company, Inc. 926 Baxter Avenue P. O. Box 4545 Louisville, Kentucky 40204 (502) 584-9713

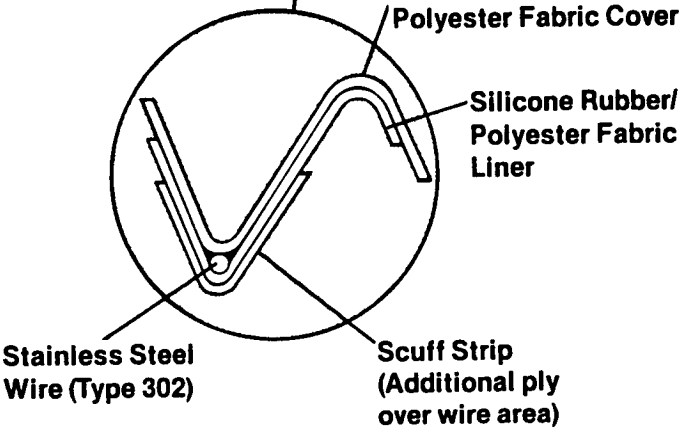
INDUSTRIAL TUBE CORPORATION
3091 INDIAN AVENUE
PERRIS, CALIFORNIA 92571
PX: 714/657-2611
FAX:714/943-0191

IT-6000 FLEXIBLE COUPLING

Coupling is chemically compatible with landfill gases.

Construction—High strength silicone rubber with polyester fabric reinforcement. Stainless steel type 302 wire is encapsulated within the inner and outer plys and therefore is not exposed to the landfill gases. Scuff strips of silicone rubber are added on the outside of the coupling over the wire areas. There are 2½" soft cuffs at each end that are flexible enough for installation over the IT-6003 PVC collars and capable of holding up under the clamp forces. A bead of silicone rubber has been added at the end of each cuff to prevent, PULL-OFF, under severe pipe movements.





DESIGN CRITERIA	MEDIA: LANDFILL GASES
Operating Temperature Range	−65°F thru +325°F
Pressure	−5 PSIG/10 hg Neg
Extension/Flexibility	50% Contraction 20% Extension
Bend Radius	1.5 × Diameter

Part Number Code IT - 6000 - 4 - 18
- Basic Part Number
- Nom. Pipe Size (Inches)
- Length In Inches (Standard OAL)

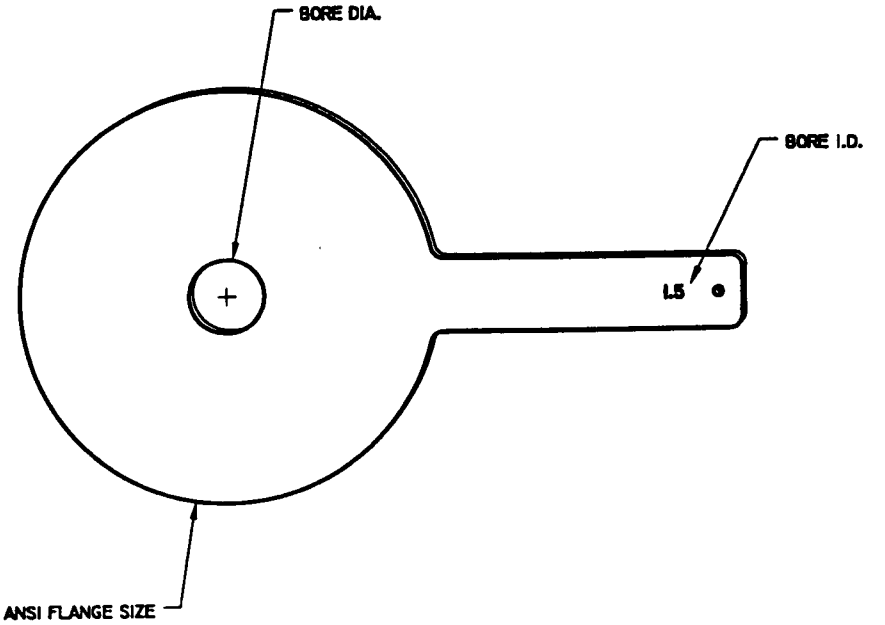
NOTES
1. 24" Length Recommended For Extreme Movement
2. 18" & 24" Lengths Standard with 2½" Soft Cuff at Each End
3. Available In All Plastic Pipe Sizes

IT-6000 FLEXIBLE COUPLING

ORIFICE PLATE SPECIFICATIONS

Manufacturer:	Irrigation Supply Company, Inc. 926 Baxter Avenue P.O. Box 4545 Louisville, Kentucky 40204 (502) 584-9713
Model:	Poly Orifice - 8" X 2"
Material:	Polypropelene - 1/4" thick
Supplying Vendor:	Irrigation Supply Company, Inc. 926 Baxter Avenue P.O. Box 4545 Louisville, Kentucky 40204 (502) 584-9713

POLYPROPELENE ORIFICE PLATE



MODEL NUMBER SPECIFICATION: POLY ORIFICE - 6" X 1.5"

BORE I.D.

FLANGE SIZE

CAN BE ORDERED FOR ANY SIZE ANSI FLANGE,
AND BORE I.D. IN 0.25 INCH INCREMENTS

MATERIALS: POLYPROPELENE, 1/4" THICK

QUICK CONNECT SPECIFICATIONS

Manufacturer: P T Coupling Company
P. O. Box 3909
Enid, Oklahoma 73702
(405) 237-4060

For Wellheads:

Adapter, Thread male NPT

Model: 15F

Size: 1 1/2"

Body: Polypropylene

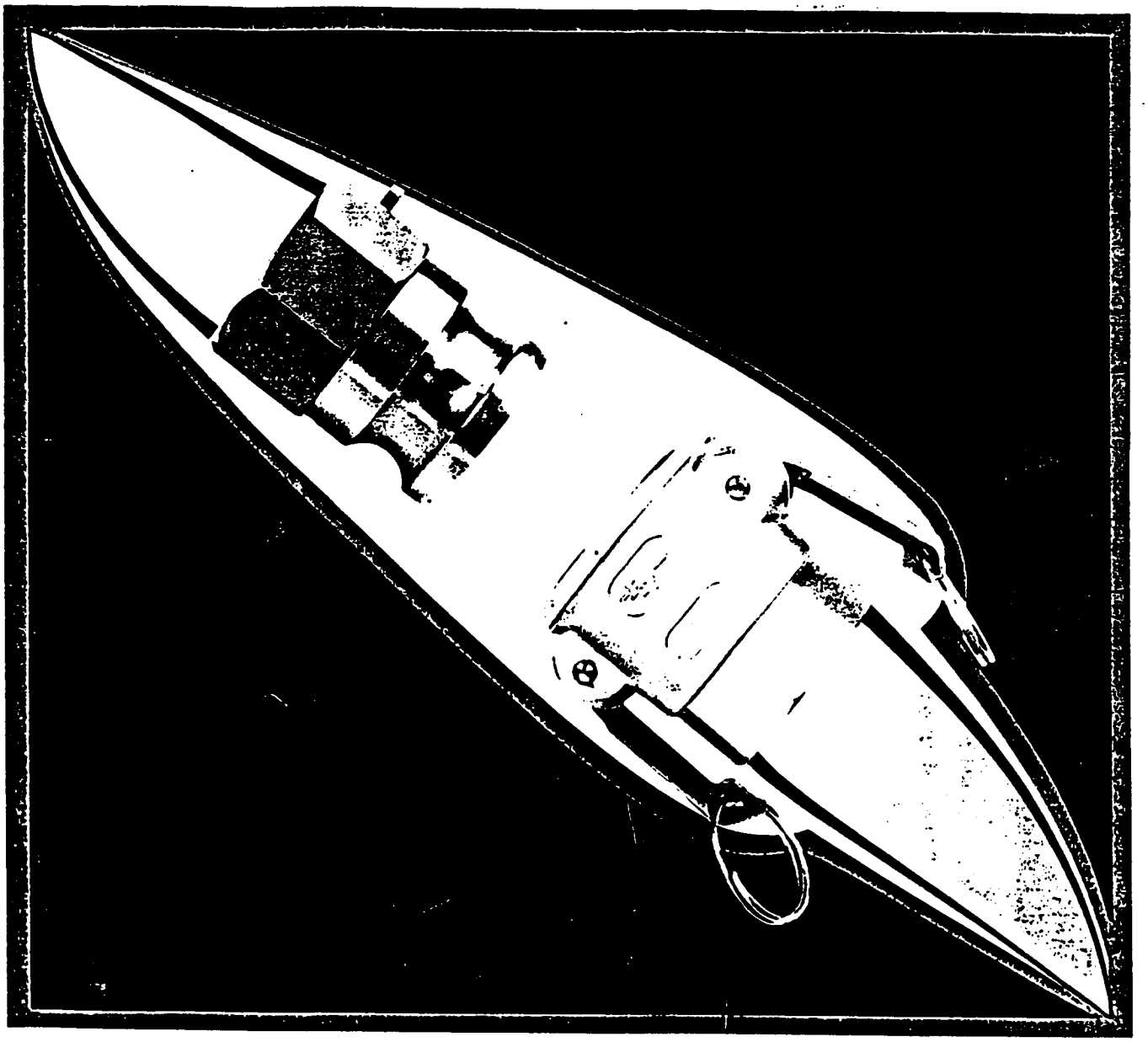
Dust Cap

Model: 15V

Size: 1 1/2"

Body: Polypropylene

Supplying Vendor: Irrigation Supply Company, Inc.
926 Baxter Avenue
Louisville, Kentucky 40204
(502) 583-6591



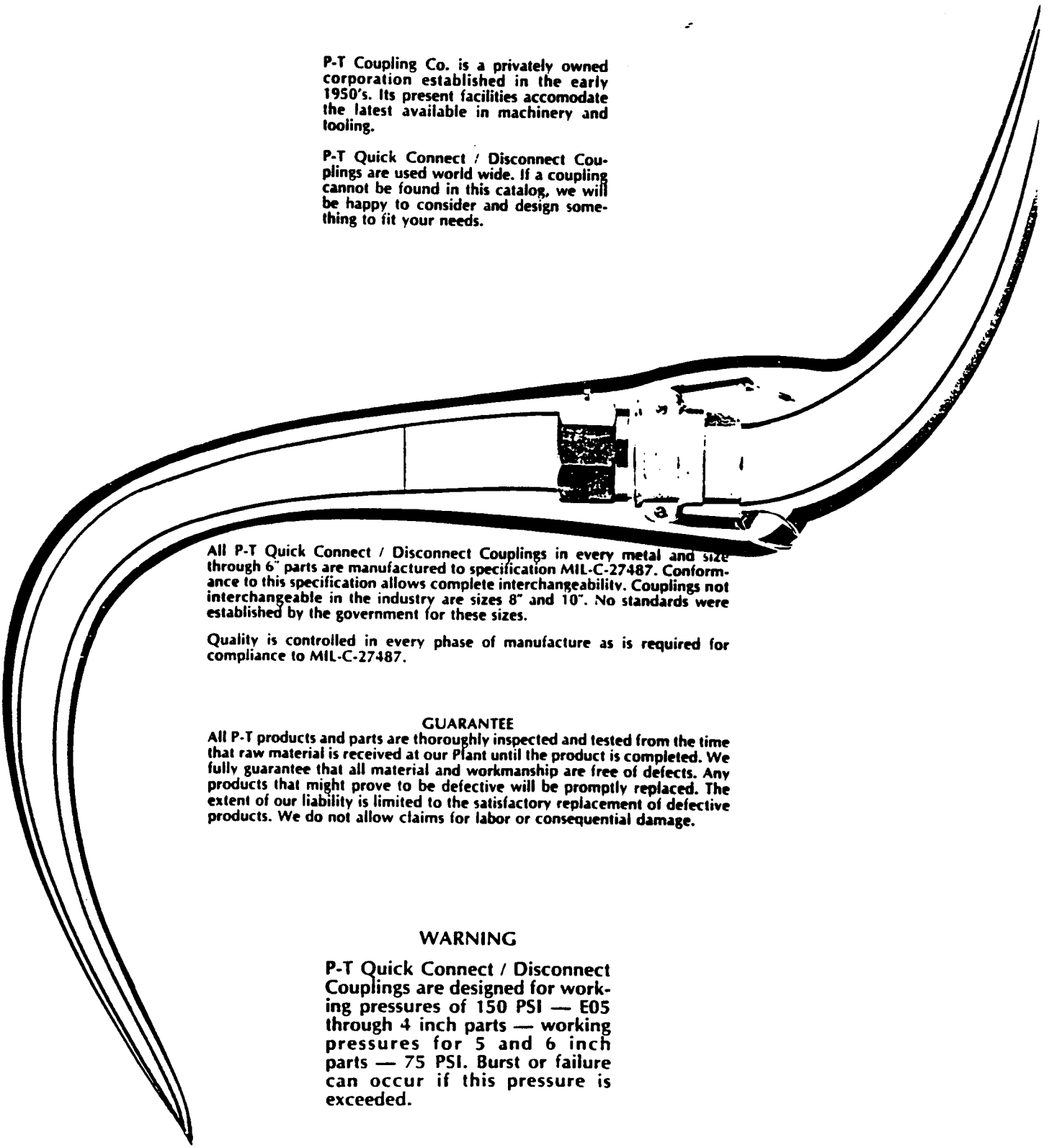
COUPLING COMPANY
P.O. BOX 3909
ENID, OKLAHOMA 73702

QUICK CONNECT / DISCONNECT COUPLING PRODUCTS

PHONE 405 237-4060 FAX 405 237 3435 TELEX 910 835 3521

P-T Coupling Co. is a privately owned corporation established in the early 1950's. Its present facilities accomodate the latest available in machinery and tooling.

P-T Quick Connect / Disconnect Couplings are used world wide. If a coupling cannot be found in this catalog, we will be happy to consider and design something to fit your needs.



All P-T Quick Connect / Disconnect Couplings in every metal and size through 6" parts are manufactured to specification MIL-C-27487. Conformance to this specification allows complete interchangeability. Couplings not interchangeable in the industry are sizes 8" and 10". No standards were established by the government for these sizes.

Quality is controlled in every phase of manufacture as is required for compliance to MIL-C-27487.

GUARANTEE

All P-T products and parts are thoroughly inspected and tested from the time that raw material is received at our Plant until the product is completed. We fully guarantee that all material and workmanship are free of defects. Any products that might prove to be defective will be promptly replaced. The extent of our liability is limited to the satisfactory replacement of defective products. We do not allow claims for labor or consequential damage.

WARNING

P-T Quick Connect / Disconnect Couplings are designed for working pressures of 150 PSI — E05 through 4 inch parts — working pressures for 5 and 6 inch parts — 75 PSI. Burst or failure can occur if this pressure is exceeded.

HOW TO ORDER

For prompt, efficient processing of your order, PLEASE follow this procedure:

1. Specify Quantity
2. Specify the P-T Part Number
3. Specify Size
4. Specify Material

For example: To order ten 3" type D Coupler made of aluminum show 10 . . . 30D Aluminum

All bronze, aluminum, and iron couplings are furnished with bronze cams and buna gaskets as standard. All stainless steel couplings are furnished with stainless cams and buna gaskets as standard. Any variation must be specified.

SHIPPING TERMS AND CONDITIONS

All orders are solicited and accepted with the understanding that the purchaser agrees to the following terms and conditions:

1. Orders are subject to approval and acceptance by P-T Coupling Co., Inc. at its home office in Enid, Oklahoma.
2. We attempt to ship all orders as promptly and efficiently as possible, however, orders are accepted with the express understanding that P-T Coupling Co. will not be liable for any losses or damages resulting from any delays in shipment or delivery due to any cause whatsoever.
3. Orders are subject to all government regulations, present and future.
4. Prices and design of products are subject to change without notice. Billings will be made at prices in effect at time of shipment.
5. Shortage of shipments must be reported within 10 days after receipt of goods.
6. For freight terms — see current price list.

RETURN OF GOODS TO P-T COUPLING CO.

If for any reason, you desire to return goods to P-T, please write to the Customer Service Department, P-T Coupling Co., Inc. for prior authorization.

Products being returned for credits must be new and in resalable condition. Minimum handling charge is 15% deductible from price now in effect or purchase price, which ever is lower. This handling charge is necessary because of our practice of individually inspecting and testing every item returned and to cover the usual costs of handling returned goods.

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P-T Coupling Company P.O. Box 3909
Enid, Oklahoma 73702 Phone 405 237-4060
FAX 405-237-3435

BRANCH WAREHOUSES

North West
Bob Matzke
6465 5th Place South
Seattle, Washington 98108
Phone: (206) 767-5421

West Coast
Circle S Sales Company
Ollie Scott
530 Van Ness St.
Fresno, California 93721
P.O. Box 362 (93708)
Phone: (209) 264-4568

L.A. Warehouse
Mark C. Smith
15735 Garfield, Unit 38
Paramount, California 90723
Phone: (213) 531-7280

North Central
Dick Payne
3770 Podlin Drive
Franklin Park, Illinois 60131
Phone: (312) 595-0350

South Central
Jim Hendricks
3137 St. Louis St.
Ft. Worth, Texas 76110
Phone: Texas 800-722-2791
Outside Texas 800-433-2926

Mountain Central
Jim Katchen
2290 Dayton
Aurora, Colorado 80010
Phone: (303) 364-2612

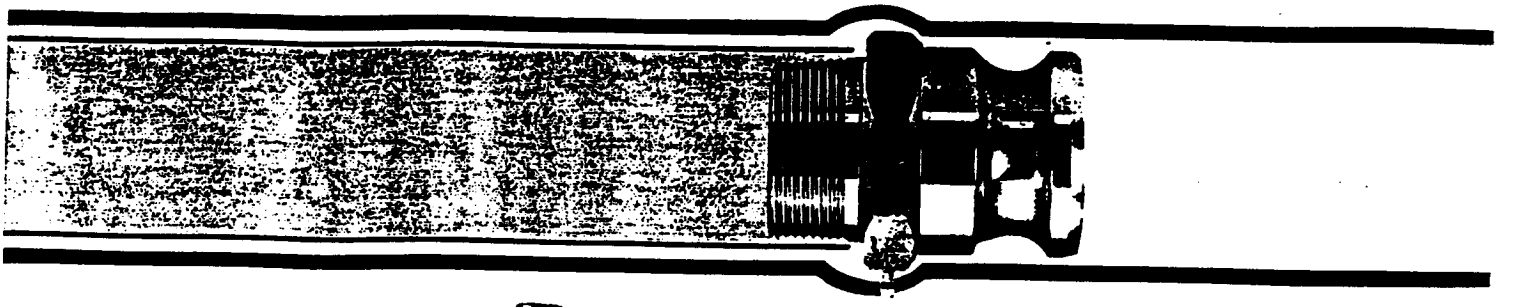
East Central
George Hale
Bellbrook Business Park, Building 6A
306 Fleetbrook Drive
Memphis, Tennessee 38116
Phone: (901) 332-4919

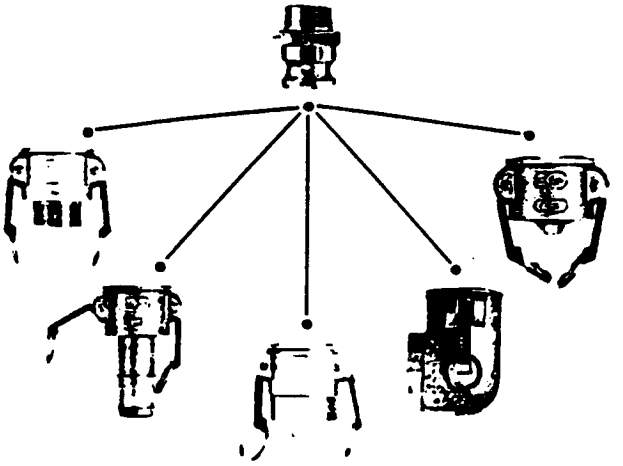
North East
Honohan Sales Company
Bob Honohan
195D Central Ave.
Farmingdale, New York 11735
Phone: (516) 293-1090/1091/1092

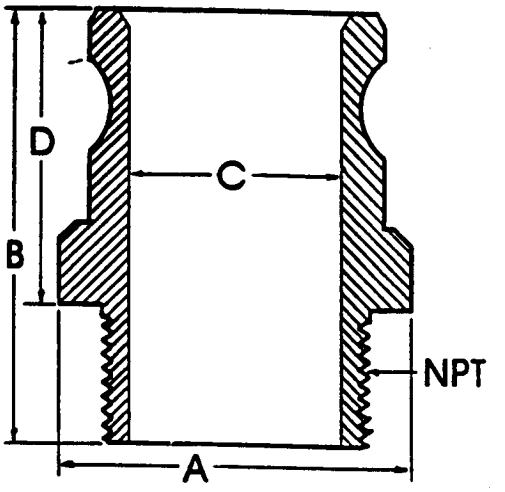
Mid-Atlantic
Gary Rooth
Route 1, Box 7
Youngsville, North Carolina 27596
Phone: (919) 556-6016

South East
Craig Rooth
2457 Mountain Industrial Blvd.
Tucker, Georgia 30085
Phone: (404) 496-0378

International Sales
Robert Marr & Son Inc.
501 5th Ave., Room 1801
New York, New York 10017
Phone: (212) 752-4770
TELEX 236683







F ADAPTER THREAD MALE NPT

DIMENSIONS approximate in inches

PART NO.	E-05-F	½F	¾F	10F	12F	15F	20F	25F	30F	40F	50F	60F	80F	100F
ADAPTER SIZE	½	⅜	¾	1	1¼	1½	2	2½	3	4	5	6	8	10
size of thread	½	½	¾	1	1¼	1½	2	2½	3	4	5	6	8	10
A MAX O.D.	1⅜	1⅜	1⅜	1⅝	2	2 5/16	2 11/16	3⅛	3¾	4⅞	4⅞	7¾	9¾	11⅛
B overall length	2 3/16	2 3/16	2 3/16	2¾	2 15/16	3 1/16	3⅜	4	4⅛	4 11/16	4⅞	5	6⅜	6¾
C MIN I.D.	13/16	13/16	13/16	1	1⅛	1 7/16	1 13/16	2¼	2⅞	3⅞	4 13/16	5⅞	7⅞	9¼
D exposed length	9/16	¼	9/16	11/16	¾	¾	¾	1⅛	1⅛	1 5/16	1 7/16	3⅜	2⅝	1½

GENERAL AVAILABILITY OF MATERIALS AND STOCKED ITEMS

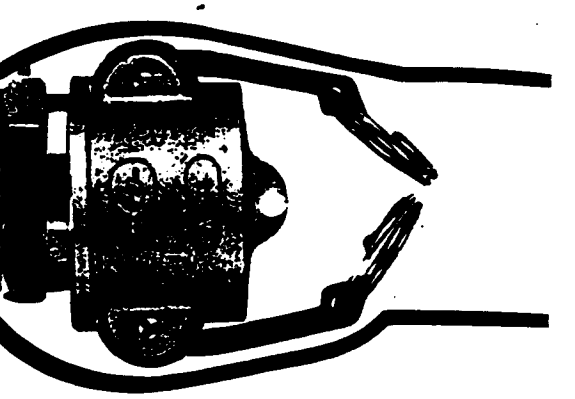
SHIPPING WEIGHTS approximate in pounds, hundreds of pounds

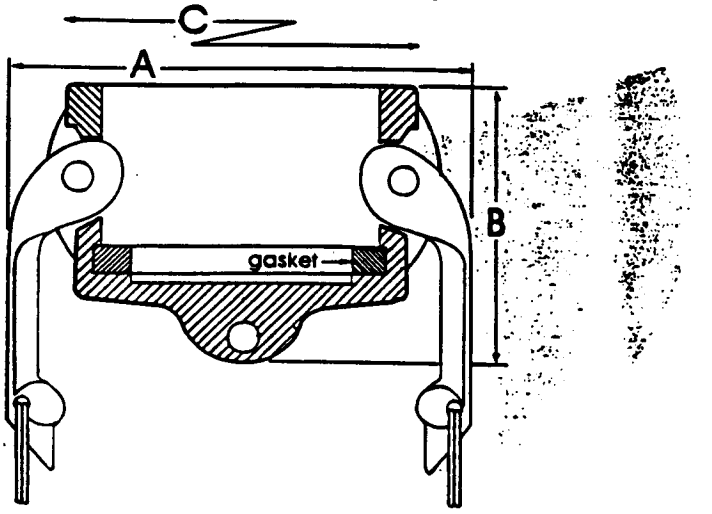
PART NO.	E-05-F	½F	¾F	10F	12F	15F	20F	25F	30F	40F	50F	60F	80F	100F
ALUMINUM	.06	.12	.12	.22	.44	.50	.53	.81	1.37	2.28	2.72	4.31	6.75	13.87
BRONZE	.19	.41	.44	.62	1.44	1.59	1.78	2.62	4.75	7.25	8.44	13.02	18.83	
Hd. Ct. ALUM	.06	.12	.12	.22	.44	.50	.53	.81	1.37	2.28	2.72	4.31		
STAINLESS STEEL	.19	.44	.31	.69	1.06	1.28	1.75	3.25	4.50	7.0	10.56	14.06		
SEMI-STEEL	.19	.31	.31	.69	1.19	1.31	1.37	2.06	4.0	5.87	6.87	11.94		
DUCTILE	.19	.31	.31	.69	1.19	1.31	1.37	2.06	4.0	5.87	6.87	11.94		
CARBON STEEL			.38	.53	1.25	1.38	1.54	2.27	4.12	6.29				
POLYPROPYLENE			.06	.12	.16	.19	.22							
NYLON						.22	.34							

☎ item by request only

generally stocked item

BASIC STANDARD PARTS





V DUST CAP

DIMENSIONS approximate inches

PART NO.	E-05-V	¾V	10V	12V	15V	20V	25V	30V	40V	50V	60V	80V	100V
CAP SIZE	½	¼	1	1¼	1½	2	2½	3	4	5	6	8	10
A MAX O.D.	1 9/16	2⅛	2⅜	3¼	3½	3⅞	4¼	5⅜	6 7/16	7½	10⅛	12⅛	15⅝
B overall length	1⅞	1⅞	2¼	2 9/16	2⅜	2⅞	2 15/16	3	3 1/16	3⅛	3⅛	3½	4⅝
C cam arms open position	2¾	4½	5⅛	7 9/16	7 13/16	8 3/16	8¾	9 15/16	11 1/16	12⅛	16⅞	18½	23½

GENERAL AVAILABILITY OF MATERIALS AND STOCKED ITEMS

SHIPPING WEIGHTS approximate in pounds, hundreds of pounds

PART NO.	E-05-V	¾V	10V	12V	15V	20V	25V	30V	40V	50V	60V	80V	100V
ALUMINUM	.12	.28	.44	.65	.81	.94	1.19	1.78	2.50	3.19	5.19	6.62	19.34
BRONZE	.34	.56	1.0	1.59	1.91	2.31	3.34	4.37	7.31	9.12	13.19	19.31	
Hd. Ct. ALUM	.12	.28	.44	.65	.81	.94	1.19	1.78	2.50	3.19	5.19	☎	
STAINLESS STEEL	.31	.53	.78	1.3	1.50	2.06	2.84	3.75	5.31	7.61	12.19	15.0	
SEMI-STEEL	.28	.56	.91	1.37	1.75	2.09	3.0	3.81	6.12	8.0	12.0		
DUCTILE	.28	.56	.91	1.37	1.75	2.09	3.0	3.81	6.12	8.0	12.0		
CARBON STEEL		.36	.86	1.38	1.65	2.0	2.89	3.79	6.34				
POLYPROPYLENE					.56	.62							
NYLON					.62	.69							

☎ item by request only

generally stocked item

GRADED BENTONITE SPECIFICATIONS

Manufacturer:	Baroid Industrial Drilling Products P. O. Box 1675 Houston, Texas 77251 (713) 987-4547
Grade:	3/8" Holeplug
Package:	50 pound bags

OR

Grade:	Benseal
Package:	50 pound bags
Supplier:	Gilbert Pump & Mechanical, Inc P.O. Box 955 Shalimar, Florida 32579 (904) 864-4000

HOLEPLUG®

Graded Bentonite

Baroid's HOLEPLUG® size-graded bentonite is a naturally-occurring clay which is used to seal and plug earthen boreholes. HOLEPLUG is mined from specially-selected ore bodies which exhibit a high swell capability, but at a slower rate than drilling mud grade bentonite. HOLEPLUG will fall through a column of water standing in the hole and reach the bottom of the hole with minimum hydration or water swelling. Complete fill of the annular space can be achieved, and bridging of the particles in the upper hole is minimized. Complete fill of the annular space is necessary to form an effective, long-term plug in compliance with environmental regulatory requirements.

HOLEPLUG is available in two particle size grades:

- HOLEPLUG 3/4" (100% of particles pass through 3/4" screen; all particles retained on 3/8" screen)
- HOLEPLUG 3/8" (100% of particles pass through 3/8" screen; all particles retained on 1/4" screen).

The size of the open annular space will determine which size should be used. When the annular space is 3/4" or more, HOLEPLUG 3/8" should be used. When the annular space is 1-1/2" or more, HOLEPLUG 3/4" should be used.

Major Advantages:

- Prevents entry of surface water into boreholes
- Prevents vertical movement of fluids in the hole between porous zones
- Forms a permanent, flexible downhole seal
- Facilitates pipe recovery
- Allows hole reentry
- Superior alternative to pelletized bentonite due to easier application
- Simple to apply and no mixing expense
- Weatherproof, easy-to-open packaging
- More cost-effective compared to pelletized bentonite

Recommended Uses:

- Highly recommended for environmental monitoring well applications
- Sealing outside casing annulus
- Sealing above gravel packs
- Plugging decommissioned bore holes
- Sealing around conductor pipe
- Sealing lost circulation zones
- Shutting off artesian wells

NOTE
This product has been certified by the National Sanitation Foundation (NSF) to contribute no adverse health problems to ground water when used as the manufacturer recommends for the construction of potable water wells.

Recommended Application Procedures:

Plugging and Stemming Drill Holes

Due to bag shipping, handling and possible slight dehydration, a small amount of fine bentonite particles may be present. For optimum results, HOLEPLUG should be poured over a mesh or screen with 1/4" openings to "sift out" the smaller particles. The screen should be large enough (approx. 1 sq. yd.) to be folded into a "V" shape to allow sifting while the product is being poured into the hole. Also, HOLEPLUG should be poured *slowly* (allow approximately two minutes to pour a 50 lb bag).

1. Open top of HOLEPLUG bag.
2. Hold the screen with one end slightly higher. The lower end should be placed over the bore hole.
3. Slowly pour HOLEPLUG diagonally down the "V" so that any fine particulate falls through the screen before the larger particles fall into the bore hole.
4. Fill hole as required (above static water level or to ground level).
5. Observe all regulatory specifications.

Stopping Loss of Circulation and Stabilizing Unconsolidated Formations

1. Pull drill pipe out of hole.
2. Pour HOLEPLUG graded bentonite into hole to fill above problem zone.
3. Drill ahead slowly with reduced pump pressure.

Plugging Artesian Water Flows

1. Pour HOLEPLUG graded bentonite into hole until water flow subsides or hole is filled to surface.
2. In case of severe flows, add BAROID® barite weighting material along with HOLEPLUG.

Amounts of HOLEPLUG Required for Plugging Applications

Hole Diameter (inches)	Hole Volume (cu. ft/ft)	Pounds HOLEPLUG Needed To Fill One Foot	Feet Filled By One Bag HOLEPLUG	Bags HOLEPLUG Needed To Fill 100 ft
2	0.022	1.6	31.3	3.2
2-1/2	0.034	2.5	20.0	5.0
3	0.049	3.5	14.3	7.0
3-1/2	0.067	4.8	10.4	9.6
4	0.087	6.3	7.9	12.6
4-1/2	0.110	7.9	6.3	15.8
5	0.136	9.8	5.1	19.6
5-1/2	0.165	11.9	4.2	23.8
6	0.196	14.1	3.5	28.2
6-1/2	0.230	16.6	3.0	33.2
7	0.267	19.2	2.6	38.4
7-1/2	0.307	22.1	2.3	44.2
8	0.349	25.1	2.0	50.2
8-1/2	0.394	28.4	1.8	56.8
9	0.442	31.8	1.6	63.6
9-1/2	0.492	35.4	1.4	70.8
10	0.545	39.2	1.3	78.4
11	0.660	47.5	1.1	95.0
12	0.785	56.5	0.89	113.0
15	1.227	88.3	0.57	176.6
18	1.767	127.2	0.39	254.4
20	2.182	157.1	0.32	314.2
25	3.409	245.4	0.20	490.8
30	4.909	353.4	0.14	706.8

Physical Characteristics:

Bulk Density, uncompacted	
HOLEPLUG 3/4"	71.8 lb/ft³
→ HOLEPLUG 3/8"	68.8 lb/ft³
Moisture	17%
Permeability of resulting plug	$K = 1.5 \times 10^{-9}$ cm/sec.
Appearance	beige to tan powder
Specific Gravity	2.5 to 2.6

Mineralogical Analysis (x-ray diffraction) – (typical Wyoming bentonite)

85%	Montmorillonite
5%	Quartz
5%	Feldspars
2%	Cristobalite
2%	Illite
1%	Calcium and Gypsum

Chemical Analysis (typical)

SiO_2	55.44%
Al_2O_3	20.14%
Fe_2O_3	3.67%
CaO	0.49%
MgO	2.49%
Na_2O	2.76%
K_2O	0.60%
Bound water	5.50%
Moisture (@ 220°F)	8.00%
TOTAL	99.09%

Environmental Information:

HOLEPLUG graded bentonite is a natural, unaltered mineral with no added chemicals or contaminants. HOLEPLUG does not spoil or ferment.

HOLEPLUG graded bentonite is environmentally safe and complies with the EPA's protocol for TCLP (toxicity characterization leaching procedure). Lab report available on request.

HOLEPLUG graded bentonite is non-toxic (96-hour LC_{50} on *Mysidopsis bahia* is greater than 100,000 ppm).

Packaging:

HOLEPLUG graded bentonite is packaged in multiwall paper bags containing 50 pounds (22.7 kg).

Availability:

HOLEPLUG may be purchased through Baroid Service Centers or from QUIK-GEL® Distributors.

Because the conditions of use of this product are beyond seller's control, the product is sold without warranty either express or implied and upon condition that purchaser make its own tests to determine the suitability for purchaser's application. Purchaser assumes all risk of use and handling of this product. This product will be replaced if defective in manufacture or packaging or if damaged. Except for such replacement, seller is not liable for any damages caused by this product or its use. The statements and recommendations made herein are believed to be accurate. No guarantee of their accuracy is made, however.

