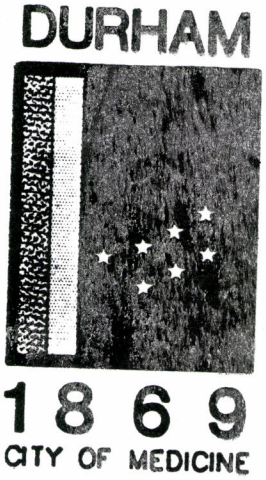
CITY OF DURHAM
SANITARY LANDFILL
TRANSITION PLAN



SCANNED
Carmen Johnson 3/6/15

City of Durham, North Carolina

April 1994

APPROVED
DIVISION OF SOLID WASTE MANAGEMENT
DATE 8/7/96 BY

0759-022

MALCOLM PIRNIE
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

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

July 21, 1994

Ms. Nancy Newell
101 City Hall Plaza
Durham, N.C. 27701

SCANNED 3/6/15

RE: Interim Review Of Water Quality Monitoring Transition Plan
City of Durham Landfill, Permit # 32-01

Dear Ms. Newell,

There is limited time available for the Solid Waste Section to review and evaluate the Water Quality Monitoring Plan submitted as part of the Transition Plan. It is not possible to do a full technical review of this plan in time to allow for the upgrading of the monitoring system and the initial sampling episode of the baseline sampling event.

Therefore the Solid Waste Section is giving interim authorization for the City of Durham to proceed with the upgrade of the groundwater monitoring system at the Durham MSWLF facility in general accordance with the proposal submitted in the monitoring plan included as part of the Transition Plan. **However, the monitoring system upgrade must meet the following conditions:**

Two additional monitoring wells should be installed along the eastern property boundary at the locations of existing wells P-1 and MW-1. (Well P-1 may be used if it is constructed according to the proper design standards.)

None of the existing monitoring wells are to be abandoned or dropped from the detection monitoring system without written authorization from the Solid Waste Section. (Existing well MW-1 is **not** to be abandoned at this time, however it does not need to be sampled as part of the detection monitoring system.)

New monitoring wells should generally be installed about 100 to 150 feet from the waste boundary.

The monitoring wells are to be constructed according to the specifications in the North Carolina Well Construction Standards (15A NCAC 2C .0108).

The monitoring wells are to be constructed according to the specifications in the "North Carolina Water Quality Monitoring Guidance Document For Solid Waste Facilities" as illustrated by the Typical Monitoring Well Schematic" diagram enclosed.

The monitoring wells are to be placed in the approved locations in areas free of garbage, refuse, or debris, and in areas not subject to flooding.

The monitoring wells are to be drilled to a depth, and the screens placed at vertical locations, that will ensure that future drought conditions, which may lower the water table, will not render the monitoring system ineffective.

Generally shallow monitoring wells shall be installed with a 15 foot screen, with the top of the screen set just above the seasonal high water table, unless hydrogeologic conditions justify changes in this design.

The sand pack should extend no more than 2 feet above the screen and no more than 1 foot below the screen. A bentonite seal of at least 1.0 foot should be installed above the screened interval. The bentonite shall be allowed adequate time to hydrate prior to grouting up the annular space of the well above the bentonite seal.

Monitoring wells shall be thoroughly developed after construction in order to reduce suspended solids, flush out the well, and re-establish equilibrium with the aquifer.

In addition to the water quality analytical data, the initial baseline sampling report must include for each monitoring well the following information: a Well Completion Record, Well Schematic Diagram, boring log, hydraulic conductivity value, porosity value, effective porosity value, and the direction and rate of ground-water flow. **This initial baseline sampling report must be received in the Solid Waste Section office on or before October 9, 1994.** The technical review and determination of adequacy of the Transition Plan Water Quality Monitoring Plan will not be completed until after the initial baseline sampling document has been received and reviewed by the Solid Waste Section.

The water quality sampling and analysis for the baseline sampling must be done according to the directives in the June 24, 1994, memorandum from the Solid Waste Section to MSWLF owners and operators. If you have any questions or comments regarding this conditional interim authorization to install monitoring wells as necessary to upgrade the monitoring system at the Durham Landfill, please contact the Solid Waste Section at (919) 733-0692.

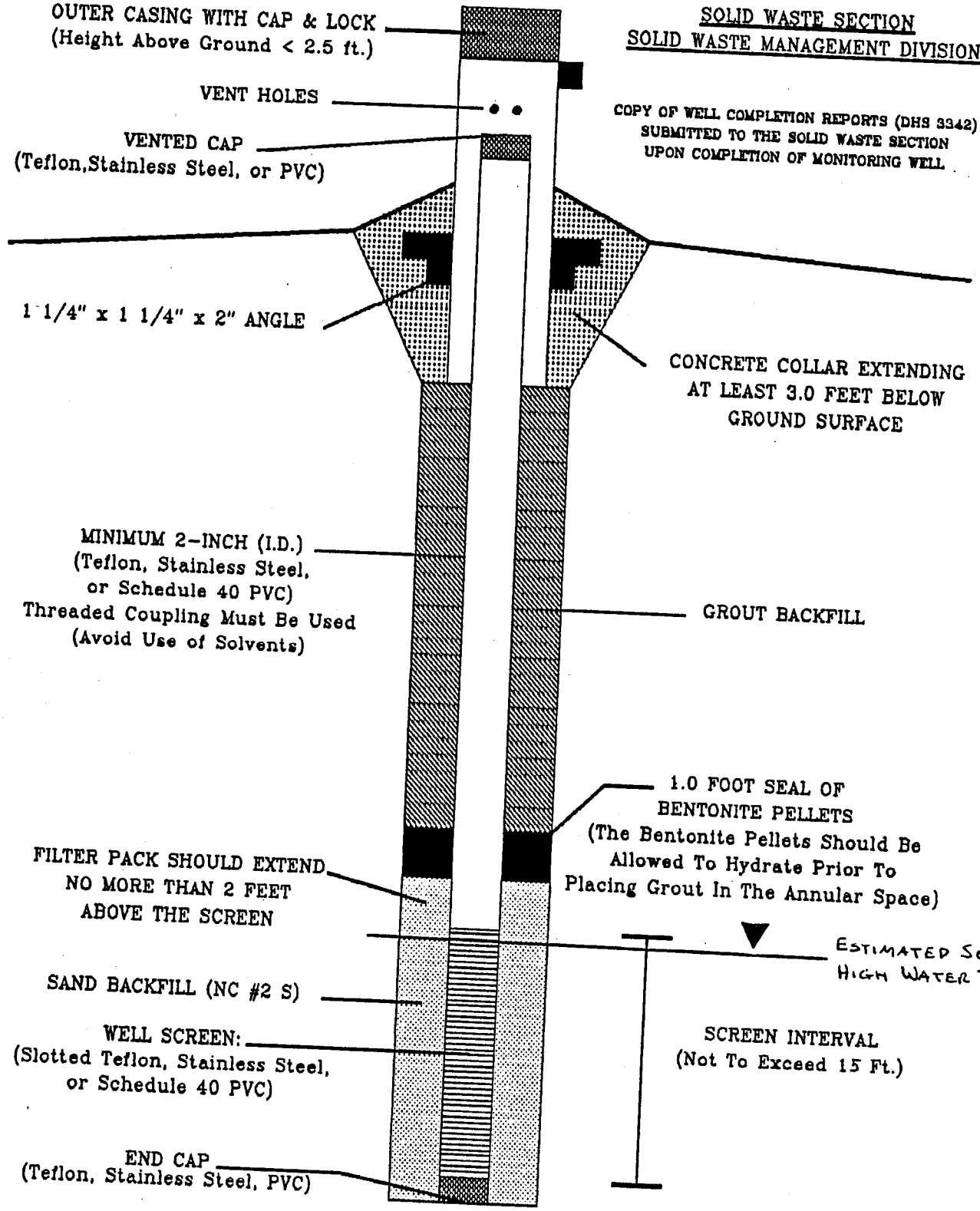
Sincerely,

Bobby Lutfy

Bobby Lutfy, Hydrogeologist
Solid Waste Section

cc: Ellis Cayton
Mark Fry
Malcolm Pirnie, Inc.

TYPICAL MONITORING WELL SCHEMATIC



SOLID WASTE SECTION
SOLID WASTE MANAGEMENT DIVISION

COPY OF WELL COMPLETION REPORTS (DHS 3342) SUBMITTED TO THE SOLID WASTE SECTION UPON COMPLETION OF MONITORING WELL

IMPORTANT

To Bobby 8/9 10:30

Date 8-8-94 Time 4:00

WHILE YOU WERE OUT

M Steve Nesbit

of Malcolm Pirnie

Phone 804 873 1-8700
AREA CODE NUMBER EXTENSION

TELEPHONED		PLEASE CALL	
CALLED TO SEE YOU		WILL CALL AGAIN	
WANTS TO SEE YOU		URGENT	
RETURNED YOUR CALL			

Message Durham

O.K. P-1 Screened above A.R.
10' below WT

P-2 MW-1

P-6 MW-7 Upgradient

+MW-5, MW-6

Signed

Plate 2 of Mon. Plan

N.C. Dept. of Environment, Health, and Natural Resources

T.D.

P-1 38ft near A.R.

322 Top Screen Elev.

-15

1-10-94 W.T. 332

307 bottom of screen

O.K.

32-01

APR 1994
Received
Solid Waste
Section

CITY OF DURHAM SANITARY LANDFILL TRANSITION PLAN

SCANNED
3/6/15

DURHAM
1869
CITY OF MEDICINE

City of Durham, North Carolina

April 1994

0759-022

MALCOLM PIRNIE
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

April 6, 1994

Mr. James C. Coffey
Environmental Engineer
North Carolina Department of Environment,
Health and Natural Resources
Solid Waste Section
401 Oberlin Road
Raleigh, North Carolina 27605

Re: City of Durham Landfill
Transition Plan

Dear Mr. Coffey:

Please find enclosed two copies of the Transition Plan for the City of Durham Landfill. This submittal comprises the initial submittal of the transition plan application. Five copies of the final application will be submitted pending acceptance by the NCDEHNR.

The Transition Plan comprises a series of attachments prepared in accordance with Rule .1617(d)(1) through (4) which requires the document to contain the following components.

- Summary Report (Attachment 1)
- Report of Operator that defines the owners plans for continued operation of the existing facility or a new facility for a minimum 5-year period (Attachment 2)
- Water Quality Monitoring Plan prepared as set forth in Subparagraph (b)(3) of Rule .1623 (Attachment 3)
- Closure and Post-Closure Plan prepared in accordance with Rule .1629 (Attachment 4)
- Operations Plan prepared in accordance with Rule .1625, including both report and drawings (Attachment 5)

The Department's ***Technical Guidance Document for Transition Plans for Existing MSWLF Units in North Carolina*** suggested an outline of the document to facilitate partial approval of specific parts of the Transition Plan. The following cross-reference has been developed to assist the department in locating the various components of the Transition Plan.

11832 ROCK LANDING DRIVE NEWPORT NEWS, VA 23606-4206 804-873-8700 FAX 804-873-8723

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Component	Location in Transition Plan Document
Summary Report	Attachment 1 - Summary Report
Location Restriction Demonstration	Attachment 4, Page 2-5
MSWLF Unit Capacity:	
- Proposed Closure Date	Attachment 2 - Report of Operator
- Compliance Schedule	Attachment 2 - Report of Operator
Local Area Study	Attachment 4, Page 2-4
Compliance Record Summary	Attachment 4, Page 2-6
Closed Unit Documentation	Attachment 4, Page 2-6
Operation Plan & Drawings	Attachment 5
Closure Plan	Attachment 4
Post Closure Plan	Attachment 4
Closure/Post-Closure Cost Estimate	Attachment 4, Pages 2-7 and 3-8
Financial Assurance Demonstration	Attachment 4, Pages 2-7 and 3-8
Water Quality Monitoring Plan	Attachment 3

We understand the Department has established a review schedule for transition plans in accordance with Rule .1604 (d)(2)(A) which requires completion of the Department's review by October 9, 1996. The City intends to continue interim waste filling within the existing limits of waste in accordance with the transition plan documents. Interim waste filling is anticipated to cease by May 1995, and may be prior to completion of the Department's review. The City also proposes implementation of a routine methane monitoring program as indicated in the transition plan documents, on or before October 9, 1994, in accordance with Rule .1626 (4)(b).

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The City has been performing replicate groundwater sampling in their efforts to establish background water quality at this site. Further replicate sampling will be deferred until such time as the City receives approval from the Department of the Water Quality Monitoring Plan contained in the Transition Plan application. Upon approval, the City will complete the remaining replicate sampling events and initiate detection monitoring as required by current NCDEHNR regulations and outlined in the Groundwater Quality Monitoring Plan.

We trust this Transition Plan submittal meets your requirements. Please do not hesitate to contact us if you have any questions or comments.

Very truly yours,

MALCOLM PIRNIE, INC.

Steve R. Nesbitt
Senior Project Engineer

cl
0759-022-100

Enclosure

c: N. L. Newell, City of Durham
M. P. Robinson, Jr., Malcolm Pirnie
R. W. Stahr, Jr., Malcolm Pirnie
S. R. Nesbitt, Malcolm Pirnie

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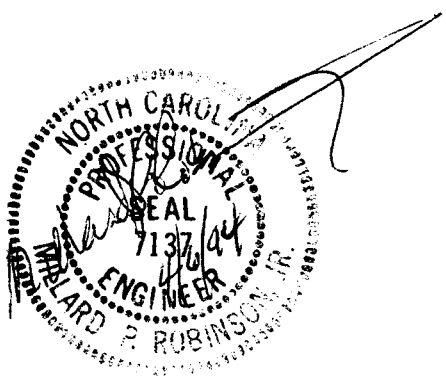
TRANSITION PLAN

CITY OF DURHAM, NORTH CAROLINA

CITY OF DURHAM SANITARY LANDFILL

APRIL 1994



Prepared By:

MALCOLM PIRNIE, INC.
11832 Rock Landing Drive, Suite 400
Newport News, Virginia 23606

0759-022

SUMMARY REPORT

This Summary Report comprises part of the City of Durham Landfill Transition Plan prepared in accordance with Subchapter 13B of the North Carolina Administrative Code, Title 15A, Department of Environment, Health and Natural Resources.

This report summarizes the transition plan application and addresses specific criteria outlined in Rule .1603(d)(2)(C). Particular attention has been paid to item (vii) of the rule which refers to the schedule for making arrangements to transfer waste to an approved solid waste disposal facility.

TRANSITION PLAN SUMMARY

The City does not intend to submit any new permit application or permit renewal application for this landfill facility. The City proposes to continue accepting waste at its existing solid waste landfill until January 1, 1998, corresponding with anticipated completion of its planned Transfer Station and diversion of all municipal solid waste materials to a landfill designed and constructed in accordance with current regulatory requirements. The Transition Plan provides supporting documentation for proposed interim waste filling until January 1, 1998.

The Transition Plan includes measures for the interim operations of the facility in accordance with all current regulatory criteria as set forth in Rule 1626. In addition, the City has been proactive in pursuing a permanent regional Household Hazardous Waste (HHW) collection program.

Closure of the facility will include a low permeability final cap comprised of compacted earthen materials placed over the proposed interim fill area as well as older portions of the fill area which received waste materials subsequent to October 9, 1991. The closure plan demonstrates that, with the exception of localized areas, portions of the landfill which stopped receiving waste by October 9, 1991 have been provided with satisfactory soil cover and are deemed closed in accordance with Federal Subtitle D and State regulatory requirements.

The groundwater quality monitoring system has been designed to provide early detection of any potential release of hazardous constituents to the uppermost aquifer. The

water quality monitoring plan proposes upgrading of the existing system to comprise a total of eight groundwater monitoring wells and four surface water monitoring stations. Background water quality will be obtained from a new monitoring well proposed at an up-gradient location along the east perimeter. The remaining groundwater monitoring wells are located down-gradient of this location and surround the landfill at the relevant point of compliance, less than 250 feet from the limits of waste, and approximately 50 feet from the facility property boundary. Detection monitoring for Appendix I Constituents will be performed on a semi-annual basis for all groundwater and surface water monitoring locations. The first monitoring event will be performed prior to completion of the transition to a Subtitle D facility and will comprise a minimum of four independent samples collected and analyzed from each groundwater monitoring well at least 2 weeks apart, as well as one sample from each surface water monitoring station. Landfill performance will be evaluated by statistical comparison of up and down-gradient water quality for each sampling event in accordance with Rule .1632.

SITE SPECIFIC EVALUATION CRITERIA

The following site-specific criteria have been addressed for the Department's use in their evaluation of the anticipated closure schedule for this facility in accordance with Rule .1603 (d)(2)(C).

Proximity of Human and Environmental Receptors

The local characterization study demonstrated that only 35 residences were identified between 300 and 1500 feet from the permitted facility boundary. A total of approximately 170 existing private residences were identified within a 2000-foot radius of the permitted facility boundary. The majority of these residents were located between 1500 and 2000 feet from the boundary.

No known surface water supply intakes were identified within the local characterization study area. Approximately 81 street addresses were identified which are not currently provided with service connections to the City of Durham water distribution system. These represent unconfirmed potable drinking water wells. Less than 40 of these street addresses were located within 1,000 feet of the permitted facility boundary. The

remaining street addresses were located between approximately 1,000 and 2,000 feet of the boundary.

Design of the MSWLF Unit

The landfill was originally designed as a natural attenuation site, and is underlain by overburden material comprised of sapprolite which has been formed by weathering of the underlying parent bedrock material. A transition zone between the sapprolite (weathered) and unweathered parent bedrock may be expected and is typical throughout the region.

The sapprolite and transition zone is expected to comprise the uppermost groundwater unit in the vicinity of the landfill. The estimated hydraulic conductivity of the groundwater unit may be expected to vary between 1×10^{-3} cm/sec to 1×10^{-4} cm/sec.

The sapprolite is underlain by relatively massive, thickly bedded, mudstone, siltstone and sandstone which comprise the Pekin formation. This bedrock formation underlies the site at relatively shallow depth ranging from between approximately 20 feet to 80 feet and effectively mitigates vertical groundwater flow. Given the nature of the bedrock and overlying sapprolite, the dominant direction of groundwater flow is anticipated to be horizontal.

Preliminary piezometric data indicates that groundwater flow in the vicinity of the site is radial, which appears consistent with localized topography and site geology. The landfill is surrounded by stream channels that represent points of groundwater discharge which should mitigate lateral migration of groundwater.

Age of the MSWLF Unit

The City of Durham landfill has been receiving municipal solid waste for over 20 years. The facility began to receive municipal solid waste in 1973.

The Size of the MSWLF Unit

Waste disposal footprint and soil borrow/stockpiles areas are approximately 89 and 20 acres, respectively.

Types and Quantities of Waste Disposed

The estimated maximum inventory of municipal solid waste materials disposed upon fill-out is approximately 3.8 million tons.

Compliance Record of Owner and Operator

Landfill inspection and evaluation reports compiled since 1986 indicate overall very good performance.

A schedule to fulfilling intent of landfill design standards

The City does not intend to submit any new permit application or permit renewal application for this landfill facility. The City anticipates beginning closure of this existing landfill on January 1, 1998, upon completion of its planned solid waste transfer station and diversion of all municipal solid waste materials to a landfill designed and constructed in accordance with current regulatory requirements.

Resource value of underlying aquifer

The uppermost aquifer underlying the site is not capable of producing high yielding potable wells and as such has limited resource value.

2

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

January 13, 1995

Mr. Ed Mussler
North Carolina Department of Environment,
Health, and Natural Resources
Division of Solid Waste Management
Solid Waste Section
Post Office Box 27687
Raleigh, North Carolina 27611-7687

Re: Report of Operator
City of Durham Sanitary Landfill

Dear Mr. Mussler:

Pursuant to the requirements of the North Carolina Administrative Code T15A:13B.1607, we are pleased to submit the Report of Operator for the referenced project. This Report of Operator is part of the Transition Plan for the City of Durham Landfill.

Anticipated Closure

The City of Durham expects to cease receiving municipal solid waste at the referenced facility by January 1, 1998 in accordance with 15A NCAC 13B Rule 0103(i). Final closure of the landfill unit will commence within the prescribed 6-month period.

Permit Schedule

The City of Durham is currently siting, permitting, and designing a solid waste transfer facility. The City does not intend to submit a new permit application or permit renewal application on this or any other MSW landfill unit.

11832 ROCK LANDING DRIVE SUITE 400 NEWPORT NEWS, VA 23606-4206 804-873-8700 FAX: 804-873-8723

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MALCOLM PIRNIE

We trust this report fulfills the Division's requirements at this time. Should you have any questions or require additional information, please contact me or Ms. Nancy Newell, Process Engineer with the City of Durham.

Very truly yours,

MALCOLM PIRNIE, INC.

for Richard W. Stahr, Jr., P.E.
Project Manager

cl
0759-022

Enclosure

c: N. L. Newell, City of Durham

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3

CITY OF DURHAM SANITARY LANDFILL
WATER QUALITY MONITORING PLAN

CITY OF DURHAM, NORTH CAROLINA

APRIL 1994

MALCOLM PIRNIE, INC.

11832 Rock Landing Drive, Suite 400
Newport News, Virginia 23606

0759-022

Transition Plan Amendment
January 1995

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1.0 INTRODUCTION

This water quality monitoring plan describes the groundwater and surface water monitoring system and the basic procedures which will be followed to collect groundwater samples for the City of Durham's Sanitary Landfill (DHR Permit No. 32-01). The purpose of the monitoring is to provide background water quality data and initiate detection monitoring at the landfill. The water quality monitoring plan for the City of Durham's Sanitary Landfill was developed to comply with the North Carolina Solid Waste Management Regulations (T15A:13B §.1632). Other sources of information used in preparing this monitoring plan include the following documents:

- Test Methods for Evaluating Solid Waste (USEPA SW-846)
- RCRA Groundwater Monitoring Technical Enforcement Guidance Document (USEPA OSWER-9950.1)
- North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities (SW-1001-87)
- Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities (USEPA EPA/530-89-026)
- Technical Guidance Document: Transition Plans for Existing MSWLF Units in North Carolina (DEHNR Rev:01/24/94 Revision 3)

This water quality plan consists of a Monitoring System Plan and Sampling and Analysis Plan in conformance with DEHNR's Technical Guidance Document for Transition Plans for Existing MSWLF Units in North Carolina. The Monitoring System Plan described in Section 2.0 of this document includes a hydrogeologic study that describes the regional and local hydrogeology at the Durham Landfill. This study was completed using published geologic and hydrologic reports and documents describing the region in conjunction with available site information from field investigations performed at the site from 1987 through 1994. Additionally, the existing monitoring wells were evaluated for their suitability for use with the new monitoring system. The Upgraded Monitoring System is described in Section 2.3, including discussions on the placement of additional wells, surface water locations, maintenance of the monitoring system, and the baseline sampling plan.

The Sampling and Analysis Plan is described in Section 3.0 of this document. This section includes a discussion of the sampling locations, frequency of sampling, and sampling procedures. Also included in the Sampling and Analysis Plan is a description of the analytical methods that will be incorporated into the analysis of collected data, data management, and quality assurance/quality control measures are reviewed.

2.0 MONITORING SYSTEM PLAN

2.1 HYDROGEOLOGIC STUDY

2.1.1 Regional Geology

The Durham Landfill is located within the Deep River Basin which is an extensional basin with deposits formed during the Triassic and Jurassic. The Deep River Basin extends along the east coast of North and South Carolina for 90 miles, from the South Carolina state line near Wadesboro, Anson County, northeastward to near Oxford, Granville County. The basin is bound by normal block-faults along the basin margins.

A series of three interconnected sub-basins have been identified within the Deep River Basin. From north to south they are the Durham, Sanford, and Wadesboro sub-basins. The Durham Landfill lies entirely within the boundaries of the Durham sub-basin. The sedimentary rocks of the Deep River Basin are part of the Chatham Group, which is divided into three formations: the Pekin which occurs along the northwestern boundary of the basin, the Cumnock which occurs in the middle of the basin, and the Sanford which occurs along the southeastern boundary of the basin. The formations are divided based on a lateral progression away from the western boundary of the basin rather than a vertical sequence. All three formations belong to the Triassic aged Newark Supergroup.

The Durham sub-basin is composed of bedrock of the Pekin formation which consists of arkosic sandstones, siltstones, and mudstones (Stewart, Ballard, and Black, 1989; Huber and others, 1993). Within the Durham sub-basin, the bedrock is informally referred to as "Lithofacies Association I, II or III" by some workers (Huber and others, 1993). The total thickness of sedimentary rocks is estimated to be approximately 6,000 feet. Within the Durham sub-basin, the sedimentary rocks are generally characterized as massively bedded, approximately 15-feet thick, dipping towards the east at 20 to 30 degrees. Some thinner beds, approximately 4 to 6 feet thick, may be present in localized areas (Hoffman and Gallagher, 1989).

2.1.2 Site Geology

The northwestern boundary of the Durham Basin is estimated to be approximately 5 miles northwest of the Durham Landfill and the southeastern boundary is over 15 miles southeast of the Durham Landfill (Stewart, Ballard, and Black, 1989). No fault has been

identified along the northwestern boundary of the basin. The Jonesboro Fault along the southeastern boundary of the basin is over 15 miles southeast of Durham, North Carolina. An unnamed, normal block-type fault occurs approximately 10 to 12 miles southeast of the site as noted on the Southeast Durham Geologic Quadrangle (Hoffman and Gallagher, 1989).

The bedrock underlying the site consists of mudstone, siltstone, and sandstone, based on observations reported in published reports for the Durham sub-basin (Fleck and White, 1989). The overburden is typically saprolite, formed from the weathering of the bedrock. Saprolitic soils generally resemble the original parent material in texture and composition of the more resistant minerals (e.g., quartz).

Soils

The soils around the landfill consist principally of White Store sandy loams in the upland areas (north, south, and east of the landfill), and Chewacla and Wehadkee soils near Ellerbee Creek (west of the landfill). Also present are Roanoke soils to the southwest and north west, Altavista silt loams, and Creedmoor sandy loams (Soil Survey of Durham County).