Baroid Drilling Fluids, Inc.
P.O. Box 1675
Houston, Texas 77251
Customer Service: (713) 987-4547

Baroid Drilling Fluids, Inc.
410 17th St., Suite 1870
Denver, Colorado 80202
(303) 825-5712

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Rev. 9/92 IDP-006
Printed in U.S.A.

BENSEAL®

Sealing and Plugging Agent

BENSEAL® is a specially-processed, uniform-sized coarse ground, non-drilling mud grade bentonite for use in sealing and grouting well casings and earthen structures. BENSEAL provides superior sealing qualities for the following applications:

- Sealing and grouting plastic or steel casings
- Sealing engineering test study holes
- Plugging to abandon earthen bore holes
- Sealing conductor pipe in and around mud tanks.

BENSEAL is highly recommended for use in environmental monitoring well construction.

Major Advantages:

- Convenient, single sack product. BENSEAL is safe and easy to use.
- Stable in storage
- Yields slowly for maximum solids without excessive thickening
- Pumps easily with minimum pump pressure
- Eliminates problems caused by premature setting up
- Reduces formation fracturing which could cause sealing loss because BENSEAL is lighter than cement
- Does not generate heat during hydration
- Prevents commingling of aquifers and contamination from surface sources
- Protects casing from corrosive waters
- Simplifies hole reentry
- Compatible with BAROID® weighting material. Density may be increased to control artesian conditions or other subsurface overpressures.

NOTE
This product has been certified by the National Sanitation Foundation (NSF) to contribute no adverse health problems to ground water when used as the manufacturer recommends for the construction of potable water wells.

Recommended Treatment Procedures:

BENSEAL forms an excellent seal when properly applied. For effective sealing, the maximum number of swelling particles is required; this is the opposite of what is desired in a drilling fluid. BENSEAL performs most efficiently in fresh water.

As A Casing Seal in Cable Tool Drilling

1) Dig a cone-shaped depression around the casing (diameter 1 ft, depth 1 ft).
2) Keep cone-shaped depression filled with dry BENSEAL as the casing is being driven.
3) *Example*: When drilling and driving a 4" pipe, use approximately 2½ pounds per foot of hole.

Lost Returns

1) Begin with the pit full of mud or water.
2) Raise pump suction off bottom and place a shovel next to it and slightly under suction.
3) *Slowly pour* dry BENSEAL into space between shovel and suction, and pump it down the hole.

BENSEAL/Sand Mixture — Grouting and Pumping

Combine BENSEAL and sand, mix well, dry, in a ratio of 1:2, to develop permeabilities of $K = 1 \times 10^{-6}$ cm/sec.

This mixture can be poured from top into holes not over 100 feet deep and through 50 feet or less of water standing in the hole.

BENSEAL/sand is often used to set shallow casing, heat-pumps, etc.

Permeability test data is available on request.

Sealing Earthen Structures

Work BENSEAL into the soil, covering completely the area which will be under water. Normal treatment is between 1 and 2 pounds per square foot depending on the condition of the soil. To treat a water-filled structure, broadcast BENSEAL evenly over the entire area, in above amounts.

Physical Characteristics:

Appearance		beige to tan powder
Dry Screen Analysis	% on 8-mesh	1
	% on 20-mesh	85
	% thru 200-mesh	3
Bulk Density, uncompacted		71.7 lb/ft³
Bulk Density, compacted		73.4 lb/ft³
Moisture		10%
Specific Gravity		2.5 to 2.6

Mineralogical Analysis (x-ray diffraction) – (typical Wyoming bentonite)

85%	Montmorillonite
5%	Quartz
5%	Feldspars
2%	Cristobalite
2%	Illite
1%	Calcium and Gypsum

Chemical Analysis (typical)

SiO_2	55.44%
Al_2O_3	20.14%
Fe_2O_3	3.67%
CaO	0.49%
MgO	2.49%
Na_2O	2.76%
K_2O	0.60%
Bound water	5.50%
Moisture (@ 220°F)	8.00%
TOTAL	99.09%

Environmental Information:

Toxic Substances Control Act:

Listed by components in Initial Inventory, July 1979.

Toxicity Data:

LC_{50} - 96 HR (Rainbow trout)
10,000 ppm
LC_{50} - 96 HR (*Mysidopsis bahia*)
>1,000,000 ppm SPP (suspended particulate phase)

BENSEAL® is not a hazardous waste or a hazardous material as defined in EPA criteria and listing 40 CFR Part 261, or DOT criteria and listing 49 CFR Part 172.

Packaging:

BENSEAL is packaged in multi-walled, water resistant paper bags containing 50 pounds (22.7 kg).

Availability:

BENSEAL may be purchased through Baroid Service Centers or QUIK-GEL® Distributors.

Because the conditions of use of this product are beyond seller's control, the product is sold without warranty either express or implied and upon condition that purchaser make its own tests to determine the suitability for purchaser's application. Purchaser assumes all risk of use and handling of this product. This product will be replaced if defective in manufacture or packaging or if damaged. Except for such replacement, seller is not liable for any damages caused by this product or its use. The statements and recommendations made herein are believed to be accurate. No guarantee of their accuracy is made, however.

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Rev. 9/92 IDP-005
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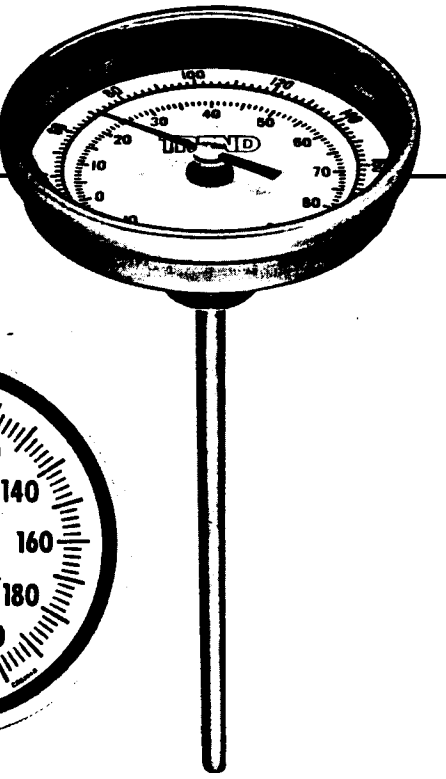
THERMOMETER SPECIFICATIONS

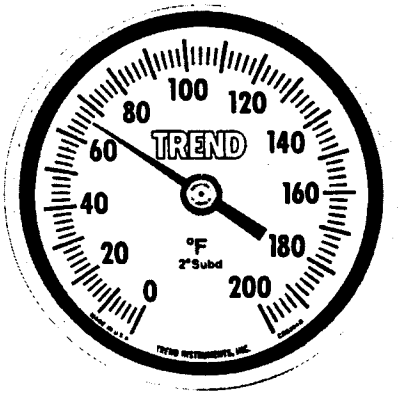
Manufacturer:	Trend Instruments, Inc. 887 South Matack Street P. O. Box 2047 West Chester, PA 19380 (215) 431-2000
Model:	Bi-thermal Thermometer Model 33
Stem/Connection:	1/4" diameter with standard lengths to 24" Standard 1/2" NPT connection
Supplier:	Irrigation Supply Company, Inc. 926 Baxter Avenue P. O. Box 4545 Louisville, Kentucky 40204 (502) 584-9713

3" INDUSTRIAL Thermometer

Bi-Metal Thermometer Model 33

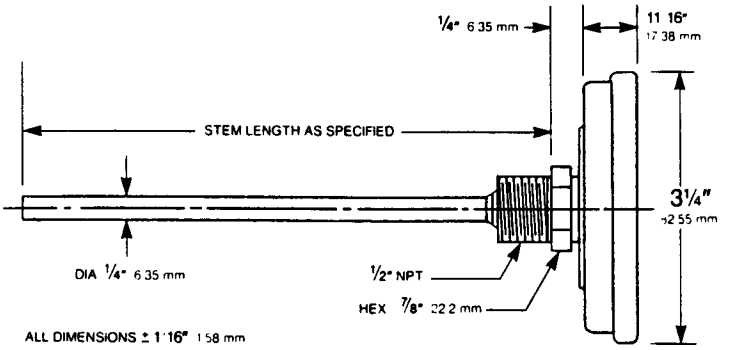


This high quality, low cost thermometer is designed for applications where a weather resistant, tamper proof case is required.



Specifications

Case: One Piece case/bezel design in corrosion resistant 304 stainless steel.
Dial: White matte finish with black markings. Dished form with Celsius on lower plane and Fahrenheit on raised plane. Also available with single scale on anti-parallax dial.
Crystal: Heavy duty clear glass, gasketed and sealed to insure weather tight integrity.
Stem/Connection: Type 304 stainless steel, ¼ inch/6.35 millimeter diameter with standard lengths to 24 inches/609 millimeter. ½ inch NPT connection is standard.
Bi-metal Element: An extremely responsive temperature sensing helix which has been carefully sized and tested, heat treated and aged to relieve inherent stresses and insure continued accuracy.
Accuracy: One percent mid-scale is standard.
Options: Special ranges, dial layouts, accuracies, stems, connections and windows.



How to Order

The catalog number indicates dial size, stem length and angle form. For standard stem diameter and connection pipe size, refer to the outline drawing. Please specify the catalog number and range required in your purchase order.

Catalog Numbers — MODEL 33

Stem Length Inches	Stem Length Millimeters	
2½	63.5	33025
4	101.6	33040
6	152.4	33060
9	228.6	33090
12	304.8	33120
15	381.0	33150
18	457.2	33180
24	609.6	33240

Standard Ranges — Dual Scale

Fahrenheit (outer scale) Range	Fig. Interval	Div.	Celsius (inner scale) Range	Fig. Interval	Div.
−100 to 100°	20°	2°	−70 to 40°	10°	1°
− 40 to 120°	20°	2°	−40 to 50°	10°	1°
**25 to 125°	10°	1°	− 5 to 50°	5°	2°
0 to 200°	20°	2°	−15 to 90°	10°	1°
0 to 250°	20°	2°	−20 to 120°	10°	1°
20 to 240°	20°	2°	− 5 to 115°	10°	1°
50 to 300°	20°	2°	10 to 150°	10°	1°
50 to 400°	50°	5°	10 to 200°	20°	2°
50 to 500°	50°	5°	10 to 260°	20°	2°
150 to 750°	100°	10°	65 to 400°	50°	5°
*200 to 1000°	100°	10°	*100 to 540°	50°	5°

*Not recommended for continuous use over 800°F or 425° C.
**Not available with 2.5"/63.5mm stem.

TREND instruments, inc.
887 South Matlack Street • Post Office Box 2047 • West Chester, PA 19380 • Phone: 215-431-2000 • Telex: 821612

DISTRIBUTED BY:

Model # 33020A205G2 has a non-standard 2" stem length and the optional 1/4" NPT connection. Range code 205 is 0/200F only.

TRENCH WARNING RIBBON SPECIFICATIONS

Manufacturer:	Ribbon purchased locally from various Manufactures and Vendors. Typical Supplier is: Reef Industries, Inc. P.O. Box 750245 Houston, Texas 77275-0245 (713) 484-6892
Type:	Terra Tape Standard 250 - 2 ml
Supplying Vendor:	Irrigation Supply Company, Inc. 926 Baxter Avenue P.O. Box 4545 Louisville, Kentucky 40204 (502) 583-6591

REEF INDUSTRIES, INC.
TERRA TAPE PRODUCTS
P.O. Box 750245
Houston, Texas 77275-0245

PHONE 1-800-231-2417
PHONE (713) 484-6892
FAX (713) 947-2053
TELEX 077-5154

BUYER BEWARE

Statement of Lesser Quality Standard Detectable Tapes

With the increased use of plastic pipe, detectable marking tapes are becoming a common specification. When demand increases so does supply.

Unfortunately, the new companies entering the market have not done sufficient research on the proper engineering of a detectable tape to ensure the tapes integrity for the life of the plastic pipe.

There are three areas a specifier should be aware of when selecting the proper detectable tape for a project.

I. Thickness of foil - the foil core is what makes the tape locatable. A minimum of .0005 inches or (.5 mils) is needed to achieve dependable locatability.

II. Tensile strength of tape - the tensile strength is what allows a person to backfill over the tape without breakage. Once a tape is broken you cannot trace it conductively to chart the path of the line. A minimum of 135 lbs. per 3" width is required for effective installation.

III. Lamination bond - All detectable tapes are composites of plastic and foil. This composite is achieved through a lamination bond of foil to a layer of plastic on either side. It is crucial that this bond stay intact during the life of the buried plastic line it is protecting. If delamination occurs after only a few years of burial, the corrosive elements in the soil will attack the foil and seriously impair the locatability of the tape.

REEF INDUSTRIES, INC.
TERRA TAPE PRODUCTS
P.O. Box 750245
Houston, Texas 77275-0245

PHONE 1-800-231-2417
PHONE (713) 484-6892
FAX (713) 947-2053
TELEX 077-5154

TERRA TAPE® SPECIFICATION SHEET

Now you have a choice. Twenty plus years have gone into the development of our Terra Tape® products.

Below is a description of our different Terra Tape® products that can be transcribed into your specification package. This will ensure that the tape you direct bury will still be working after many years.

1. Terra Tape® Standard 250: Standard marking tape shall consist of a 2 mil,4 mil or 6 mil inert plastic film specifically formulated for prolonged use underground. It shall be resistant to alkalis, acids, and other destructive agents commonly found in the soil. 2 mil tape shall have a minimum tensile strength of 10 lbs. per 3" wide strip and a minimum elongation of 300%. 4 mil tape shall have a minimum tensile strength of 30 lbs. per 3" wide strip and a minimum elongation of 400%. 6 mil tape shall have a minimum tensile strength of 38 lbs. per 3" strip and a minimum elongation of 600%. Tape shall bear a continuous printed message normally repeated every 16 to 36 inches warning of the installation buried below.

2. Terra Tape® Extra Stretch™ 540: Extra Stretch™ 540 marking tape shall consist of 6 ply copolymer film bonded together without the use of adhesives, specifically formulated for prolonged use underground. It shall be resistant to alkalis, acids, and other destructive agents commonly found in the soil. Extra Stretch™ 540 tape shall have a minimum thickness of 6 mils, minimum tensile strength of 80 lbs. per 3" width strip, and a minimum elongation of 800%. Tape shall bear a continuous printed message normally repeated every 16 to 36 inches warning of the installation buried below.

3. Terra Tape® Sentryline™ Detectable:

A. Terra Tape® Sentryline™ Detectable 620 marking tape shall consist of one layer of aluminum foil laminated between two layers of inert plastic film. It shall be resistant to alkalis, acids, and other destructive agents commonly found in the soil.The lamination bond should be strong enough that the layers cannot be seperated by hand. Tape shall be a minimum of 4.5 mils thick with a minimum tensile strength of 60 lbs. in the machine direction and 58 lbs. in the transverse direction per 3" wide strip. Tape shall be imprinted with a continuous warning message normally repeated every 16 to 36 inches. It shall be inductively locatable and conductively traceable using a standard pipe and cable locating device.

B. Terra Tape® Sentryline™ Detectable 1350 marking tape shall consist of one layer of aluminun foil laminated between two layers of inert plastic film with a scrim reinforcement. It shall be resistant to alkalis, acids, and other destructive agents commonly found in the soil. The lamination bond should be strong enough that the layers cannot be separated by hand. Tape shall be a mininum of 9 mils thick with a minimum tensile strength of 125 lbs. in the machine direction and 125 lbs. in the transverse direction per 3" wide strip. Tape shall be imprinted with a continuous warning message normally repeated every 16 to 36 inches. It shall be inductively locatable and conductively traceable using a standard pipe and cable locating device.

BLOWER/FLARE SKID ASSEMBLY

LFG SPECIALTIES, INC. UTILITY FLARE SYSTEM

Enclosed are the Indexes and Equipment Descriptions (Section I) of the Operation and Maintenance Manual for Utility Flare System, dated September 1996. O&M Manuals in their entirety are included as an attachment to this document.

LFG SPECIALTIES, INC.

LFG SPECIALTIES, INC.

SERIAL NO. 1365

LANDFILL GAS UTILITY FLARE SYSTEM

OPERATION & MAINTENANCE MANUAL

PIEDMONT RECYCLING & DISPOSAL FACILITY

PIEDMONT LANDFILL

KERNERSVILLE, NORTH CAROLINA

SEPTEMBER 1996

Main Office

Plant

705 Friendship Drive
P.O. Box 332
New Concord, Ohio 43762
614.826-7686 Fax: 614.826-4948

Printed on Recycled Paper

LFG SPECIALTIES, INC.

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- Flare Controller Flame-Trol I
- Control Rack
- Shipping / Installation
- Technical Data
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- Igniter Spark Plug
- Thermocouple Elements
- UV Falme Detector
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LFG SPECIALTIES, INC.

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- Gauges

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- Surge Protector
- Flame Detector Relay
- Temperature Controller
- Blower Ammeter
- Pilot, Igniter, and Down Time Timers
- Control Panel Lights and Switches
- Circuit Breakers
- Phase Converter
- Control Panel Heater
- Lighting Equipment

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LFG SPECIALTIES, INC.

PROPOSAL NO: 59602 DATE: 5/8/1996

LFG Specialties, Inc. is pleased to submit this proposal to furnish the following equipment in response to your RFP (request for proposal) of May 1, 1996.

Each 8 in. diameter x 23 ft. OAH utility "candle type" landfill gas flare system complete with Flame-Trol I automatic flare controller and associated peripheral equipment as described:

This flare is sized for the following conditions:

Flows

Maximum	1100	SCFM
Minimum	110	SCFM

LFG (landfill gas)

Methane content	40-60	%
Supply temperature	100	°F
Supply pressure	1 - 8	in. W.C.

The flare will be LFG Specialties, Model CF820I8 and include the following standard equipment:

FLARE STACK

*** Constructed of 8 in. x 12 ft. of standard schedule 40 pipe

*** Self supporting base plate with support gussets, welded to the skid assembly

*** 8 in. 150# flanged LFG inlet connection

*** 2 in. NPT drain port with plug at base of stack

COMBUSTOR ASSEMBLY

*** 8 in. x 5 ft. 304 stainless steel burner tip flange connected to stack

*** Flame retainer, 304 stainless steel ribbing system in burner tip to produce optimum swirl, obtaining high efficiency mixing and holding the flame at the flare tip.

*** 22 in. x 4 ft. 304 stainless steel windshield to retain flame at the flare tip and provide retention time for efficient combustion

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*** 3 each 3 in. lifting eyes, 120° apart, cut into windshield support ribs at tip of stack for ease of installation

IGNITOR ASSEMBLY

*** 2 in. diameter 304 stainless steel pilot tip with integral spark plug connection/housing

*** Spark plug ignitor, eliminates gap problems often incurred with straight rod type ignitors

*** 110/5,000V single pole transformer mounted in NEMA 4 enclosure

*** High temperature ignitor leads in ½ in. conduit

*** Pilot nozzle in ½ in. stainless steel pipe

*** Chromel-Alumel (type k) thermocouple in stainless steel thermal well to give pilot confirmation

*** Ultraviolet flame scanner to give flame confirmation and provide flare safety shutdown

PERIPHERAL EQUIPMENT - INCLUDED WITH UTILITY FLARE

INLET GAS TEMPERATURE SENSOR

Landfill gas high temperature safety shutdown. A temperature probe located in the flare inlet gas header will monitor the gas temperature and initiate a safety shutdown in case of an above normal gas temperature. The system will close the main header valve and shutdown the blower in case of gas high temperature due to flashback or abnormal operating conditions

VARIABLE FLARE TIP

Variable tip with manual adjustment from 4" to 8" diameter. Variable tip will provide optimum combustion efficiency and adjustment of landfill gas velocity at varying flow rates and methane content

FLAME ARRESTER

1 each 8 in. Varec or equal all aluminum flame arrester with clean out cover to facilitate in place maintenance

AUTOMATIC HEADER VALVE

1 each 8 in. bubble-tight wafer type butterfly valve with ductile iron body, nitrile Seat materials and stainless steel stem and disk. Valve will be driven by a GH-Bettis or equal pneumatic actuator with a spring operated "fail safe" closing in case of a power failure.

GAS BLOWER

System will include 1 each Aerovent Model 25-6-HPB-3500-15 Series 14, arrangement #8 high pressure blower with full welds interior and exterior housing, Farboil-Backed Aeromatic epoxy coating on airstream parts, AMCA "B" spark resistant, housing drain, aluminum alloy wheel complete with drive shaft and teflon/viton shaft seal. Blower will be driven by a 15 Hp, 3 phase, 230/460 VAC, 60 hertz, 256T frame TEFC electric motor. Unit will provide a 1100 SCFM gas flow at 38" W.C. inlet vacuum and 10" W.C. discharge pressure

A 15 HP Ronk Type 2S Add-A-Phase power converter will be provided to drive the three phase blower motor using available 240V, single phase power supply.

FLOW METER

1 each T.I. or equal thermal flow probe meter with signal conditioner electric controller. The thermal flow meter provides a standard CFM reading without the need for separate compensating pressure or temperature tranceducers. The meter will have a 4 to 20mA linear output signal for the instantaneous gas flow with a digital display reading in SCFM. Flow meter controller will be installed in a NEMA 4 enclosure and mounted to the flare control rack

SKID ASSEMBLY

Mounting flare and blower with associated controls and piping to a 8 ft. x 24 ft. heavy-duty structural steel sub-base with non-skid floor plate welded over all open areas. The skid will constructed of I-beams and other materials sufficiently rigid to withstand all loading and hauling forces. All necessary bracing, mounting pads and piping supports are provided for proper equipment installation and alignment.

Package will include interconnecting piping and valves between

KOP, blower and flare:

*** Piping unless otherwise stated will be standard schedule 40 metal pipe with flanged connections for equipment and valving

*** Valves unless otherwise stated will be PVC butterfly type

*** Piping system to be fully supported employing base mountings and pipe stands

FLAME-TROL I
UTILITY FLARE CONTROL SYSTEM

The LFG Specialties Flame-Trol I is a technically advanced fully integrated, 100% automatic flare controller. The Flame-Trol I is specifically designed to provide the operator full flexibility to set or change any temperature and/or time setting utilized in the automatic operation of a utility "candle type" flare.

FEATURES OF THE FLAME-TROL I INCLUDE:

1) Ultraviolet Flame Scanner

   A) The ultraviolet scanner and associated controller provide flame confirmation and initiate "flare safety shutdown". Upon loss of flame, the scanner will automatically shutdown the blowers and close the automated header valve (if utilized). The flame scanner has a maximum response time of 4 seconds, providing almost immediate system shutdown.

   B) The scanner also provides a safety lockout on the start up of the blowers and opening of the header valve, until confirmation of the pilot flame.

2) Temperature controller which offers complete flexibility to set temperature points at which certain functions will be initiated. These functions are:

   A) "System shutdown", should the ultraviolet scanner fail to operate for any reason, the temperature controller will act as a back-up safety shutdown. Upon loss of temperature at the flare tip the controller will also automatically shutdown the system.

   B) "Blower on", When the pilot burner reaches the appropriate temperature, set by operator, to indicate the pilot is in fact burning, the controller starts the blower motor automatically.

   C) "Pilot off", After the blower has been started, the pilot remains burning until the temperature at the flare tip has reached the ideal burning temperatures as set by operator, and the Flame-Trol I shuts off the propane supply to the pilot.

   The system will then operate as long as there is any flame at the flare tip. The controller also features a constant L-E-D temperature read-out.

3) Pilot Timer and Pilot Failure Indicator

A) This timer begins the instant the ignition cycle begins. It is set by the operator at the maximum time required for the propane pilot to achieve the blower on temperature and the methane supply to be ignited. This time will typically be 2 to 3 minutes. At the end of this time, the propane supply valve will be closed and the pilot flame extinguished, if not already shut off by the temperature controller.

B) The pilot timer also controls the "pilot failure" function of Flame-Trol I. Upon initiation of the automatic ignition cycle this timer begins timing down. Should the pilot not achieve the "blower on" temperature (set in the pilot temperature controller) in the time set in the pilot timer, the entire system will be shut down. The "pilot failure" indicator light will then come on. The system will not attempt to automatically reignite until the pilot problem has been remedied. If it is determined that the propane supply has not been exhausted or another problem with the pilot system cannot be found, the operator may attempt automatic reignition by pushing the "reset" button.

4) Down Time Timer

A) If the methane supply to the flare tip has been exhausted or the flame is extinguished by wind or other causes, the blowers are automatically shut down and the down timer starts. This timer has a range of one second to 999 hours. The operator determines the length of time necessary to rejuvenate the methane supply and sets this timer accordingly. Once the timer has completed its cycle, the system will open the pilot valve and the ignitor will fire to automatically reignite the flare. The timer has an LCD display in effect when the system is in the "down time" function.

5) Ignitor Timer

A) The ignitor timer allows the operator to set the time the ignitor will spark during the ignition cycle. This allows for the adjustment of the spark duration to compensate for the distance of the propane supply from the flare; thus extending the life of the ignitor plug, transformer and other pilot components.

6) Manual/Auto Switch

A) The system also features a convenient manual/off/auto switch which allows the operator to completely bypass the automatic controls and operate the flare manually.

7) The Flame-Trol I is enclosed in a NEMA 4 "outdoor" weather proof enclosure, suitable for control rack/wall mounting.

A) "Indicator Lights", Mounted on the controller are indication lights for; power on, ignition on, pilot on, blowers on, flare safety shutdown.

B) Also, mounted to the controller is a 110V, 15A duplex outlet in a NEMA 5-20R receptacle box with covers.

ADDITIONAL CONTROL EQUIPMENT

*** CONTROL RACK ***

The Flame-Trol I automatic flare controller, associated motor starters, main control power supply and pilot supply controls will all be mounted on a free standing control rack. The rack will be fabricated from 6 in. x 2 in. channel A-36, sandblasted and painted with rust resistant zinc oxide primer and overcoat of heavy duty industrial enamel.

The following will be fully mounted, piped and wired on the control rack:

*** Flame-Trol I automatic flare controller in NEMA 4 enclosure

*** 1 each alarm beacon will be installed to give visual warning during system shutdowns

*** 1 each 15 HP Ronk Type 2S Add-A-Phase power converter to drive the three phase blower motor from the single phase 240V power supply

*** 1 each 15 Hp induction motor starter, 3 pole, 460 VAC magnetic, full voltage type, with normally open holding circuit, manual reset and overload relay, installed in NEMA 4 enclosure, (for landfill gas blower motor)

*** 1 each AC ammeter on LFG blower motor circuit with 200% scale

*** 1 each hour meters on LFG blower motor circuit

*** The main power panel for 240V, 1 phase, 60HZ, 2 poles power supply with solid copper neutral and ground bus connections, multi-pole circuit breaker with common trip, installed in a weatherproof enclosure

*** A 170W mercury vapor security light with photocell and on/off switch (shipped loose for field installation)

*** A 120V, 15A duplex outlet in a weatherproof NEMA 5-20R receptacle box with covers

*** Pilot gas control system including: strainer, pressure control regulator, pressure gauge with isolation valve, fail-close solenoid valve with manual override and main manual shut off valve

TECHNICAL DATA

A. Flare Tip size -- 8 in.

B. Overall Height -- 23 ft.

C. Turndown Ratio -- 10:1

D. Destruction efficiency at 1100 SCFM flow with gas methane content 40 to 60% -- 98% overall destruction of total hydrocarbons

Guaranteed to meet E.P.A. emission standards for landfill gas disposal in utility "candle type" flares.

Note: Flare is designed in accordance with the United States Environmental Protection Agency (EPA) established criteria for open flares, 40 CFR 60.18

E. Minimum flow rate to maintain stable flame and 98% destruction efficiency -- 110 SCFM

F. Minimum methane content required to maintain stable flame and 98% destruction efficiency -- 30%

NOTE:

Wind loads: Designed for 100 mph wind loading (per ASCE 7-88, Exp. C)

LFG SPECIALTIES, INC.

COMPONENT LIST
JOB 1365

COMPONENT	MANUFACTURER	MODEL	NOTES
Pilot Gas System:			
shutoff valve	Conbraco	Appollo 100	
line strainer	Mueller	#11M	
solenoid valve	ASCO	#8210G94EMO	
regulator	Fisher	#64/33	
pressure indicator	Winters	P-800	0-15 psi
Flare Stack Components:			
igniter pilot system	LFG Specialties	Utility	
igniter transformer	Webster	#612-6A7	
igniter spark plug	Auburn	I-64-1	
thermocouple elements	Pyromation	K8C-9-50-084-K-Z	84"
		K8C-9-50-108-K-Z	108"
UV flame detector	Honeywell	C7035A1031	
temperature switch	Burling	M1C-314-A-17040-08	
Fuel Gas Compression /Delivery:			
flame arrester	Varec	#5010	8" Aluminum
flow meter	Thermal Instruments	#926	
flexible coupling	Super Flex		8" X 6" EDP
gas blower	Aerovent	25/6 HPB S CL BLOWER	15Hp
blower motor	US MOTORS	A930A	15HP
auto b-fly valve	Grinnell	WD-8170-3	8", Buna
valve actuator	Bettis	CB525-SR80	pneumatic
manual b-fly valve	Grinnell	WD-8171-3	8" LVR, Buna
gages	Dwyer	MAG #2080-V	vacuum
	Dwyer	MAG #2020-V	pressure
	Ashcroft	#30EI60E040-0/250F	temperature
Flame-Trol Control Ctr:			
main disconnect	Westinghouse	RFDN225,EHD3100,INK250	125AMP
motor control/starter	Cutler-Hammer	ANG16GN0	starter
surge protector	Ditek	DTK-600-3CM	600V, 3 ph
flame detector relay	Honeywell	R7023C-1001	
temperature controller	Fuji	PYZ4RAY1-5V	
blower ammeter	Simpson	F351-46-0	
timers	Omron	H3CA-8	
panel lights/switches	General Electric	CR104P	
circuit breakers	Westinghouse	FDB2100L,QC1010,QC1020	
phase converter	RONK	80A	1 KVA min
lighting equipment	Regent	NH 2404	170 watt
panel heater	Hoffman	D-AH1001a	

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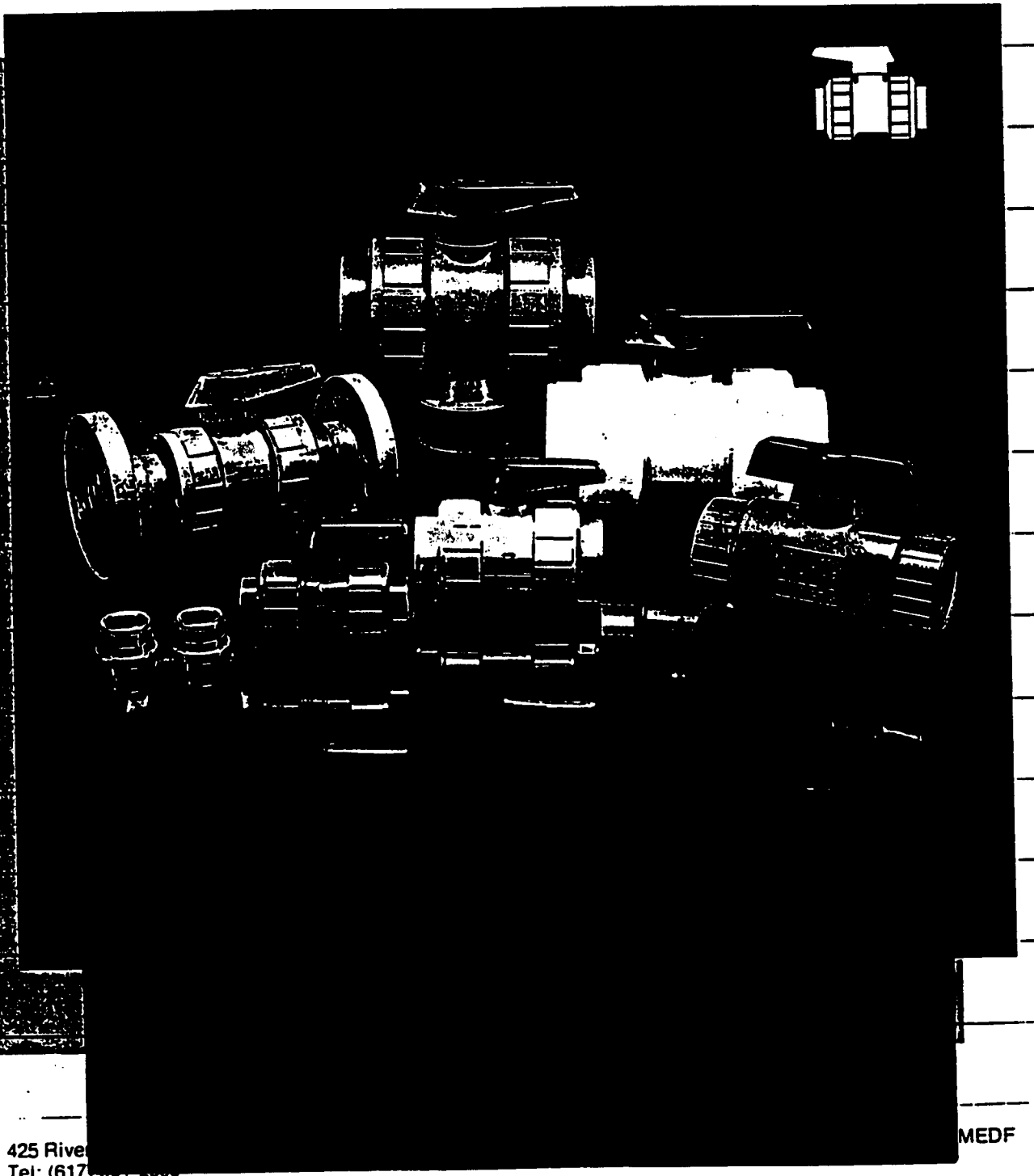
BALL VALVE SPECIFICATIONS

Manufacturer:	Asahi/America 425 Riverside Avenue Medford, Massachusetts 02155 (617) 391-2353
Model:	Duo Bloc True Union Ball Valve
Size(s):	2"
Body:	PVC
Seats:	Teflon backed with EPDM
Seals:	EPDM
Vendor:	Irrigation Supply Company, Inc. 926 Baxter Avenue P.O. Box 4545 Louisville, Kentucky 40204 (502) 583-6591

ASAHI/AMERICA®

BALL VALVES



425 Rive
Tel: (617

MEDF

BALL VALVES
INTRODUCTION

Introduction
Discussion
Warranty
Liabilities

Introduction

For over 15 years Asahi/America has been at the forefront of thermoplastic valve technology. The Asahi/America line is now the broadest in the industry in terms of size range, valve types, materials, features, and options. Advanced molding techniques, rigid engineering standards, and a wide choice of corrosion resistant thermoplastic and elastomeric materials ensure the highest level of reliability for all Asahi/America valves, even in the most severe corrosive applications.