The White Store, Altavista, and Creedmoor soils are all upland soils, occurring at the higher elevations and on slopes. The White Store soils are typically moderately well drained, low permeability, and high shrink-swell capacity and weather from Triassic mudstone. The Altavista soils are formed from weathered Triassic mudstone and generally have a finer texture than the White Store soils. These soils have hydraulic properties similar to the White Store soils and a lower shrink-swell capacity. The Creedmoor soils are also formed from weathered Triassic mudstone and have a similar texture as the White Store soils but with a low shrink-swell capacity. The higher shrink-swell capacity of the White Store soils can result in cracks in the soil at the surface. These cracks typically extend only into the B-horizon, where the shrink swell cycle is less frequent and soil from the overlying A-horizion is deposited through illuviation. The principal effect of the higher shrink-swell capacity is to increase the infiltration rates.

The Chewacla-Wehadkee association and the Roanoke soils occur on flood plains and consist of somewhat to poorly drained loamy soils with low to moderate permeability. These soils are typically formed from alluvial deposits and not from weathering underlying bedrock. Groundwater table in these soils is typically high, between one and two feet of the surface.

Saprolite

The Durham Landfill site is underlain by greater than 80 feet of saprolite and weathered rock in the eastern portion of the site with a gradational transition zone of soil and weathered rock to competent rock, based on site boring logs. In the western portion of the site, in the floodplain near Ellerbee Creek, the saprolite is approximately 25 feet thick. Based on soil borings for monitoring wells MW-3, MW-4, and test borings P-1, P-2, P-3, P-4, and MW-2, the unconsolidated overburden at the site consists of sediments derived from the weathering of the underlying Triassic aged mudstones and siltstones of the Pekin Formation. The saprolite consists primarily of fine sand to silt with a minor percentages of medium-sand and clay. Based on the borings logs, there does not appear to be any laterally-continuous, well-defined layers of clay. The saprolite consistently is composed of fine-sand to silt which is a typical weathering product of siltstone.

Bedrock

The bedrock units underlying the site belong to the Pekin Formation which consists of arkosic sandstones, siltstones, and mudstones (Stewart, Ballard, and Black, 1989; Huber and others, 1993). The Pekin Formation has been locally been sub-divided into three lithofacies associations (Huber and others, 1993). Contact between the lithofacies is gradational, and the landfill in located near the gradational contact between Lithofacies I and II.

No mappable faults have been identified within the area of the Durham Landfill. The closest mappable fault is the Jonesboro Fault located approximately 15 miles southeast of Durham, North Carolina and an unnamed, normal block-type fault approximately 10 to 12 miles southeast of the site. Because block faults do not tend to generate numerous sympathetic faults, it is unlikely that any faults, which could influence groundwater flow, are located within the immediate vicinity of the landfill.

2.1.3 Site Hydrogeology

Surface Water

Surface water features appear to have a significant influence on local groundwater flow around the landfill. The dominate surface water feature is Ellerbee Creek, which flows past the western boarder of the landfill. Ellerbee Creek is a major tributary of the Neuse River and serves as the principal drainage basin in the area around the landfill.

Perennial streams, which are tributaries of Ellerbee Creek, are located near the northern and southern edges of the Landfill. The stream to the north branches at the northeast corner of the landfill, with one branch extending to the southeast, partially encircling the landfill. The headwaters of this branch is a pond located approximately 400 feet east of the landfill edge (Figure 2-1). Based on available groundwater and surface water elevations, the pond appears to be a groundwater recharge point, while the streams serve principally as groundwater discharge points.

Groundwater

Saprolite and the underlying transition zone to unweathered bedrock comprises the water table aquifer at the site. The saprolite consists primarily of sand which would have a higher permeability and transmissivity than the underlying bedrock. Studies performed on the hydraulic effects of remnant structure within saprolite units indicate that remnant structures influence groundwater flow. These studies indicate that groundwater flows preferentially along remnant structures within the saprolite such as foliated zones (Fleck and White, 1989) or, as may be the case of the Durham Landfill, along more permeable layers derived from weathering of coarser-grained bedrock.

The bedrock underlying the site consists of massively bedded mudstone, sandstone, and siltstone and has been noted to contain only minor fracturing. Based on this information, the dominant groundwater flow path should be horizontal, through the more permeable saprolite and transition zone.

Groundwater elevations from on-site wells and surface water elevations provided information on groundwater flow direction. The regional direction of groundwater flow in this area appears to be to the west, toward Ellerbee Creek. There also appears to be a local groundwater flow component toward the streams adjacent to the landfill and away from the pond east of the landfill. This results in a general radial flow direction away from the landfill and toward the streams. Groundwater flow near the western and northern boundary is assumed to be west-northwest, toward Ellerbee Creek and its unnamed tributary north of the landfill. On the northeast and east side of the landfill, groundwater flow appears to be to the northeast, toward the stream on the northeast side of the landfill. Results from a recent hydrogeologic study prepared by Bain, Palmer and Associates appears to confirm the local groundwater flow direction toward the streams. Along the southern border of the landfill, groundwater flow is assumed to be in a south-southwest direction, toward the perennial stream located south of the landfill.

TABLE 2-1

DURHAM LANDFILL MONITORING WELL INFORMATION

(all units are expressed in feet)

Well ID	Distance to Waste Boundary	Distance to Property Boundary	Elevation of Well (MSL)	Groundwater Elevation
MW-1	100'	130'	341'	306.2'
MW-2	170'	300'	290'	285.1'
MW-3	60'	70'	284.2'	287.5'
MW-4	150'	60'	292.69'	294.6'
Test P-1	75'	550'	340.53'	328.4'
Test P-2	10'	200'	339.93'	310.1'
Test P-3	75'	140'	342.89'	314.2'
Test P-4	50'	120'	339.71'	320.1'

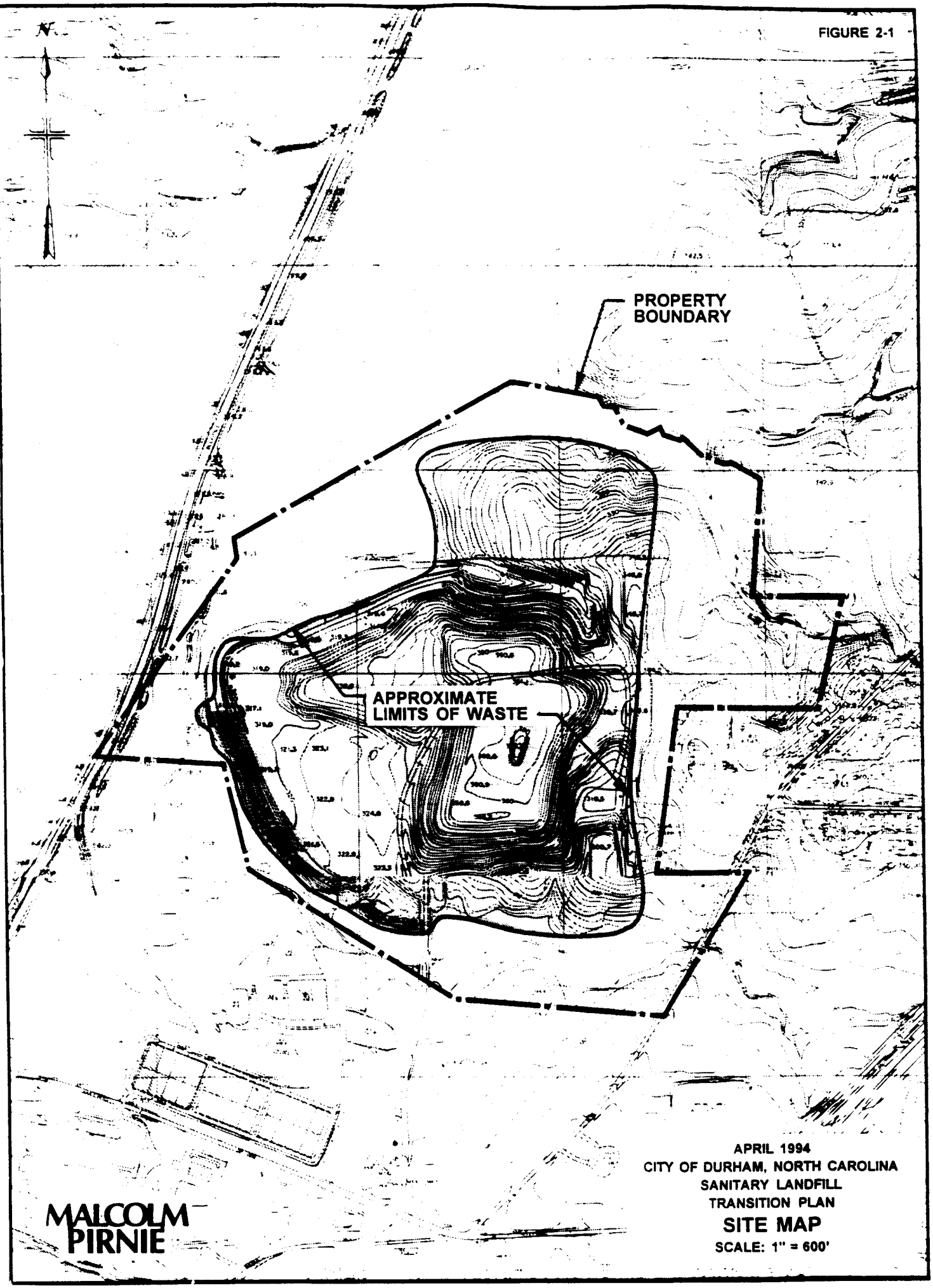
TABLE 2-2

Summary of Well Construction

WELL CONSTRUCTION INFORMATION

Well ID	Date Installed	Elevation at Casing (feet MSL)	Casing	Screen Interval		GW Depth (feet)	Screen Type	Opening Slot	Granular Backfill	Filter Pack		Bentonite Seal (feet)
				Depth (feet)	Elevation (feet)					above (feet)	below (feet)	
MW-1	04/18/85	306.2	SCH 40 PVC	68-78	228.2 - 238.2	68	SCH40PVC	0.010	#78m GRAVEL	2.5'	2.5'	4.00'
MW-2	04/19/85	285.1	SCH 40 PVC	8-18	267.1 - 277.1	10	SCH40PVC	0.010	#78m GRAVEL	5'	2'	2.00'
MW-3	11/09/88	287.5	SCH 40 PVC	13-23	264.5 - 274.5	6	SCH40PVC	0.010	8-16 SAND	1'	2'	1.00'
MW-4	11/08/88	294.6	SCH 40 PVC	10.5-20.5	274.1 - 284.1	8	PVC	0.010	8-16 SAND	2'	2'	2.00'
P-1	12/21/93	328.4	SCH 40 PVC	25.7-40.7	287.7 - 302.7	14.8	PVC	0.010		2'	none	2.00'
P-2	12/17/93	310.09	SCH 40 PVC	27.3-42.3	263.8 - 282.8	32.1	PVC	0.010		2'	none	2.00'
P-3	12/21/93	314.24	SCH 40 PVC	27.3-42.3	268.2 - 283.2	32.0	PVC	0.010		2'	none	2.00'
P-4	01/03/94	320.14	SCH 40 PVC	31-46	274.1 - 289.1	22.6	PVC	0.010		4.25'	none	2.25'

FIGURE 2-1



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CITY OF DURHAM, NORTH CAROLINA
SANITARY LANDFILL
TRANSITION PLAN

SITE MAP

SCALE: 1" = 600'

MALCOLM PIRNIE

In-situ hydraulic conductivity (slug tests) were conducted in monitoring wells MW-2, MW-3, and MW-4 in March 1994. Both rising and falling head tests were conducted, and the average of the two tests were used to estimate hydraulic conductivity at each well. Results of the rising and falling head tests are presented in Appendix A.

Saturated hydraulic conductivity (K_{sat}) varied between $8x10^{-5}$ cm/sec to $4x10^{-3}$ cm/sec, with the lowest K_{sat} in MW-2 to the northwest, increasing to the southwest. The increase is consistent from MW-2 through MW-4 and may represent a general site-wide trend of increasing K_{sat} toward the south. Based on the boring logs for MW-3 and MW-4 and the additional boring drilled adjacent to MW-2 in March 1994, the sand to silty sand water bearing unit is thinner to the northwest (MW-2), increasing in thickness at MW-3 and MW-4 to the south. Boring logs for the wells are in Appendix B.

Groundwater flow velocity at each of the wells was estimated based on the measured hydraulic conductivity, assumed effective porosity based on grain size, and a hydraulic gradient established from existing wells. The effective porosity n_e was taken from published values of porosity for sands and silts. For a conservative estimate (higher flow velocity), the lower range of porosity was used. The reported values of porosity for sand ranges between 0.20 and 0.35 (EPA 625/6-87-016 and Fetter, 1980). To provide a higher estimated flow velocity, an n_e of 0.2 was used. Based on the available data, groundwater flow velocity for the western wells range from a low of 0.03 ft/day ($1.2x10^{-5}$ cm/sec) at MW-2 to 1 ft/day ($3.5x10^{-4}$ cm/sec) at MW-4.