The valves in this catalog represent one segment of the Asahi/America line. Other valves are grouped according to type or special function in separate catalogs. On the back cover of this brochure you will find a brief representation of the complete product line as an aid to requesting additional information.

If, however, you have a requirement for a valve with features not contained in any of our literature, please contact our engineering department to discuss our custom fabrication capability. Chances are we have already encountered a similar request and can accommodate your special needs with a minimum of effort.

Ball Valves: Discussion

This valve performs an on/off function and its name is derived from the flow-controlling ball located within the body of the valve. A hole through the center of the ball along one axis connects the inlet and outlet ports of the body. The ball itself is held in place by, and rotates 90° within, Teflon® seats which provide permanent lubrication and keep the valve "bubble tight". Elastomer "O" rings are used for stem and carrier seals to prevent leakage to the atmosphere. In the open position the flow is straight-through and there is no pressure drop when the porting through the ball is the same size as the inside diameter of the pipe. Asahi/America ball valves are quick opening and closing, a quarter turn is all that is necessary. They are easy to maintain, and they give tight sealing with low torque. Asahi/America offers three major types of ball valves: (1) True Union Ball Valves; (2) Omni® Ball Valves; and (3) Multiport Ball Valves. True Union Ball Valves can be lifted from the line—without having to move the piping—simply by loosening the two union nuts; the valve can be disassembled, and parts may be replaced. Asahi/America's Omni® series are economical, one-piece valves which cannot be taken apart. Multiport Ball Valves are three-way ball valves with True Union design on the left and right ports and fixed molded bottom port.

The use of Multiporting Ball Valves simplifies piping and eliminates the need for an additional valve and Tee fitting because an "L" ported ball permits flow from the bottom entry to either the left or right ports or to an OFF position. An optional Tee ported ball allows simultaneous left and right flow. Asahi/America's True Union Ball Valves and Multiport Ball Valves may be electrically or pneumatically operated. The Electromni® is an electrically actuated Onmi® Ball Valve. The Omnimatic® is a pneumatically actuated Omni® Ball Valve.

Asahi/America's thermoplastic valves provide a dependable and economical way to handle corrosive chemicals like sulfuric and hydrofluoric acid, nitric acid, and other oxidizing chemicals, as well as caustics, solvents, halogens and other problem materials, at temperatures to 250° F, pressures to 150 PSI and flows up to 18,500 gpm. When we speak of corrosion resistance, we refer to the ability of a material to withstand physical and chemical deterioration when it reacts with its environment, and particularly with oxygen. Corrosion, itself, has become a term which applies mostly to metals because the process is primarily an electrochemical one. There is ionization or corrosion at the surfaces due to electrical potentials that are created between positive and negative poles formed when unlike metals are joined in the same electrically conductive medium or when fluids that surround the metals have different ionic concentrations. Because thermoplastics are dielectric, meaning that they cannot easily support a charge, they are practically immune from corrosion in the conventional sense. There are some chemicals that can cause thermoplastics to deteriorate. For this reason, we have a thermoplastic chemical resistance chart, which we will be happy to send you upon request.

Warranty and Liabilities

To the best of our knowledge the information contained herein is accurate. However, neither Asahi/America, Inc. nor any of its affiliates assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of the suitability of any information or material for the use contemplated, or the manner of use, is the sole responsibility of the user.

Warranty
Liabilities
Thermoplastic Materials
Elastomeric Materials
Note

Due to our policy of continuous product improvement, we reserve the right to change or modify design without incurring any obligation to furnish or install such changes or modifications on products previously or subsequently sold.

WARRANTY
THE SALE BY ASAHI/AMERICA, INC. OF ITS PRODUCTS IS EXPRESSLY CONDITIONED UPON AND SUBJECT TO ALL TERMS AND CONDITIONS SET FORTH ON THE BACK COVER OF THIS CATALOG.

Thermoplastic Materials

PVC (POLYVINYL CHLORIDE) TYPE 1, GRADE 1 Asahi/America uses an unplasticized PVC polymer in all of its PVC valves. This material has an excellent chemical resistance, strength, rigidity, and modulus of elasticity. It resists attack by most acids and strong alkalis, as well as gasoline, kerosene, aliphatic alcohols and hydrocarbons, and salt solutions. Aromatics, chlorinated organic compounds, and lacquer solvents do have effect upon PVC's chemical properties. Its temperature range is 140° F. PVC's low cost and overall balance of properties make it the material best suited to the widest number of corrosive applications.

CPVC (CHLORINATED POLYVINYL CHLORIDE) TYPE 4, GRADE 1 The properties of CPVC and its advantages are very similar to those of PVC; however, its working temperature range is higher (200° F.) than that of PVC. It should be specified in some instances where hot corrosive liquids are being handled and an extra margin of safety is required.

PP (POLYPROPYLENE) TYPE 1 Polypropylene, a member of the polyolefin family, is one of the lightest plastics known. It is highly crystalline, thus is strong and hard. It possesses excellent chemical resistance to many acids, alkalies and organic solvents. PP is not recommended for use with chlorinated hydrocarbons and aromatics. Its upper temperature limit is slightly lower than that of CPVC.

PVDF (POLYVINYLIDENE FLUORIDE) PVDF is a high modular weight fluorocarbon that has superior abrasion resistance, chemical resistance, dielectric properties, and mechanical strength. The remarkable fact is that it maintains these characteristics over a temerature range of -40° F. to 250° F. PVDF is highly resistant to wet or dry chlorine, bromine and other halogens, most strong acids and bases, aliphatics, aromatics, alcohols, and chlorinated solvents. It is not, however, recommended for ketones or esters. Asahi/America's PVDF resin conforms with FDA No. 177.2510 requirements for contact with food.

Elastomeric Materials

TEFLON® (TFE FLUOROCARBONS) This fluorocarbon is almost totally insoluble and chemically inert. Teflon® in application on bearing surfaces exhibits a natural lubricity that makes lubrication completely unnecessary. It has a very high thermal stability, is nonflammable, and exhibits a very low dielectric constant.

VITON® Viton® is a fluoroelastomer which is used as an "O" ring material in many Asahi/America valves. It resists a wide range of chemicals, including mineral acids, salts, and chlorinated hydrocarbons. The maximum temperature is 250° F.

EPDM (ETHYLENE) PROPYLENE TERPOLYMER) This elastomer is particularly suited to diaphragms, valve seats, and "O" rings. It can stand up to a wide variety of acids, bases, alcohols, and oxidizing chemicals. The maximum temperature is 212° F.

Note

Caution: Asahi/America valves are not recommended for use in compressed air service. When testing, only hydrostatic pressure testing is recommended with a gradual increase in pressure.

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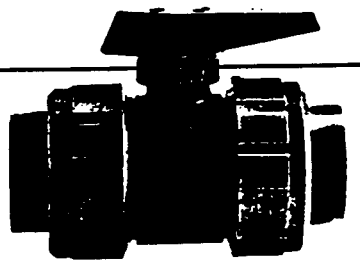
DUO BLOC®
TRUE UNION BALL VALVES

Features, Options
Sample Specifications
Parts
Pressure vs. Temperature
Dimensions



SPECIFICATIONS

SIZES: ½"–6"*
MODELS: Socket, Threaded, Flanged (ANSI), Butt
BODIES: PVC, CPVC, PP, PVDF (KYNAR®)
SEATS: Teflon® backed with EPDM or VITON®
SEALS: EPDM or VITON®

FEATURES

- True Union design eliminates the need for flanges and permits installation or repair without expanding the pipeline.
- Blocks in two directions, upstream and downstream, leaving full pressure on the opposite end of the valve.
- One-piece, capsule feature (PVC and CPVC models, ½"- 2") prevents over-tightening of seating components.
- Teflon seats with elastomeric backing cushions ensure bubble tight shut off and a low fixed torque, while at the same time compensating for wear.
- Available with EPDM or Viton® "O" rings.
- All sizes rated for vacuum service.
- Threaded-in carriers on all sizes of PVDF and PP models and on 2½"- 4" size of CPVC and PVC models prevents over-tightening of seating components.
- Two sets of end connectors (socket and threaded) included with all PVC and CPVC models in ½"–2" sizes. This reduces by up to 50% ball valve inventories.
- Valve capsule guaranteed for 2 years when used as recommended.

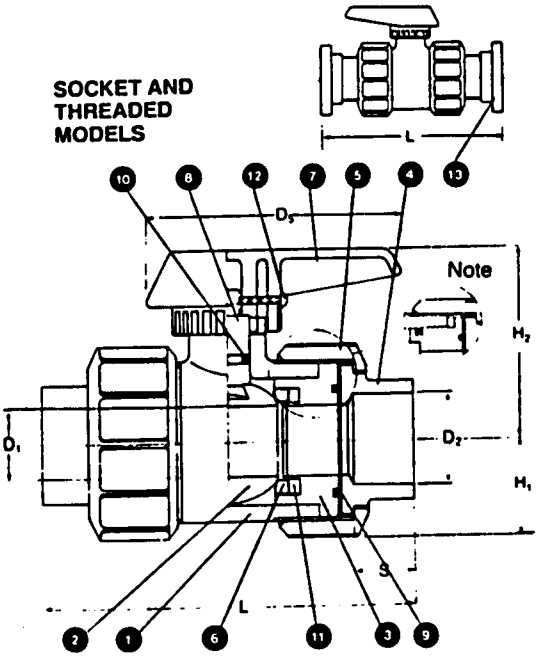
OPTIONS (See options under Multiport valves)

SAMPLE SPECIFICATIONS

All thermoplastic ball valves in sizes ½" through 4" shall be of a true union design with two-way blocking capability. PVC and CPVC True Union Ball Valves (sizes ½" through 2") shall be of a one piece capsule. All PVC and CPVC True Union Ball Valves (sizes ½" through 2") shall include both socket and threaded end connectors. All True Union Ball Valves shall have Teflon® seats with elastomeric backing cushions of the same material as the valve seals. True Union Ball Valves must carry a 2 year guarantee, as manufactured by Asahi/America, Inc., 425 Riverside Avenue, Medford, MA.

FLANGED MODEL*

SOCKET AND THREADED MODELS



PARTS

No.	Parts	Pcs.	Materials
1	Body	1	PVC, CPVC, PP, PVDF
2	Ball	1	PVC, CPVC, PP, PVDF
3	Carrier	2	PVC, CPVC, PP, PVDF
4	Connector	2	PVC, CPVC, PP, PVDF
5	Union Nut	2	PVC, CPVC, PP, PVDF
6	Ball Seat	2	Teflon®
7	Handle	1	ABS
8	Stem	1	PVC, CPVC, PP, PVDF
9	Face "O" Ring	2	Viton® EPDM
10	Stem "O" Ring	1	Viton® EPDM
11	Seat Cushion	2	Viton® EPDM
12	Screw	1	Stainless Steel
13	Flange	2	PVC, CPVC, PP, PVDF

Note: PVC and CPVC models, size 2½", 3" and 4", and all PP and PVDF models feature threaded-in carriers.

PRESSURE VS. TEMPERATURE (PSI, WATER, NON-SHOCK)

	PVC	CPVC				PP			PVDF			
Size	30°F 120°F	30°F 120°F	140°F	175°F	195°F	-5°F 85°F	140°F	175°F	-5°F 140°F	175°F	195°F	210°F
½–2"	150	150	120	85	55	150	85	60	150	120	110	85
2½–6"	150	150	20	85	55	150	70	40	150	120	110	85

DIMENSIONS (IN INCHES UNLESS OTHERWISE NOTED)

Size	Weight Socket/ Threaded (lbs.)	Weight Flanged (lbs.)	D_1	D_2 Socket	D_2 Threaded	S Socket	L Butt Fusion	L Socket	L Threaded	L Flanged PVC/ CPVC/ PP/PVDF	D_5	H_2	H_1	C, Values Gal./Min. @ 1 PSI Pressure Drop
½"	0.38	2.00	0.59	0.85	NPT ½	0.69	4.57	3.86	3.82	5.63	2.76	1.97	.95	11.9
¾"	0.67	2.25	0.79	1.06	NPT ¾	0.72	5.00	4.53	4.65	6.77	3.54	2.24	1.19	30.0
1"	1.00	2.50	0.98	1.33	NPT 1	0.87	5.35	5.28	5.35	7.36	3.94	2.64	1.38	46.8
1¼"	1.39	3.25	1.22	1.67	NPT 1¼	0.94	6.00	5.83	5.87	7.48	4.13	3.07	1.57	80.0
1½"	2.18	4.00	1.50	1.91	NPT 1½	1.09	6.29	6.65	6.69	8.35	4.53	3.35	1.87	140.0
2"	2.93	4.75	1.77	2.39	NPT 2	1.16	7.04	7.56	7.76	9.21	5.12	3.74	2.09	185.0
2½"	4.86	8.50	2.28	2.89	NPT 2½	1.75	9.70	9.45	8.46	10.20	5.91	4.45	2.62	320.0
3"	8.07	13.00	2.76	3.52	NPT 3	1.87	11.63	11.10	10.39	11.97	8.66	5.12	2.99	430.0
4"	21.00	33.00	3.54	4.52	NPT 4	2.00	14.85	13.90	14.17	14.65	11.02	6.54	4.13	720.0

*6" Ball Valve is venturied up from 4".
*See Page 10 for details.

OPTIONS for BALL VALVES

- Special Handles and Operators
- Remote Operating Nuts
- Stem Extensions
- Teflon "O" Rings
- Split Ring Flange

SPECIAL HANDLES

LOCKING HANDLES—to prevent unauthorized cycling of a valve. Designed to be secured with a padlock.

Locking Handle

SPRING RETURN HANDLES—allows for failsafe manual operation.

Spring Return Handle

REMOTE OPERATING NUTS

CHAIN OPERATORS

REMOTE OPERATING NUTS—available in 2" square or "T" configurations. They are used for remote operation of a valve by an extended wrench.

Operating Nuts

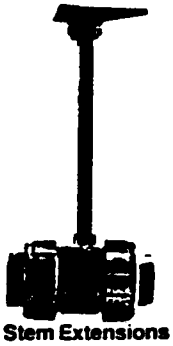
LIMIT SWITCHES—Manual Valve with Limit Switches (SPDT) for sequencing with other equipment or for remote position indication with lights.

Limit Switches

STEM EXTENSIONS

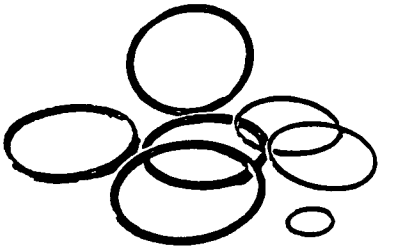
TEFLON® ENCAPSULATED "O" RINGS

STEM EXTENSIONS—for valves located in remote locations. Fabricated of either a one-piece or two-piece construction for one extension. Small economical extension also available for panel mounts.



Stem Extensions

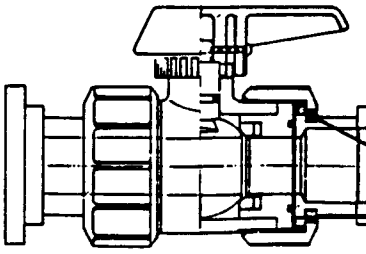
TEFLON® ENCAPSULATED "O" RINGS—for greater corrosion resistant seals. These seals can be installed in all PP and KYNAR Ball Valves and in PVC and CPVC Ball Valves size 2½"-4."



Encapsulated O-Rings

SPLIT RING FLANGE

SPLIT RING FLANGE—molded flange assembly allows for field conversion of a socket or a thread true union valve to a flange valve with no cementing required.



PROJECT DOCUMENTATION
PHOTOGRAPHS

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

PHOTOGRAPHS

TOP TO BOTTOM
CLOCKWISE

- Well Boring (Typical)
- Measuring Depth to Aggregate
- Placing Bentonite Seal

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

PHOTOGRAPHS

TOP TO BOTTOM

- Wellhead Assembly (Typical)
- Header/Tee Lateral to Well (Typical)

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

PHOTOGRAPHS

TOP TO BOTTOM

- Blind Flange (Typical)
- Branch Saddle (Typical)

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

PHOTOGRAPHS

TOP TO BOTTOM

- Flange Connection with Protective Coating (Typical)
- Installation of 10" x 12" x 14" PE Reducer Sta. 13+50 Line H-H' (Typical of Reducers)

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

PHOTOGRAPHS

TOP TO BOTTOM

- Grading of Sand Bedding (Typical)
- Piping Placement

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

PHOTOGRAPHS

COUNTER CLOCKWISE
TOP TO BOTTOM

- Grading of Sand Bedding (Typical)
- Compaction of Sand Cover (Typical)
- Installation of Warning Tape (Typical)

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

PHOTOGRAPHS

TOP TO BOTTOM

- Condensate Drain DL-2 Tie-in Area
- Condensate Drain DL-2 Gravel Backfilled Base

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

PHOTOGRAPHS

TOP TO BOTTOM

Condensate Drain DL-2
Sta. 16 + 40 Line H-H'

- Drain Detail
- Geotextile Wrap on DL-2 Drain

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

PHOTOGRAPHS

TOP TO BOTTOM

Condensate Drain DL-2

- Sta. 16+40 Line C-C' Tie-in
- Pipe to Condensate Drain

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

PHOTOGRAPHS

TOP TO BOTTOM

18" Condensate Knockout
DL-1 Sta. 9+01 Line H-H'

- 12" Blind Flange for Blower Tie-in
- 18" Stacked Tee

LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

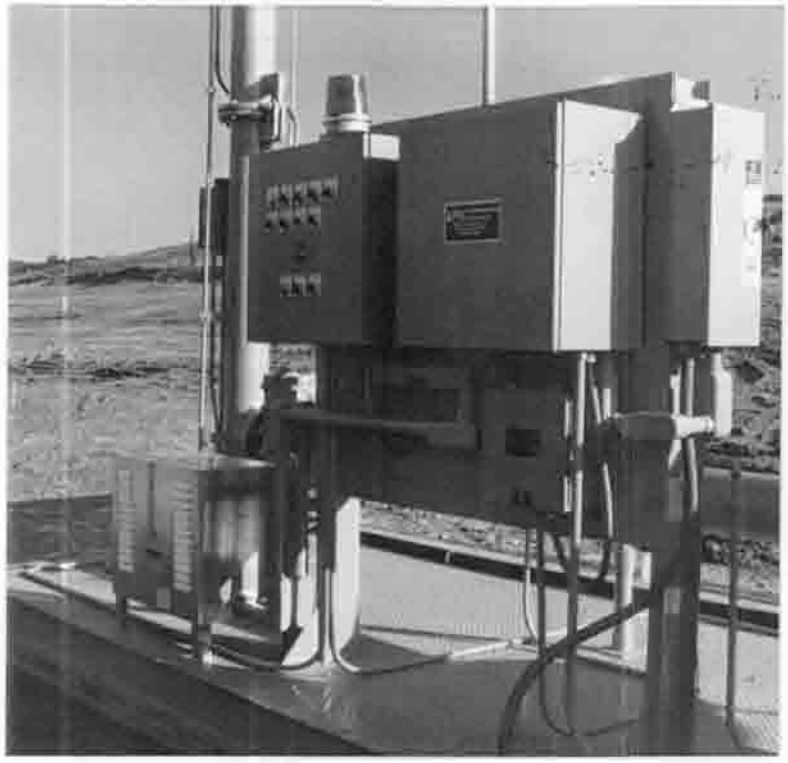
PHOTOGRAPHS

TOP TO BOTTOM

- 2" PE Condensate Drain from Blower/Flare to DL-1
- Blower/Flare Skid

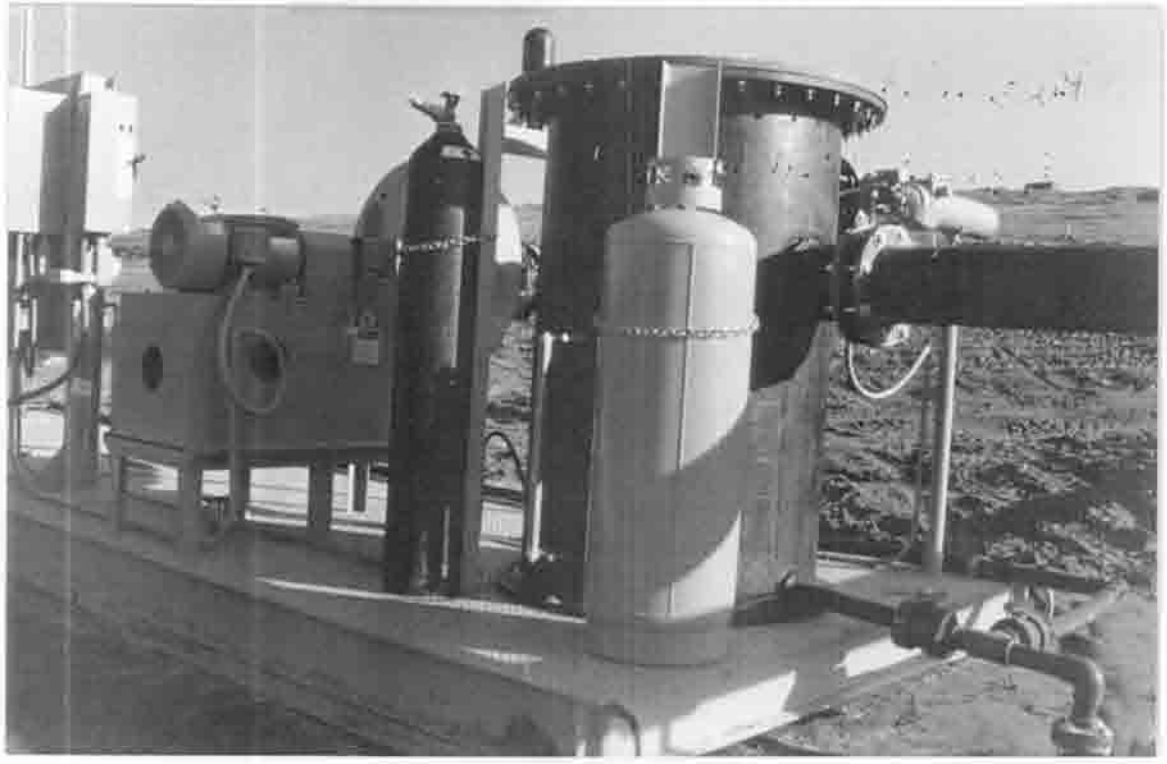
LANDFILL GAS MANAGEMENT SYSTEM
FOR
PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

PHOTOGRAPHS



TOP TO BOTTOM

- Blower/Flare Controls
- Blower/Flare Skid



34-06

- End of Booklet -

Record Documentation
Phase I Landfill Gas Management System
for
Piedmont Landfill and Recycling Center

Nov. 1996

CF
34-06

Piedmont Landfill
and Recycling Center
9900 Freeman Road
Kernersville, North Carolina 27284
910/595-6677
FAX: 910/595-9735

OCT 1996
RECEIVED
SWS-WSRO

A Waste Management Company

October 16, 1996

Mr. Brent Rockett
North Carolina Dept of Environment, Health, and Natural Resources
Solid Waste Section (SWS)
585 Waughtown Street
Winston-Salem, NC

Re: Notification of New Cell Construction: Piedmont Landfill & Recycling Center (PLFRC), Kernersville, NC Permit No. 34-06

Dear Mr. Rockett:

As you know, the PLFRC has been excavating soils in the area of the landfill that is to be the next constructed cell, i.e. Phase 3, Cell 2, Subcell 2. We are using these soils for cover in our routine landfill operations. On your visit the other day you inquired as to when excavating for borrow soil ends and construction of the new cell begins. We interpret it this way: The PLFRC, like most solid waste management facilities, contracts with independent earthwork/geosynthetic contractors to construct landfill cells. This process involves specific construction drawings that show interim stormwater management schemes for example, with specific specifications and bid documents. It is a distinct process, one that is planned and known. It was our interpretation that any work prior to this contractor commencing work on this specific project was not "construction of a new cell" and therefore we did not need to notify the SWS. However, rather than enter into further discussion about it, we are hereby notifying the SWS of new cell construction (Phase 3, Cell 2, Subcell 2) as required by Permit Condition No. GENERAL (G) 5 b.

If you have any questions, feel free to contact either myself or Ed Gibson @ (910) 595-6677.

Sincerely,

William R. Lewis, P.E.
Division President and General Manager

cc: Ed Gibson

Printed on Recycled Paper

Forsyth Co.
34-06

Piedmont Landfill
and Recycling Center
9900 Freeman Road
Kernersville, North Carolina 27284
910/595-6677
FAX: 910/595-9735

A Waste Management Company

October 15, 1996

OCT 1996
RECEIVED
SWS-WSRO

Mr. Brent Rockett
North Carolina Dept of Environment, Health, and Natural Resources
Solid Waste Section (SWS)
585 Waughtown Street
Winston-Salem, NC

Re: Report of Activities Surrounding the September 4, 1996 Event at the Piedmont Landfill & Recycling Center (PLFRC), Kernersville, NC Permit No 34-06

Dear Mr. Rockett:

At your request, the following is a report on the activities leading up to and following the September 4, 1996 incident:

LOCATION OF INCIDENT: South side of landfill, just opposite of the PLFRC's leachate storage tank area.

EVENT HISTORY: In the week prior to September 3, 1996, the PLFRC had received 3.5 inches of rainfall, causing severe erosion and unworkable conditions at the landfill. Then on September 3-4, (through 6 AM September 4, 1996), the site received 2 inches of rain. This large amount of rain caused one of the stormwater diversion berms to fail. This stormwater runoff came from the landfilled area that had received intermediate cover. These rains also caused severe erosion of the intermediate cover. This runoff not only carried the soil cover but also carried with it waste paper and plastic that had been exposed by the eroding intermediate cover. Most of the waste paper and plastic ended up in our stormwater ditch leading to Sediment Pond Number 1, located in the southwest corner of the site. However, a small amount entered this pond but because of the filter system we have on the outflow structure, no waste left this pond.

Also, we estimate that 3-5 tons of silt entered this stormwater ditch during this rain event.

COUNTERMEASURES EMPLOYED: PLFRC employees along with temporary labor cleaned the stormwater ditch of all trash by September 5, 1996.

After these rains, the PLFRC immediately sought the help of an independent, earthwork contractor, Morgan Corporation, to aid PLFRC personnel in making immediate, necessary repairs to all stormwater structures, including diversion berms, ditches, cover, etc. Morgan arrived on site early afternoon on August 30, 1996 and by September 5, 1996 had completed the necessary repairs to these structures.

To ensure that no unusual contaminants were leaving the Sediment Pond, a sample was taken from the outlet and tested for leachate indicators. Attached is that analysis.

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ACTION TO PREVENT REOCCURRENCE:

This event alerted the PLFRC to the importance of doing a better job of planning for stormwater management during the interim phase of landfill operations. We have now instituted plans for additional inspections to determine the adequacy of stormwater management during this period.

If you have any questions, feel free to contact either myself or Ed Gibson @ (910) 595-6677.

Sincerely,

William R. Lewis, P.E.
Division President and General Manager

cc: Ed Gibson

RESEARCH & ANALYTICAL LABORATORIES, INC.
Analytical/Process Consultations
Phone (910) 996-2841

CHAIN OF CUSTODY RECORD

JOB NO.	PROJECT NAME
	PIEDMONT LANDFILL / POND #1

SAMPLERS (SIGNATURE): [signature]

SAMPLE NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	2L G (BNA, Herb./Pest.)	2 40ml Vials (VOA)	250ml G (TOX)	250ml P (TOC)	1L P,G (BOD, TSS, Unpreserved, etc.)	1L G (Phenol, Oil & Grease)	1L P,G (COD, N,P)	1L P,G (Metals, Hardness)	1L P,G (CYANIDE)	Sterile P,G (Coliform)	WATER/WASTEWATER	MISC.	REQUESTED ANALYSIS
SEDPOND1	9-5-96	11:00		X	SEDIMENT POND # 1	4													*

RELINQUISHED BY	DATE/TIME	RECEIVED BY
MIKE McFEELEY	960905 14:00	
RELINQUISHED BY	DATE/TIME	RECEIVED BY

REMARKS:
* SEE SID CHAMPION FOR REQUESTED PARAMETERS.

Research & Analytical Laboratories, Inc.

Analytical/Process Consultations

RESEARCH & ANALYTICAL LABS. SIDNEY L. CHAMPION NC #34 DIRECTOR CERTIFIED ANALYSIS

Waste Management of Carolinas, Inc.
9900 Freeman Road
Kernersville, NC 27284
Attn: Edward L. Gibson

Date Sample Collected : 09/05/96
Date Sample Received : 09/05/96
Date Sample Analyzed : 09/05/96
Date of Report : 09/23/96
Analyses Performed by : JK -JG

Parameter	Results (Lab Sample Number 279552)
Total Sodium	8.75 mg/l
Ammonia - Nitrogen	<1.0 mg/l
Total Kjeldahl Nitrogen	4.18 mg/l
Total Manganese	0.969 mg/l
Total Calcium	11.8 mg/l
Total Magnesium	15.6 mg/l
Chloride	5.46 mg/l
Total Potassium	7.35 mg/l
Total Alkalinity	20.9 mg/l
Dissolved Solids	470 mg/l
Sulfate	13.8 mg/l
Total Iron	62.5 mg/l
Total Organic Carbon	4.48 mg/l
Nitrate - Nitrogen	<0.050 mg/l

Clients Sample Source : PIEDMONT LANDFILL
Number : POND #1
Time Collected (Hrs) : 1100

mg/l = milligrams per liter = parts per million
< = less than or below detection limits

P.O. Box 473 • 106 Short Street • Kernersville, North Carolina 27284 • 910/996-2841

CF
34-06

Piedmont Landfill
and Recycling Center
9900 Freeman Road
Kernersville, North Carolina 27284
910/595-6677
FAX: 910/595-9735

A Waste Management Company

August 23, 1996

Ms. Sherri Coghill
North Carolina Dept. of Environment, Health, and Natural Resources
Solid Waste Section (SWS)
401 Oberlin Road
Raleigh, NC 27611

Re: Response to our August 8, 1996 Request to Use a Small Portion of the Landfill Buffer for Use in Locating a Gas Flare; (Second Request); Piedmont Landfill & Recycling Center (PLFRC), Kernersville, NC. Permit Number 34-06

Dear Ms. Coghill:

This is to confirm our August 21, 1996 telephone conversation concerning the above referenced subject.

It is my understanding that the SWS has no problem with the flare being located as per this August 8, 1996 letter. If this is not in accordance with your understanding of our conversation, please let me know immediately.

Thanks!

Sincerely,

Edward L. Gibson, P.E.
Facility Engineering Manager

AUG 1996
Received
Solid Waste
Section

cc: Bill Lewis
Mark Taylor
Mike Rodgers

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CF

Piedmont Landfill
and Recycling Center
9900 Freeman Road
Kernersville, North Carolina 27284
910/595-6677
FAX: 910/595-9735

A Waste Management Company

August 8, 1996

Ms. Sherri Coghill
North Carolina Dept. of Environment, Health, and Natural Resources
Solid Waste Section (SWS)
401 Oberlin Road
Raleigh, NC 27611

Re: Request to Use a Small Portion of the Landfill Buffer for Use in Locating a Gas Flare; (Second Request); Piedmont Landfill & Recycling Center (PLFRC), Kernersville, NC. Permit Number 34-06

Dear Ms. Coghill:

As you know, we sent a letter to you dated July 11, 1996 requesting to use a small portion of PLFRC's buffer for use in locating a skid mounted gas flare. This new location was to be situated in the buffer area west of Sediment Pond No. 2. With your subsequent approval, we surveyed the area to determine the feasibility of constructing the pipe network under the large gabion lined stormwater ditch running along the north side of the landfill (draining into Sed Pond No. 2). We determined this not to be feasible, and therefore we are proposing another location: in the north central buffer area near Leachate Sump "A". See attached map. The surrounding area is thickly wooded, is undeveloped, and **THERE ARE NO RESIDENCES OR BUILDINGS WITHIN 2,000 FEET OF THIS PROPOSED FLARE LOCATION.**

Please let us know your decision as soon as possible. Of course, if you have any questions, feel free to contact either Bill Lewis or myself @ (910) 595-6677.

Sincerely,

verbally approved
8/21/96
SKC

Edward L. Gibson, P.E.
Facility Engineering Manager

cc: Bill Lewis
Mark Taylor
Mike Rodgers

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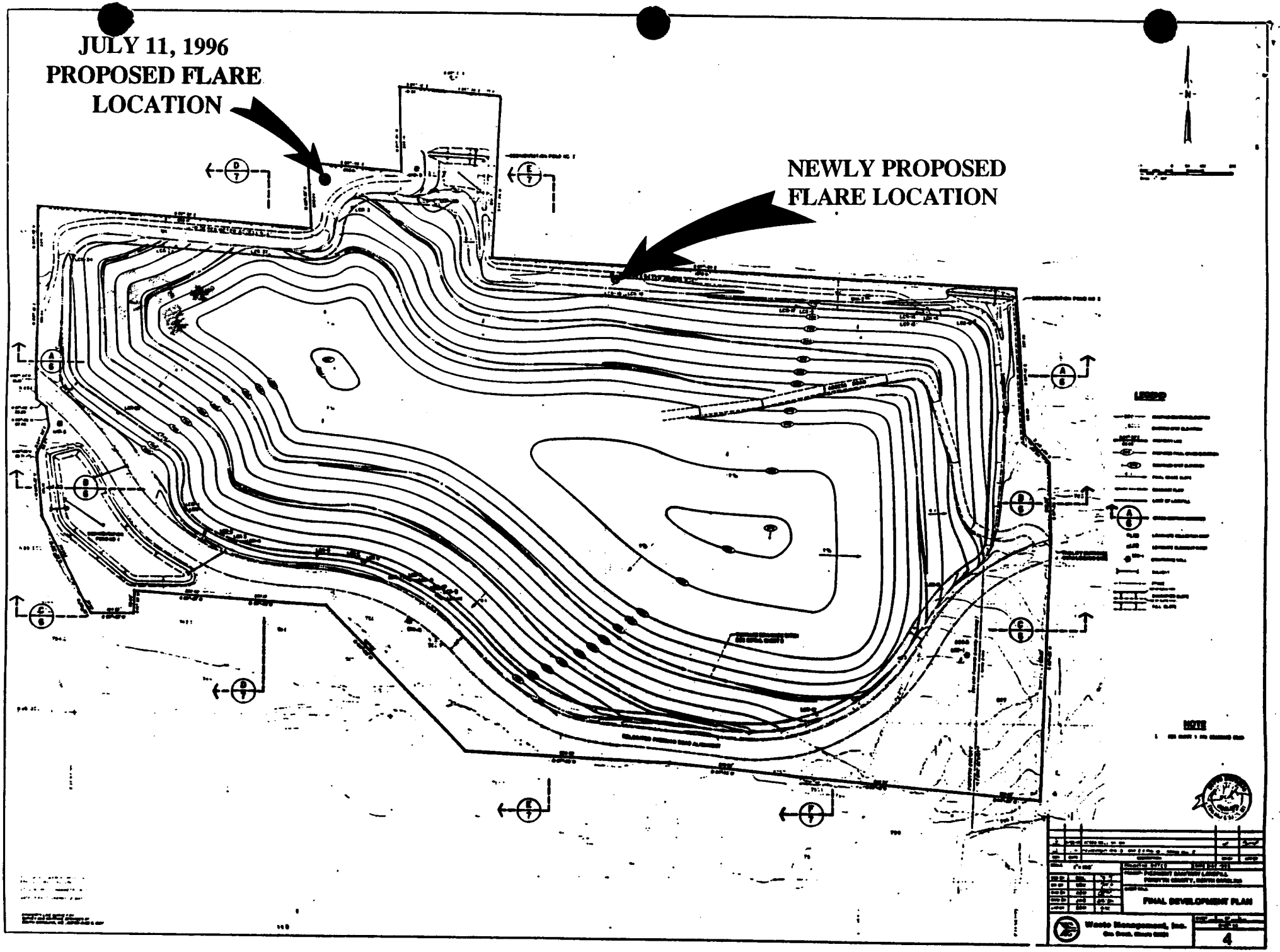
JULY 11, 1996
PROPOSED FLARE
LOCATION
NEWLY PROPOSED
FLARE LOCATION
LEGEND
NOTE
FINAL DEVELOPMENT PLAN
Waste Management, Inc.
4

CF

State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Solid Waste Management

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
William L. Meyer, Director

DEHNR

July 31, 1996

Mr. William R. Lewis
Piedmont Landfill and Recycling Center
9900 Freeman Road
Kernersville, North Carolina 27284

RE: Alternative Final Cover
Piedmont Landfill and Recycling Center
Permit No. ~~36-04~~ 34-06

Dear Mr. Lewis:

The Solid Waste Section has completed its review of the request for alternative final cover submitted on July 19, 1996. The Section has determined that the Piedmont Landfill and Recycling Center has adequately demonstrated that the alternatives presented meet the requirements of Rule .1627(c)(2)(A) and (B), and hereby approves your request. Your request and this approval will be added to the list of approved documents for Permit No. ~~36-04.~~ 34-06

If you have any questions or comments regarding this correspondence, please contact Sherri Coghill at (919)733-0692, ext. 259.

Sincerely,

James C Coffey

James C. Coffey, Supervisor
Permitting Branch
Solid Waste Section

cc: Thomas M. Yanoschak, Rust Environment & Infrastructure
Julian Foscue
Brent Rockett
Matt Gantt

P.O. Box 27687,
Raleigh, North Carolina 27611-7687
Voice 919-733-4996

N C
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34-06

-Booklet-

Petition for Alternative Cover

July, 1996

Piedmont Landfill and Recycling Center

34-06

PETITION FOR
ALTERNATIVE FINAL COVER

PIEDMONT LANDFILL & RECYCLING CENTER

KERNERSVILLE, NORTH CAROLINA

JULY, 1996

APPROVED
DIVISION OF SOLID WASTE MANAGEMENT
DATE 7/31/96 BY SLC

PREPARED BY:

RUST ENVIRONMENT & INFRASTRUCTURE
15 BRENDAN WAY
GREENVILLE, SOUTH CAROLINA, 29615

Thomas M. Yanosek
7/12/96

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INTRODUCTION

The purpose of this report is to request approval from the North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR) Division of Solid Waste Management for two alternative final cover designs for the Piedmont Landfill & Recycling Center (PLFRC) in Kernersville, North Carolina. In accordance with the requirements for alternative final cover systems stipulated in NCAC Rule .1627(c)(2), this petition demonstrates that the two alternative designs provide essentially an equivalent or greater reduction in infiltration when compared to the currently permitted design and shows that neither alternative will be adversely affected by erosion. In addition, stability analyses show that the alternative designs will be stable under the design seismic conditions.

Since the proposed alternative final cover designs contain components that are not included in the currently permitted final cover design, a revised Construction Quality Assurance (CQA) Plan for Final Cover Systems is provided as Appendix A to this petition. The revised CQA plan addresses all of the components of both alternative designs.

The currently permitted final cover system at PLFRC consists of the following (from the top down): a 2-foot thick protective cover layer, a geotextile/geonet/geotextile drainage composite, a 40 mil coextruded VLDPE/HDPE textured geomembrane, and a 1.5-foot thick cohesive soil layer with a specified maximum hydraulic conductivity of 1×10^{-5} cm/sec. Two different alternative final cover systems were evaluated. The variations of these alternatives from the currently permitted final cover system are noted below:

Alternative 1

Replace the currently permitted 40 mil coextruded VLDPE/HDPE textured geomembrane with 40 mil textured Polyethylene (e.g. CoverSeal or approved equivalent), and reduce the thickness of the protective cover layer to a minimum of 1.5 feet with the top six inches capable of supporting vegetation.

Alternative 2

Replace the geomembrane as noted above for Alternative 1, provide a geosynthetic clay liner (GCL) beneath the geomembrane, and replace the 1.5-foot thick cohesive soil layer with a minimum 10-inch thick supporting soil layer without a permeability specification.

Details of the currently permitted and both of the proposed alternative final cover designs are provided in Figure 1.

POLYETHYLENE GEOMEMBRANE

The currently permitted final cover system for PLFRC specifies the use of a 40 mil coextruded VLDPE/HDPE textured geomembrane. Both alternative final cover designs discussed within this petition specify the use of a polyethylene geomembrane (e.g. CoverSeal or approved equivalent). The revised geomembrane requirements are reflected in the attached CQA Plan for Final Cover Systems (Appendix A). Manufacturer's quality control specifications for CoverSeal are included in Appendix B.

EVALUATION OF INFILTRATION

The US EPA Hydrologic Evaluation of Landfill Performance (HELP) Model Version 3.04a (Schroeder et al., 1994) was used to determine the infiltration rates through the currently permitted final cover system and the two alternative final cover systems. The HELP model is a quasi-two-dimensional hydrologic model of water movement across, into, through, and out of landfills. The model accepts weather, soil, and design data, and uses solution techniques that account for the effects of surface storage, snow melt, runoff, infiltration, evapotranspiration, vegetative growth, soil moisture storage, lateral subsurface drainage, leachate recirculation, unsaturated vertical drainage, and leakage through soil, geomembrane, or composite liners. The model facilitates rapid estimation of the amounts of runoff, evapotranspiration, drainage, leachate collection, and liner leakage that may be expected to result from the operation of a wide variety of landfill designs. The primary purpose of the model is to assist in the comparison of design alternatives as judged by their water balances.

The input data for the soil and geosynthetic components of the currently permitted and alternative final cover designs were obtained from the library of default soil and geosynthetic characteristics contained within the HELP model. Care was taken to select input values that closely represented materials that are currently used, or are proposed for use, at the site. A hydraulic conductivity of 1×10^{-5} cm/sec was manually input to represent the cohesive soil layer for the currently permitted design and for Alternative No. 1, in accordance with the current permit conditions. The initial water content of the soil components was determined from the model. For the geomembrane components, a pinhole density of seven holes per acre was assumed while installation defects were assumed to be at a frequency of one hole per acre. The placement quality of the geomembranes was assumed to be good.

In determining the amount of runoff from the various final cover designs, the HELP model was allowed to calculate the SCS runoff curve number assuming a good stand of grass, a surface slope of 4:1 (25%) and a slope length of 160 feet. These values are consistent with the current permit requirements.

Evapotranspiration data was obtained from the HELP model database for Greensboro, North Carolina. Precipitation, temperature, and solar radiation data were synthetically generated by the HELP model using coefficients for Greensboro.

Copies of each of the output files for the HELP model runs that were performed for the currently permitted final cover and the two alternatives are included in Appendix C. The following is a summary of the calculated average annual infiltration values through the various final cover designs:

	Infiltration Through Final Cover (inches/year)	**Infiltration Through Final Cover (cubic feet/year)**
Currently Permitted Final Cover Design	.04	145
Alternative No. 1	.04	149
Alternative No. 2	.02	73

From the above results, Alternative No. 1 is shown to result in essentially the same amount of average annual infiltration as the currently permitted design (difference of 0.002%). Alternative No. 2 indicates a decrease in infiltration of approximately half the amount of the average annual infiltration through the currently permitted design. Both alternatives therefore meet the regulatory requirement of achieving an equivalent or greater reduction in infiltration as the currently permitted final cover.

EVALUATION OF STABILITY

Stability analyses were performed to demonstrate that the two alternative final cover designs would be stable under seismic conditions. An infinite slope analysis (Matasovic, 1991) was used to evaluate the potential for slippage between the various geosynthetic components of the final cover design. The stability calculations are included in Appendix D.

In accordance with Subtitle D requirements, the design horizontal seismic acceleration that was used in the analyses is equivalent to the acceleration associated with a 90 percent probability of not being exceeded in 250 years. As shown in the earthquake acceleration map reproduced in Appendix D, a design acceleration of 0.11g was used for the site.

The strength parameters associated with each of the geosynthetic interfaces were evaluated using a library of direct shear test data for similar soils and materials. Although the direct shear test data is not site-specific, it is considered representative for the materials that are, or will be, used at the site. The test data were then used to determine the most critical, or weakest, interface under the applied normal stress due to the protective soil cover. Residual strength values were used because of the likelihood that movement along the final cover will result in the mobilization of residual conditions. Hydrated conditions under low normal stresses were assumed for the interface strengths associated with the geosynthetic clay liner (GCL) of Alternative No. 2.

As shown in Appendix D, the calculated seismic factors of safety for Alternative No. 1 and Alternative No. 2 were 3.17 and 1.71, respectively. A seismic factor of safety of at least 1.0 is

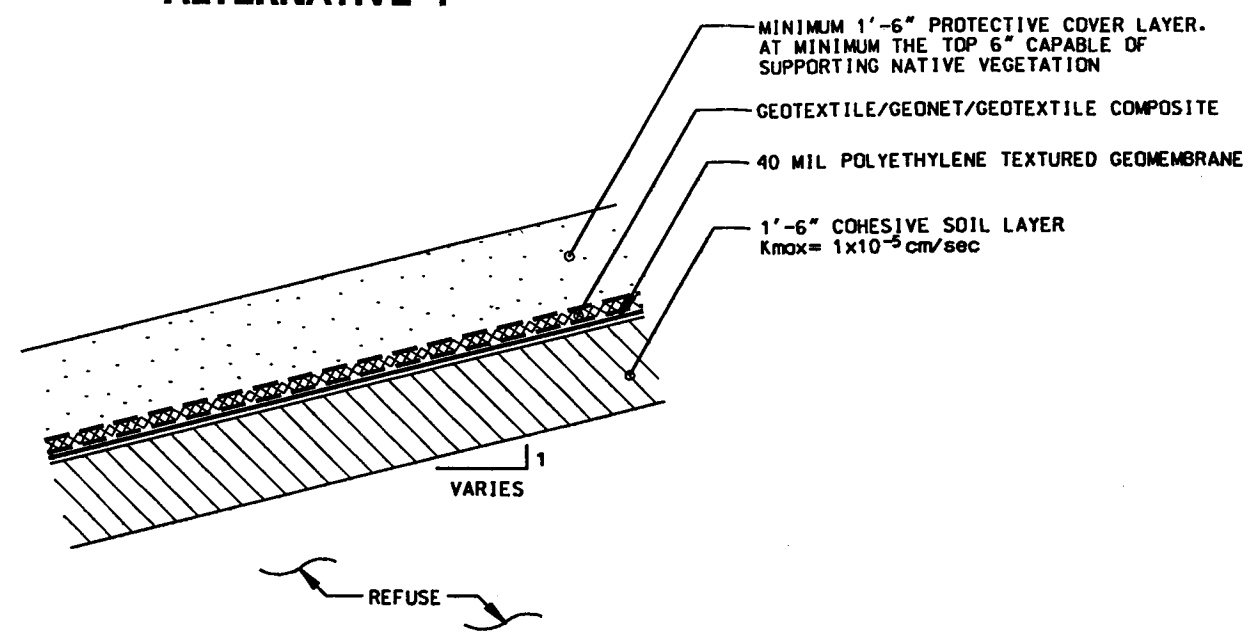
Matasovic, N., "Selection of Method for Seismic Slope Stability Analysis", Proceedings of the 2nd International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics," St. Louis, MO, Vol . 2, pp. 1057-1062, 1991.

Schroeder, P.R., N.M. Aziz, C.M. Lloyd, and P.A. Zappi, "The Hydrologic Evaluation of Landfill Performance (HELP) Model: User's Guide for Version 3," US EPA, Cincinnati, OH, 1994.

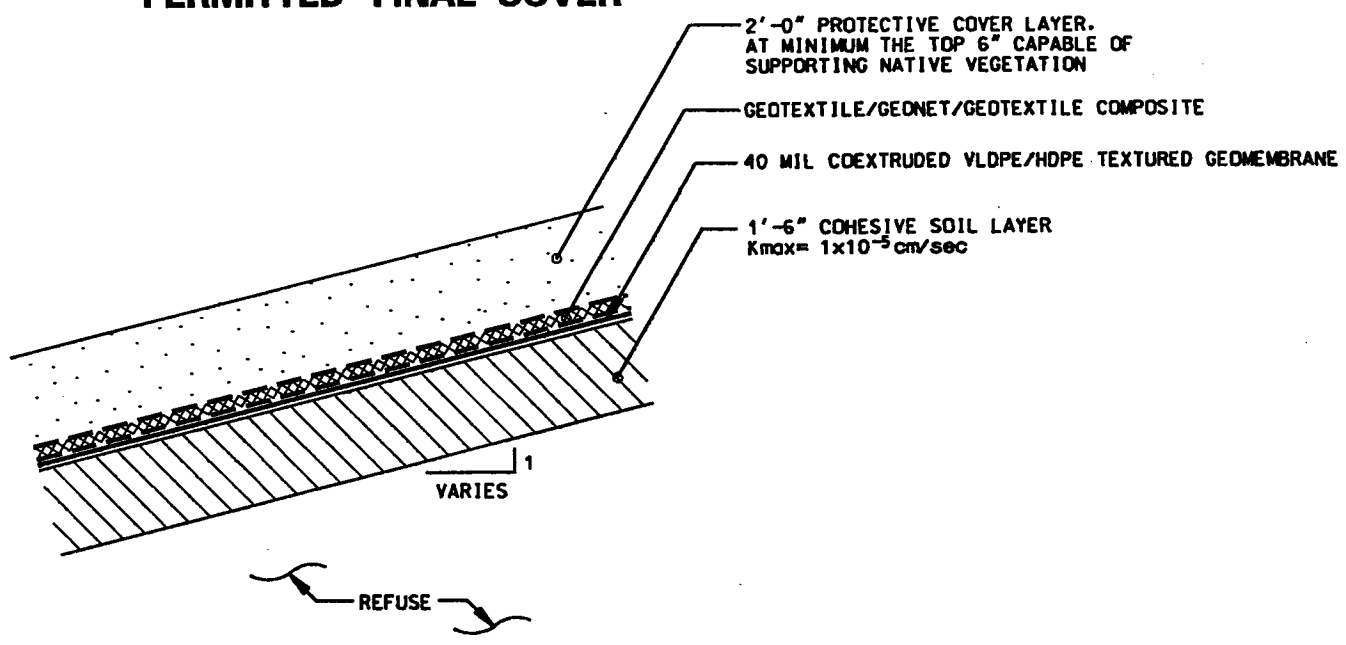
US EPA, "Evaluating Cover Systems for Solid and Hazardous Waste," SW-867, Washington DC, 1982.

US EPA, "RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities," Cincinnati, OH, 1994.

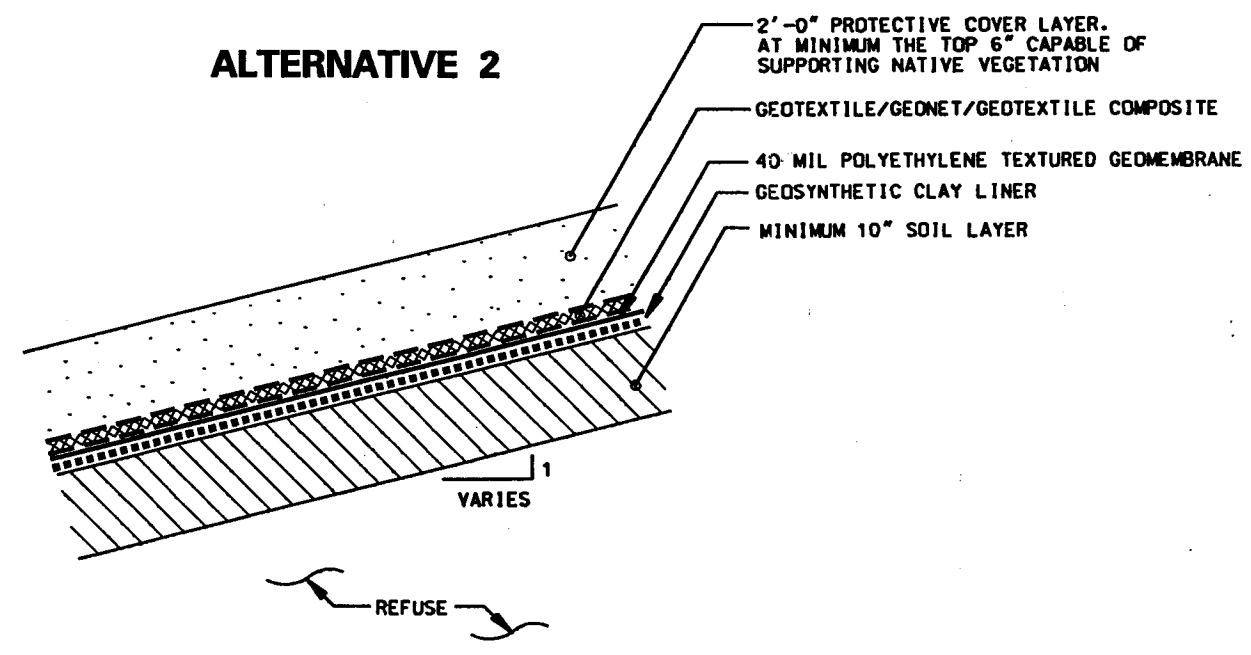
ALTERNATIVE 1



PERMITTED FINAL COVER



ALTERNATIVE 2



RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 1
FINAL COVER DETAILS

PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, FORSYTH COUNTY, NORTH CAROLINA

7221FGR1.DGN

APPENDIX A

CONSTRUCTION QUALITY ASSURANCE PLAN
FINAL COVER SYSTEMS

CONSTRUCTION QUALITY ASSURANCE PLAN
FINAL COVER SYSTEMS

PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, NORTH CAROLINA

JULY 1996

NORTH CAROLINA PROFESSIONAL SEAL 20443 ENGINEER PATRICK J. FLOOD

7-12-96

RUST ENVIRONMENT & INFRASTRUCTURE
P.O. BOX 24000
GREENVILLE, SOUTH CAROLINA 29616

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1.0 INTRODUCTION

Waste Management of Carolinas, Inc. (WMCI) currently owns and operates the Piedmont Landfill and Recycling Center (PLFRC) located at 9900 Freeman Road in Kernersville, North Carolina. The landfill facility operates under permit 34-06 and was originally permitted in 1989. The permit was renewed in 1994. The landfill facility is approximately 108 acres in Forsyth County and borders Guilford County. This Final Cover CQA Plan applies to the entire landfill unit.

This document only applies to the final cover system at PLFRC. Two alternative final cover designs are being proposed and are defined as follows:

Alternative 1: From the refuse, there shall be 1.5 feet of compacted cohesive soil with a specified maximum hydraulic conductivity of $1x10^{-5}$ cm/sec, 40 mil polyethylene textured geomembrane, a composite drainage layer consisting of geotextile/geonet/geotextile, and a minimum of 1.5 feet of protective cover with a minimum of the top 6 inches capable of supporting native vegetation.

Alternative 2: From the refuse, there shall be a minimum of 10 inches of compacted soil, geosynthetic clay liner (GCL), 40 mil polyethylene textured geomembrane, a composite drainage layer consisting of geotextile/geonet/geotextile, and 2 feet of protective cover with a minimum of the top 6 inches capable of supporting native vegetation.

Drawings of Alternative 1 and Alternative 2 are shown in Figure 1 at the end of the text.

The purpose of this document is to define the scope and procedures used to verify that the construction performed meets the project requirements. This document also details the formal procedures and test methods utilized to ensure conformance of construction to plans, specifications, or other criteria established for the project. The CQA Plan outlined herein will encompass the following elements on the PLFRC project:

a. Pre-Construction Testing
b. Compacted Soil Liner

c. Geomembrane Liner
d. Geosynthetic Clay Liner
e. Geocomposite Drainage Layer
f. Protective Cover/Vegetative Support Layer
g. Documentation Report

This Final Cover CQA Plan details the necessary information and guidance to verify that the final cover system is constructed in compliance with permitted plans and State regulations and guidance. The specified quality assurance testing and measures, along with the required testing frequencies, are also provided herein. Also detailed in this plan are the organization and minimum qualifications of the CQA personnel as well as the minimum standards for construction, testing, and documentation to assure quality construction

2.0 PROJECT QUALITY ASSURANCE/QUALITY CONTROL TEAM

Prior to starting construction activities, a preconstruction meeting will be held to discuss project details, including construction management organization, team member duties, and reporting requirements.

2.1 PROJECT TEAM RESPONSIBILITIES

The project team responsible for implementing the CQA Plan shall be technically accountable to the site owner or designated owner representatives. The CQA project team shall consist of a Quality Assurance Project Manager (CQAPM), Certifying Engineer (CE), Senior Site Quality Assurance (SSQA) Manager, and, if required, an appropriate number of technicians to accomplish the work plan. The CQA team shall use sound engineering judgement when determining what additional procedures, other than those outlined in this plan, may be required in order to further assure the construction quality. The CQA team shall operate independently of the designated owner representatives' quality control team. All designated owner representatives shall be responsible for submitting the procedures and results of their quality control program to the CQAPM for review, approval, and documentation.

2.2 CONSTRUCTION QUALITY ASSURANCE PROJECT MANAGER (CQAPM)

The CQAPM shall have experience managing geotechnical engineering, earthwork, and geosynthetics testing for CQA programs. The CQAPM shall be knowledgeable of permit requirements and design plans for the project. The CQAPM is responsible for ensuring that the flow of information between the SSQA Manager and CE is presented to the site owner and designated owner representatives for problem resolutions. If a construction procedure does not meet the design requirements, a resolution meeting will be called and all parties must agree on the action needed to bring the construction within the design requirements.

The CQAPM will visit the site to inspect and document the work activities periodically during the duration of the project. The CQAPM shall be responsible for the overall administration of the quality assurance procedures and for the control of construction quality control documents. The CQAPM shall be responsible for oversight and coordination of the CQA program (CE, SSQA Manager and CQA technicians), surveying, and testing laboratories. The CQAPM, CE, and SSQA Manager shall have frequent dialogue on project status.

2.3 CERTIFYING ENGINEER (CE)

The CE shall be a professional engineer registered in the State of North Carolina with experience performing geotechnical engineering and earthwork testing for other CQA programs. The CE shall have extensive knowledge of the design plans and CQA documents for the project and is responsible (in conjunction with the CQAPM) for informing the contractor or owner of any portion of the work or construction procedures that does not meet the design plans and CQA documents. The CE and the CQAPM may be the same individual.

The CE will periodically visit the site to examine the work to ensure that the design plans and CQA documents are being met. The CE shall also review field and laboratory test data as well as field reports to ensure design specification compliance. Any item requiring attention or approval shall be attended to promptly by the CE and CQAPM. The CE shall be responsible for certification of the final construction as being in conformance with the design plans and CQA documents. Final certification of any element of the project shall be based on conformance to the design plans and CQA documents, conformance to the plan as well as sound engineering judgement; CE shall have the ultimate responsibility for approving and disapproving any element of the project based on the above mentioned factors.

2.4 SENIOR SITE QUALITY ASSURANCE MANAGER (SSQA)

The SSQA Manager is the primary on-site representative of the CQA team. The SSQA Manager is responsible for performing or assuring performance of the sampling and testing required for implementation of this CQA plan. The SSQA Manager shall be selected by the CQAPM and CE and is accountable to the CQAPM. The SSQA Manager shall be familiar with the tests, processes, and materials involved in the construction of compacted cohesive soil, geomembrane liners, and other construction elements. The SSQA Manager shall be proficient in conducting laboratory tests, nuclear density and moisture content tests and visual soil classification; he should also be familiar with geomembrane liner testing and processes.

The SSQA Manager shall monitor all appropriate construction operations. He shall oversee sampling and field testing mandated in this plan, design plans, and specifications. The SSQA Manager shall log site operations together with the test results and submit them once a week to the CQAPM for

review and distribution. Any non-compliance item shall be documented and reported to the CQAPM immediately. If necessary, the CQAPM or CE shall assume the duties and responsibilities of the SSQA Manager.

2.5 QUALITY ASSURANCE TECHNICIANS

If required, Quality Assurance technicians may assist the SSQA Manager in performance of his duties. CQA technician(s) shall report directly to the SSQA Manager. All test results shall be forwarded daily to the SSQA Manager to be included in the weekly report.

3.0 DOCUMENTATION PROCEDURES

3.1 STANDARD REPORTING PROCEDURES

The SSQA Manager and/or the CQA Technicians shall issue reports of construction activities. These reports shall include, as a minimum, the following information:

1. An identifying sheet number for cross-referencing and documentation control.
2. Date, project name, location, and other identification.
3. Weather conditions.
4. Problems encountered and resolutions.
5. Descriptions and locations of ongoing construction.
6. Equipment and personnel in work area, including subcontractors.
7. Descriptions and specific locations of areas, or units, of work being tested and/or observed and documented.
8. Locations where samples were taken.
9. A summary of test results, failures, and retests.
10. Observations of the following operations for geosynthetics, as stipulated in this Final Cover CQA Plan:
    a. Material delivery
    b. Unloading and on-site storage and transport
    c. Sampling for conformance testing
    d. Deployment operations
    e. Jointing/seaming operations
    f. Conditions of panel before and after placement
    g. Visual inspection of walkovers
    h. Repair locations

3.1.1 Applicable Forms

The SSQA Manager will utilize forms appropriate to the type of information being recorded or transmitted. These forms will include Daily Field Reports, Weekly Progress Reports, and various soil test data reporting forms. In addition, various geosynthetic information and test data forms will be used. Other forms will be used as necessary.

3.2 PROBLEM/DEFICIENCY/IDENTIFICATION AND CORRECTIVE ACTION

The SSQA Manager is required to inform the General Contractor and/or the Geosynthetic Contractor, or their representatives, in a timely manner, of any difference between the interpretation of the plans and specifications by the contractors and the SSQA Manager. In addition, any actual or suspect work deficiencies shall be brought to the owner's representative's attention.

3.3 PLAN MODIFICATIONS

Design or specification changes shall be made only with written approval of the owner's representative and the Design Engineer. The CQAPM shall promptly document the information necessary whenever any approved changes are made in the field that deviate from the initial design or permit. This documentation shall be included in the Construction Documentation Report.

3.4 PHOTOGRAPHIC DOCUMENTATION

Photographs shall be taken to document observations, problems, or deficiencies, or work in progress. Photograph logs will include the date, location, direction of view, time of day, and description of activity. Photographs will be filed in chronological order in a permanent protective file by the SSQA Manager. One set of prints and negatives shall be turned over to the site owner at the conclusion of the project.

3.5 FINAL CONSTRUCTION DOCUMENTATION REPORT

After the completion of final cover construction, the SSQA Manager shall prepare a final documentation report covering the installation and testing of the complete final cover system. This report shall certify that construction of the final cover system has been constructed in substantial conformance with the design plans, permit, and this Final Cover CQA Plan. A copy of this report shall be issued to the site owner following completion of the protective/vegetative layer and project surveying.

3.5.1 Report Contents

The final documentation report shall include a narrative describing the construction activities and

schedule as well as summarizing soil and geosynthetic test results. Also, the report shall contain a section presenting a certification of closure construction. This certification section shall be signed and sealed by the CE.

CQA testing data generated during construction shall be included in appendices to the report. Also included will be copies of the Construction Meeting Minutes, Design Modifications, and Record Drawings.

3.5.2 List of Record Drawings

At a minimum, the documentation report will include the following Record Drawings:

1. Top of Compacted Cohesive Soil
2. Top of Protective/Vegetative Soil Layer
3. Geomembrane Perimeter Location

Record Drawings shall be prepared and sealed by a surveyor registered to practice in the State of North Carolina.

4.0 COMPACTED COHESIVE SOIL FOR ALTERNATIVE 1

4.1 PRECONSTRUCTION SAMPLING AND TESTING

Preconstruction sampling and testing will be conducted to determine the properties and suitability of soils for construction of the compacted cohesive soil cap. These requirements will be conducted according to Table 1.

The compacted cohesive soil shall be constructed in accordance with the following specifications, except where required differently by the design plans and specifications.

a. Compaction as necessary to meet the required permeability.
b. Allowable moisture content greater than or equal to optimum as determined by standard Proctor (ASTM D 698) and as necessary to meet specified permeability.
c. Required soil hydraulic conductivity of 1.0×10^{-5} cm/sec as determined by ASTM D 5084. (This is not required under the GCL for Alternative 2.)
d. Maximum compacted lift thickness of 6 inches or depth of sheepsfoot, whichever is less.
e. Minimum compacted cohesive soil lift thickness of 1.5 feet. (Minimum soil lift thickness of 10 inches if GCL is used.)
f. Not placed below temperatures of 32 degrees F; unless material temperature is demonstrated as above freezing.

4.2 CONSTRUCTION MONITORING

Quality control of the compacted cohesive soil shall consist of monitoring the work as soil construction procedures. Laboratory and field testing shall be performed in conjunction to ensure that compacted cohesive material conformance and construction performance specifications are achieved.

1) Monitoring and Observations

The SSQA Manager will monitor and test the compacted cohesive soil during construction to ensure performance specifications are achieved. The CE will visit the site periodically as construction progress warrants. Such visits will be frequent enough so that he is fully

knowledgeable of the construction methods and performance so that he can determine that quality control monitoring and testing activities are adequate to meet the terms and intent of this document.

Observations shall include, but not be limited to, the following:

a. Classification, moisture content and distribution, particle size, and other physical properties of the soil during placement and compaction.
b. Type and level of compactive effort, including roller type and weight, drum size and foot length, and number of passes.
c. Action of compaction equipment on soil surface (i.e. foot penetration, rolling, pumping, or shearing).
d. Maximum clod size and breakdown of soil structure.
e. Method of bonding lifts together for fill locations.
f. Removal of stones, roots or other foreign materials which may damage overlying geosynthetic components or adversely affect compaction, lift bonding, and in-place testing/sampling.
g. Repair of areas where damage due to excess moisture, insufficient moisture, or freezing may have occurred.

2) Construction Testing

During compacted cohesive soil construction, the minimum testing and sampling program shown in Table 1 shall be conducted to ensure that adequate compaction and material conformance are being achieved.

4.3 POST-CONSTRUCTION CARE OF THE COMPACTED COHESIVE SOIL

The constructed cohesive soil shall be protected from desiccation and frost damage. Conversely, the area shall be kept free of standing water by adequately grading and/or water removal. Damage caused by rain shall be repaired, and if the lift must be reworked, then appropriate retesting shall be performed.

5.0 GEOSYNTHETICS

This section presents general procedures, quality control and quality assurance testing requirements for the geosynthetic components used in construction. The geosynthetic liner system for this project may include the following components:

a. Geonet with a double-sided heat bonded non-woven geotextile
b. 40- mil textured geomembrane - Presently CoverSeal™ will be used, although an equivalent textured polyethylene geomembrane may be substituted in the future
c. Geosynthetic Clay Liner

5.1 PRE-INSTALLATION MATERIAL EVALUATION

Prior to the installation of any geosynthetic layer (geomembrane or geocomposite), the manufacturer or installer shall provide the CQAPM with quality control certificates signed by an acceptable responsible party employed by the manufacturer. Each quality control certificate shall include roll identification numbers, testing procedures, and results of quality control tests. The quality control tests shall be performed in accordance with project-specific testing methods and subject to the following testing frequency. The quality control testing may be performed in the manufacturing plant. The CQAPM shall review the test results prior to acceptance to ensure that the certified minimum properties meet the project specifications. Results shall be given for the tests presented below. Details on acceptance criteria are presented on Table 2.

Geocomposite

1 per 40,000 ft^2	• Mass Per Unit Area (ASTM D 3776) • Thickness (ASTM D 1777) • Geotextile-Geonet Adhesion (ASTM D 413)

Geosynthetic Clay Liner

1 per 10,000 ft^2	• Moisture Content (ASTM D 4643) • Mass Per Unit Area (ASTM D 3776)
(1 per 100,000 ft^2)	• Hydraulic Conductivity (GRI GCL-2)

Geomembrane

1 per 100,000 ft^2	• Density (ASTM D 1505)
	• Carbon Black Content (ASTM D 1603)
	• Thickness (ASTM D 5199)
	• Tensile Properties (ASTM D 638)
(1 per 250,000 ft^2)	• Multi-Axial Tensile Elongation (GRI GM-4)

1) Handling and Storage of Geosynthetics

Geosynthetics are usually shipped in rolls and shall be marked to show the following minimum information. Manufacturer's certificates should be cross-referenced to rolls delivered on site.

a. Name of manufacturer/fabricator
b. Product type
c. Product thickness
d. Manufacturing batch code or roll number
e. Date of manufacture
f. Physical dimensions (length and width)

The SSQA Manager or the CQA technicians shall inspect the geosynthetic material.. The material shall be inspected for any damages from punctures, tears, blocking, and crumpling during preparation for shipment or unloading. The shipment should be rejected if the product is not consistent with what was originally approved.

5.2 CONFORMANCE TESTING

The manufacturer's quality control certificates will be used to show conformance to the project specifications. The quality control certificates shall be submitted to SSQA Manager for review, comment, and inclusion into the final report.

The CQAPM or his field staff shall ensure that geomembrane property values guaranteed by the manufacturer in its specifications are met.