Durham Landfill
Horizontal Hydraulic Conductivity

Well Location	Falling Head (cm/sec)	Rising Head (cm/sec)	Geometric Mean (cm/sec)	Hydraulic Gradient (ft/ft)	Effective Porosity	Velocity (cm/sec)
MW-2	1.0E-04	5.3E-05	7.3E-05	0.0309	0.2	1.1E-05
MW-3	4.1E-04	6.3E-04	5.1E-04	0.0195	0.2	5.0E-05
MW-4	2.5E-03	5.4E-03	3.7E-03	0.0178	0.2	3.3E-04
Mean	9.9E-04	2.0E-03	1.4E-03	2.3E-02	2.0E-01	1.3E-04

2.2 EVALUATION OF EXISTING MONITORING SYSTEM

2.2.1 Number and Location of Monitoring Wells

Prior to December 1993, the groundwater monitoring system consisted of four existing monitoring wells: MW-1 (formerly DL-1), MW-2 (formerly DL-2), MW-3, and MW-4, located around the perimeter of the landfill. The City of Durham subsequently performed additional hydrogeologic investigations to evaluate groundwater flow along the east property boundary. In December 1993, four test wells (P-1, P-2, P-3, and P-4) were installed along the northeast border of the site (see Plate 1). In the fall of 1994, additional monitoring wells MW-7 and MW-8 were installed along the east property line to provide further information regarding the direction of groundwater flow.

2.3 PROPOSAL FOR AN UPGRADED MONITORING SYSTEM

The upgraded monitoring system will consist of eight groundwater quality monitoring wells shown on Plate 2, and four surface water sampling locations. Additional up- and down-gradient monitoring wells have been installed to supplement the existing groundwater monitoring system. The groundwater monitoring network will be comprised of the following eight groundwater monitoring wells:

- MW-2, MW-3, MW-4, MW-5, and MW-6 along the north, south, and west permitted facility boundary.
- Recently installed MW-7 and MW-8 along the east permitted facility boundary.
- P6 as a background water quality monitoring location.

The remaining monitoring wells P1, P2, P3, and P4 will be used for water table elevation data only.

Monitoring well MW-1 will be abandoned due to evidence of past tampering. The security casing was breached and debris dumped into the well. Abandonment will be accomplished according the procedures outlined in Section 2.3.7 of this report.

Surface water samples will be collected in the small stream at the northeast end of the site and in the stream that runs along the southeastern edge of the site, prior to exiting

the site boundary. Two samples will also be collected from Ellerbee Creek, one collected upstream and the other downstream of the landfill. The upstream sample will be collected on the downstream side of the Club Road bridge crossing. The downstream sample will be collected immediately downstream from the confluence with the small stream at the north end of the landfill. Figure 2-3 depicts the approximate sampling locations to be included in the upgraded water quality monitoring system.

2.3.1 Design of Wells

Monitoring wells and test wells which comprise the current groundwater quality monitoring network were installed over a 7-year period from 1985 until 1994. Monitoring wells MW-1 and MW-2 were constructed in 1985 with similar specifications. These wells consist of flush-threaded, 2-inch ID Schedule 40 PVC. Monitoring wells MW-3 and MW-4 were constructed in 1988, also with flush-threaded, 2-inch Schedule 40 PVC. Test wells P-1, P-2, P-3, and P-4 were constructed in late 1993 and early 1994 and are constructed with similar materials as the previous wells. Table 2-1 presents a summary of well construction information.

All of the monitoring wells contain a screen that is either 10 or 15 feet in length, with 0.01-inch slot openings. All wells are screened in the saprolite and weathered rock overlying competent bedrock. The following table summarizes the lithology in the screened intervals:

MONITORING AND TEST WELLS - SCREENED INTERVAL	
Well ID	**Formation Description**
MW-2	Sandy Clay to Fine Sand
MW-3	Fine/Medium Sand/Very Dense
MW-4	Very Dense, Silty Sand
P-1	Fine Sand and Silt
P-2	Fine Sand and Silt
P-3	Sand with some Silt
P-4	Silt and Fine Sand

Boring logs for these wells are provided in Appendix B. In addition to the internal design information listed above, all wells are complete with the following external design:

- A concrete collar that firmly anchors the outer wall casing directing surface water away from the well head.
- A protective outer well casing and lock.
- An inner well casing protected with a vented cap.
- A weep hole in the outer casing to eliminate water collection.
- An identification tag that provides:
  - Well identification number
  - Drilling contractor name and registration number
  - Total depth of well
  - Depth to screen
  - Warning indicating the well is not to be used for water supply and that the well may contain hazardous materials

To meet these requirements, some of the existing wells had to be repaired and upgraded. This included addition of concrete to the well collars of all wells to divert water away from the well head. The inner well caps had to be vented and a weep hole drilled in the outer security casing. An identification tag was added to MW-1 and MW-2 and additional information added to the tags identifying MW-3 and MW-4. Warning signs were also posted on all wells.

2.3.2 Maintenance of Wells

All monitoring wells will be maintained to ensure the adequacy of the monitoring system (per DEHNR Technical Guidance Document for Transition Plans for Existing MSWLF Units in North Carolina Rev:01/24/94 Revision 3).

At each monitoring well, the following items will be checked regularly to ensure the wells are properly maintained:

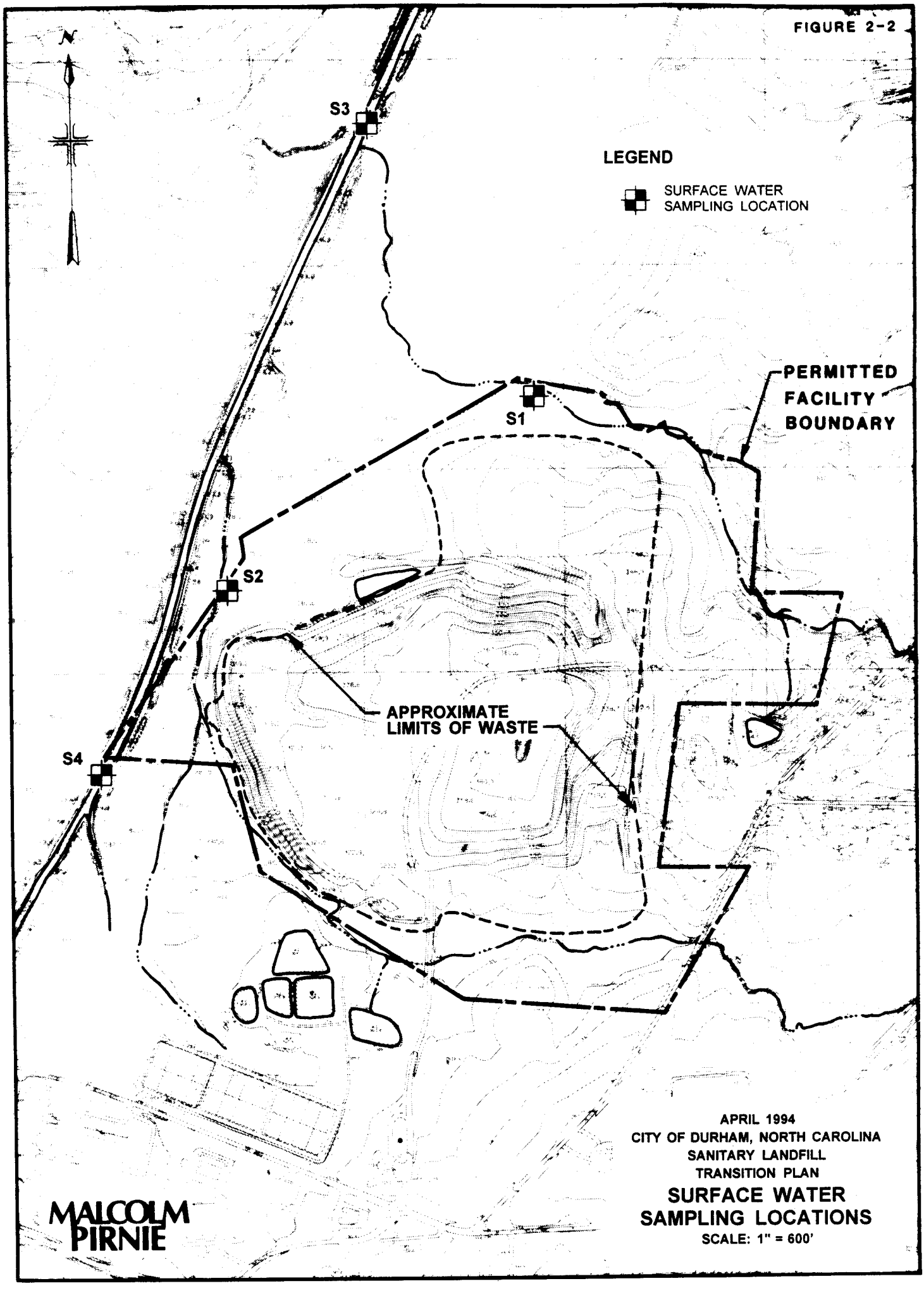
- Surface water is diverted away from the well head.
- The concrete pad is intact and free of cracks.
- Surface water has not undercut the concrete pad.
- The outer casing is secured and locked.
- The well identification tag is legible.
- The grout between the inner and outer well casings is all the way to the ground surface.
- The inner well casing is firmly grouted in place.
- The inner and outer well casings remain upright and unobstructed.
- Monitoring wells are visible and adequately protected from moving equipment and obstruction due to brush and weeds.

2.3.3 Surface Water Monitoring System

Two streams run contiguous to the property that discharge into Ellerbee Creek approximately 150 feet from the property boundary. The northern stream is the confluence of two intermittent streams that flow from storm water detention ponds, both of which are located off-site. The northern stream passes through the site for approximately 2,000 feet. The southern stream also originates from an off-site storm water detention pond, and it passes through the site for a distance of 1,500 feet, receiving discharge from an on-site storm water detention basin located at the southern edge of the site. Surface water samples will also be collected from Ellerbee Creek. One sample will be collected upstream from the landfill and downstream from Club Road and the other sample will be collected from Ellerbee Creek downstream from the confluence with the small stream at the northern end of the landfill.

The surface water locations will be sampled for Appendix I constituents at the locations shown on Figure 2-3. These samples will be collected and analyzed at the same frequency and for the same constituents as the groundwater samples. Surface water samples will be compared with the North Carolina Surface Water Quality Standards.

FIGURE 2-2



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SANITARY LANDFILL
TRANSITION PLAN

SURFACE WATER SAMPLING LOCATIONS

SCALE: 1" = 600'

MALCOLM PIRNIE

2.3.4 Baseline Sampling Plan

The monitoring wells will be sampled in four independent events, at least 2 weeks apart for Appendix I constituents to establish characteristic groundwater quality levels. The surface water sampling locations will be sampled for the same parameters at the same time to establish baseline surface water quality levels.

2.3.5 Well and Piezometer Abandonment

Monitoring well MW-1 will be abandoned as part of the monitoring system upgrade. Well abandonment for any well at the site will be conducted in accordance with 15 NCAC 2C, § .0113 (a) (2) of the Well Construction Standards. Abandonment will be accomplished by injecting neat cement from the bottom of the well to the top by means of a tremie pipe. Any casing installed in the boring will be left in place with the top cut level to existing grade and a flush mount cover installed over the abandoned well.

TABLE 2-1

SUMMARY OF WELL CONSTRUCTION
WELL CONSTRUCTION INFORMATION

Well ID	Date Installed	Elevation at Casing (feet MSL)	Casing	Screen Interval		Screen Type	Opening Slot	Granular Backfill	Filter Pack		Bentonite Seal (feet)
				Depth from t. Casing (feet)	Elevation (feet)				above (feet)	below (feet)	
MW-1	04/18/85	N/A	SCH 40 PVC	68 - 78	228.2 - 238.2	SCH 40 PVC	0.010	GRAVEL	2.5	2.5	4.00
MW-2	04/19/85	287.3	SCH 40 PVC	8 - 18	267.1 - 277.1	SCH 40 PVC	0.010	GRAVEL	5	2	2.00
MW-3	11/09/88	286.23	SCH 40 PVC	13 - 23	264.5 - 274.5	SCH 40 PVC	0.010	SAND	1	2	1.00
MW-4	11/08/88	306.27	SCH 40 PVC	10.5 - 20.5	274.1 - 284.1	PVC	0.010	SAND	2	2	2.00
MW-5	08/17/94	N/A	SCH 40 PVC	12 - 22		SCH 40 PVC	0.010	SAND	0	none	2.00
MW-6	08/19/94	289.63	SCH 40 PVC	10 - 17	267.6 - 279.6	SCH 40 PVC	0.010	SAND	0	none	2.00
MW-7	09/17/94	313.18	SCH 40 PVC	8 - 15.5	297.7 - 305.2	SCH 40 PVC	0.010	SAND	0	none	1.00
MW-8	09/18/94	318.45	SCH 40 PVC	18 - 26.0	292.5 - 300.5	SCH 40 PVC	0.010	SAND	0	none	1.00
P-1	12/21/93	346.94	SCH 40 PVC	25.7 - 40.7	287.7 - 302.7	PVC	0.010	SAND	2	none	2.00
P-2	12/17/93	N/A	SCH 40 PVC	27.3 - 42.3	263.8 - 282.8	PVC	0.010	SAND	2	none	2.00
P-3	12/21/93	350.92	SCH 40 PVC	27.3 - 42.3	268.2 - 283.2	PVC	0.010	SAND	2	none	2.00
P-4	01/03/94	N/A	SCH 40 PVC	31 - 46	274.1 - 289.1	PVC	0.010	SAND	4.25	none	2.00
P6	03/08/94	350.94	SCH 40 PVC	41.5 - 61.5	289.4 - 309.4	PVC	0.0010	SAND	59.0	39.0	3.50

3.0 SAMPLING AND ANALYSIS PLAN

3.1 SAMPLE LOCATION AND FREQUENCY

The proposed groundwater monitoring system is shown on Plate 2. The routine monitoring frequency for all Appendix I Detection Monitoring Constituents for the groundwater monitoring wells and surface water locations identified for water quality monitoring will be on a semi-annual basis for the life of the facility and for 30 years post-closure. For each year, one sampling event will be in the fall (November) and the second in the spring (May). The first semi-annual sampling event will occur prior to completion of the transition of the facility to Subtitle D requirements. It will consist of a minimum of four independent samples collected and analyzed from each well. The independent samples for each well will be collected at least 2 weeks apart. Also, during this sampling event, one sample will be collected from each surface water location. During subsequent semi-annual sampling events, only one sample will be collected and analyzed from each well and surface water locations.

3.2 SAMPLING PROCEDURES

Sampling activities for wells will consist of the following steps:

- Groundwater level measurements
- Equipment decontamination
- Well purging
- Sample withdrawal
- Field measurements

Sampling activities for surface water will consist of the following steps:

- Sample collection
- Field measurements

These activities are listed in the order in which they will be conducted. The first activity for the wells will be to measure the groundwater levels and evacuate the wells, as described in Sections 3.2.1 and 3.2.3. All water levels will be measured and wells evacuated prior to collecting the water quality samples. Because of the number of wells to be sampled, it may require two days to sample all the wells. In this event, only the wells which will be sampled that day will be evacuated; however, water levels for all the wells will be obtained the same day.

After the wells have been evacuated, samples will be collected as described in Section 3.2.4. Sample collection will start with the first well which was evacuated and continue in order of evacuation. Number and frequency of samples collected will vary during the monitoring program as described in Section 3.1.

3.2.1 Groundwater Level Measurements

Groundwater levels will be measured in all monitoring wells at the time of sampling, before the monitoring wells are purged. An electronic water level indicator, such as an M-scope, will be used to establish depth to groundwater. This water level meter will be decontaminated between well measurements in accordance with Section 3.2.2. Also, depth to the bottom of the well will be measured at this time. The water level indicator will be capable of accurately measuring depth to groundwater to the nearest 0.01 foot. All measurements will be recorded to the nearest 0.01 foot. The water level will be measured from the top of the PVC well casing.

3.2.2 Equipment Decontamination

The equipment decontamination procedure will consist of the following steps:

- Phosphate-free soap wash
- Tap water rinse
- Dilute (one or two normal) nitric acid rinse
- Deionized water or distilled water rinse
- Isopropyl alcohol rinse

- Air dry
- For storage, wrap equipment in aluminum foil (shiny side out)

The water level indicator will be decontaminated in the field between use at each well. Decontamination for the water level indicator will not include the nitric acid rinse or foil wrap.

3.2.3 Well Evacuation

Well evacuation will be conducted in accordance with the Technical Enforcement Guidance Document (TEGD). After the water level measurements are made, a minimum of three well casing volumes of groundwater will be purged from the wells. If the well is purged dry before the three casing volumes are removed, the well will be allowed to recover to within 90 percent of its original level within 24 hours before sampling without additional bailing. Well evacuation may be accomplished with either the permanent, dedicated well pump, or certified clean disposable polyethylene disposable bailers.

The number of well volumes required for purging a 2-inch well is indicated in Figure 3-1. Height of the water column is determined by measuring depth to groundwater and subtracting it from the total well depth.

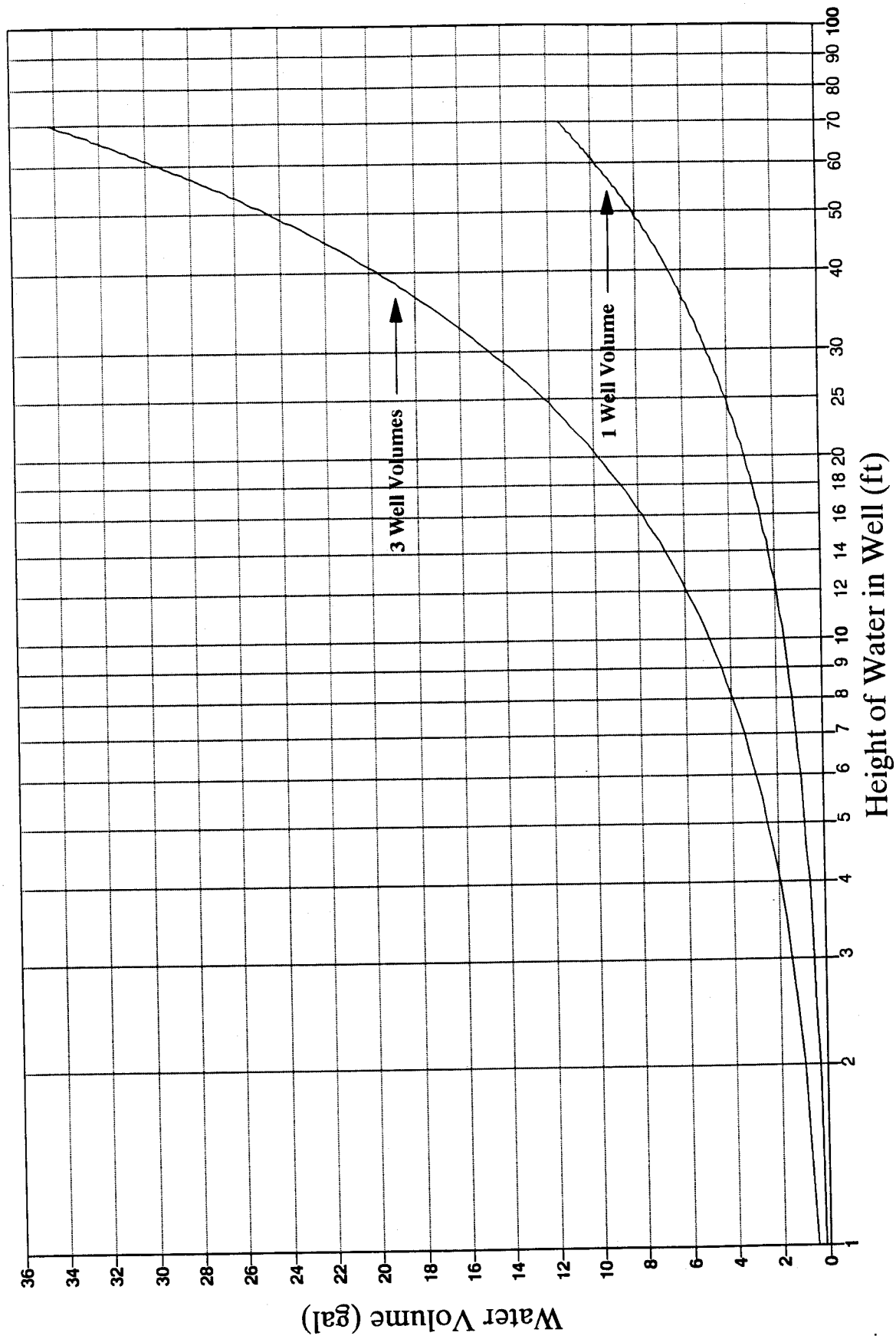
3.2.4 Sample Collection

After the water level in the well has recovered sufficiently, a sample will be withdrawn using either precertified clean disposable teflon bailers or permanent dedicated stainless steel and teflon bladder pumps installed in each well. The first sample aliquot withdrawn from the well will be used for field measurements. Subsequent aliquots will be poured into sample containers for laboratory analyses. Samples for laboratory analysis will be collected in the following order:

- Volatile organic compounds
- Metals

Durham Landfill

Monitoring Well Purge Volumes



The sample for volatile organics will be poured slowly into two 40-ml VOC containers with teflon caps. The container will be filled to the top such that there are no air bubbles (no headspace). The sample for metals will be collected in polyethylene containers.

3.2.5 Water Quality Field Measurements

The first and last aliquot of sample withdrawn from the well will be used for establishing pH, specific conductance, and temperature in the field. Two replicate measurements will be made from the first aliquot and two replicate measurements from the last aliquot, for a total of four replicate measurements.

Specific conductance will be determined by a conductivity meter, such as a YSI Model 33 using a Wheatstone bridge-type electrode. The standard equipment checks, as described in the instrument's manual, will be made to the conductivity meter prior to sampling. Temperature will be measured using a National Bureau of Standards (NBS) grade thermometer, or a thermometer checked in the laboratory against a NBS grade thermometer.

The pH will be determined electrometrically, using a combination glass and reference electrode. A two-point calibration will be used to calibrate the meter prior to use in the morning and afternoon of each sampling event. The calibration will be accomplished with certified pH buffer solutions which bracket the anticipated range of pH for the samples. Temperature of the sample will be measured and the pH meter corrected either manually or by automatic temperature control (ATC). Both temperature and pH calibration check will be performed at each monitoring location.

3.2.6 Surface Water Sample Collection

Surface water samples will be collected from four locations: one from the stream at the southwest corner of the landfill, one from the stream at the northwest corner of the landfill, and two from Ellerbee Creek (Figure 1-3). These samples will be collected by first rinsing the laboratory cleaned sampling container with deionized water then twice with the surface water at the monitoring point. Next, the container will be inverted several inches below the surface of the water and tilted up to allow the water to fill the container. The sample will then be poured into the appropriate container for transport to the laboratory, as described in Section 3.3. For metals analyses, a wide-mouth plastic (LPE) container will be used to collect the surface water sample from the stream; and for organic analyses, a

glass container will be used. These containers will be supplied by the laboratory with a clean set used at each of the four surface water sampling points. Latex gloves will be used in collecting the sample to reduce the chance of contaminating the sample.

3.3 SAMPLE PRESERVATION AND TRANSPORT

Parameters have been established for sample size, volume, containers and preservation. Handling procedures have been established to ensure proper management of the samples from collection to analysis.

3.3.1 Containers and Preservation

Sample containers will be specific to the parameters being analyzed. For VOCs (volatile organic compounds), a minimum sample volume of 80 ml will be stored in two 40-ml glass vials with teflon-lined septum. The metals will be stored in polyethylene containers (certified clean and metal-free) and preserved with nitric acid (pre-added) such that the pH is less than 2. Minimum sample volume for the metals is 500 ml. All sample containers will be stored on ice for transport to the laboratory.

3.3.2 Handling Procedures

Sample tracking from the time of collection through analysis will be accomplished through chain-of-custody logs. The chain-of-custody logs will be used to insure the appropriate handling procedures are followed. A number of the parameters require special treatment in collection and storage. VOC samples should be poured such that there is no headspace in the sample container. After collection, samples will be stored on ice for transportation to the laboratory.

3.4 ANALYTICAL METHODS

All samples will be analyzed for constituents listed in Appendix I of the Subtitle D regulations (Part 258). The constituents, along with their analytical methods used are listed on Table 3-1. In addition to the Appendix I constituents, pH, specific conductance, and temperature will be measured in the field, as described in Section 3.3.5. The pH will be

measured in accordance with SW-846 Method 9040, and specific conductance will be measured in accordance with SW-846 Method 9050.

3.5 QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance and quality control (QA/QC) are those measures taken to ensure the data produced from the monitoring program is not erroneous. The principal components of the QA/QC program which will be followed for the Durham Landfill are discussed below.

3.5.1 Chain-of-Custody

Chain-of-custody provides a means of tracking a sample from the time of collection through analysis. This is accomplished through the use of the following documentation:

- Field logbook
- Sample labels and seals
- Chain-of-custody record
- Sample analysis request sheets
- Laboratory logbook

Field Logbook

The field logbook will be used to record detailed information on each sampling event. Items which will be included in the field book are listed in the Technical Enforcement Guidance Document.

Sample Labels and Seals

Sample labels and seals will be attached to each sample bottle. The sample labels will be used to identify the sample location, date and time of collection, sample collector, parameters to be analyzed, and type of preservation. A sample seal will be placed on each bottle, or a seal will be placed on the shipping container to insure the samples are not disturbed during transportation.