5.3 GEOMEMBRANE INSTALLATION

1) Liner Subgrade Preparation and Acceptance

Prior to the installation of the geomembrane, the liner subgrade shall be checked for irregularities, protrusions, debris, stones, standing water, and abrupt changes in grade. The soil liner surface shall be prepared by rolling with a smooth-drum roller or hand-worked to minimize the surface roughness and to flatten protruding soil or rock particles prior to geomembrane deployment. Loose rocks/stones which could damage the geomembrane shall be removed. Excessive voids, dimples or pit marks shall be filled in with a similar soil mixture. The surface shall not exhibit excessive desiccation or pumping prior to geomembrane deployment. Written acceptance of the subgrade is required from both the geomembrane's installer and the SSQA Manager prior to deployment.

2) Geomembrane Deployment

The geomembrane shall be installed in direct and uniform contact with the compacted cohesive soil or GCL and shall not be placed during inclement weather. Seaming should not take place when ambient temperatures are below 40°F or above 104°F unless trial seams reveal acceptable results at lower/higher temperatures. In general, no support equipment shall be allowed on the geomembrane. Personnel working on the geomembrane shall not smoke, wear damaging shoes, or engage in any other activity likely to damage the geomembrane. Only those sections of the geomembrane that are to be placed and seamed in one day should be unrolled.

3) Panel Marking

For this project, liner markings shall be color coded. Any spray paint used must be environmentally safe and be water-based. Writing on the liner shall be strictly limited to documentation purposes only.

4) Panel Installation

In general, seams should be oriented parallel to the line of maximum slope, i.e., oriented up and down, not across the slope. In corners and odd-shaped geometric locations, the number of field seams should be minimized. When horizontal seams are necessary, adjacent seams shall be staggered horizontally, with the up slope panel overlapping the lower panel ("shingling"). Avoid locating panel intersections closer than 5 feet to the toe of the slope. Objects such as leachate collection sump risers, cleanout riser pipes, and gas vents which will penetrate the cover shall be booted as necessary to prevent infiltration of water or migration of landfill gas.

Panels shall have a minimum four inches finished overlap. Field seaming shall only be performed by the method or methods approved by the manufacturer, either by extrusion welding or double-tracked fusion welding. Fishmouths or wrinkles at the seam overlap shall be cut along the ridge of the wrinkle in order to achieve a flat overlap and the cut shall be seamed and/or patched. Patches shall extend at least 6" beyond the cut in all directions. Seams shall extend to the outside edge of panels placed in the anchor trench.

Panel layout and field seams shall be given an identification code, mapped and logged to record relevant installation information. Minor, superficial scars that are extruded will not receive a repair number. All butt seams, inner cell tie-ins, perimeter envelope seams shall be treated as one seam and have continuous stationing.

5.4 GEOMEMBRANE INSTALLATION QUALITY CONTROL

The SSQA Manager or the CQA technicians will visually monitor sheet quality and periodic seaming procedures during installation. The installer is responsible for providing and documenting quality control testing of the installed material in accordance with the drawings and specifications.

The installer's QC technicians shall monitor and document the following installation and testing operations and provide a copy to the SSQA Manager or CE for review:

a. Trial Seams
b. Panel Placement
c. Panel Seaming

d. Nondestructive Testing
e. Destructive Seam Testing
f. Test Failures and Repairs

Refer to Table 3 for minimum acceptable values for peel and shear testing.

5.5 GEOSYNTHETIC CLAY LINER INSTALLATION

During shipment and storage, the GCL shall be protected from ultraviolet light exposure, precipitation, excessive humidity, puncture, cutting, or any other damaging conditions. GCL rolls shall be stored away from wet ground and be covered with a watertight tarp or under a roof to protect the stored rolls from hydration. The roll wrappings shall be removed shortly before deployment.

The SSQA Manager shall observe rolls prior to deployment at the site and report any deviations from the above requirements to the CQA PM and the Site Engineer.

The SSQA Manager shall review the GCL panel deployment progress and advise the CQAPM on its conformance with the actual field conditions. The SSQA Manager shall verify that the Installer handles the GCL material in such a manner as to ensure that it is not damaged, and the following are complied with:

1. On slopes, the GCL rolls shall be securely anchored and the GCL material then deployed down the slope in such a manner as to keep the GCL panel in tension.
2. The GCL should be installed with the proper side of the material facing upward. The proper orientation of the material should be specified by the project specifications.
3. The Installer shall take any necessary precautions to prevent damage to the underlying soil during placement of the GCL.
4. During placement of the GCL, care shall be taken not to entrap beneath the GCL any stones, excessive dust or moisture that could damage the GCL.

5. After installation, a visual examination of the GCL shall be carried out over the entire surface to ensure that no potentially harmful foreign objects damaged areas are present.
6. Excess loss of bentonite on edges during deployment should be minimized.

No more GCL material should be deployed during one working day than can be covered by the end of that day. Exceptions to this requirement may occur if dry weather is forecast for several consecutive days. GCL deployment shall not be undertaken during precipitation or when there is an immediate threat of precipitation. Adjacent GCL panels shall be joined according to project plans and specifications and meet the following requirements:

1. Edge seam overlaps shall be a minimum of 6 inches.
2. Roll end seam overlaps shall be a minimum of 12 inches.
3. End to end seams on slopes shall be minimized. If they are required, the SSQA Manager shall contact the Design Engineer to verify the method used to attach the GCLs has adequate tensile strength.

Any portion of the GCL exhibiting flaws shall be repaired. Prior to acceptance of the installed GCL, the Installer shall locate and repair damaged areas of the liner as directed by the SSQA Manager. Defects or damage can be identified by either rips or tears in the GCL, delamination of the geotextiles, or premature hydration.

Rips or tears in the GCL shall be covered by another piece of material meeting the project specifications. The material shall extend over the entire damaged area with a minimum six inch overlap in all directions. Addition of bentonite to patches shall be in accordance with the project specifications.

Where the GCL has been exposed to moisture prior to placement of overlying material, the material shall be removed and replaced with material meeting the project specifications.

5.6 GEOCOMPOSITE INSTALLATION

The installer shall handle all geocomposite in such a manner as to ensure that it is not damaged in any way. During placement of geocomposite, care shall be taken not to entrap dirt or excessive dust in

the geonet that could cause clogging of the drainage system, and/or stones that could damage the adjacent geomembrane. If dirt or excessive dust is entrapped in the geocomposite, it should be cleaned prior to placement of the next material on top of it. In this regard, care shall be taken with the handling of sandbags, to prevent puncturing the sandbag.

Geocomposite seams and overlaps must, at a minimum, meet the following requirements:

a. Adjacent rolls shall be overlapped by at least 4 inches.
b. The geonet overlaps shall be tied with plastic fasteners. Tying devices shall be white or yellow for easy inspection. Metallic devices are not allowed.
c. Tying shall be every 5 feet along the length at the adjacent rolls and every 6 inches along end-to-end seams.
d. In the corners of the sideslopes, where overlaps between perpendicular geocomposite strips are required, an extra layer of geocomposite shall be unrolled along the slope, on top of the previously installed geocomposite, from top to bottom of the slope.

The geotextile portion of the geocomposite shall be continuously sewn. Spot sewing is not allowed. Any sewing shall be done using thread with chemical and ultraviolet light resistance properties equal to or exceeding those of the geotextile. The color of the sewing thread shall contrast the background color of the geotextile. Sewing shall be done using machinery and stitch types specified in the project specifications or as approved in writing by the owner's representative and the CE.

5.7 GEOCOMPOSITE REPAIRS

Any holes or tears in the geocomposite shall be repaired using the following two procedures.

a. On sideslopes, a patch made from the same geocomposite shall be thermally bonded into place in accordance with the project specifications. Should any tear exceed 10% of the width of the roll, that roll shall be removed from the slope and replaced.

b. On non-sideslope areas, a patch made from the same geocomposite shall be thermally bonded into place with a minimum of 12 inches overlap in all directions. Care shall be taken to remove any soil or other material which may have penetrated the torn geocomposite.

6.0 PROTECTIVE\VEGETATIVE COVER

A minimum of 18 inches will be placed on Alternative 1, and 24 inches will be placed over the GCL (Alternative 2). The protective and vegetative cover system is installed to protect the components of the lining system and help minimize erosion by supporting vegetative growth. The top 6 inches of the protective layer will be capable of supporting vegetative growth. Before the protective or vegetative cover is placed over the geomembrane, all destructive and nondestructive testing must be completed and approved by the CQAPM.

1) Preconstruction Material Evaluation

Materials selected for use in the protective/vegetative cover system shall be verified by the SSQA Manager to comply with the design plans for the project. Materials for the vegetative layer and protective cover layer shall be selected to meet the performance requirements specified in the design which should include requirements for particle size. Representative samples of the protective\vegetative layers shall be obtained and tested in accordance with the following schedule:

Preconstruction Material Testing for Protective/Vegetative Materials		
Test	**Method**	**Frequency**
Particle-Size Analysis	**ASTM D 422**	**1/source**

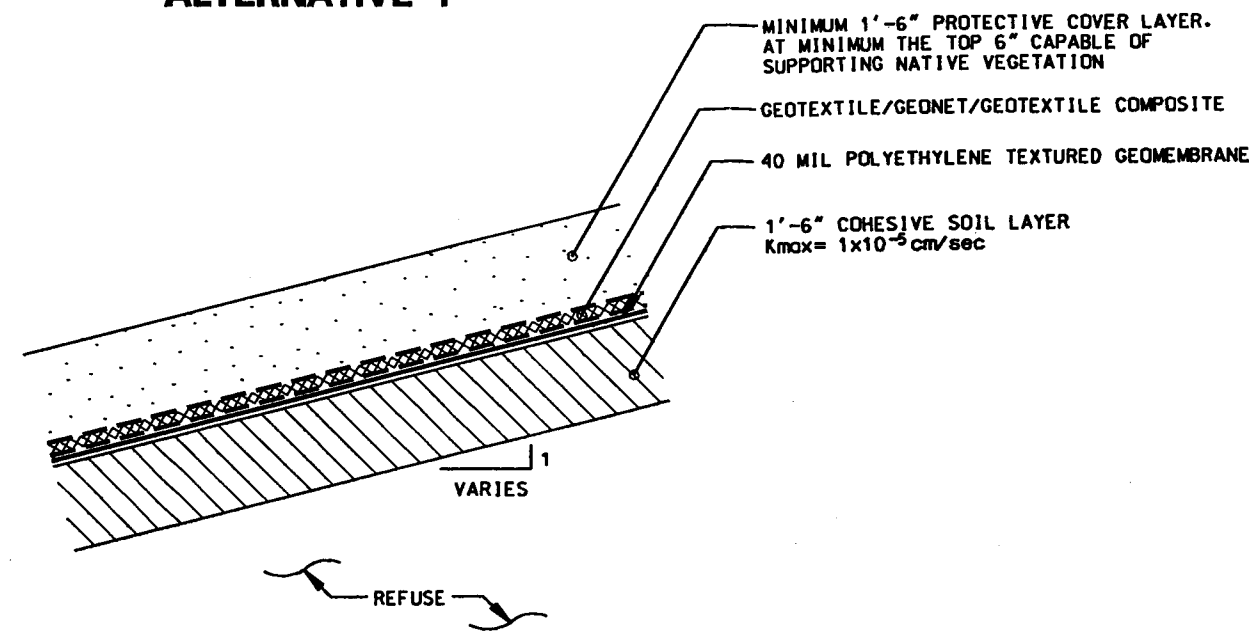
2) Construction Conformance Testing

Protective cover materials selected for use shall be tested at regular intervals for minimum thickness verifications. Minimum testing frequency shall be one thickness measurement per acre.

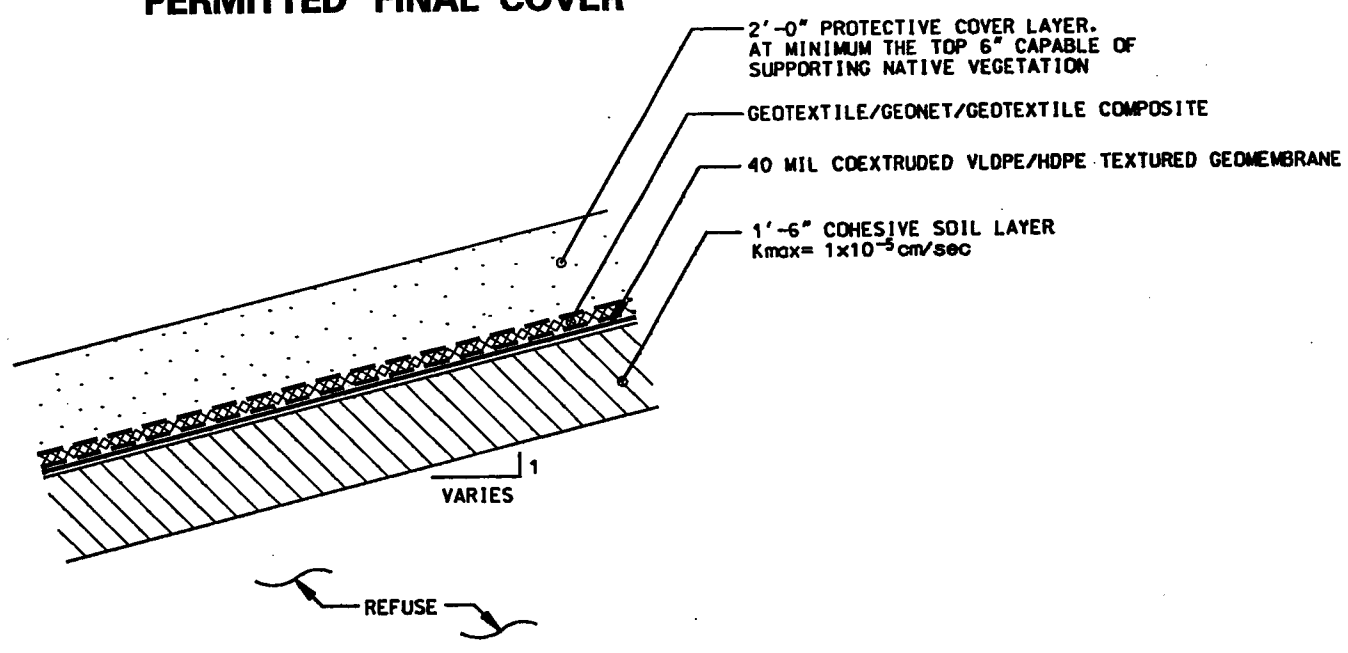
Placement of protective cover materials over geosynthetic liners shall generally not proceed at ambient temperatures below 32°F or above 104°F, but should be conducted at the coolest part of the day to minimize the development of wrinkles or folding of the geosynthetic materials. A minimum of one foot of material is required between low ground pressure dozers and the geomembrane. Greater material thickness must be maintained above the geomembrane to support heavier spreading

equipment and hauling vehicles. In such cases, a minimum thickness of two feet of protective cover shall be used unless otherwise specified in the design. The vegetative layer or protective cover does not necessarily require compaction control. The firmness of the vegetative cover varies with the type of vegetation specified for the cover. Care shall be exercised in placement so as not to shift or damage the underlying geosynthetic layers. The overall thickness of protective/vegetative cover materials shall be verified by either survey methods or careful excavations with thickness measurements.

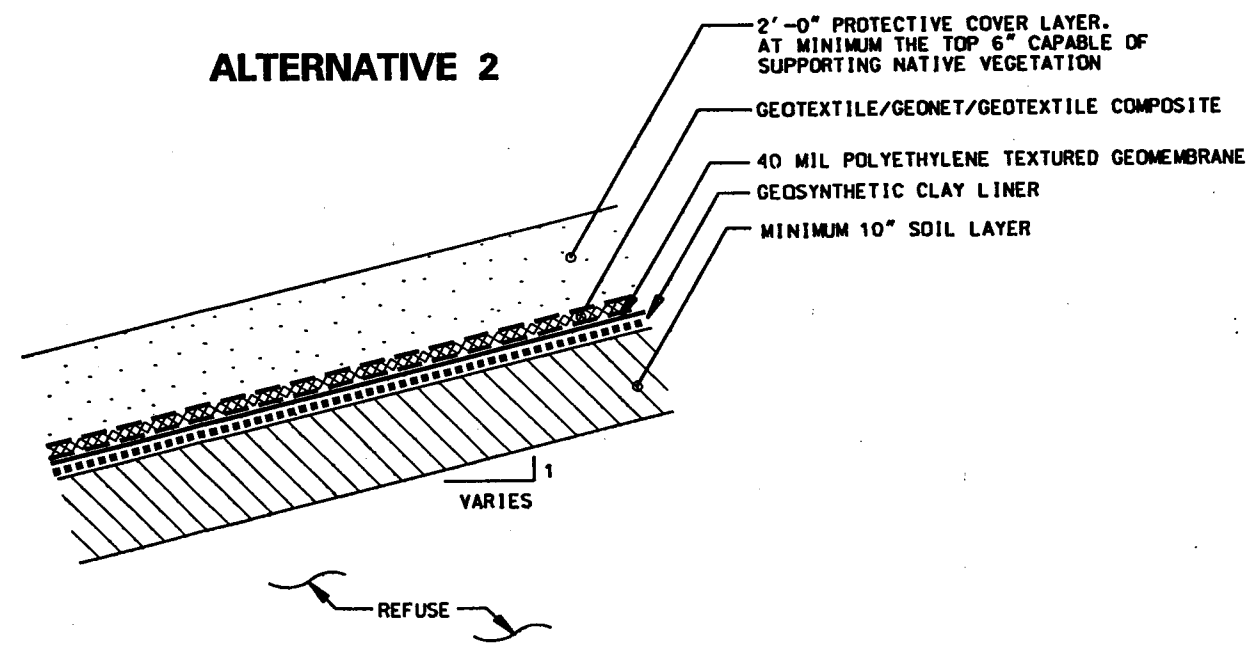
ALTERNATIVE 1



PERMITTED FINAL COVER



ALTERNATIVE 2



RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 1
FINAL COVER DETAILS

PIEDMONT LANDFILL AND RECYCLING CENTER
KERNERSVILLE, FORSYTH COUNTY, NORTH CAROLINA

7221FGR1.DGN

TABLE 1

QA Testing Frequencies and Criteria for Compacted Cohesive Soil

Pre-Construction Qualification		
Test	**ASTM Method**	**Quantity**
Atterberg Limits	D4318	1 per source
Compaction	D698	1 per source
Particle Size	D1140	1 per source
Moisture Content	D2216	1 per source
Permeability	D5084	1 per source
Construction Testing		
Atterberg Limits	D4318	1/5,000 yd^3
Compaction	D698	1/5,000 yd^3
Particle Size	D1140	1/5,000 yd^3
Moisture Content	D2216	1/5,000 yd^3
Permeability	D5084	1/5,000 yd^3
Nuclear Density/Moisture	D2922	1/lift/10,000 ft^2
Testing Criteria		
Classification	CL, CH, SC, ML, MH, CL-ML	
Particle Size	Maximum size 4 inches	
Organics	PT, OH, OL not suitable for fill	

TABLE 2

QA Testing Frequencies and Criteria For Geosynthetic Clay Liner (Manufacturer's Data)

Test Name	Test Method	Frequency	Specified Value
Moisture Content (Bentonite)	ASTM D 4643	1/10,000 ft^2	10 percent max.
Mass per Unit Area	ASTM D 3776	1/10,000 ft^2	1.06 lbs/ft^2 min.
Hydraulic Conductivity	GRI GCL-2	1/100,000 ft^2	$1x10^{-9}$ cm/sec max.

TABLE 3

Minimum Peel and Shear Testing Values

40-mil Coverseal				
Geomembrane Seams				
Property	**Qualifier**	**Unit**	**Specified Value**	**Test Method**
Bonded Seam Strength	Min.	lb/in	35	ASTM D 4437*
Peel Adhesion:				
Fusion	Min.	lb/in	30	ASTM D 4437*
Extrusion	Min.	lb/in	25	ASTM D 4437*

*Note: Test Methods Modified

Coverseal		
Test Method Modifications		
Property	**Test Method**	**Modifications**
Tensile Properties	ASTM D 638	Type IV Die. ASTM D 638 test specimen shall be used. The Grip separation shall be 2.5 inches. This test does not require the use of extensometers. The rate of grip separation will be 2 inches per minute. A gauge length of 1.3 inches for yield values, and 2.0 inches for break values shall be used to calculate percent elongation from grip movement.
Bonded Seam Strength and Peel Adhesion	ASTM D 4437	For shear tests, the sheet shall yield before failure of the seam. For peel adhesion, seam separation shall not extend more than 10% into the seam. For either test, testing shall be discontinued when the sample has visually yielded.

APPENDIX B

COVERSEAL MANUFACTURER'S SPECIFICATIONS

NSC

40 mil *FRICTION SEAL CS* GEOMEMBRANE QUALITY CONTROL SPECIFICATIONS

FRICTION SEAL CS, National Seal Company's advanced textured polyethylene geomembrane is manufactured by attaching a friction surface to NSC's high quality *CoverSeal* geomembrane. The Friction surface is made from high molecular weight polyethylene resins compounded specifically for use in NSC geomembranes. The resins have been formulated to provide chemical and ultraviolet resistance for final cover applications. NSC produces *FRICTION SEAL CS* with a textured surface on one or both sides of the parent sheet.

The following properties, considered to be the most applicable for final cover applications, are tested every 100,000 ft^2 of geomembrane. Multi-axial tensile elongation is tested every 250,000 ft^2.

SHEET PROPERTIES	METHOD	UNITS	MINIMUM[1]
Thickness	ASTM D5199		
Average		mils	40.0
Individual		mils	36.0
Density[2]	ASTM D 1505	g/cm^3	0.92 - 0.94
Carbon Black Content[2]	ASTM D 1603	percent	2.0 - 3.5
Tensile Properties[3]	ASTM D 638		
Stress at Break		psi	2300
Strain at Break	2.0" gage length	percent	300
	2.5" gage length (NSF)	percent	240
Multi-axial elongation	GRI, GM-4	percent	30

1 Except where noted, this value represents the minimum acceptable test value for a roll.

2 Testing performed on base sheet.

3 Stress and strength values are normalized to the nominal base sheet thickness. NSC certifies properties based on values calculated using nominal thickness only. Stress values calculated using actual product thickness is not guaranteed due to the lack of industry accepted thickness test procedures for friction sheet.

STANDARD ROLL DIMENSIONS

Width 15 feet Weight 3,000 lbs

This information contained herein has been compiled by National Seal Company and is, to the best of our knowledge, true and accurate. All suggestions and recommendations are offered without guarantee. Final determination of suitability for use based on any information provided, is the sole responsibility of the user. There is not implied or expressed warranty of merchantability of fitness of the product for the contemplated use.

NSC reserves the right to update the information contained herein in accordance with technological advances in the material properties.

APPENDIX C

HELP MODEL OUTPUT FILES

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                 HELP MODEL VERSION 3.04a  (10 JULY 1995)                 **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************


PRECIPITATION DATA FILE:     C:\HELP304a\pied1.D4
TEMPERATURE DATA FILE:       C:\HELP304a\pied1.D7
SOLAR RADIATION DATA FILE:   C:\HELP304a\pied1.D13
EVAPOTRANSPIRATION DATA:     C:\HELP304a\pied1.D11
SOIL AND DESIGN DATA FILE:   C:\HELP304a\PERMIT.D10
OUTPUT DATA FILE:            C:\HELP304a\PERMIT.OUT


TIME:  10:20     DATE:   7/ 9/1996


******************************************************************************

     TITLE:  Piedmont Landfill Currently Permitted Final Cover

******************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                  LAYER  1
                                  --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   8
          THICKNESS                    =     24.00   INCHES
          POROSITY                     =      0.4630 VOL/VOL
          FIELD CAPACITY               =      0.2320 VOL/VOL
          WILTING POINT                =      0.1160 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2828 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.369999994000E-03 CM/SEC
       NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  4.63
                FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

LAYER 2

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 20

THICKNESS	=	0.20	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0133	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	10.0000000000	CM/SEC
SLOPE	=	25.00	PERCENT
DRAINAGE LENGTH	=	160.0	FEET

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.04	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	7.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	18.00	INCHES
POROSITY	=	0.4190	VOL/VOL
FIELD CAPACITY	=	0.3070	VOL/VOL
WILTING POINT	=	0.1800	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2811	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 8 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 25.% AND A SLOPE LENGTH OF 160. FEET.

SCS RUNOFF CURVE NUMBER	=	75.20	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	24.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	6.788	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	11.112	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.784	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	11.850	INCHES
TOTAL INITIAL WATER	=	11.850	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
GREENSBORO NORTH CAROLINA

STATION LATITUDE	=	35.13	DEGREES
MAXIMUM LEAF AREA INDEX	=	3.50	
START OF GROWING SEASON (JULIAN DATE)	=	90	
END OF GROWING SEASON (JULIAN DATE)	=	305	
EVAPORATIVE ZONE DEPTH	=	24.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	7.60	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	70.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR GREENSBORO NORTH CAROLINA

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.51	3.37	3.88	3.16	3.37	3.93
4.27	4.19	3.64	3.18	2.59	3.38

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR GREENSBORO NORTH CAROLINA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
37.50	39.90	48.00	58.30	66.50	73.50
77.20	76.30	69.90	58.40	48.50	40.20

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR GREENSBORO NORTH CAROLINA

AND STATION LATITUDE = 35.13 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 20

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.71	3.27	4.10	2.81	3.05	3.96
	4.76	5.13	3.82	2.52	2.60	3.80
STD. DEVIATIONS	1.65	1.38	1.92	1.36	1.29	2.53
	1.98	2.38	2.39	1.71	1.91	1.80
RUNOFF						
TOTALS	0.017	0.027	0.079	0.006	0.001	0.034
	0.034	0.057	0.082	0.034	0.018	0.037
STD. DEVIATIONS	0.069	0.057	0.235	0.018	0.003	0.130
	0.108	0.134	0.128	0.070	0.074	0.076
EVAPOTRANSPIRATION						
TOTALS	1.167	1.493	2.643	3.056	4.142	3.476
	4.298	3.151	2.674	2.576	1.015	0.893
STD. DEVIATIONS	0.296	0.325	0.391	0.610	0.868	1.625
	1.545	1.053	0.721	0.959	0.295	0.275
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	1.7448	1.3119	1.9672	0.6793	0.2749	0.4392
	0.5751	0.6682	1.2182	0.6229	0.5401	1.4593
STD. DEVIATIONS	1.5960	0.8568	1.4445	0.6604	0.4804	0.4972
	0.6416	0.6404	1.0980	0.7277	0.9358	1.3054
PERCOLATION/LEAKAGE THROUGH LAYER 3						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0054	0.0041	0.0048	0.0038	0.0021	0.0027
	0.0032	0.0031	0.0032	0.0027	0.0019	0.0031
STD. DEVIATIONS	0.0065	0.0043	0.0056	0.0044	0.0025	0.0032

	0.0038	0.0037	0.0034	0.0024	0.0017	0.0024

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0007	0.0006	0.0008	0.0003	0.0001	0.0002
	0.0002	0.0003	0.0005	0.0002	0.0002	0.0006
STD. DEVIATIONS	0.0006	0.0004	0.0006	0.0003	0.0002	0.0002
	0.0002	0.0002	0.0004	0.0003	0.0004	0.0005

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 20

	INCHES		CU. FEET	PERCENT
PRECIPITATION	42.52	(7.072)	154363.9	100.00
RUNOFF	0.425	(0.3409)	1543.20	1.000
EVAPOTRANSPIRATION	30.585	(3.6655)	111023.98	71.924
LATERAL DRAINAGE COLLECTED FROM LAYER 2	11.50101	(4.11434)	41748.664	27.04561
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.00003	(0.00001)	0.099	0.00006
AVERAGE HEAD ON TOP OF LAYER 3	0.000	(0.000)		
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.04007	(0.04046)	145.466	0.09424
CHANGE IN WATER STORAGE	-0.027	(1.2053)	-98.39	-0.064

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 20

	(INCHES)	(CU. FT.)
PRECIPITATION	3.76	13648.800
RUNOFF	1.022	3709.5210
DRAINAGE COLLECTED FROM LAYER 2	1.52550	5537.56689
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.000002	0.00903
AVERAGE HEAD ON TOP OF LAYER 3	0.018	
MAXIMUM HEAD ON TOP OF LAYER 3	0.034	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	0.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000951	3.45315
SNOW WATER	2.87	10419.2432

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3786
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1160

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 20

LAYER	(INCHES)	(VOL/VOL)
1	7.0445	0.2935
2	0.0048	0.0239
3	0.0000	0.0000
4	4.2584	0.2366
SNOW WATER	0.000	

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                 HELP MODEL VERSION 3.04a  (10 JULY 1995)                 **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:     C:\HELP304a\pied1.D4
TEMPERATURE DATA FILE:       C:\HELP304a\pied1.D7
SOLAR RADIATION DATA FILE:   C:\HELP304a\pied1.D13
EVAPOTRANSPIRATION DATA:     C:\HELP304a\pied1.D11
SOIL AND DESIGN DATA FILE:   C:\HELP304a\ALT1.D10
OUTPUT DATA FILE:            C:\HELP304a\ALT1.OUT


TIME:  14: 9     DATE:   7/ 9/1996


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     TITLE:  Piedmont Landfill Alternative Final Cover No. 1

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                  LAYER  1
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                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   8
          THICKNESS                    =     18.00   INCHES
          POROSITY                     =      0.4630 VOL/VOL
          FIELD CAPACITY               =      0.2320 VOL/VOL
          WILTING POINT                =      0.1160 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2740 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.369999994000E-03 CM/SEC
        NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  4.63
                 FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
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LAYER 2

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 20

THICKNESS	=	0.20	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2173	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	10.0000000000	CM/SEC
SLOPE	=	25.00	PERCENT
DRAINAGE LENGTH	=	160.0	FEET

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.04	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	7.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	18.00	INCHES
POROSITY	=	0.4190	VOL/VOL
FIELD CAPACITY	=	0.3070	VOL/VOL
WILTING POINT	=	0.1800	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2906	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 8 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 25.% AND A SLOPE LENGTH OF 160. FEET.

SCS RUNOFF CURVE NUMBER	=	75.20	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	18.2	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	4.975	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	8.504	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.089	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	10.206	INCHES
TOTAL INITIAL WATER	=	10.206	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
GREENSBORO NORTH CAROLINA

STATION LATITUDE	=	35.13	DEGREES
MAXIMUM LEAF AREA INDEX	=	3.50	
START OF GROWING SEASON (JULIAN DATE)	=	90	
END OF GROWING SEASON (JULIAN DATE)	=	305	
EVAPORATIVE ZONE DEPTH	=	18.2	INCHES
AVERAGE ANNUAL WIND SPEED	=	7.60	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	70.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR GREENSBORO NORTH CAROLINA

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.51	3.37	3.88	3.16	3.37	3.93
4.27	4.19	3.64	3.18	2.59	3.38

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR GREENSBORO NORTH CAROLINA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
37.50	39.90	48.00	58.30	66.50	73.50
77.20	76.30	69.90	58.40	48.50	40.20

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR GREENSBORO NORTH CAROLINA

AND STATION LATITUDE = 35.13 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 20

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.71	3.27	4.10	2.81	3.05	3.96
	4.76	5.13	3.82	2.52	2.60	3.80
STD. DEVIATIONS	1.65	1.38	1.92	1.36	1.29	2.53
	1.98	2.38	2.39	1.71	1.91	1.80
RUNOFF						
TOTALS	0.016	0.026	0.082	0.005	0.001	0.041
	0.035	0.057	0.088	0.036	0.018	0.040
STD. DEVIATIONS	0.062	0.056	0.235	0.016	0.003	0.158
	0.103	0.132	0.139	0.073	0.077	0.085
EVAPOTRANSPIRATION						
TOTALS	1.278	1.587	2.809	3.091	3.558	3.603
	4.479	3.378	2.841	2.510	1.061	1.014
STD. DEVIATIONS	0.188	0.259	0.309	0.660	0.966	1.680
	1.542	1.052	0.729	0.965	0.348	0.259
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	1.6171	1.4256	1.7776	0.4106	0.1895	0.2623
	0.3491	0.6254	1.2853	0.5035	0.5338	1.8962
STD. DEVIATIONS	1.7097	1.0473	1.4627	0.6197	0.5154	0.6271
	0.7357	1.1208	1.5116	0.7646	1.1814	1.4370
PERCOLATION/LEAKAGE THROUGH LAYER 3						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0085	0.0056	0.0068	0.0027	0.0009	0.0013
	0.0012	0.0011	0.0038	0.0038	0.0012	0.0043
STD. DEVIATIONS	0.0099	0.0053	0.0089	0.0033	0.0025	0.0031

	0.0026	0.0024	0.0048	0.0079	0.0015	0.0042

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0094	0.0093	0.0104	0.0025	0.0011	0.0016
	0.0020	0.0037	0.0078	0.0030	0.0032	0.0111
STD. DEVIATIONS	0.0100	0.0068	0.0086	0.0038	0.0030	0.0038
	0.0043	0.0066	0.0092	0.0045	0.0072	0.0084

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 20

	INCHES		CU. FEET	PERCENT
PRECIPITATION	42.52	(7.072)	154363.9	100.00
RUNOFF	0.445	(0.3460)	1615.57	1.047
EVAPOTRANSPIRATION	31.208	(3.0868)	113285.60	73.389
LATERAL DRAINAGE COLLECTED FROM LAYER 2	10.87615	(4.78660)	39480.422	25.57620
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.00025	(0.00011)	0.924	0.00060
AVERAGE HEAD ON TOP OF LAYER 3	0.005	(0.002)		
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.04113	(0.04203)	149.290	0.09671
CHANGE IN WATER STORAGE	-0.046	(0.7045)	-167.96	-0.109

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 20

	(INCHES)	(CU. FT.)
PRECIPITATION	3.76	13648.800
RUNOFF	1.009	3662.5615
DRAINAGE COLLECTED FROM LAYER 2	1.56950	5697.29590
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.000029	0.10511
AVERAGE HEAD ON TOP OF LAYER 3	0.285	
MAXIMUM HEAD ON TOP OF LAYER 3	0.565	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	0.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.001685	6.11681
SNOW WATER	2.87	10419.2432

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3607
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1148

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 20

LAYER	(INCHES)	(VOL/VOL)
1	4.8231	0.2680
2	0.0440	0.2201
3	0.0000	0.0000
4	4.4139	0.2452
SNOW WATER	0.000	

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                 HELP MODEL VERSION 3.04a  (10 JULY 1995)                 **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:     C:\HELP304a\pied1.D4
TEMPERATURE DATA FILE:       C:\HELP304a\pied1.D7
SOLAR RADIATION DATA FILE:   C:\HELP304a\pied1.D13
EVAPOTRANSPIRATION DATA:     C:\HELP304a\pied1.D11
SOIL AND DESIGN DATA FILE:   C:\HELP304a\ALT2.D10
OUTPUT DATA FILE:            C:\HELP304a\ALT2.OUT


TIME:  14:27     DATE:   7/ 9/1996


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     TITLE:  Piedmont Landfill Alternative Final Cover No. 2

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                  LAYER  1
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                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   8
          THICKNESS                    =     24.00   INCHES
          POROSITY                     =      0.4630 VOL/VOL
          FIELD CAPACITY               =      0.2320 VOL/VOL
          WILTING POINT                =      0.1160 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2828 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.369999994000E-03 CM/SEC
        NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  4.63
                 FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
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LAYER 2

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 20

THICKNESS	=	0.20	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0133	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	10.0000000000	CM/SEC
SLOPE	=	25.00	PERCENT
DRAINAGE LENGTH	=	160.0	FEET

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.04	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	7.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 4

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.24	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 8

THICKNESS	=	10.00	INCHES
POROSITY	=	0.4630	VOL/VOL
FIELD CAPACITY	=	0.2320	VOL/VOL
WILTING POINT	=	0.1160	VOL/VOL

INITIAL SOIL WATER CONTENT = 0.2006 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.369999994000E-03 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 8 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 25.% AND A SLOPE LENGTH OF 160. FEET.