Table 3-1
Appendix I
Constituents for Assessment Monitoring

Inorganic Constituents		Method Reference	NC GW Standard	
Antimony	(Total)	3005,6010	NE	mg/L
Arsenic	(Total)	3005,6010	0.05	mg/L
Barium	(Total)	3005,6010	2	mg/L
Beryllium	(Total)	3005,6010	NE	mg/L
Cadmium	(Total)	3005,6010	0.005	mg/L
Chromium	(Total)	3005,6010	0.05	mg/L
Cobalt	(Total)	3005,6010	NE	mg/L
Copper	(Total)	3005,6010	1	mg/L
Lead	(Total)	3005,6010	0.015	mg/L
Nickel	(Total)	3005,6010	0.1	mg/L
Selenium	(Total)	3005,6010	0.05	mg/L
Silver	(Total)	3005,6010	0.018	mg/L
Thallium	(Total)	3005,6010	NE	mg/L
Vanadium	(Total)	3005,6010	NE	mg/L
Zinc	(Total)	3005,6010	2.1	mg/L

Organic Constituents	Method Reference	NC GW Standard	
Acetone	8260	700	ug/L
Acrylonitrile	8260	NE	ug/L
Benzene	8260	1	ug/L
Bromochloromethane	8260	NE	ug/L
Bromodichloromethane	8260	NE	ug/L
Bromoform	8260	0.19	ug/L
Carbon disulfide	8260	NE	ug/L
Carbon tetrachloride	8260	0.3	ug/L
Chlorobenzene	8260	50	ug/L
Chloroethane	8260	NE	ug/L
Chloroform	8260	0.19	ug/L
Dibromochloromethane	8260	NE	ug/L
o-Dichlorobenzene	8260	620	ug/L
p-Dichlorobenzene	8260	75	ug/L
1,2-Dibromoethane (EDB)	8260	0.000	ug/L

Organic Contituents (continued)	Method Reference	NC GW Standard	
1,2-Dibromo-3-chloropropane	8260	0.03	ug/L
trans-1,4-Dichloro-2-butane	8260	NE	ug/L
1,1 Dichloroethane	8260	700	ug/L
1,1-Dichloroethylene	8260	7	ug/L
cis-1,2-Dichloroethylene	8260	70	ug/L
trans-1,2-Dichloroethylene	8260	70	ug/L
1,2-Dichloromethane	8260	5	ug/L
cis-1,3-Dichloropropene	8260	NE	ug/L
trans-1,3-Dichloropropene	8260	NE	ug/L
1,2-Dichloropropane	8260	0.56	ug/L
Ethylbenzene	8260	29	ug/L
2-Hexanone	8260	NE	ug/L
Methyl bromide	8260	NE	ug/L
Methyl chloride	8260	NE	ug/L
Methyl ethyl ketone (MEK)	8260	170	ug/L
Methyl iodide	8260	NE	ug/L
4-Methyl-2-pentanone (MIBK)	8260	NE	ug/L
Methylene bromide	8260	NE	ug/L
Methylene chloride	8260	5	ug/L
Styrene	8260	100	ug/L
1,1,1,2-Tetrachloroethane	8260	NE	ug/L
1,1,2,2-Tetrachloroethane	8260	NE	ug/L
Tetrachloroethylene (TCA)	8260	0.7	ug/L
Toluene	8260	1000	ug/L
1,1,1-Trichloroethane	8260	200	ug/L
1,1,2-Trichloroethane	8260	NE	ug/L
Trichloroethylene (TCE)	8260	2.8	ug/L
Trichlorofluoromethane (CFC-11)	8260	2100	ug/L
1,2,3-Trichloropropane	8260	NE	ug/L
Vinyl acetate	8260	NE	ug/L
Vinyl chloride	8260	0.02	ug/L
Xylenes	8260	530	ug/L

Notes: Method References from Test Methods for Evaluating Solid Waste - Physical/Chemical Methods (SW-846)
NE = NOT ESTABLISHED: Substances which arenot naturally occurring and for which no standard is specified shall not be permitted in detectable concentrations.

Chain-of-Custody and Analysis Request Forms

A chain-of-custody record will be kept for each sample, and will be filled out at the time of sample collection. Information contained on a chain-of-custody record is listed in the TEGD. A sample analysis request sheet will also be filled out at the time of sample collection. Information for the sample request sheet can be incorporated in the chain-of-custody record.

Laboratory Logbook

A laboratory logbook(s) will be maintained by the laboratory for tracking the storage, processing and analysis of each sample. The laboratory logbook will contain information on sample storage location; preparation techniques, such as digestion or extraction methods; instrumentation used for sample analysis; results of routine QC samples for each batch of sample analyzed; and dates, times, and personnel performing each processing and analysis step.

3.5.2 Field Activities

Field Blanks

One trip blank and one equipment blank will be collected for each day of sampling. The trip blank will consist of a container of Type II reagent grade water which is transported to the site and returned to the laboratory without being opened. For surface water samples, one equipment blank will be taken per sampling event. No equipment blanks for groundwater samples will be necessary because dedicated pumps will be used for sample collection.

Equipment Calibration

The field equipment will be calibrated in the laboratory prior to field use, with the calibration checked in the field at each sample location. Field adjustment to the equipment will be made as necessary and recorded in the field log. The principal field equipment will be a pH meter, a conductivity meter, a thermometer, and a water level indicator. Calibration logs for the field equipment will be maintained by the laboratory and provided to the Division of Solid Waste Management on request. Appropriate calibration checks in the field will be recorded on the field logs and submitted with the data analysis.

The pH meter will be calibrated using a two-point standard which should bracket the anticipated range in pH. The pH will be field checked at each location and adjustments will be made as necessary. The calibration checked values, along with the temperature of the solution, will be recorded on the field logs.

The thermometer, conductivity meter, and water level indicator do not require field calibration. These instruments will be checked in the laboratory to insure proper operation. The thermometer will either be NBS certified or calibrated against an NBS certified thermometer in the laboratory. The conductivity meter will be check per manufacturers instructions, and against a calibration standard.

Equipment Decontamination

Dedicated pumps used to collect samples from each location will be decontaminated prior to installation. Once installed, they will not require additional decontamination. Containers used to collect the samples from surface waters will be decontaminated in the laboratory using the same protocol used to clean the sample transportation-and-storage containers.

3.5.3 Laboratory Activities

Other than chain-of-custody, laboratory measures used to ensure the acceptability of analytical results include the use of calibration blanks, calibration verification standards, sample spikes, surrogate spikes, and laboratory replicates. Results of analyses on these quality control measures will be reported with the results of the sample analyses.

A calibration blank consists of Type II water which is used as a continuing calibration check for the instrument. A calibration verification standard consists of Type II water with a known concentration of the analyte used as a continuing calibration check on the instrument. A sample spike is of a known amount of standard added to a sample replicate prior to processing the sample. The spike is used to calculate percent recovery and provides information on matrix interferences. Sample spikes are primarily used with inorganic samples. Surrogate spikes are compounds which are either not present in the water quality sample, or are not of interest in the monitoring program. The surrogate spikes have chemical behavior similar to the compounds of interest, and are added to the sample prior to processing in the same manner as sample spikes. Surrogate spikes are used primarily for organic analyses to check for matrix interferences and calculate percent recovery. Laboratory replicates are samples which are split from the same container prior to

processing. The laboratory replicates are then processed and analyzed as separate samples. The quality control samples (calibration blanks and control standards, sample spikes, surrogate spikes, and laboratory replicates) will be analyzed at a minimum frequency of one per 20 samples, or one per analytical batch, whichever frequency is greater.

3.6 DATA MANAGEMENT AND DATA ANALYSIS

This section establishes the methods which will be used to handle data values below detectable levels, missing data and outliers. Recordkeeping requirements are addressed as well as the statistical analysis methods to be used in evaluating the data. Reporting requirements for the analytical results, quality control data and charts and statistical analyses are also presented.

3.6.1 Data Management

Values Below Detectable Levels

Several methods are available for dealing with values reported below the detection limit (BDL). The method selected will depend on the percentage of values which are BDL for a given parameter. Criteria used for selecting the method is in accordance with the Guidance Document on the Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities (USEPA 530/SW-89-026).

For parameters with BDLs accounting for less than 15 percent of the data, the non-detect value will be replaced with one-half the method detection limit (MDL/2). For parameters with greater than 15 percent non-detects but less 50 percent, a rank order non-parametric test will be used. The non-parametric test is specified in Section 3.7.2 of this document. If the number of non-detects is 50 percent or greater, the test of proportions will be used to establish significance.

Missing Data

The method used to handle missing data will depend on the number of missing values for each parameter. If there is only one missing value, the average of the non-missing values for that location should be substituted for that value. If one of the replicate measurements are missing, then the average of the remaining three replicate measurements will be used to replace the missing value. In the case of more than one missing value at a given location, Rubin's method for providing estimates of these values will be used.

Outliers

Outliers, or extreme observations in the data typically result from sampling or analytical errors. There are several tests which can be used to establish the probability that a given value is an outlier. The methods used in evaluating outliers is in accordance with ASTM Standard Practice of Dealing with Outlying Observations (ASTM E178).

The first step in identifying outliers is visual inspection of the data. The visual inspection will be augmented by the use of the Shewhart-Cusum control chart. If, based on visual examination and Shewhart-Cusum control chart, one of the reported values appear to be an outlier, the statistical method recommend in ASTM E-178 will be used.

Recordkeeping

Results of the monitoring program will be retained on file by the City. These records will include all field logs, chain-of-custody logs, routine quality control reports, and analytical results.

3.6.2 Statistical Analysis

The statistical method used to analyze the data will depend on specific characteristics of each parameter. Some of the criteria used in selecting the statistical method are discussed in Section 3.7.1. The "default" statistical method which will be used to test for significance is parametric ANOVA, as specified in 15 ANCAC 13B.1632.

Evaluation of Background Data

Data from the first semi-annual sampling event will be evaluated to establish if there is significant variability between sampling locations for any of the Appendix I constituents across the site. If there is significant variability between wells, then the use of background to compliance well comparisons would not be appropriate for this site. Instead, intra-well comparisons would be used to test for possible leachate contamination.

Evaluation of Data After First Semi-Annual Sampling Event

Groundwater Quality

For routine groundwater monitoring, evaluation of the data will be conducted in accordance with 15A NCAC 13B.1632 and USEPA 530/SW-89-026. The choice of the statistical method will depend on criteria specific to each parameter. A flow chart of the selection process is presented on Figure 3-2. The selection process will be conducted for each parameter individually. As a consequence, multiple test methods may be required to complete the analysis.

First, the number of non-detects will be assessed. If 50 percent or more of the data is below detectable levels, then the test of proportions will be used to evaluate the data. If the number of non-detects is 15 percent or greater, but less than 50 percent, the Kruskal-Wallis test will be used. Kruskal-Wallis is a rank-order non-parametric ANOVA test. If the number of non-detects is less than 15 percent, a parametric ANOVA will be used. Before using ANOVA, the non-detects will be replaced with a value of half the method detection limit (MDL/2). Parametric one-way ANOVA will be used to compare the upgradient well concentrations with the downgradient well concentrations. The residuals from the ANOVA will be tested for normality of variance using Cochran's C. If the residuals are not normally distributed, then the non-parametric Kruskal-Wallis test will be used. If the residuals are normally distributed, the results of the parametric ANOVA will be used. If, based on the results of the selected analysis, one or more of the locations were significantly different from the other locations, then the Scheffe's F Test will be used to identify the location(s).

Groundwater Flow

Groundwater levels will be measured at each monitoring well for each sampling event. These levels will be converted to groundwater elevations and plotted on a base map of the facility. This will be used to establish existing groundwater flow direction. Groundwater flow direction and rate will be evaluated at each well for each sampling event on a semi-annual basis, prior to submission of the report.

Darcy's Law will be used to estimate flow direction and rate:

$$v = \frac{Ki}{n_e}$$

where v = velocity,

K = hydraulic conductivity at each well,

i = hydraulic gradient at each well, and

n_e = effective porosity at each well.

Analysis of Variance (ANOVA)

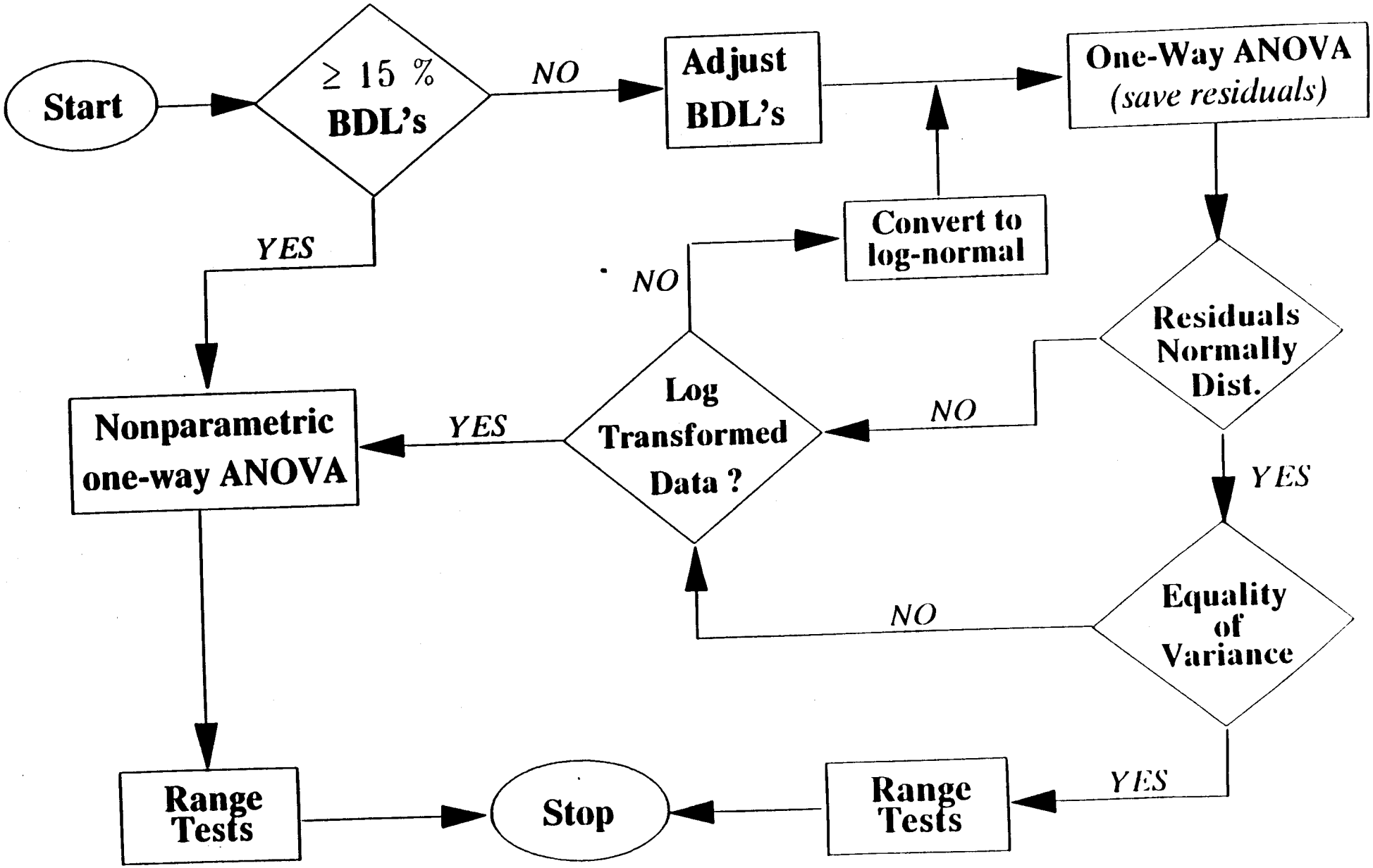


FIGURE 3-2

3.6.3 Reporting

Detection Monitoring

During the first semi-annual sampling event, results of the laboratory analyses will be submitted to the DEHNR within 30 days after the laboratory submits the analytical results to the City. On a semi-annual basis, a report will be prepared which presents the results of the groundwater monitoring for that event. This report will include, but is not limited to, the analytical results, quality control data and charts, and statistical analyses. The report will be submitted within 14 days of completing the statistical analysis for the analytical data from the groundwater samples.

If one of the upgradient monitoring wells test significantly different, this information will be submitted with the annual report. Along with the test results, the following possibilities will be addressed:

- The difference is a result of natural spatial variability
- The difference is a result of natural temporal variability
- The difference is a result of sampling or analytical variability
- The difference is a result of a Type I error
- Groundwater flow direction is from the landfill toward the monitoring well

Natural spatial and temporal variability will be addressed through an analysis of the water quality data and stratigraphic information for the landfill site. Sampling or analytical variability will addressed through the quality control samples. Direction of groundwater flow will be reassessed by examining the water level elevations in the monitoring wells and piezometers. The possibility of a Type I error (the statistical test incorrectly indicated that there was a significant difference) will be addressed in two ways. First alternate statistical tests will be used, if appropriate. Also, the assumptions used in applying the test will be investigated. Some of the relevant assumptions are that the background water quality is relatively homogeneous (from the same population), normal distribution about the mean, and equal sample size.

If one of the downgradient monitoring wells test significantly different, the DEHNR will be notified of this occurrence within 14 days of this finding and the well(s) will be re-sampled within 30 days of the analysis. Duplicate samples (two samples collected from the same well at the same time) will be obtained from the well and analyzed. The standard quality control checks will be used for the re-sampling, including use of field blanks, sample (matrix) spikes, and laboratory duplicates. If, as a result of the re-sampling, there is still a significant difference at that well, the DEHNR will again be notified within 14 days following the confirmation. At this point an assessment monitoring program will be implemented.

Assessment Monitoring

If a statistically significant increase in the compliance well(s) is confirmed, within 90 days following the confirmation of a statistically significant increase an assessment monitoring program will be implemented. The assessment monitoring will be designed to meet the requirements in SWM .1633. The program will be designed to assess the rate and extent of migration of leachate in the groundwater. Within 90 days after the assessment monitoring program is triggered, additional groundwater samples will be collected from the compliance (downgradient) wells and analyzed for constituents in Appendix II of 40 CFR §258. Following analysis of these samples, both background and compliance wells will be resampled and analyzed for any Appendix II constituents detected in the downgradient wells. Four independent samples will be collected from each monitoring well and analyzed to establish a baseline for the new constituents.

The background concentration, as defined by the upgradient wells, will be established for each of the Appendix II constituents detected from the samples. Background to compliance well concentrations will be statistically tested using the methods outlined in Section 3.7.2 of this document. Groundwater protection standards will also be developed for each Appendix II constituent detected in the downgradient wells. These standards will be based on established MCLs from SWM .1634(h) and (i). If the constituent does not have an MCL, or the background concentration exceeds the MCL, the protection standard will be based on the background concentration.

If, as a result of the statistical tests, it is determined that the compliance wells do not have significantly higher concentrations than the background wells, the detection monitoring program will be reinstituted. The DEHNR will be notified that the detection monitoring program was reinstated within 30 days following completion of the assessment.

If the concentrations of the Appendix II constituents for the compliance wells are statistically higher than the background wells, but are below the groundwater protection standards, then assessment monitoring will continue. Sample frequency for the assessment monitoring will be semi-annual for the active life of the facility, or until the detection monitoring is reinstated or corrective measures are required.

If, as a result of the assessment monitoring, it is determined that there is a statistically significant increase in concentration for compliance wells for constituents under Appendix II, the DEHNR will be notified within 14 days of this finding. At this point, requirements under §.1633 will be implemented. Once the appropriate corrective measures are approved, a corrective action monitoring program will be implemented.

Corrective Action Monitoring

Corrective action monitoring will be used to provide information to support the corrective action plan approved by the Department of Environment, Health, and Natural Resources. The corrective action monitoring program will be developed in accordance with §.1637.

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MALCOLM PIRNIE

MALCOLM PIRNIE, INC.
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

November 22, 1994

Nancy Lee Newell, P.E.
Solid Waste Process Engineer
City of Durham
1833 Camden Avenue
Durham, North Carolina 27704

Re: City of Durham Landfill
Replicate Groundwater Sampling

Dear Ms. Newell:

Further to our revised DRAFT Groundwater Quality Monitoring Plan (GWQMP) we provide the following additional comments concerning the sampling and analytical protocol to be used for the remaining replicate groundwater sampling. Please be aware that the State has not yet approved the GWQMP and, consequently, changes could follow their review.

The GWQMP confirms the monitoring network is to be comprised of the following eight groundwater monitoring wells.

- MW2, MW3, MW4, MW5, and MW6 along the north, south, and west permitted facility boundary.
- Recently installed MW7 and MW8 along the east permitted facility boundary.
- P6 as a background water quality monitoring location.

We have proposed to use the remaining monitoring wells P1, P2, P3, and P4 for water table elevation data only. The GWQMP has proposed decommissioning of MW1.

In the event the NCDEHNR does not approve elimination of P1 and P3 from the water quality network, these wells should be included in all subsequent replicate sampling events.

We believe the remaining three replicate groundwater sampling events should proceed at the above designated monitoring wells using the following protocol.

Second Sampling Event

- The second sampling event should proceed using disposable bailers. Filtered and unfiltered groundwater samples should be obtained for total and dissolved metals analyses included in the detection monitoring schedule shown on Table 3-1 of the GWQMP.

11832 ROCK LANDING DRIVE SUITE 400 NEWPORT NEWS, VA 23606-4206 804-873-8700 FAX: 804-873-8723

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- Additional groundwater samples should be obtained for metals analysis utilizing Method 3030c (similar to unfiltered total metals however utilizing a weaker acid digestion method in the laboratory) for those parameters exceeding NCAC 2L groundwater quality standards on the first sampling event. Review of analytical data indicates the following exceedances of North Carolina Groundwater Standards (NCGWS) from samples collected during the first replicate sampling event.

  - MW5 demonstrated exceedances for Barium, Chromium, Lead, Nickel and Zinc.

  - MW6 demonstrated exceedances for Chromium and Lead

  - P6 demonstrated exceedances for Chromium and Lead. In addition P6 indicated Barium present in concentration of 1834 ug/L, approaching the NCGWS of 2000 ug/L for this analyte.

Additional Method 3030c metals analysis should be performed for each of the above listed analytes at those monitoring well locations which demonstrated exceedance of NCGWS.

Third and Final Replicate Sampling Events

- Redevelopment of the monitoring wells should be deferred until such time as the dedicated bladder pumps are installed.

- Filtered and unfiltered samples should be obtained from the third and final replicate sampling events using the proposed dedicated groundwater sampling pumps.

We trust this clarifies the groundwater monitoring protocol. Please call us if you have any questions.

Very truly yours,

MALCOLM PIRNIE, INC.

Steve R. Nesbitt
Senior Project Engineer

cl
0759-022

c: R. W. Stahr, Jr., Malcolm Pirnie
S. R. Nesbitt, Malcolm Pirnie
Robert J. Goldstein, Goldstein & Associates

SRNL1122.WPF

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APPENDIX A

SLUG TESTS

DURHAM LANDFILL
WELL LOCATION MW-2

Le =	305 cm	rc =	2.54 cm
Lw =	254 cm	rw =	9.21 cm
H =	558 cm	A =	2.50
		B =	0.40
Re/rw =	2.224	Le/rw =	33.103

Falling Head
SE1000B
Environmental Logger
03/15 10:33

Unit# 00869 Test# 5

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 30.40
Offset 0.15

Step# 0 03/09 09:14

Time (min)	Head (ft)	Time (sec)	H/Ho	K (cm/sec)
0	0			
0.0033	0			
0.0066	-0.01			
0.0099	0.01			
0.0133	2.37			
0.0166	2.36			
0.02	1.46			
0.0233	0.81			
0.0266	2.57			
0.03	3.38			
0.0333	3.18			
0.05	2.62			
0.0666	1.88			
0.0833	3.03			
0.1	2.13			
0.1166	2.04			
0.1333	1.93			
0.15	2.28			
0.1666	3.23			
0.1833	2.25	1.0	0.697	8.49E-03
0.2	2.23	2.0	0.690	4.35E-03
0.2166	2.21	3.0	0.684	2.98E-03
0.2333	2.19	4.0	0.678	2.29E-03
0.25	2.18	5.0	0.675	1.85E-03
0.2666	2.16	6.0	0.669	1.58E-03
0.2833	2.15	7.0	0.666	1.37E-03
0.3	2.14	8.0	0.663	1.21E-03
0.3166	2.13	9.0	0.659	1.09E-03
0.3333	2.12	10	0.656	9.91E-04
0.4167	2.06	15	0.638	7.06E-04
0.5833	1.96	25	0.607	4.70E-04
0.6667	1.92	30	0.594	4.08E-04
0.75	1.88	35	0.582	3.64E-04
0.8333	1.86	40	0.576	3.25E-04
0.9167	1.82	45	0.563	3.00E-04
1	1.79	50	0.554	2.78E-04
1.0833	1.76	55	0.545	2.60E-04
1.1667	1.73	60	0.536	2.45E-04
1.25	1.7	65	0.526	2.32E-04

Rising Head
SE1000B
Environmental Logger
03/15 10:48

Unit# 00869 Test# 6

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 30.40
Offset 0.15

Step# 0 03/09 09:45

Time (min)	Head (ft)	Time (sec)	H/Ho	K (cm/sec)
0	0			
0.0033	-1.01			
0.0066	-1.34			
0.0099	0.04			
0.0133	-0.75			
0.0166	-2.4			
0.02	-1.42			
0.0233	-2.25			
0.0266	-0.46			
0.03	-0.11			
0.0333	-1.14			
0.05	-2.61			
0.0666	-2.56	1.0	0.981	4.57E-04
0.0833	-2.52	2.0	0.966	4.13E-04
0.1	-2.51	3.0	0.962	3.07E-04
0.1166	-2.49	4.0	0.954	2.77E-04
0.1333	-2.48	5.0	0.950	2.41E-04
0.15	-2.47	6.0	0.946	2.16E-04
0.1666	-2.46	7.0	0.943	1.99E-04
0.1833	-2.45	8.0	0.939	1.86E-04
0.2	-2.44	9.0	0.935	1.76E-04
0.2166	-2.43	10	0.931	1.68E-04
0.2333	-2.41	11	0.923	1.71E-04
0.25	-2.41	12	0.923	1.56E-04
0.2666	-2.4	13	0.920	1.52E-04
0.2833	-2.39	14	0.916	1.48E-04
0.3	-2.38	15	0.912	1.45E-04
0.3166	-2.37	16	0.908	1.42E-04
0.3333	-2.36	17	0.904	1.39E-04
0.4167	-2.32	22	0.889	1.26E-04
0.5	-2.28	27	0.874	1.18E-04
0.5833	-2.25	32	0.862	1.09E-04
0.6667	-2.22	37	0.851	1.03E-04
0.75	-2.19	42	0.839	9.83E-05
0.8333	-2.16	47	0.828	9.48E-05
0.9167	-2.13	52	0.816	9.20E-05
1	-2.1	57	0.805	8.98E-05
1.0833	-2.08	62	0.797	8.62E-05
1.1667	-2.05	67	0.785	8.49E-05