SCS RUNOFF CURVE NUMBER	=	75.20	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	24.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	6.788	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	11.112	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.784	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	8.977	INCHES
TOTAL INITIAL WATER	=	8.977	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM GREENSBORO NORTH CAROLINA

STATION LATITUDE	=	35.13	DEGREES
MAXIMUM LEAF AREA INDEX	=	3.50	
START OF GROWING SEASON (JULIAN DATE)	=	90	
END OF GROWING SEASON (JULIAN DATE)	=	305	
EVAPORATIVE ZONE DEPTH	=	24.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	7.60	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	70.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR GREENSBORO NORTH CAROLINA

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.51	3.37	3.88	3.16	3.37	3.93
4.27	4.19	3.64	3.18	2.59	3.38

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR GREENSBORO NORTH CAROLINA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
37.50	39.90	48.00	58.30	66.50	73.50
77.20	76.30	69.90	58.40	48.50	40.20

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR GREENSBORO NORTH CAROLINA
AND STATION LATITUDE = 35.13 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 20

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.71	3.27	4.10	2.81	3.05	3.96
	4.76	5.13	3.82	2.52	2.60	3.80
STD. DEVIATIONS	1.65	1.38	1.92	1.36	1.29	2.53
	1.98	2.38	2.39	1.71	1.91	1.80
RUNOFF						
TOTALS	0.017	0.027	0.079	0.006	0.001	0.034
	0.034	0.057	0.082	0.034	0.018	0.037
STD. DEVIATIONS	0.069	0.057	0.235	0.018	0.003	0.130
	0.108	0.134	0.128	0.070	0.074	0.076
EVAPOTRANSPIRATION						
TOTALS	1.167	1.493	2.643	3.056	4.142	3.476
	4.298	3.151	2.674	2.576	1.015	0.893
STD. DEVIATIONS	0.296	0.325	0.391	0.610	0.868	1.625
	1.545	1.053	0.721	0.959	0.295	0.275
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	1.7448	1.3119	1.9672	0.6793	0.2749	0.4392
	0.5751	0.6682	1.2182	0.6229	0.5401	1.4593
STD. DEVIATIONS	1.5960	0.8568	1.4445	0.6604	0.4804	0.4973
	0.6416	0.6404	1.0980	0.7277	0.9358	1.3054

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 5

TOTALS	0.0027	0.0021	0.0024	0.0019	0.0011	0.0014
	0.0016	0.0015	0.0016	0.0013	0.0009	0.0015
STD. DEVIATIONS	0.0035	0.0023	0.0030	0.0023	0.0013	0.0017
	0.0020	0.0019	0.0018	0.0012	0.0008	0.0012

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0007	0.0006	0.0008	0.0003	0.0001	0.0002
	0.0002	0.0003	0.0005	0.0002	0.0002	0.0006
STD. DEVIATIONS	0.0006	0.0004	0.0006	0.0003	0.0002	0.0002
	0.0002	0.0002	0.0004	0.0003	0.0004	0.0005

****

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 20

	INCHES		CU. FEET	PERCENT
PRECIPITATION	42.52	(7.072)	154363.9	100.00
RUNOFF	0.425	(0.3409)	1543.20	1.000
EVAPOTRANSPIRATION	30.585	(3.6655)	111023.98	71.924
LATERAL DRAINAGE COLLECTED FROM LAYER 2	11.50103	(4.11435)	41748.746	27.04566
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00000	(0.00000)	0.011	0.00001
AVERAGE HEAD ON TOP OF LAYER 3	0.000	(0.000)		
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.01997	(0.02158)	72.504	0.04697
CHANGE IN WATER STORAGE	-0.007	(1.2033)	-25.52	-0.017

****

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 20

	(INCHES)	(CU. FT.)
PRECIPITATION	3.76	13648.800
RUNOFF	1.022	3709.5210
DRAINAGE COLLECTED FROM LAYER 2	1.52550	5537.57617
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000000	0.00007
AVERAGE HEAD ON TOP OF LAYER 3	0.018	
MAXIMUM HEAD ON TOP OF LAYER 3	0.034	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	0.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000527	1.91164
SNOW WATER	2.87	10419.2432

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3786
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1160

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 20

LAYER	(INCHES)	(VOL/VOL)
1	7.0445	0.2935
2	0.0048	0.0239
3	0.0000	0.0000
4	0.1800	0.7500
5	1.6070	0.1607
SNOW WATER	0.000	

****
****

APPENDIX D

STABILITY CALCULATIONS

PROJECT NO. 39603.100

CLIENT Piedmont Landfill SUBJECT Stability Analyses

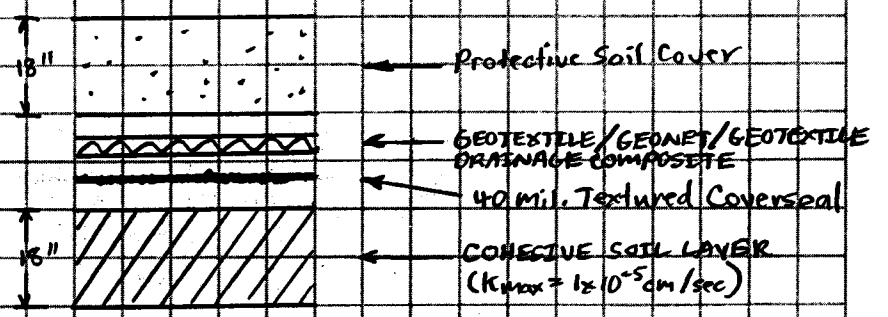
PROJECT Alternative Final Cover

Prepared By TMY Date 7/9/96

Reviewed By _____ Date _____

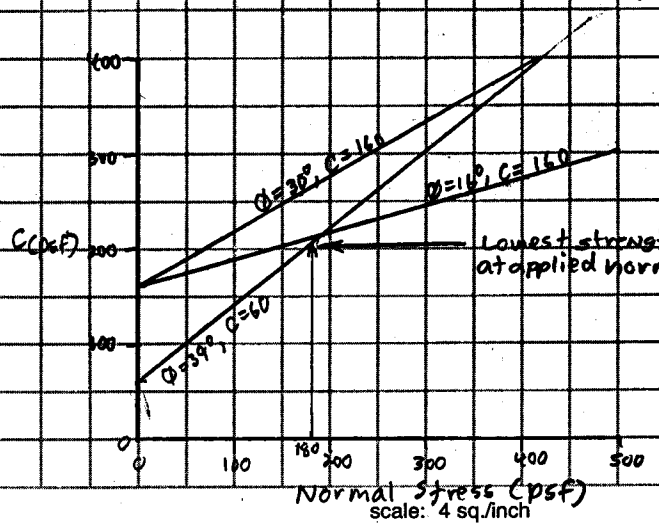
Approved By _____ Date _____

Alternative 1



Based on an evaluation of available direct shear test data on similar soils/geosynthetics, the following interface strength parameters are assigned (based on low confining stresses and residual strengths):

Interface	ϕ (deg)	C (psf)
Drainage Composite/Soil	39	60 * ← Critical Interface (see below)
Drainage Composite/Text. C/S	16	160
Text. C/S / Cohesive Soil	30	160



Applied normal stress due to cover soil:

1.5 ft (120 lb/ft³) = 180 lb/ft²

scale: 4 sq./inch

The critical interface is therefore between the drainage composite and the protective soil cover with $\phi = 39°$, $C = 60$ psf

From the attached Seismic Risk and Site Vicinity maps, the design horizontal acceleration for the site = $n_g = 0.11g$ (90% probability of not being exceeded in 250 years).

Using attached infinite slope equation with the following parameters: $n_g = 0.11$, $\gamma = 120$ lb/ft^3, $\gamma_w = 62.4$ lb/ft^3, $C = 60$ psf, $\phi = 39°$, $z = 1.5$ ft, $\beta = \tan^{-1}\frac{1}{4} = 14.04°$, $d_w = 1.5$ ft*

* due to the presence of the geonet, there will be essentially no lateral flow within the protective soil cover.

$$\therefore FS = \frac{\left(\frac{60}{120(1.5)\cos^2 14.04°}\right) + \tan 39°\left[1 - 0\right] - 0.11 \tan 14.04° \tan 39°}{0.11 + \tan 14.04°}$$

$$= \frac{0.35 + 0.81 - 0.02}{0.36} = \underline{\underline{3.17}} > 1.0 \quad \text{OK!}$$

RUST Rust Environment & Infrastructure

CALCULATION SHEET

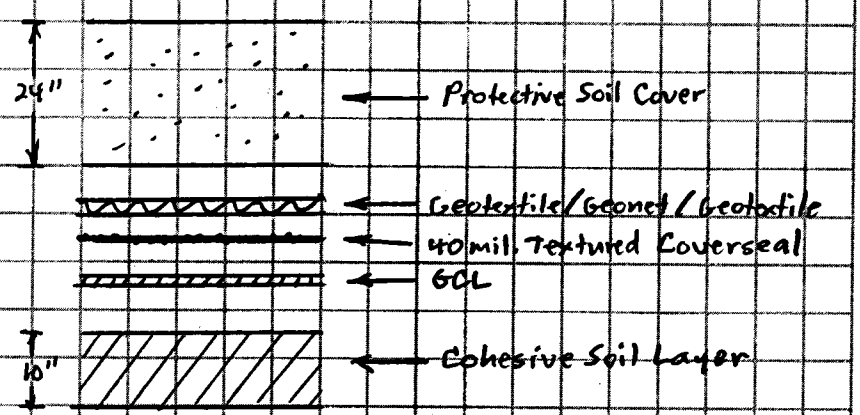
PROJECT NO. _____

CLIENT _____ SUBJECT _____ Prepared By _____ Date _____

PROJECT _____ Reviewed By _____ Date _____

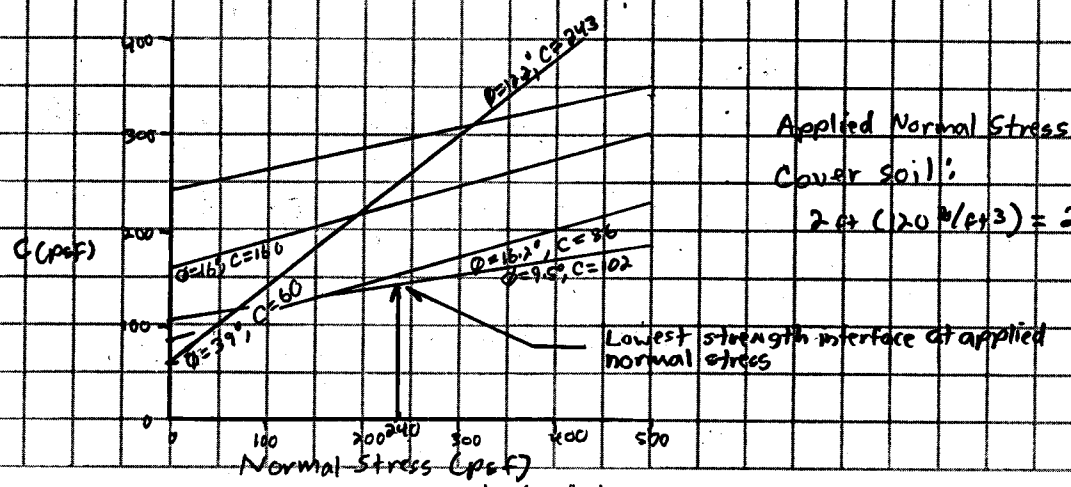
Approved By _____ Date _____

Alternative 2



Interface	Ø (deg.)	C (psf)
Drainage Composite/Soil	39	60
Drainage Composite/Text. C/S	16	160
Text. C/S/GCL*	16.2	86
GCL (Internal)*	9.5	102
GCL*/Cohesive Soil Layer	12.2	243

* Assumes GCL is hydrated under low confining stress



Applied Normal Stress Due to Cover Soil:

$2\,ft\,(120\,lb/ft^3) = 240\,lb/ft^2$

PROJECT NO. _____

CLIENT _____ SUBJECT _____ Prepared By _____ Date _____

PROJECT _____ Reviewed By _____ Date _____

Approved By _____ Date _____

The critical interface is therefore the internal interface for the hydrated GCL with $\phi = 9.5°$, $C = 102$ psf.

Using attached infinite slope equation with the following parameters:

$n_g = 0.11$ $\gamma = 120$ lb/ft³ $\gamma_w = 62.4$ lb/ft³

$C = 102$ psf $\phi = 9.5°$ $z = 2$ ft

$\beta = 14.04°$ $d_w = 2$ ft

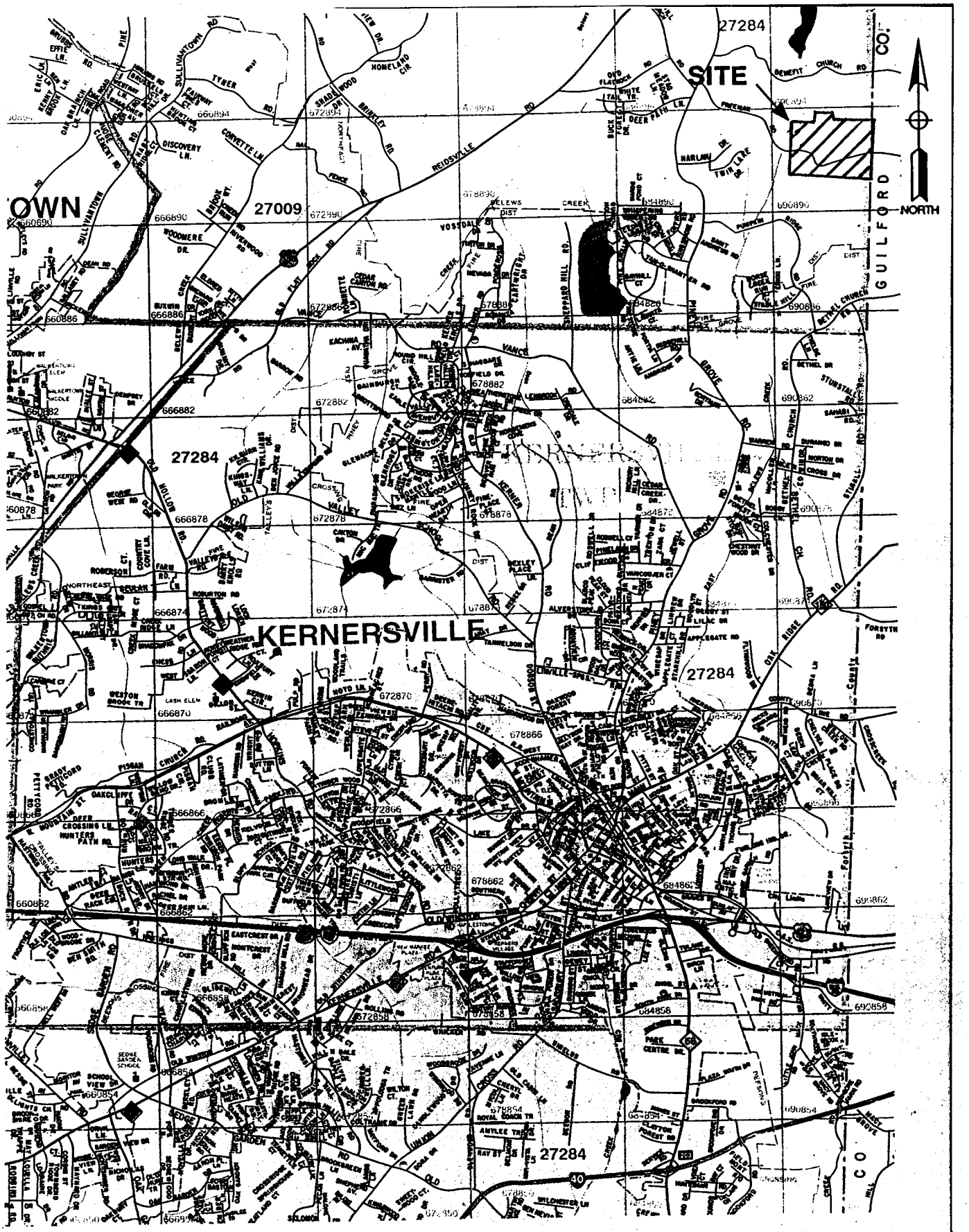
$$\therefore FS = \frac{\frac{102}{120(2)(\cos^2 14.04°)} + \tan 9.5° [1-0] - 0.11 \tan 14.04° \tan 9.5°}{0.11 + \tan 14.04°}$$

$$= \frac{0.45 + 0.17 - 0.0046}{0.36} = \underline{\underline{1.71}} > 1.0 \quad \text{OK!}$$

References

Algermissen, S.T., D.M. Perkins, P.C. Thenhaus, S.L. Hanson, and B.L. Bender, "Probabilistic Earthquake Acceleration and Velocity Maps for the United States and Puerto Rico", U.S.G.S. Misc. Field Studies Map MF-2120, 1990.

Matasovic, N., "Selection of Method for Seismic Slope Stability Analysis", Proc. 2nd Int. Conf. on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics, St. Louis, Mo, Vol. 2, pp. 1057-1062, 1991.



Scale in Miles

0 .5 1 2

RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE 1

SITE VICINITY MAP

Design Hydrogeologic Investigation
Piedmont Landfill and Recycling Center
Forsyth County, North Carolina

RUST E&I Project No. 87221.700

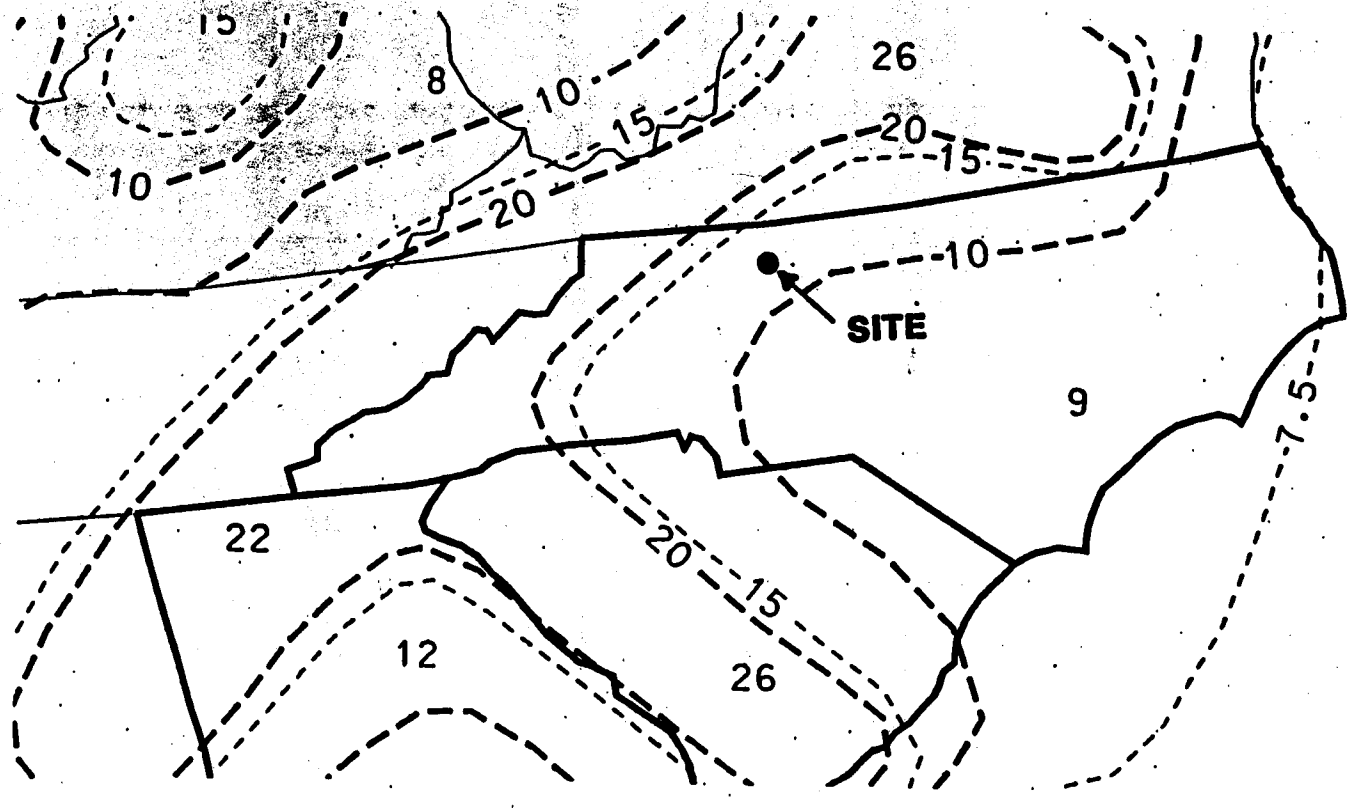
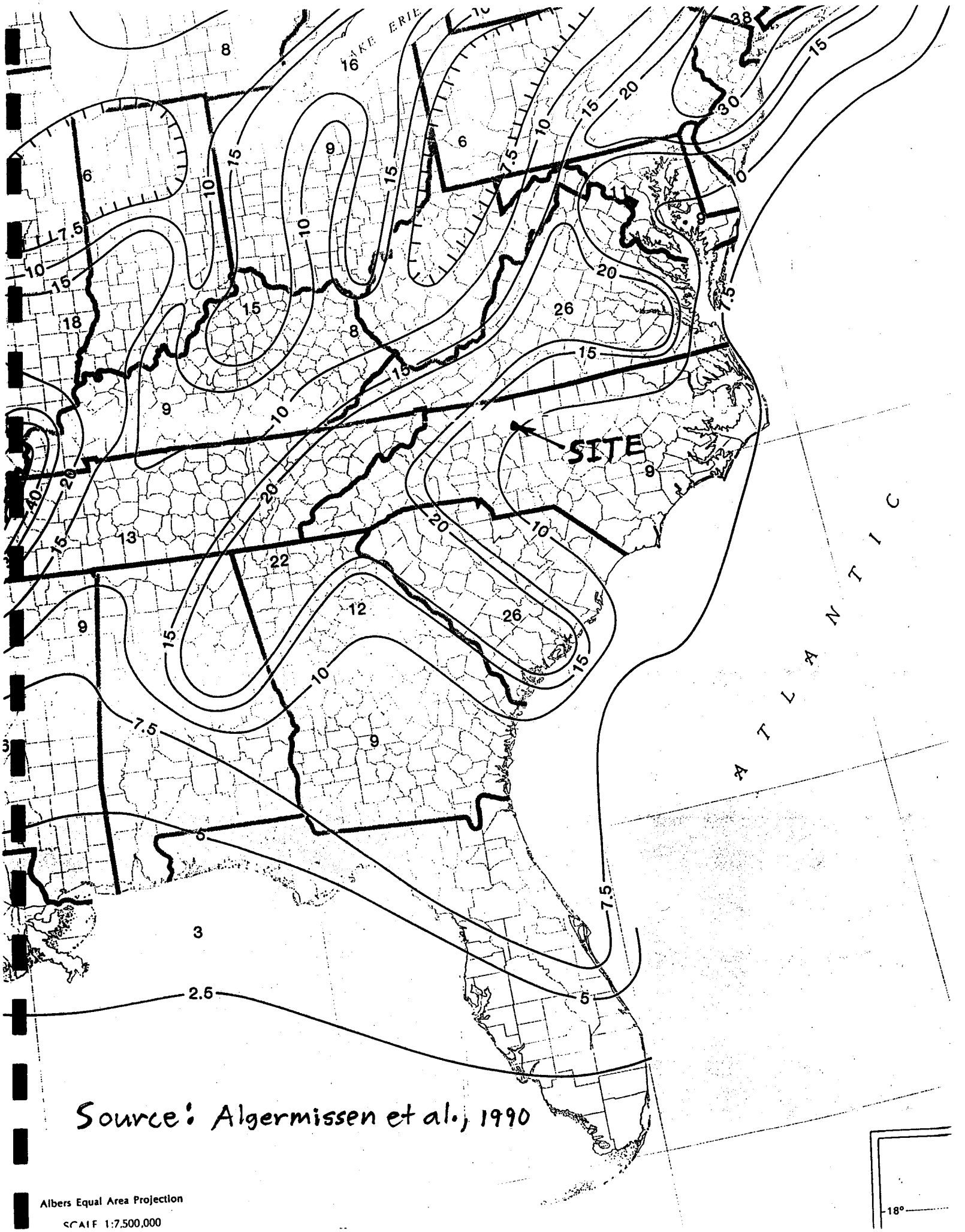


Figure 3
250-Year 90-Percent
Nonexceedance Contours



Source: Algermissen et al., 1990

LANDFILL COVER DESIGN

- USE INFINITE SLOPE ANALYSIS (MATASOVIC, 1991)

$$FS = \frac{c/(\gamma \cdot z \cdot \cos^2\beta) + \tan\phi\left[1 - \gamma_w(z - d_w)/(\gamma \cdot z)\right] - n_g \cdot \tan\beta \cdot \tan\phi}{n_g + \tan\beta}$$

$$K_y = \frac{c/(\gamma \cdot z \cdot \cos^2\beta) + \tan\phi\left[1 - \gamma_w(z - d_w)/(\gamma \cdot z)\right] - \tan\beta}{1 + \tan\beta \cdot \tan\phi}$$

- where

FS	=	factor of safety
K_y	=	yield acceleration
n_g	=	seismic coefficient
γ	=	unit weight of slope materials
γ_w	=	unit weight of water
c	=	cohesion of failure surface
ϕ	=	angle of internal friction of failure surface
z	=	depth to failure surface
d_w	=	depth to water table that is assumed parallel to slope

APPENDIX E

SOIL LOSS CALCULATIONS

RUST Rust Environment & Infrastructure Inc.

CLIENT:	*Peidmont Landfill & Recycling Center*	**Page Number:**	1 of 1
		Project Number:	39603.100
PROJECT:	*Alternative Final Cover*	**Prepared By:**	GAS
		Reviewed By:	TMY
SUBJECT:	*Estimated Soil Loss*	**Approved By:**	

Purpose: To estimate the soil loss due to water erosion of the final cover.

Calculation Method: Use the universal soil loss equation.

A = R * k * LS * C * P = 3.220758 (tons/acre/year)
= 0.015431 (Inches / year)

Were:
A = Soil loss (tons/acre/year)
R = Rainfall erosion index (100 ft. tons/acre * inch/hr)
K = Soil Erodibility Factor (tons/acre per unit of R)
LS = Slope length and steepness Factor
C = Vegetative Cover Factor
P = Erosin control practice factor

Assumptions:

R =	200	(See figure 5.2)
K =	0.24	(For sandy clay)
LS =	7.46	(See calculation below)
C =	0.01	(Final vegetation equivalent to native, table 5.6)
P =	0.9	(Track walking, table 5.7)
G =	115	(Unit wt. of soil)

Note: From the permit application a weighted average was taken to determin the soil characteristics. Percent silt = 23, percent sand = 66. From figure 5.6 K = 0.24.

Calculation: Use the following equation:

LS = (65.41 * s^2 / (s^2 + 10,000) +
(4.56 * s / SQR(s^2 + 10,000) + 0.065)) * (L / 72.5)^m

Were:

LS = Slope length and steepness Factor =	7.46
L = Slope length in ft. =	160
S = Slope steepness in percent =	25
m = 0.5 for s > 5% =	0.5

Reference:

1) USEPA SW-867 Evaluating Cover Systems For Solid and Hazardous Waste, Sept. 1980.

2) Goldman, Jackson and Bursztynsky, Erosion & Sediment Control Handbook, McGraw Hill, 1986.

TABLE 5.2 USDA Soil Permeability Classes (14)

Class	Estimated inches/hour through saturated undisturbed cores under ½-in head of water
Very slow	Less than 0.06
Slow	0.06–0.2
Moderately slow	0.2–0.6
Moderate	0.6–2.0
Moderately rapid	2.0–6.0
Rapid	6.0–20
Very rapid	More than 20

5.2 USING THE UNIVERSAL SOIL LOSS EQUATION TO ESTIMATE SOIL LOSS

5.2a The Equation

The general form of the universal soil loss equation is:

$$A = R \times K \times LS \times C \times P$$

where A = soil loss, tons/(acre) (year)
R = rainfall erosion index, in 100 ft · tons/acre × in/hr
K = soil erodibility factor, tons/acre per unit of R
LS = slope length and steepness factor, dimensionless
C = vegetative cover factor, dimensionless
P = erosion control practice factor, dimensionless

In metric units,

$$A \text{ (in t/ha)} = R \text{ (in J/ha)} \times K \text{ (in t/J)} \times LS \times C \times P$$

To convert the English units of R (100 ft · tons/acre × in/hr) to a convenient metric equivalent, multiply R by 1.70. This yields R in units of 10^7 J/ha × mm/hr. Multiply English units of K by 1.32. The product will then be in units of tonnes/hectare. Alternatively, to convert A from tons/acre to tonnes/hectare, multiply by 2.24.

The soil loss is an estimated annual average. The rainfall erosion index contains both an energy component and an intensity component. The LS, C, and P factors are ratios of soil loss from the site to soil loss from a unit area of a standard plot with these characteristics: 72.6 ft (22.1 m) long, 9 percent slope, tilled, bare soil.

To calculate soil loss, each of the factors is assigned a numerical value. The

five factors are then multiplied together to produce an estimate of soil eroded from the site in an average year. When an estimate of required sediment storage volume is needed, the units of weight can be converted to volume by assuming a density for the sediment.

Careful evaluation of site characteristics is important to obtain reasonable soil loss estimates. Construction sites may vary from less than one acre to several hundred acres. Because soil erodibility varies greatly over large areas, a soil loss estimate is needed for each drainage area controlled by a sediment basin. A drainage area should be no larger than 100 acres (40 ha) and preferably much smaller. If a drainage area contains more than one soil type, it should be further subdivided into areas of homogeneous soil type. In addition, the length-slope LS, cover C, and surface condition P factors may differ with parts of a site. To produce the most accurate estimate, calculate soil loss separately for each homogeneous area (area of similar K, LS, C, and P) and add the estimates together.

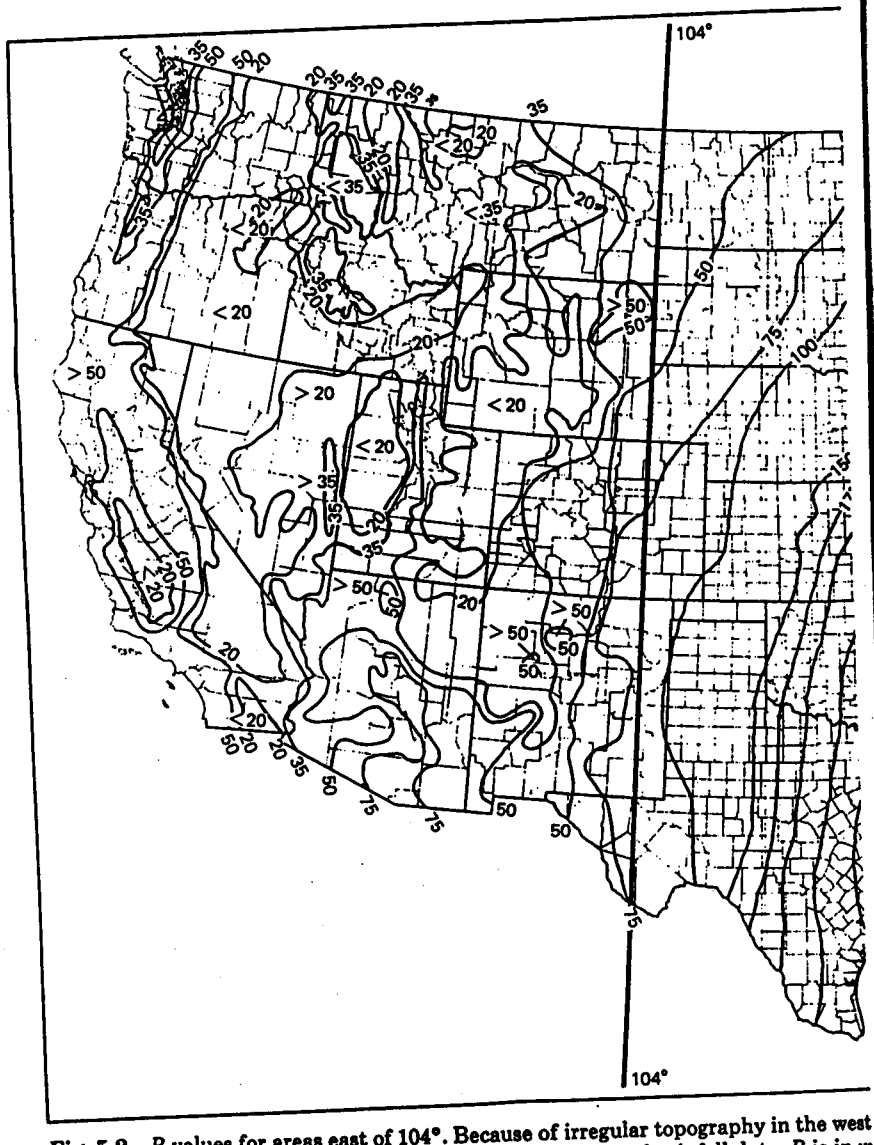
Generally, a site can easily be divided into drainage areas served by a sediment basin or trap. Then, within each drainage area, homogeneous categories can be described, such as house pads, cut and fill slopes between pads, and unpaved road surfaces. Certain erosion control practices are associated with each one of these categories. House pads normally have a very gentle slope and a compacted surface which is not seeded, so LS, C, and P values should be the same for all of them. Slopes between pads are often at a 2:1 gradient, 20 to 40 ft (6 to 12 m) long, trackwalked and seeded. Examples of the use of these factors in the soil loss equation are provided in the following sections.

Note that the USLE assigns different meanings to two letters also used in the rational method runoff equation. The distinctions listed below must be kept clear to avoid miscalculations:

Symbol	Rational method	USLE
A	Acres (hectares)	Tons/acre (tonnes/hectare)
C	Runoff coefficient	Vegetative cover factor

5.2b Rainfall Erosion Index R

The rainfall erosion index R is a measure of the erosive force and intensity of rain in a normal year. The two components of the factor are the total energy E and the maximum 30-min intensity I_{30} of storms. The rainfall erosion index is the sum of the product $E \times I_{30}$ for all the major storms in an area during an average year. Values of R have been computed for the continental United States from rainfall records and probability statistics, so R should not be considered a precise factor for any given year or location. Its principal value, and that of the soil loss equation itself, is as a predictive tool and risk evaluator: Construction activities in areas with high R values will require greater attention to erosion



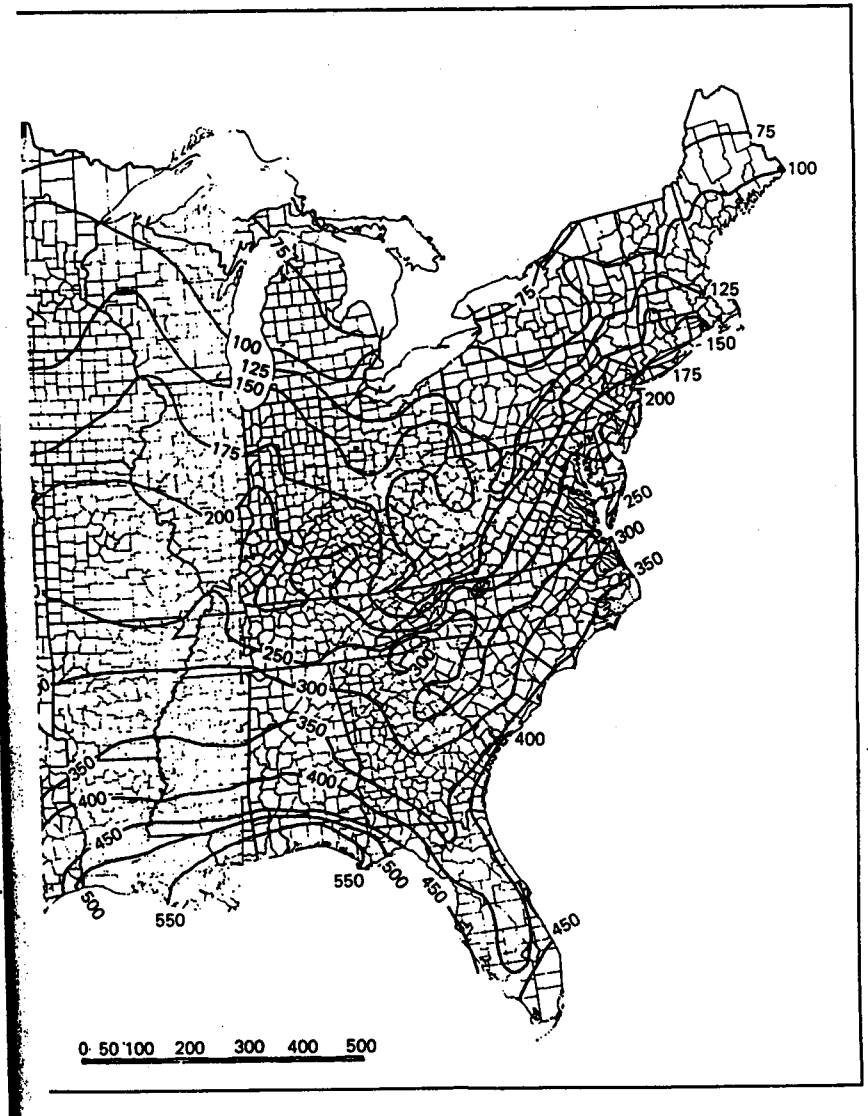


Fig. 5.2 *R* values for areas east of 104°. Because of irregular topography in the west United States, calculate *R* values in this region by using local rainfall data. *R* is in u of 100 ft · tons/acre per in/hr. To convert *R* to units of 10^7 J/ha per mm/hr, multiply 1.70. (20) Scale is in miles.

Length	100 ft (30.5 m)	100 ft (30.5 m)	100 ft (30.5 m)
Slope	3:1	2:1	1.5:1
LS	9.43	17.82	26.68
Factor increase	1	1.9	2.8

The effect of length is not as great as the effect of slope angle: LS increases 30 to 50 percent for each doubling of length. For example, on a 2:1 slope, LS doubles when L is quadrupled:

Slope	2:1	2:1	2:1
Length	30 ft (9.1 m)	60 ft (18.3 m)	120 ft (36.6 m)
LS	9.76	13.81	19.42
Factor increase	1	1.4	2

Thus, very long slopes and especially, long, steep slopes, should not be constructed. Those that already exist should not be disturbed.

Slope length can be shortened by installing midslope diversions. Local building codes often require terraces or drainage ditches at specified intervals. Chapter 70 of the *Uniform Building Code* specifies a 30-ft (9.1-m) interval. (9) Several erosion control manuals recommend 15-ft (4.6-m) intervals between terraces. (2, 18). Because these intervals are defined as vertical rise, the slope length would be somewhat longer.

Decreasing steepness will require use of more land and so must be incorporated early in the project design. To ensure slope stability, a maximum gradient is frequently recommended by the soils engineer.

5.2e Cover Factor C

The cover factor C is defined as the ratio of soil loss from land under specified crop or mulch conditions to the corresponding loss from tilled, bare soil. The C is *not* the same as the runoff coefficient C used in the rational method.

In the USLE, the C factor reduces the soil loss estimate according to the effectiveness of vegetation and mulch at preventing detachment and transport of soil particles. On construction sites, recommended control practices include the seeding of grasses and the use of mulches. These measures are often considered "temporary"—they are designed to control erosion primarily during the construction period. Permanent landscaping may be added later, or temporary erosion control plants may be left as a permanent cover. Any product that reduces the amount of soil exposed to raindrop impact will reduce erosion. Table 5.6 lists C factors for various ground covers. The C values for vegetation were obtained from USDA publications (14, 20); those for mulch were obtained from Burgess Kay at the University of California, Davis, who tested materials on experimental plots under a rainfall simulator. (11)

When the soil surface is bare, C is 1.0. At the other end of the scale, undisturbed native vegetation is assigned a value of 0.01; hence the advantage of retaining as much existing vegetation as possible is clear. A C value of 0.1 is used

TABLE 5.6 C Values for Soil Loss Equation*

Type of cover	C factor	Soil loss reduction, %
None	1.0	0
Native vegetation (undisturbed)	0.01	99
Temporary seedings:		
90% cover, annual grasses, no mulch	0.1	90
Wood fiber mulch, ¾ ton/acre (1.7 t/ha), with seed†	0.5	50
Excelsior mat, jute†	0.3	70
Straw mulch†		
1.5 tons/acre (3.4 t/ha), tacked down	0.2	80
4 tons/acre (9.0 t/ha), tacked down	0.05	95

*Adapted from Refs. 11, 15, and 20

†For slopes up to 2:1.

if a complete cover of newly seeded annual grasses is well established before the onset of rains.

In many areas, seed and wood fiber mulch are applied hydraulically shortly before the rainy season. The early rains cause the seeds to germinate, but a complete grass cover is not established until at least 4 weeks later. During the germination and early growth period, the wood fiber mulch provides only marginal protection. A C value of 0.5 is an appropriate average representing little protection initially and more thorough protection when the grass is well established.

On bare soils mulch can provide immediate reduction in soil loss, and it performs better than temporary seedings in some cases. Straw mulch is more effective than wood fiber mulch; it reduces loss about 80 percent (C value, 0.2) when it is applied at the rate of 3000 lb/acre (3.4 t/ha) and tacked down. Additional reduction is obtained with 8000 lb/acre (90 t/ha) of straw, but this rate may not be cost-effective.

Wood fiber mulch alone (without seed) provides very little soil loss reduction; it primarily helps seeds to become established so that the new grass can provide the erosion control. Other products, such as jute, excelsior, and paper matting, provide an intermediate level of protection; the C value equals approximately 0.3. Test results of various mulch treatments are presented in Chap. 6.

5.2f Erosion Control Practice Factor P

The erosion control practice factor P is defined as the ratio of soil loss with a given surface condition to soil loss with up-and-down-hill plowing. Practices that reduce the velocity of runoff and the tendency of runoff to flow directly downslope reduce the P factor. In agricultural uses of the USLE, P is used to describe plowing and tillage practices. In construction site applications, P reflects the roughening of the soil surface by tractor treads or by rough grading, raking, or disking.

TABLE 5.7 *P* Factors for Construction Sites (Adapted from Ref. 15)

Surface condition	*P* value
Compacted and smooth	1.3
Trackwalked along contour*	1.2
Trackwalked up and down slope†	0.9
Punched straw	0.9
Rough, irregular cut	0.9
Loose to 12-in (30-cm) depth	0.8

*Tread marks oriented up and down slope.

†Tread marks oriented parallel to contours, as in Figs. 6.9 and 6.10.

P values appropriate for construction sites are listed in Table 5.7.

- A surface that is compacted and smoothed by grading equipment is highly susceptible to sheet runoff and is assigned a *P* value of 1.3.
- Trackwalking is given a value of 1.2 if the vehicle traverses along the contour. The *P* value is relatively high because the depressions left by cross-slope tracking resemble up-and-down furrows and worsen runoff conditions.
- Trackwalking up and down slope reduces *P* to 0.9. The tread marks act as slope benches; they reduce runoff velocity and trap soil particles (see Fig. 6.10).
- Punched straw is assigned a *P* value of 0.9 because the action of punching the straw into the soil roughens the surface and creates a trackwalking effect.
- When the soil surface is disked or otherwise loosened to a depth of 1 ft, a slightly lower *P* value of 0.8 may be used. This condition is unlikely to occur on a construction site because compaction, not loosening, is required when fill slopes are constructed.

Clearly, changing the surface condition does not provide much direct reduction in soil loss; all the *P* values are close to 1.0. However, roughening the soil surface is essential before seeding because it greatly increases plant establishment (see Chap. 6) and thus also reduces the *C* factor. Vegetation, mulch, slope length, and gradient have far more significant effects on the erosion process and provide greater opportunities to reduce soil loss.

5.2g Combined Effects of LS, *C*, and *P*

Of the five factors in the USLE, the *R*, LS, and *C* factors have the widest range. Although *R* for a site is constant and *K* is essentially a constant, slope length and gradient, cover, and, to a limited extent, surface condition can be manipulated. Slope length and vegetative cover are the most effective and easily implemented measures.

Table 5.8 compares the effect on the soil loss estimates of varying LS, *C*, and *P*. For example, a building pad with a 1 percent slope, smooth surface, and no cover has a fractional soil loss potential. A 2:1 slope, common between terraced

TABLE 5.8 Combined Effects of LS, *C*, and *P* on Soil Loss

Slope gradient	Slope length	Surface condition	Ground cover	LS	*C*	*P*	Product LS × *C* × *P*	Reduction, %[a]
2:1	40 ft (12.2 m)	Smooth	Bare	11.27	1.0	1.3	14.65	—
2:1	40 ft (12.2 m)	Tracked; tread marks oriented up and down slope	Seed and wood fiber mulch, ¾ ton/acre (1.7 t/ha)	11.27	0.5	1.2	6.76	54
2:1	40 ft (12.2 m)	Tracked; tread marks parallel to contours	Seed and wood fiber mulch, ¾ ton/acre (1.7 t/ha)	11.27	0.5	0.9	5.07	65
2:1	20 ft (6.1 m)	Tracked; tread marks parallel to contours	Seed and wood fiber mulch, ¾ ton/acre (1.7 t/ha)	7.97	0.5	0.9	3.95	73
2:1	40 ft (12.2 m)	Tracked; tread marks parallel to contours	Punched straw, 1.5 tons/acre (3.4 t/ha)	11.27	0.2	0.9	2.03	86
2:1	20 ft (6.1 m)	Tracked; tread marks parallel to contours	Punched straw, 1.5 tons/acre (3.4 t/ha)	7.97	0.2	0.9	1.43	90
1%	100 ft (30.5 m)	Smooth	Bare	0.12	1.0	1.3	0.16	—

[a]Compared to the example on the first line (LS × *C* × *P* = 14.65).

Solution: For type IA storm area,

$$R = 10.2p^{2.2} = 28.7$$
$$R_s = 1.5(27.6 \text{ in}) = 41.4 \qquad [0.059(701 \text{ mm}) = 41.4]$$
$$R_t = R_s + R = 28.7 + 41.4 = 70.1$$

5.2c Soil Erodibility Factor *K*

The soil erodibility factor *K* is a measure of the susceptibility of soil particles to detachment and transport by rainfall and runoff. Texture is the principal factor affecting *K*, but structure, organic matter, and permeability also contribute. *K* values range from 0.02 to 0.69.

Several methods can be used to estimate a *K* value for a site, but a nomograph method using analyses of site soils is the most reliable. If a recent soil survey for the area has been published and minimal soil disturbance is anticipated, the *K* value listed in the survey of the soil series found on the site can be used.

Nomograph Method

The preferred method for determining *K* values is the nomograph method. Use of the nomograph requires a particle size analysis to determine the percentages of sand, very fine sand, silt, and clay. The size range for each class is listed in Table 5.1. ASTM D-422 (1) is a standard hydrometer analysis for particle size distribution. (Specific particle sizes can be designated in the request for analysis. More typically, values are reported for specified size intervals, such as every 5 or 10 μm. The fee for a particle size analysis is normally only a small fraction of the total fee for a geotechnical report.)

The determination of the *K* value should be based on the soil exposed during the critical rainfall months. Subsoils exposed during grading will have *K* values different from the topsoil *K* value. On large sites, several samples should be taken and analyzed separately to ensure that differences in soil texture are detected. If fill is imported, this material also should be characterized.

The more carefully the site soils are characterized, the more accurate the *K* values will be. If analysis indicates significant variation in soil erodibility, it might be advisable to use different *K* values for different parts of the site and to focus erosion control efforts on the most susceptible areas. A simpler and more conservative approach is to use the highest value obtained by analysis for all parts of the site, since it may not be possible to know exactly what soils will be exposed or how varied the soils are.

A nomograph developed by Erickson of the SCS-Utah office (6), based on the original nomograph provided by Wischmeier (21), is reproduced in Fig. 5.6. To use the nomograph, enter the triangle with any two of the particle size percents: total sand and silt; silt and clay; or clay and total sand. Use whole numbers. Follow the dashed straight lines to their point of intersection. From that point, follow parallel to the dotted curves to the right side of the triangle, where the *K* values are listed.

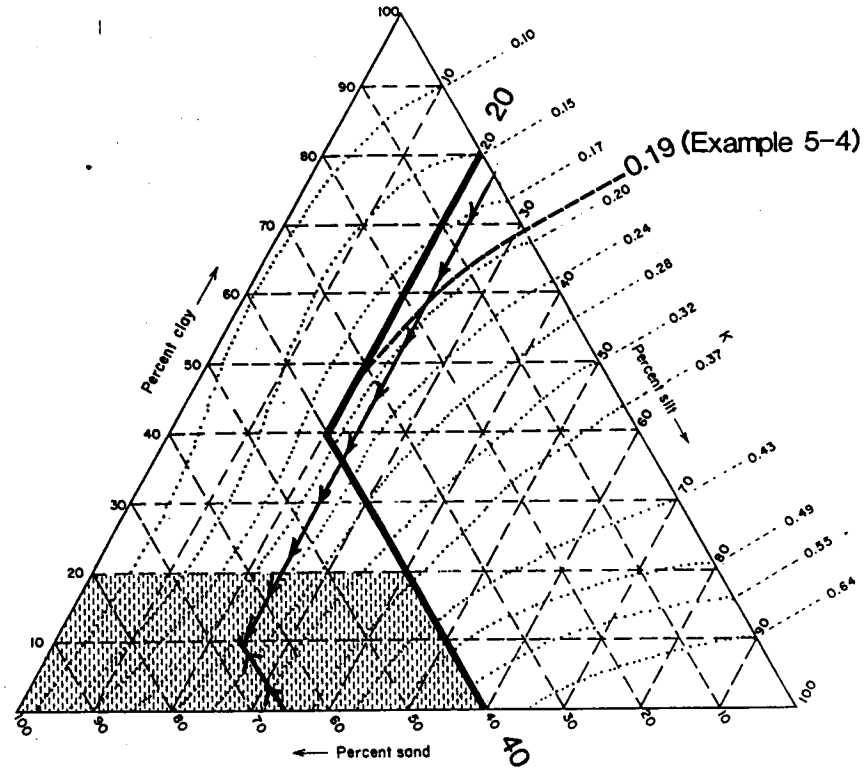


Fig. 5.6 Triangular nomograph for estimating *K* value. (6) See Table 5.3 for adjustments to *K* value under certain conditions.

EXAMPLE 5.4

Given: A soil with the following particle size distribution.

Component	Size, mm	Fraction, %
Sand	2.0–0.1	30
Very fine sand	0.1–0.05	10
Silt	0.05–0.002	20
Clay	Less than 0.002	40

Find: Texture and *K* value.

Solution: Entering Fig. 5.1 with 40 percent total sand and 20 percent silt, the texture is found to be on the border between clay and clay loam. Entering Fig. 5.6 with the same percents (see bold lines), the *K* value is found to be 0.19.

Table 5.3 describes adjustments to the *K* factor. Adjustment 1 is a correction for very

- End of Booklet -

Petition for Alternative Cover

July, 1996

Piedmont Landfill and Recycling Center

Piedmont Landfill
and Recycling Center
9900 Freeman Road
Kernersville, North Carolina 27284
910/595-6677
FAX: 910/595-9735

A Waste Management Company

July 29, 1996

Ms. Sherri Coghill
North Carolina Dept. of Environment, Health, and Natural Resources
Department of Solid Waste Management (SWS)
401 Oberlin Road
Raleigh, NC 27611

APPROVED
DIVISION OF SOLID WASTE MANAGEMENT
DATE 7/31/96 BY SLC

Re: Answers to your Questions Concerning the **PETITION FOR ALTERNATIVE FINAL COVER**; Piedmont Landfill & Recycling Center (PLFRC), Kernersville, NC

Dear Ms. Coghill:

Please consider this our response to your questions based upon the review of the **PETITION FOR ALTERNATIVE FINAL COVER** by RUST E & I, Inc. dated July 1996.

- Question: Have there been any final cover failures at other landfills that had used one of our proposed alternatives (or very similar schemes)? One specific area of concern was, if a gas collection is not working, did the gas pressure push the final cover off the slope?

  Answer: I have talked to RUST E & I (RUST) on this subject. They are very knowledgeable of all of WMI's landfills and, know of no instances where this has happened.

- Question: If the PLFRC chooses Alternative No. 2, what specific GCL will be used and, are the specifications of the GCL in line with the shear strength values used in the stability calculations?

  Answer: Presently, the PLFRC plans to use **BENTOFIX™**, a GCL manufactured by a company owned by National Seal Company (NSC). Attached you will find an explanation from RUST demonstrating that their stability calculations used direct shear values of BENTOFIX™ given to them by NSC. If the PLFRC does use a GCL other than BENTOFIX™, please understand that we will use one with equivalent engineering specifications.

We appreciate your expedient response in this matter and if you have any questions, feel free to contact either Ed Gibson or myself @ (910) 595-6677.

Sincerely,

Edward L. Gibson, P.E.
Facility Engineering Manager

cc: William R. Lewis
Tom Yanoschak

JUL 1996
Received
Solid Waste
Section

Internal Shear Properties

Notes

Date	Lab	Interface Tested	Test Cond.	Shear Rate (in/min)	Normal Stress (psi)	Peak Shear Stress (psf)	Peak Friction Angle (deg)	Peak Adhesion (psf)	Residual Shear Stress (psf)	Residual Friction Angle (deg)	Residual Adhesion (psf)	Comments
4/13/95	NSC	NS - Internal	Hydrated	0.04	5	1018	29	694	197	4	130	95033P
					10	1625			226			
					20	2273			361			
9/7/94	NSC	NS - Internal	Hydrated	0.04	60	3869	15	1485	1540	9	254	94070P1
					80	4243			1996			
					100	5374			2403			
9/7/94	NSC	NS - Internal	Hydrated	0.04	60	3113	21	0	1442	10	0	94070P2
					80	4123			1861			
					100	5698			2476			
(1) NA	NSC	NS - Internal	Hydrated	0.04	0.5	373	41	357	300	15	302	95049T
					1	554			378			
					2	587			374			
9/18/93	GSC	NS - Internal	Hydrated	0.04	3	763	32	485	101	13	5	93086T
					6	979			216			
					9	1296			288			
9/2/94	NSC	NS - Internal	Hydrated	0.04	60	3113	21	0	1442	10	0	94070P-2
					80	4123			1861			
					100	5698			2476			
11/30/94	NSC	NW - Internal	Hydrated	0.04	3	328	33	113	272	19	161	94023T
					6	792			532			
					10	1001			633			
12/7/93	NSC	NW - Internal	Hydrated	0.04	140	8064	21	0	2592	1	16	93086T
					170	10944			2736			
					200	10368			2736			

Internal Shear Properties

Date	Lab	Interface Tested	Test Cond.	Shear Rate (in/min)	Normal Stress (psi)	Peak Shear Stress (psf)	Peak Friction Angle (deg)	Peak Adhesion (psf)	Residual Shear Stress (psf)	Residual Friction Angle (deg)	Residual Adhesion (psf)	Comments
4/1/95	NSC	NS - Internal	Hydrated	0.04	5	1018	24	970	226	11	20	95033P-A
					10	1625			226			
					20	2273			361			
					28	3307			862			
					49	3389			1518			
					69	5585			1941			
					97	7017			2585			
4/1/95	NSC	NS - Internal	Hydrated	0.04	5	1309	23	1307	332	11	72	95033P-B
					10	1769			320			
					20	2844			575			
					28	3283			792			
					49	4612			1477			
					69	5330			2068			
3/22/96	GSC	NS - Internal	Hydrated	5	14	1670	22	880	346	5	185	NA
					28	2592			576			
					56	4176			907			
5/10/96	GSC	NS - Internal	Hydrated	0.04	14	1353	22	565	274	6	80	NA
					28	2218			547			
					56	3802			950			
									Avg,	9.5	102	

(2)

Interfacial Shear Properties

Date	Lab	Interface Tested	Test Cond.	Shear Rate (in/min)	Normal Stress (psi)	Peak Shear Stress (psf)	Peak Friction Angle (deg)	Peak Adhesion (psf)	Residual Shear Stress (psf)	Residual Friction Angle (deg)	Residual Adhesion (psf)	Comments
8/2/93	NSC	NS-W / TN3002-1120	Dry	0.04	3.5	199	21.4	9	175	16.4	48	93031A-1
					7	398			309			
					14	804			723			
					28	1568			1195			
8/2/93	NSC	NS-NW / TN3002-1120	Dry	0.04	3.5	209	24.3	14	176	21.3	26	93031A-2
					7	464			418			
					14	973			885			
					28	1797			1556			
8/2/93	NSC	NS-W / 60mil tex HDPE	Dry	0.04	3.5	431	28.3	209	228	15.7	255	93031A-3
					7	796			403			
					14	1297			696			
					28	2351			1224			
8/2/93	NSC	NS-NW / 60mil tex HDPE	Dry	0.04	3.5	778	33.5	354	387	18.8	255	93031A-4
					7	989			687			
					14	1539			863			
					28	3065			1633			
5/5/94	NSC	NS-W / Hypalon	Dry	0.04	1	123	21	56	117	21	52	94029S-1
					3	205			201			
					6	398			389			
5/5/94	NSC	NS-NW / Gas Vent Sand	Dry	0.04	1	152	29	64	135	29	52	94029S-2
					3	295			288			
					6	554			536			
5/5/94	NSC	NS-W / 60mil Sm. HDPE	Dry	0.04	1	144	11	0	127	10	0	94029S-3
					3	226			198			
					6	418			393			
5/5/94	NSC	NS-NW / Gen. Fill Sand	Dry	0.04	1	451	27	72	447	25	93	94029S-4
					3	783			755			
					6	1186			1132			

Interfacial Shear Properties

Date	Lab	Interface Tested	Test Cond.	Shear Rate (in/min)	Normal Stress (psi)	Peak Shear Stress (psf)	Peak Friction Angle (deg)	Peak Adhesion (psf)	Residual Shear Stress (psf)	Residual Friction Angle (deg)	Residual Adhesion (psf)	Comments
4 3/14/95	TRI	NS-NW / Silty Clay	Hydrated	0.001	5	801	24.4	485	NA	NA	NA	95076F
					10	1157			NA			
					20	1789			NA			
8/24/95	NSC	NS-W / Silty Clay	Dry	0.004	0.7	78	36	3.7	NA	NA	NA	95076F
					1.4	144			NA			
					4.2	435			NA			
4/17/95	TRI	NS-NW / 60mil tex HDPE	Hydrated	0.001	5	633	15.6	430	358	17.6	124	94102S
					10	827			571			
					20	1234			1039			
9/25/95	NSC	NS-NW / 60mil tex HDPE	Dry	0.002	0.7	197	53	71	127	37	60	95089S
					1.7	423			259			
					2.8	599			349			
9/25/95	NSC	NS-W / Silty Clay	Dry	0.04	0.7	82	32	27	70	NA	NA	
					1.7	193			181			
					2.8	267			271			
3 5/15/96	STS	NS-NW / 40 mil Tex. PVC	Hyrated	0.04	1.4	164	16.8	100	186	16.2	86	NA
					2.8	215			232			
					4.2	285			338			
5/14/96	GSC	NS-NW / 60 mil Tex HDPE	Hydrated	0.04	14	1138	21	340	648	13	170	NA
					28	1800			1080			
					56	3398			2045			
3/28/96	NSC	NS-NW / 60 mil smooth HDPE	Hydrated	0.2	11.5	206	9	0	148	8	0	96038S
					33	558			452			
					52	1190			965			
3/28/96	NSC	NS-NW / 60 mil smooth HDPE	Hydrated	0.2	35	821	9	62	801	6	333	96038S
					55	1400			1227			
					76	1769			1408			

Interfacial Shear Properties

Date	Lab	Interface Tested	Test Cond.	Shear Rate (in/min)	Normal Stress (psi)	Peak Shear Stress (psf)	Peak Friction Angle (deg)	Peak Adhesion (psf)	Residual Shear Stress (psf)	Residual Friction Angle (deg)	Residual Adhesion (psf)	Comments
4/26/06	NSC	NS-NW / 60 mil smooth HDPE	Hydrated	0.2	11.5	353	11	61	288	7	105	96038S
					33	989			784			
					52	1473			1059			
4/12/96	NSC	NS-W / 60 mil smooth HDPE	Hydrated	0.2	11.5	357	13	0	259	9	0	96038S
					33	911			698			
					52	1691			1190			
5/16/96	STS	NS-W / TN3002-1125	Hydrated	0.04	1.4	118	26.8	27	116	22.9	45	
					2.8	249			242			
					4.2	320			285			
5/23/96	STS	NS-NW / 40 mil Textured PVC	DRY	0.04	1.4	131	28.5	26	NA	NA	NA	
					2.8	250						
					4.2	348						

BENTOFIX® THERMAL LOCK TECHNICAL SPECIFICATIONS

GCL DATA

PROPERTY	TEST	STANDARD	UNITS	*BENTOFIX NS*
Physical				
-Mass Per Unit Area	ASTM D5261	minimum	lb/ft² (g/m²)	1.06 (5390)
-Thickness	ASTM D5199	typical	in (mm)	0.24 (6.0)
Mechanical				
-Grab Tensile[1]	ASTM D4632	typical	lb (N)	120 (530)
-Puncture	ASTM D4833	typical	lb (N)	130 (590)
-Friction Angle[2]	ASTM D5321	minimum	degrees	25
-Peel Strength	ASTM D4632	minimum	lb (N)	15
Hydraulic				
-Water Permeability[3]	GRI GCL-2	maximum	cm/s	$1x10^{-9}$

COMPONENTS

COMPONENT	TEST	STANDARD	UNITS	*BENTOFIX NS*
Carrier Geotextile				woven
-Mass Per Unit Area	ASTM D5261	minimum	oz/yd² (g/m²)	3.25 (110)
Cover Geotextile				nonwoven
-Mass Per Unit Area	ASTM D5261	minimum	oz/yd² (g/m²)	6.0 (200)
Sodium Bentonite				
-Mass Per Unit Area		minimum	lb/ft² (g/m²)	1.0 (4900)
-Montmorillonite Content	Methylene-Blue	typical	Meq	90
-Moisture Content	ASTM D4643	maximum	%	10
-Swell Index	USP NF XVII	minimum	ml	25
-PlateWater Absorption	ASTM E 946	minimum	%	840
-Fluid Loss	API 13B	maximum	ml	18
-Confined Swell	GRI-GCL 1	minimum	%	350

ROLL SIZE

DIMENSION		STANDARD	UNITS	*BENTOFIX NS*
-Width x Length[4]		nominal	ft (m)	15.5 x 125 (4.7 x 38.1)
-Area per Roll		minimum	ft² (m²)	1938 (180)
-Packaged Weight		typical	lb (kg)	2150 (977)

10/19/95NS

NOTES:

1. Typical tensile values given for weakest principle direction.
2. Samples hydrated under an initial normal stress of 7.5 psi (50 kPa) and sheared internally.
3. Water permeability values given correspond to effective stress of 30 psi (206 kPa).
4. Nominal roll dimensions exclusive of protective edge area.

The information contained herein has been compiled by National Seal Company and is, to the best of our knowledge, true and accurate. All suggestions and recommendations are offered without guarantee. Final determination of suitability for use based on any information provided, is the sole responsibility of the user. There is no implied or expressed warranty of merchantability of fitness of the product for the contemplated use.

NSC
NATIONAL SEAL COMPANY
245 Corporate Blvd., Suite 300
Aurora, IL 60504
(708) 898-1161 • (800) 323-3820
Fax: (708) 898-3461

printed on recycled paper

34-06

Piedmont Landfill
and Recycling Center
9900 Freeman Road
Kernersville, North Carolina 27284
910/595-6677
FAX: 910/595-9735

A Waste Management Company

July 16, 1996

Ms. Sherri Coghill
North Carolina Dept. of Environment, Health, and Natural Resources
Department of Solid Waste Management (SWS)
401 Oberlin Road
Raleigh, NC 27611

Re: Petition for Alternative Final Cover; Piedmont Landfill & Recycling Center (PLFRC), Kernersville, NC

Dear Ms. Coghill:

Please consider this a request on behalf of the PLFRC to change its permitted final cover design as allowed under 15A NCAC 13B .1627 (c)(2). Please use the enclosed report (3 copies) from RUST E & I, Inc.entitled **PETITION FOR ALTERNATIVE FINAL COVER** in your assessment of this request. As you will see, it demonstrates that the requested design provides essentially the equivalent or a reduction in infiltration compared to the existing permitted design. As you will also see in this report, there is also a final cover Construction Quality Assurance Plan (CQA Plan) that would replace the existing Plan.

Sherri, it is the PLFRC's intention to construct final cover on a 25 acre portion of the landfill beginning August of this year. We would certainly appreciate your expedient response in this matter and if you have any questions, feel free to contact either Ed Gibson or myself @ (910) 595-6677.

Sincerely,

William R. Lewis, P.E.
Division President & General Manager

cc: Ed Gibson

Printed on Recycled Paper

Piedmont Landfill
and Recycling Center
9900 Freeman Road
Kernersville, North Carolina 27284
910/595-6677
FAX: 910/595-9735

[redacted]

A Waste Management Company

July 11, 1996

Ms. Sherri Coghill
North Carolina Dept. of Environment, Health, and Natural Resources
Solid Waste Section (SWS)
401 Oberlin Road
Raleigh, NC 27611

Re: Request to Use a Small Portion of the Landfill Buffer for Use in Locating a Gas Flare; Piedmont Landfill & Recycling Center (PLFRC), Kernersville, NC. Permit Number 34-06

Dear Ms. Coghill:

In order to be in compliance with our Permit Condition number GENERAL (G) 8 (b), please consider this as a request to use a small portion of PLFRC's buffer for use in locating a skid mounted gas flare.

As you know, we are presently constructing a portion of our permitted gas control system. The portion that will be completed this year will consist of approximately 25 extraction wells, along with the associated headers, blower, and flare. We have determined that the best place for this flare is in the north central part of the site, in the buffer area just west of Sediment Pond Number 2. The surrounding area is thickly wooded, is undeveloped, and there are no residences or buildings within 2,000 feet of this proposed flare location. Attached please find a map showing the proposed flare.

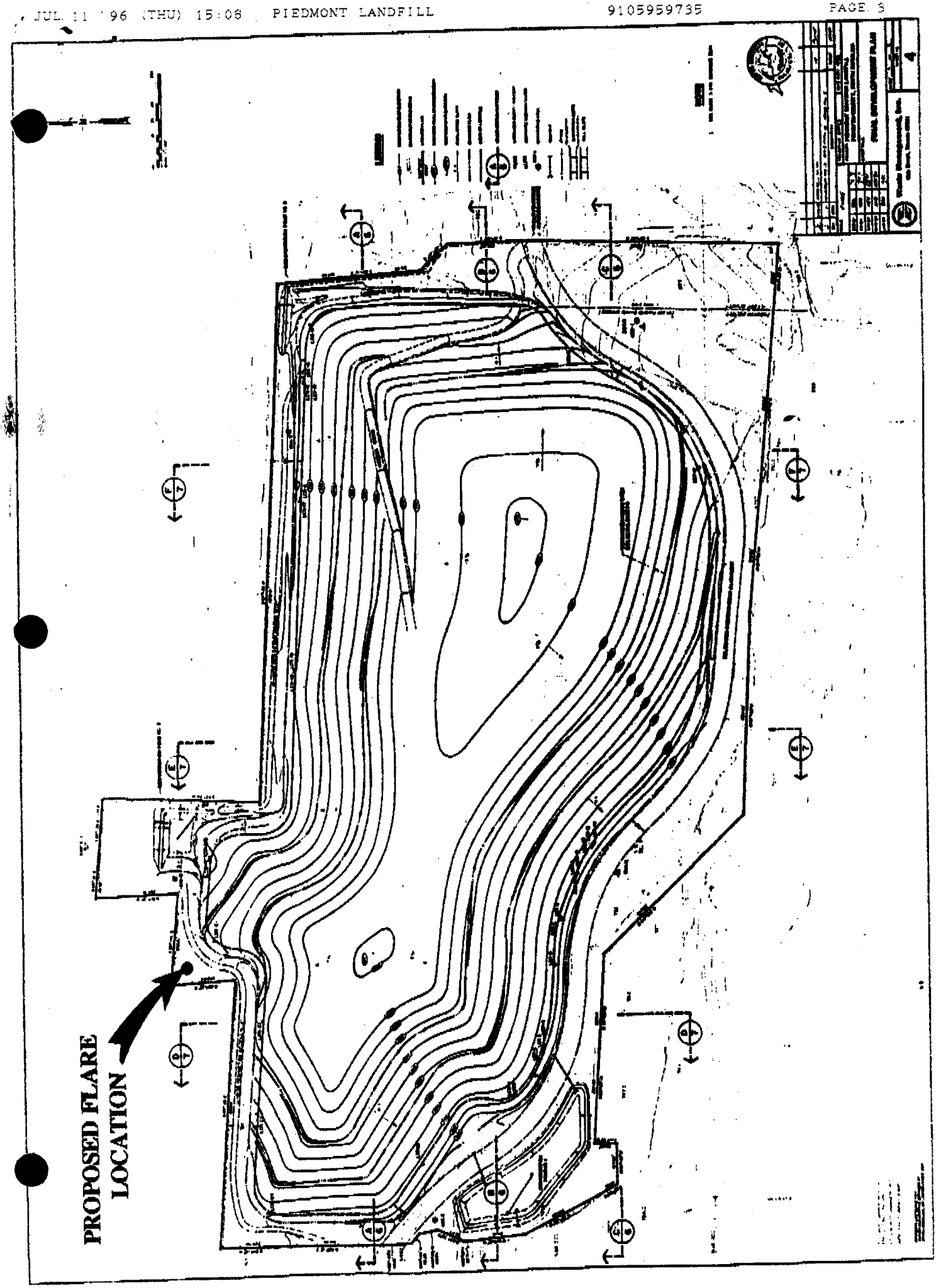
We would appreciate it if you would let us know your decision as soon as possible. Of course, if you have any questions, feel free to contact either Bill Lewis or myself @ (910) 595-6677.

Sincerely,

Edward L. Gibson, P.E.
Facility Engineering Manager

Approved location of flare in telephone conversation w/ Bill Lewis on 7/12/96. SLC

cc: Bill Lewis
Mark Taylor
Mike Rodgers


PROPOSED FLARE LOCATION

CF
34-04

Piedmont Landfill
and Recycling Center
9900 Freeman Road
Kernersville, North Carolina 27284
910/595-6677
FAX: 910/595-9735

A Waste Management Company

June 28, 1996

Ms. Sherri Coghill
North Carolina Dept. of Environment, Health, and Natural Resources
Solid Waste Section (SWS)
401 Oberlin Road
Raleigh, NC 27611

Re: Confirmation of Design Change Request for the Piedmont Landfill & Recycling Center (PLFRC) Gas Control System, Kernersville, NC

Dear Ms. Coghill:

This is to confirm our telephone conversation yesterday concerning a request for a minor design change in the PLFRC's gas control system.

Several weeks ago you reminded me of 15A NCAC .1626 (9)(a)(ii), whereby gas condensate could not be dripped into landfill areas that did not have a liner/leachate collection system designed in accordance with .1624. Because of this situation we had to revise our permitted design to meet this regulation. We therefore chose to drip gas condensate into leachate sump "A" instead of sump "4", and also chose to drip gas condensate into leachate sump "D" instead of Sump "7".

When the gas system contractor was field surveying this new gas header route this week, it was noticed that in order to maintain the 3 % minimum grade on the gas header pipe (as required by the approved Solid Waste Permit Plans, Drawing 17, Note 4), there would not be enough vertical room to install the drip leg. As you may or may not know, the basis for the 3% minimum grade is provide for more than adequate slope for condensate removal, allowing room for landfill consolidation. However, since some of the header lines are near the edge of the landfill where consolidation should not be as great, a lesser minimum slope (such as 2%) could be used for those areas.

It is my understanding, based upon our telephone conversation that the SWS had no problem in allowing this change from 3% to 2%, and that this change must be documented on the as-builts produced for this project.

If you have any questions, feel free to contact either Bill Lewis or myself @ (910) 595-6677.

Sincerely,

Edward L. Gibson, P.E.
Facility Engineering Manager

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CF - 34-026

Piedmont Landfill
and Recycling Center
9900 Freeman Road
Kernersville, North Carolina 27284
910/595-6677
FAX: 910/595-9735

A Waste Management Company

May 31, 1996

Ms. Sherri Coghill
North Carolina Dept. of Environment, Health, and Natural Resources
Department of Solid Waste Management (SWS)
401 Oberlin Road
Raleigh, NC 27611

Re: Correction to 1994 Permit Renewal/Transition Application; Piedmont Landfill & Recycling Center (PLFRC), Kernersville, NC

Dear Ms. Coghill:

As required by 15A NCAC 13B .1604 (b) (2) (L) (iv), the PLFRC hereby is informing the SWS of incorrect information supplied in the above referenced application.

In reviewing all of our information to determine if the PLFRC would be subject to the recently promulgated New Source Performance Standards (NSPS) for municipal solid waste landfills, we discovered an error in the following document:

- On Line "O)" of **APPENDIX B** of the **ENGINEERING PLAN**, (this is the PIEDMONT LANDFILL AIRSPACE TRACKING REPORT), it reports "Total Available Site Gate Tons" as 6,213,322. This is incorrect. The units are incorrect. If you'll notice the equation that determined this quantity, it should be BCY, not tons. Therefore, line "O)" should read: **Total Available Site BCY (N+((Tons rec'd to date *2000))/E: 6,213,322.**

Enclosed please find a corrected/revised APPENDIX B.

If you have any questions, feel free to contact either Ed Gibson or myself @ (910) 595-6677.

Sincerely,

William R. Lewis, P.E.
Division President & General Manager

cc: Ed Gibson
Operating Record

Printed on Recycled Paper

APPENDIX B

PIEDMONT LANDFILL AIRSPACE TRACKING REPORT AS OF 1/31/94

Basis of Airspace Volumes

A) Remaining BCY*, Modules 1,2,5,6,1,2,3 as of 1/9/94, (no final cover):	1,099,749
B) Remaining BCY, full site, as of 1/9/94 (no final cover):	5,278,659
C) BCY consumed between 7/1/93 and 1/9/94** :	229,996
D) Gate Tons Received between 7/1/93 and 1/9/94,Tons:	147,318
E) Refuse/Int/Daily Cover Density Factor, (D/C)*2000,Gate lbs/Bank CY:	1,281

* Bank cubic yards (in-place cubic yards)

** Dates represent when topographic surveys took place

PRESENT ANALYSIS

F) Total Tons Landfilled between 1/9/94 and 1/31/94:	24,747
G) Total Gate Tons Received, This Month :	32,920
H) Tons Landfilled since 1/9/94, tons:	24,747
I) Remaining BCY Mods 1,2,5,6,1,2,3 as of this date, A-(H/(E/2000)):	1,061,113
J) Gate Tons Available, Modules 1,2,5,6,1,2,3, I*(E/2000):	679,669
K) Monthly Refuse Gate Rate, (for site life calc), TONS***:	61,967
L) MONTHS REMAINING, (J / K):	11
M) REMAINING TOTAL SITE LIFE, YRS , ((B-(H+(2000/E)))/(K*(2000/E)))/12:	4.5
N) REMAINING BCY, FULL SITE, AS OF THIS DATE, B-(H+(2000/E)):	5,240,023
0) Total Available Site BCY, (N+((Tons rec'd to date*2000))/E:	6,213,322
P) Monthly Average gate tons for last 6 months:	26,404
Q) Daily average gate tons for past 6 months:	1,108

*** Calculation based upon the following criteria:

a) Gate tons per day:	2,600
b) Days per week:	5.5
c) Weeks per year:	52
d) Latest density:	1,281

CF

State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Solid Waste Management

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
William L. Meyer, Director

DEHNR

May 22, 1996

Mr. William R. Lewis
Piedmont Landfill and Recycling Center
9900 Freeman Road
Kernersville, North Carolina 27284

Re: Gas Collection System Design Change Approval
Piedmont Landfill and Recycling Center
Permit No. 34-06

Dear Mr. Lewis:

The Solid Waste Section has completed review of the requested design change for installation of the gas collection system and hereby issues approval. This approval and the referenced request will be added to the approved documents for Piedmont Landfill.

If you have any questions or comments, please contact Sherri Coghill at (919)733-0692, ext. 259.

Sincerely,

James C Coffey

James C. Coffey, Supervisor
Permitting Branch
Solid Waste Section

cc: Julian Foscue
Brent Rockett
Matthew Gant

P.O. Box 27687, Raleigh, North Carolina 27611-7687 Telephone 919-733-4996 FAX 919-715-3605
An Equal Opportunity Affirmative Action Employer 50% recycled/ 10% post-consumer paper

Piedmont Landfill
and Recycling Center
9900 Freeman Road
Kernersville, North Carolina 27284
910/595-6677
FAX: 910/595-9735

A Waste Management Company

March 29, 1996

Ms. Sherri Coghill
North Carolina Dept. of Environment, Health, and Natural Resources
Department of Solid Waste Management (SWS)
401 Oberlin Road
Raleigh, NC 27611

Re: Request for Minor Design Change: Location of Header Lines for the Gas Collection/Control System for the Piedmont Landfill & Recycling Center (PLFRC), Kernersville, NC

Dear Ms. Coghill:

Please consider this a request on behalf of the PLFRC for a minor design change related to the gas control/collection system. Specifically, the PLFRC requests that we be allowed to change the location of the header pipes from *above* the geomembrane to *below* the geomembrane. The following is the explanation/justification for this request.

As you can from Detail 11 on Drawings No. 18 of the PLFRC's Permitted plans, the gas collection lines (i.e., header pipes) are located above the final cover geomembrane, within the two feet of protective soil layer. The reason for this location was for ease of maintenance - - access to repair the header pipes was easier since we would not have to damage the geomembrane to get to the header. However, there is one major disadvantage to having this header above the geomembrane: When it comes to constructing this collection system, if the geomembrane has already been laid, then placing construction equipment (such as a backhoe) on this geomembrane in order to dig the header trench would damage parts of the liner, thereby requiring extra repairs. The solution to this, of course, would be to have the header located *below* the geomembrane. In other words, construct the gas collection system first, then come back and lay the final cover, including the geomembrane. The main disadvantage of this construction is, in order to perform repairs on the header pipe, repairs would have to be made to the final cover. We feel, however, that a major cost saving will occur because the gas collection contractor will mobilize only once: to construct the entire system, instead of twice: once to construct the wells, and again when the final cover contractor(s) have finished placing this final cover. This cost savings should outweigh the costs of liner repair.

Sherri, it is the PLFRC's intention to commence this gas control/collection system cover on a 30 acre portion of the landfill in May of this year. We would certainly appreciate your expedient response in this matter and if you have any questions, feel free to contact either Ed Gibson or myself @ (910) 595-6677.

Sincerely,

William R. Lewis, P.E.
Division President & General Manager

cc: Ed Gibson
Brent Rockett

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Piedmont Landfill
and Recycling Center
9900 Freeman Road
Kernersville, North Carolina 27284
910/595-6677
FAX: 910/595-9735

A Waste Management Company

February 8, 1996

Ms. Sherri Coghill
North Carolina Dept of Environment, Health, and Natural Resources
Department of Solid Waste Management (SWS)
401 Oberlin Road
Raleigh, NC 27611

Re: ***Revision*** to the January 31, 1996 Leachate Management Submittal as Required by October 17, 1994 Solid Waste Permit Condition **OPERATION (O) 3 (c)**; Piedmont Landfill & Recycling Center (PLFRC), Kernersville, NC

Dear Ms. Coghill:

As you know, the PLFRC submitted the above referenced report on January 31, 1996. Since this submittal, we noticed two errors: one, that the semi-annual leachate analysis was not included and two, the Sump A meter reading for February was missing. We apologize for this oversight and are now submitting a fully corrected report. We ask that you please dispose of the report submitted on January 31, 1996. Thanks!

If you have any questions, feel free to contact either Ed Gibson or myself @ (910) 595-6677.

Sincerely,

William R. Lewis, P.E.
Division President & General Manager

cc: Ed Gibson

Printed on Recycled Paper

PIEDMONT LANDFILL & RECYCLING CENTER

Leachate Collection and Removal System

MONTHLY LOG

Date	Sump Number	Meter Reading	Meter Reading Difference (Volume in Gallons)
01/25/95	1	5112	592
	2	1575	523
	5,6	44682	2,766
	7	30774	30,774
	4	72891	72,891
		Total:	107,546

SUMP NUMBER	Area Draining to Sump, Sq. Ft
1	174,240
2	130,680
5,6	435,600
4	261,360
7	304,920
Total:	1,306,800

PIEDMONT LANDFILL & RECYCLING CENTER

Leachate Collection and Removal System

MONTHLY LOG

Date	Sump Number	Meter Reading	Meter Reading Difference (Volume in Gallons)
02/28/95	1	5201	89
	2	1764	189
	5,6	45356	674
	7	14266	14,266
	4	41732	41,732
	A	70354	70,354
		Total:	127,304

SUMP NUMBER	Area Draining to Sump, Sq. Ft.
1	174,240
2	130,680
5,6	435,600
4	261,360
A	273,000
7	304,920
Total:	1,579,800

NEW SUBCELL OPENED FEBRUARY 1995

PIEDMONT LANDFILL & RECYCLING CENTER

Leachate Collection and Removal System

MONTHLY LOG

Date	Sump Number	Meter Reading	Meter Reading Difference (Volume in Gallons)
03/31/95	1	5201	0
	2	2156	392
	5,6	45356	0
	7	20280	20,280
	4	41200	41,200
	A	404626	404,626
		Total:	466,498

SUMP NUMBER	Area Draining to Sump, Sq. Ft.
1	174,240
2	130,680
5,6	435,600
4	261,360
A	273,000
7	304,920
Total:	1,579,800

PIEDMONT LANDFILL & RECYCLING CENTER

Leachate Collection and Removal System

MONTHLY LOG

Date	Sump Number	Meter Reading	Meter Reading Difference (Volume in Gallons)
04/29/95	1	5236	35
	2	2470	314
	5,6	46688	1,332
	7	19280	19,280
	4	39250	39,250
	A	45126	45,126
		Total:	105,337

SUMP NUMBER	Area Draining to Sump, Sq. Ft.
1	174,240
2	130,680
5,6	435,600
4	261,360
A	273,000
7	304,920
Total:	1,579,800

PIEDMONT LANDFILL & RECYCLING CENTER

Leachate Collection and Removal System

MONTHLY LOG

Date	Sump Number	Meter Reading	Meter Reading Difference (Volume in Gallons)
05/31/95	1	5654	418
	2	2807	337
	5,6	47230	542
	7	6580	6,580
	4	41073	41,073
	A	37261	37,261
	B	62527	62,527
		Total:	148,738

SUMP NUMBER	Area Draining to Sump, Sq. Ft.
1	174,240
2	130,680
5,6	435,600
4	261,360
A	273,000
B	261,000
7	304,920
Total:	1,840,800

NEW SUBCELL OPENED MAY 1995

PIEDMONT LANDFILL & RECYCLING CENTER

Leachate Collection and Removal System

MONTHLY LOG

Date	Sump Number	Meter Reading	Meter Reading Difference (Volume in Gallons)
06/30/95	1	5961	307
	2	3160	353
	5,6	47950	720
	7	14900	14,900
	4	21462	21,462
	A	926	926
	B	636787	636,787
		Total:	675,455

SUMP NUMBER	Area Draining to Sump, Sq. Ft.
1	174,240
2	130,680
5,6	435,600
4	261,360
A	273,000
B	261,000
7	304,920
Total:	1,840,800

PIEDMONT LANDFILL & RECYCLING CENTER

Leachate Collection and Removal System

MONTHLY LOG

Date	Sump Number	Meter Reading	Meter Reading Difference (Volume in Gallons)
07/31/95	1	5961	0
	2	3440	280
	5,6	48860	910
	7	744	744
	4	21630	21,630
	A	432	432
	B	149112	149,112
		Total:	173,108

SUMP NUMBER	Area Draining to Sump, Sq. Ft.
1	174,240
2	130,680
5,6	435,600
4	261,360
A	273,000
B	261,000
7	304,920
Total:	1,840,800

PIEDMONT LANDFILL & RECYCLING CENTER

Leachate Collection and Removal System

MONTHLY LOG

Date	Sump Number	Meter Reading	Meter Reading Difference (Volume in Gallons)
08/31/95	1	6382	421
	2	3818	378
	5,6	50023	1,163
	7	9865	9,865
	4	44784	44,784
	A	775	775
	B	75480	75,480
		Total:	132,866

SUMP NUMBER	Area Draining to Sump, Sq. Ft.
1	174,240
2	130,680
5,6	435,600
4	261,360
A	273,000
B	261,000
7	304,920
Total:	1,840,800

PIEDMONT LANDFILL & RECYCLING CENTER

Leachate Collection and Removal System

MONTHLY LOG

Date	Sump Number	Meter Reading	Meter Reading Difference (Volume in Gallons)
09/29/95	1	6678	296
	2	4117	299
	5,6	51000	977
	7	11071	11,071
	4	22927	22,927
	A	139	139
	B	39965	39,965
		Total:	75,674

SUMP NUMBER	Area Draining to Sump, Sq, Ft.
1	174,240
2	130,680
5,6	435,600
4	261,360
A	273,000
B	261,000
7	304,920
Total:	1,840,800

PIEDMONT LANDFILL & RECYCLING CENTER

Leachate Collection and Removal System

MONTHLY LOG

Date	Sump Number	Meter Reading	Meter Reading Difference (Volume in Gallons)
10/31/95	1	6894	216
	2	4451	334
	5,6	51265	265
	7	32135	32,135
	4	49187	49,187
		Total:	82,137

SUMP NUMBER	Area Draining to Sump, Sq. Ft.
1	174,240
2	130,680
5,6	435,600
4	261,360
A	273,000
B	261,000
7	304,920
Total:	1,840,800

PIEDMONT LANDFILL & RECYCLING CENTER

Leachate Collection and Removal System

MONTHLY LOG

Date	Sump Number	Meter Reading	Meter Reading Difference (Volume in Gallons)
11/30/95	1	6900	6
	2	5140	689
	5,6	63308	12,043
	7	65000	65,000
	4	55927	55,927
	A	6910	6,910
	B	7010	7,010
		Total:	147,585

SUMP NUMBER	Area Draining to Sump, Sq. Ft.
1	174,240
2	130,680
5,6	435,600
4	261,360
A	273,000
B	261,000
7	304,920
Total:	1,840,800

PIEDMONT LANDFILL & RECYCLING CENTER

Leachate Collection and Removal System

MONTHLY LOG

Date	Sump Number	Meter Reading	Meter Reading Difference (Volume in Gallons)
12/30/95	1	7059	159
	2	5383	243
	5,6	64551	1,243
	7	61970	61,970
	4	21348	21,348
	A	27221	27,221
	B	31534	31,534
		Total:	143,718

SUMP NUMBER	Area Draining to Sump, Sq. Ft.
1	174,240
2	130,680
5,6	435,600
4	261,360
A	273,000
B	261,000
7	304,920
Total:	1,840,800

PIEDMONT LANDFILL & RECYCLING CENTER
Leachate Collection and Removal System

Month	Leachate Removed, gallons
Jan-95	107,546
Feb-95	127,304
Mar-95	466,498
Apr-95	105,337
May-95	148,738
Jun-95	675,455
Jul-95	173,108
Aug-95	132,866
Sep-95	75,674
Oct-95	82,137
Nov-95	147,585
Dec-95	143,718
TOTAL:	2,385,966

Research & Analytical Laboratories, Inc.

Analytical/Process Consultations

RESEARCH & ANALYTICAL LABS. SIDNEY L. CHAMPION NC #34 DIRECTOR CERTIFIED ANALYSIS

Appendix 1 - Subtitle D Groundwater Monitoring - Volatile Organic Analysis From Selected Sampling Locations From Piedmont Landfill and Recycling Center, Kernersville, NC, 09 August 1995

Parameter EPA Method 8260 Volatile Organics	Quantitation Limit(mg/l)	Sump#1 (mg/l)	Sump#2 (mg/l)	Sump#5-6 (mg/l)	Sump#4 (mg/l)	Sump#7 (mg/l)	Sump A (mg/l)	Sump B (mg/l)
Methylene Chloride	0.010	BQL	0.007	0.007	0.041	0.013	0.034	0.036
Trichlorofluoromethane	0.005	BQL	BQL	BQL	0.011	BQL	0.017	0.020
1,1-Dichloroethene	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,1-Dichloroethane	0.005	BQL	BQL	BQL	0.108	0.018	0.094	0.104
Chloroform	0.005	BQL	BQL	BQL	0.009	BQL	0.010	0.011
Carbon Tetrachloride	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,2-Dichloropropane	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Trichloroethene	0.005	BQL	BQL	BQL	0.012	BQL	0.012	0.014
Dibromochloromethane	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,1,2-Trichloroethane	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Tetrachloroethene	0.005	BQL	BQL	BQL	0.008	BQL	0.007	0.007
Chlorobenzene	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Trans-1,2-Dichloroethene	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,2-Dichloroethane	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,1,1-Trichloroethane	0.005	BQL	BQL	BQL	0.039	BQL	0.054	0.058
Bromodichloromethane	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Cis-1,3-Dichloropropene	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Benzene	0.005	0.014	0.018	0.015	0.007	0.011	0.006	0.006
Trans-1,3-Dichloropropene	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Bromoform	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,1,2,2-Tetrachloroethane	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Toluene	0.005	0.343	0.008	0.039	0.293	0.318	0.275	0.263
Ethyl Benzene	0.005	0.047	0.096	BQL	0.026	0.024	0.026	0.028
Chloromethane	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Bromomethane	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Vinyl Chloride	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Chloroethane	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Acetone	0.100	BQL	0.275	0.193	BQL	BQL	BQL	BQL
Carbon Disulfide	0.100	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Vinyl Acetate	0.050	BQL	BQL	BQL	BQL	BQL	BQL	BQL
2-Butanone	0.100	0.430	BQL	BQL	4.67	0.266	4.00	4.17
4-Methyl-2-Pentanone	0.100	BQL	BQL	BQL	BQL	BQL	BQL	BQL
2-Hexanone	0.050	BQL	BQL	BQL	0.113	BQL	0.080	0.073
Styrene	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Total Xylenes	0.005	0.096	0.236	0.080	0.047	0.064	0.045	0.046
Acrylonitrile	0.200	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,2-Dichlorobenzene	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,4-Dichlorobenzene	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Trans-1,4-Dichloro-2-butene	0.100	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Cis-1,2-Dichloroethene	0.005	BQL	BQL	BQL	0.016	BQL	0.013	0.013
Methyl Iodide	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Bromochloromethane	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Dibromomethane	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,1,1,2-Tetrachloropropane	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,2,3-Trichloropropane	0.015	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,2-Dibromo-3-Chloropropane(DBCP)	0.025	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,2-Dibromethane(EDB)	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Sample Number		245859	245860	245862	245861	245863	245864	245865
Sample Date		8/9/95	8/9/95	8/9/95	8/9/95	8/9/95	8/9/95	8/9/95
Sample Time (hrs)		0900	0900	0900	0900	0900	0900	1500

mg/l = milligrams per liter = parts per million
BQL = Below Quantitation Limit

P.O. Box 473 • 106 Short Street • Kernersville, North Carolina 27284 • 910/996-2841

Research & Analytical Laboratories, Inc.

Analytical/Process Consultations

RESEARCH & ANALYTICAL LABS. SIDNEY L. CHAMPION NC #34 DIRECTOR CERTIFIED ANALYSIS

Appendix 1 - Subtitle D Groundwater Monitoring - Inorganic Analysis From Selected Sampling Locations From Piedmont Landfill and Recycling Center, Kernersville, NC, 09 August 1995

Parameter Inorganics	Quantitation Limit(mg/l)	Sump#1 (mg/l)	Sump#2 (mg/l)	Sump#5-6 (mg/l)	Sump#4 (mg/l)	Sump#7 (mg/l)	Sump A (mg/l)	Sump B (mg/l)
Arsenic	0.010	BQL	BQL	BQL	BQL	0.010	BQL	BQL
Antimony	0.030	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Barium	0.500	9.09	4.08	0.934	1.09	0.844	1.18	1.26
Beryllium	0.002	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Cadmium	0.001	0.006	0.001	0.010	0.030	0.009	0.034	0.035
Chromium	0.010	BQL	BQL	BQL	BQL	0.029	BQL	BQL
Cobalt	0.010	BQL	BQL	BQL	0.074	BQL	0.112	0.133
Copper	0.200	BQL	BQL	BQL	0.728	BQL	BQL	BQL
Lead	0.010	BQL	BQL	0.012	0.094	BQL	0.023	0.026
Nickel	0.050	BQL	0.070	BQL	0.711	BQL	BQL	BQL
Selenium	0.020	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Silver	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Thallium	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Zinc	0.050	0.074	0.070	0.105	0.658	BQL	0.055	0.094
Vanadium	0.040	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Sample Number		245859	245860	245862	245861	245863	245864	245865
Sample Date		8/9/95	8/9/95	8/9/95	8/9/95	8/9/95	8/9/95	8/9/95
Sample Time (hrs)		0900	0900	0900	0900	0900	0900	1500

mg/l = milligrams per liter = parts per million
BQL = Below Quantitation Limit

P.O. Box 473 • 106 Short Street • Kernersville, North Carolina 27284 • 910/996-2841

RESEARCH & ANALYTICAL LABORATORIES, INC.
Analytical/Process Consultations
Phone (910) 996-2841

CHAIN OF CUSTODY RECORD

826IN_KV. DB5(5,6)

JOB NO.	PROJECT NAME
	PIEDMONT LANDFILL LEACHATE

SAMPLERS (SIGNATURE): Michael Mitchell

SAMPLE NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	2L G (BNA, Herb./Pest.)	2 40ml Vials (VOA)	250ml G (TOX)	250ml P (TOC)	1L P,G (BOD, TSS, Unpreserved, etc.)	1L G (Phenol, Oil & Grease)	1L P,G (COD, N,P)	1L P,G (Metals, Hardness)	Sterile P,G (CYANIDE)	Sterile P,G (Coliform)	WATER/WASTEWATER	MISC.	REQUESTED ANALYSIS
SUMP 1	8/9/95	09:00		X	245859														APPENDIX 1
SUMP 2	8/9/95	↓		X	860														APPENDIX 1
SUMP 4	8/9/95			X	861														APPENDIX 1
SUMP 5&6	8/9/95			X	862														APPENDIX 1
SUMP 7	8/9/95			X	863														APPENDIX 1
SUMP A	8/9/95	↓		X	864														APPENDIX 1
SUMP B	8/9/95	15:00		X	865														APPENDIX 1
T.B.					866														

RELINQUISHED BY	DATE/TIME	RECEIVED BY
N. McFeeley	8-9-95 15:30	[illegible]
RELINQUISHED BY	DATE/TIME	RECEIVED BY

REMARKS: DO NOT COMPOSITE

RESEARCH & ANALYTICAL LABORATORIES, INC.

Analytical/Process Consultations

RESEARCH & ANALYTICAL LABS. SIDNEY L. STRAUSS NO 634 DIRECTOR CERTIFIED ANALYSIS

Appendix 1 - Subtitle D Groundwater Monitoring - Volatile Organic Analysis From Selected Sampling Locations From Piedmont Landfill and Recycling Center, Kernersville, NC, 29 Setpember 1995

Parameter EPA Method 8260 Volatile Organics	Quantitation Limit(mg/l)	Sump#1 (mg/l)	Sump#2 (mg/l)	Sump#5-6 (mg/l)	Sump#4 (mg/l)	Sump#7 (mg/l)	Sump A (mg/l)	Sump B (mg/l)
Methylene Chloride	0.010	0.010	0.016	BQL	0.030	0.018	0.016	0.013
Trichlorofluoromethane	0.005	BQL	BQL	BQL	0.058	BQL	BQL	0.008
1,1-Dichloroethene	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,1-Dichloroethane	0.005	BQL	BQL	BQL	0.378	0.033	0.340	0.540
Chloroform	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Carbon Tetrachloride	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,2-Dichloropropane	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Trichloroethene	0.005	BQL	BQL	BQL	0.007	BQL	0.006	BQL
Dibromochloromethane	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,1,2-Trichloroethane	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Tetrachloroethene	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Chlorobenzene	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Trans-1,2-Dichloroethene	0.005	BQL	0.009	BQL	BQL	BQL	BQL	BQL
1,2-Dichloroethane	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,1,1-Trichloroethane	0.005	BQL	BQL	BQL	0.011	BQL	0.015	0.007
Bromodichloromethane	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Cis-1,3-Dichloropropene	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Benzene	0.005	0.040	0.053	0.069	0.016	0.018	0.014	0.011
Trans-1,3-Dichloropropene	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Bromoform	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,1,2,2-Tetrachloroethane	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Toluene	0.005	0.205	0.015	0.015	0.685	0.926	0.380	0.450
Ethyl Benzene	0.005	0.079	0.143	BQL	0.040	0.033	0.044	0.044
Chloromethane	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Bromomethane	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Vinyl Chloride	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Chloroethane	0.010	BQL	BQL	BQL	0.356	BQL	BQL	BQL
Acetone	0.100	BQL	BQL	BQL	2.33	2.67	4.14	3.45
Carbon Disulfide	0.100	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Vinyl Acetate	0.050	BQL	BQL	BQL	BQL	BQL	BQL	BQL
2-Butanone	0.100	BQL	BQL	BQL	3.67	2.42	5.85	4.93
4-Methyl-2-Pentanone	0.100	BQL	BQL	BQL	BQL	BQL	BQL	BQL
2-Hexanone	0.050	BQL	BQL	BQL	0.264	0.386	0.234	0.219
Styrene	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Total Xylenes	0.005	0.275	0.583	0.496	0.133	0.161	0.116	0.110
Acrylonitrile	0.200	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,2-Dichlorobenzene	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,4-Dichlorobenzene	0.005	0.008	BQL	0.013	BQL	BQL	0.005	0.012
Trans-1,4-Dichloro-2-butene	0.100	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Cis-1,2-Dichloroethene	0.005	BQL	BQL	BQL	0.088	0.011	0.134	0.111
Methyl Iodide	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Bromochloromethane	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Dibromomethane	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,1,1,2-Tetrachloropropane	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,2,3-Trichloropropane	0.015	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,2-Dibromo-3-Chloropropane(DBCP)	0.025	BQL	BQL	BQL	BQL	BQL	BQL	BQL
1,2-Dibromethane(EDB)	0.005	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Sample Number		250815	250816	250818	250817	250819	250820	250821
Sample Date		9/29/95	9/29/95	9/29/95	9/29/95	9/29/95	9/29/95	9/29/95
Sample Time (hrs)		0730	0745	0820	----	0810	----	----

mg/l = milligrams per liter = parts per million
BQL = Below Quantitation Limit

RESEARCH & ANALYTICAL LABORATORIES, INC.

Analytical/Process Consultations

RESEARCH & ANALYTICAL LABS. SIDNEY L. CHAMPION NC #34 DIRECTOR CERTIFIED ANALYSIS

Appendix 1 - Subtitle D Groundwater Monitoring - Inorganic Analysis From Selected Sampling Locations From Piedmont Landfill and Recycling Center, Kernersville, NC, 29 September 1995

Parameter Inorganics	Quantitation Limit(mg/l)	Sump#1 (mg/l)	Sump#2 (mg/l)	Sump#5-6 (mg/l)	Sump#4 (mg/l)	Sump#7 (mg/l)	Sump A (mg/l)	Sump B (mg/l)
Arsenic	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Antimony	0.030	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Barium	0.500	8.76	4.22	0.748	1.25	0.717	1.26	1.28
Beryllium	0.002	0.002	0.002	0.002	BQL	0.002	BQL	BQL
Cadmium	0.001	0.006	0.002	0.008	0.040	0.017	0.052	0.002
Chromium	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Cobalt	0.010	BQL	BQL	BQL	0.080	BQL	0.134	0.128
Copper	0.200	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Lead	0.010	0.018	0.008	0.010	0.025	0.011	0.024	0.022
Nickel	0.050	BQL	0.064	BQL	BQL	BQL	BQL	BQL
Selenium	0.020	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Silver	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Thallium	0.010	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Zinc	0.050	0.095	BQL	0.081	BQL	0.056	0.078	0.100
Vanadium	0.040	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Sample Number		250815	250816	250818	250817	250819	250820	250821
Sample Date		9/29/95	9/29/95	9/29/95	9/29/95	9/29/95	9/29/95	9/29/95
Sample Time (hrs)		0730	0745	0820	----	0810	----	----

mg/l = milligrams per liter = parts per million
BQL = Below Quantitation Limit

P.O. Box 473 • 106 Short Street • Kernersville, North Carolina 27284 • 910/996-2841

RESEARCH & ANALYTICAL LABORATORIES, INC.
Analytical/Process Consultations
Phone (910) 996-2841

CHAIN OF CUSTODY RECORD

826 IN_KV.DB5

WATER/WASTEWATER | MISC.

JOB NO.

PROJECT NAME: PIEDMONT LF LEACHATE

SAMPLERS (SIGNATURE): [signature]

SAMPLE NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	2L G (BNA, Herb./Pest.)	40ml Vials (VOA)	250ml G (TOX)	250ml P (TOC)	1L P,G (BOD, TSS, Unpreserved, etc.)	1L G (Phenol, Oil & Grease)	1L P,G (COD, N,P)	1L P,G (Metals, Hardness)	1L P,G (CYANIDE)	Sterile P,G (Coliform)	REQUESTED ANALYSIS
SUMP 1	9-29-95	07:30		X	250815			X						X			APPENDIX 1
SUMP 2	9-29-95	07:45		X	816			X						X			APPENDIX 1
SUMP 4	9-29-95			X	817			X						X			APPENDIX 1
SUMP 5&6	9-29-95	08:20		X	818			X						X			APPENDIX 1
SUMP 7	9-29-95	08:10		X	819			X						X			APPENDIX 1
SUMP A	9-29-95			X	820			X						X			APPENDIX 1
SUMP B	9-29-95			X	821			X						X			APPENDIX 1
					TB 822												

RELINQUISHED BY	DATE/TIME	RECEIVED BY
[signature]	9-29-95 11:00	[signature]
[signature]	9-29-95 1445	S. Miller

REMARKS: DO NOT COMPOSITE ON ICE