1.3333	1.67	70	0.517	2.22E-04
1.4166	1.64	75	0.508	2.13E-04
1.5	1.63	80	0.505	2.01E-04
1.5833	1.6	85	0.495	1.95E-04
1.6667	1.58	90	0.489	1.87E-04
1.75	1.56	95	0.483	1.80E-04
1.8333	1.53	100	0.474	1.76E-04
1.9167	1.51	105	0.467	1.70E-04
2	1.49	110	0.461	1.66E-04
2.5	1.38	140	0.427	1.43E-04
3	1.3	170	0.402	1.26E-04
3.5	1.21	200	0.375	1.16E-04
4	1.14	230	0.353	1.07E-04
4.5	1.09	260	0.337	9.84E-05
5	1.04	290	0.322	9.20E-05
5.5	0.98	320	0.303	8.77E-05
6	0.94	350	0.291	8.30E-05
6.5	0.9	380	0.279	7.92E-05
7	0.87	410	0.269	7.53E-05
7.5	0.85	440	0.263	7.14E-05
8	0.81	470	0.251	6.93E-05
8.5	0.79	500	0.245	6.63E-05
9	0.76	530	0.235	6.43E-05
9.5	0.74	560	0.229	6.19E-05
10	0.72	590	0.223	5.99E-05
12	0.65	710	0.201	5.32E-05
14	0.6	830	0.186	4.77E-05
16	0.56	950	0.173	4.34E-05
18	0.52	1,070	0.161	4.02E-05
20	0.48	1,190	0.149	3.77E-05
22	0.45	1,310	0.139	3.54E-05
24	0.43	1,430	0.133	3.32E-05
26	0.41	1,550	0.127	3.13E-05
28	0.39	1,670	0.121	2.98E-05
30	0.37	1,790	0.115	2.85E-05

Geometric Mean **1.02E-04**

1.25	-2.03	72	0.778	8.22E-05
1.3333	-2	77	0.766	8.14E-05
1.4166	-1.98	82	0.759	7.93E-05
1.5	-1.96	87	0.751	7.75E-05
1.5833	-1.93	92	0.739	7.72E-05
1.6667	-1.91	97	0.732	7.58E-05
1.75	-1.89	102	0.724	7.45E-05
1.8333	-1.87	107	0.716	7.34E-05
1.9167	-1.84	112	0.705	7.35E-05
2	-1.82	117	0.697	7.25E-05
2.5	-1.72	147	0.659	6.68E-05
3	-1.62	177	0.621	6.34E-05
3.5	-1.52	207	0.582	6.15E-05
4	-1.45	237	0.556	5.84E-05
4.5	-1.38	267	0.529	5.62E-05
5	-1.31	297	0.502	5.46E-05
5.5	-1.25	327	0.479	5.30E-05
6	-1.2	357	0.460	5.12E-05
6.5	-1.15	387	0.441	4.99E-05
7	-1.1	417	0.421	4.88E-05
7.5	-1.06	447	0.406	4.75E-05
8	-1.01	477	0.387	4.69E-05
8.5	-0.98	507	0.375	4.55E-05
9	-0.95	537	0.364	4.43E-05
9.5	-0.91	567	0.349	4.37E-05
10	-0.88	597	0.337	4.29E-05
12	-0.77	717	0.295	4.01E-05
14	-0.7	837	0.268	3.70E-05
16	-0.63	957	0.241	3.50E-05
18	-0.57	1,077	0.218	3.33E-05
20	-0.52	1,197	0.199	3.17E-05
22	-0.48	1,317	0.184	3.03E-05
24	-0.45	1,437	0.172	2.88E-05
26	-0.42	1,557	0.161	2.76E-05
28	-0.4	1,677	0.153	2.63E-05
30	-0.37	1,797	0.142	2.56E-05
32	-0.35	1,917	0.134	2.47E-05
34	-0.33	2,037	0.126	2.39E-05
36	-0.32	2,157	0.123	2.29E-05

END

Geometric Mean **5.27E-05**

DURHAM LANDFILL
WELL LOCATION MW-3

Le =	305 cm	rc =	2.54 cm
Lw =	449 cm	rw =	9.21 cm
H =	753 cm	A =	2.50
		B =	0.40
Re/rw =	2.495	Le/rw =	33.103

Falling Head
SE1000B
Environmental Logger
03/15 10:30

Unit# 00869 Test# 3

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 30.40
Offset 0.15

Step# 0 03/08 13:57

Time (min)	Head (ft)	Time (sec)	H/Ho	K (cm/sec)
0	0			
0.0033	0			
0.0066	-0.03			
0.0099	0.01			
0.0133	0.7			
0.0166	0.69			
0.02	0.37			
0.0233	0.66			
0.0266	1.55			
0.03	1.64			
0.0333	1.32			
0.05	1.7			
0.0666	2.3			
0.0833	2.2			
0.1	2.03			
0.1166	1.97			
0.1333	1.91			
0.15	1.87			
0.1666	1.85			
0.1833	1.99			
0.2	1.75	1	0.879	3.39E-03
0.2166	1.7	2	0.854	2.08E-03
0.2333	1.67	3	0.839	1.54E-03
0.25	1.64	4	0.824	1.28E-03
0.2666	1.61	5	0.809	1.12E-03
0.2833	1.58	6	0.794	1.02E-03
0.3	1.55	7	0.779	9.42E-04
0.3166	1.52	8	0.764	8.89E-04
0.3333	1.49	9	0.749	8.49E-04
0.4167	1.38	14	0.693	6.90E-04
0.5	1.27	19	0.638	6.24E-04
0.5833	1.18	24	0.593	5.75E-04
0.6667	1.11	29	0.558	5.31E-04
0.75	1.03	34	0.518	5.11E-04
0.8333	0.96	39	0.482	4.93E-04

Rising Head
SE1000B
Environmental Logger
03/15 10:32

Unit# 00869 Test# 4

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 30.40
Offset 0.15

Step# 0 03/08 14:30

Time (min)	Head (ft)	Time (sec)	H/Ho	K (cm/sec)
0	0			
0.0033	-0.01			
0.0066	-3.07			
0.0099	-1.59			
0.0133	-2.36			
0.0166	-1.21			
0.02	-1.41			
0.0233	-1.68			
0.0266	-2.76			
0.03	-2.53	0.20	0.917	1.13E-02
0.0333	-2.49	0.40	0.902	6.76E-03
0.05	-2.38	1.4	0.862	2.79E-03
0.0666	-2.29	2.4	0.830	2.05E-03
0.0833	-2.21	3.4	0.801	1.72E-03
0.1	-2.15	4.4	0.779	1.50E-03
0.1166	-2.09	5.4	0.757	1.36E-03
0.1333	-2.03	6.4	0.736	1.27E-03
0.15	-1.98	7.4	0.717	1.18E-03
0.1666	-1.93	8.4	0.699	1.12E-03
0.1833	-1.89	9.4	0.685	1.06E-03
0.2	-1.85	10	0.670	1.02E-03
0.2166	-1.81	11	0.656	9.77E-04
0.2333	-1.77	12	0.641	9.46E-04
0.25	-1.73	13	0.627	9.20E-04
0.2666	-1.7	14	0.616	8.88E-04
0.2833	-1.66	15	0.601	8.72E-04
0.3	-1.64	16	0.594	8.38E-04
0.3166	-1.61	17	0.583	8.18E-04
0.3333	-1.58	18	0.572	8.00E-04
0.4167	-1.45	23	0.525	7.26E-04
0.5	-1.34	28	0.486	6.72E-04
0.5833	-1.24	33	0.449	6.32E-04
0.6667	-1.16	38	0.420	5.96E-04
0.8333	-1.02	48	0.370	5.43E-04
0.9167	-0.95	53	0.344	5.27E-04

0.9167	0.9	44	0.452	4.76E-04
1	0.87	49	0.437	4.46E-04
1.0833	0.82	54	0.412	4.33E-04
1.1667	0.77	59	0.387	4.25E-04
1.25	0.73	64	0.367	4.14E-04
1.3333	0.69	69	0.347	4.05E-04
1.4166	0.65	74	0.327	3.99E-04
1.5	0.63	79	0.317	3.84E-04
1.5833	0.6	84	0.302	3.77E-04
1.6667	0.57	89	0.286	3.71E-04
1.75	0.54	94	0.271	3.66E-04
1.8333	0.52	99	0.261	3.58E-04
1.9167	0.5	104	0.251	3.51E-04
2	0.47	109	0.236	3.50E-04
2.5	0.37	139	0.186	3.20E-04
3	0.3	169	0.151	2.96E-04
3.5	0.25	199	0.126	2.75E-04
4	0.21	229	0.106	2.59E-04
4.5	0.18	259	0.090	2.45E-04
5	0.15	289	0.075	2.36E-04
5.5	0.14	319	0.070	2.20E-04
6	0.12	349	0.060	2.12E-04
6.5	0.11	379	0.055	2.02E-04
7	0.1	409	0.050	1.93E-04
7.5	0.09	439	0.045	1.86E-04
8	0.08	469	0.040	1.81E-04
8.5	0.07	499	0.035	1.77E-04
9	0.07	529	0.035	1.67E-04
9.5	0.06	559	0.030	1.65E-04
10	0.06	589	0.030	1.57E-04
12	0.04	709	0.020	1.45E-04
14	0.03	829	0.015	1.34E-04
16	0.02	949	0.010	1.28E-04
18	0.02	1,069	0.010	1.14E-04
20	0.01	1,189	0.005	1.18E-04
22	0.01	1,309	0.005	1.07E-04
24	0.01	1,429	0.005	9.78E-05
26	0.01	1,549	0.005	9.02E-05
28	0	1,669	0.000	
30	0.01	1,789	0.005	7.81E-05
32	0.01	1,909	0.005	7.32E-05

END

Geometric Mean **4.08E-04**

1	-0.89	58	0.322	5.12E-04
1.0833	-0.85	63	0.308	4.90E-04
1.1667	-0.8	68	0.290	4.78E-04
1.25	-0.76	73	0.275	4.64E-04
1.3333	-0.71	78	0.257	4.57E-04
1.4166	-0.68	83	0.246	4.43E-04
1.5	-0.65	88	0.236	4.32E-04
1.5833	-0.62	93	0.225	4.22E-04
1.6667	-0.59	98	0.214	4.14E-04
1.75	-0.56	103	0.203	4.07E-04
1.8333	-0.54	108	0.196	3.97E-04
1.9167	-0.51	113	0.185	3.93E-04
2	-0.5	118	0.181	3.81E-04
2.5	-0.39	148	0.141	3.48E-04
3	-0.32	178	0.116	3.19E-04
3.5	-0.26	208	0.094	2.99E-04
4	-0.22	238	0.080	2.80E-04
4.5	-0.19	268	0.069	2.63E-04
5	-0.16	298	0.058	2.52E-04
5.5	-0.14	328	0.051	2.40E-04
6	-0.13	358	0.047	2.25E-04
6.5	-0.12	388	0.043	2.13E-04
7	-0.11	418	0.040	2.03E-04
7.5	-0.09	448	0.033	2.02E-04
8	-0.09	478	0.033	1.89E-04
8.5	-0.08	508	0.029	1.84E-04
9	-0.07	538	0.025	1.80E-04
9.5	-0.07	568	0.025	1.71E-04
10	-0.07	598	0.025	1.62E-04
12	-0.05	718	0.018	1.47E-04
14	-0.04	838	0.014	1.33E-04
16	-0.04	958	0.014	1.17E-04
18	-0.03	1,078	0.011	1.11E-04
20	-0.03	1,198	0.011	9.96E-05

END

Geometric Mean **6.32E-04**

DURHAM LANDFILL
WELL LOCATION MW-4

Le =	305 cm	rc =	2.54 cm
Lw =	425 cm	rw =	9.21 cm
H =	730 cm	A =	2.50
		B =	0.40
Re/rw =	2.470	Le/rw =	33.103

Falling Head
SE1000B
Environmental Logger
03/15 10:24

Unit# 00869 Test# 1

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 30.40
Offset 0.15

Step# 0 03/08 12:43

Time (min)	Head (ft)	Time (sec)	H/Ho	K (cm/sec)
0	0			
0.0033	0.33			
0.0066	1.63			
0.0099	2.25			
0.0133	1.68			
0.0166	1.44			
0.02	1.37			
0.0233	1.17			
0.0266	1.12			
0.03	0.89			
0.0333	0.51			
0.05	0.74			
0.0666	0.45			
0.0833	0.08			
0.1	0.35			
0.1166	0.3	1.0	0.857	4.05E-03
0.1333	0.27	2.0	0.771	3.40E-03
0.15	0.25	3.0	0.714	2.93E-03
0.1666	0.23	4.0	0.657	2.75E-03
0.1833	0.22	5.0	0.629	2.43E-03
0.2	0.21	6.0	0.600	2.23E-03
0.2166	0.19	7.0	0.543	2.28E-03
0.2333	0.18	8.0	0.514	2.17E-03
0.25	0.18	9.0	0.514	1.93E-03
0.2666	0.17	10	0.486	1.89E-03
0.2833	0.16	11	0.457	1.86E-03
0.3	0.16	12	0.457	1.71E-03
0.3166	0.16	13	0.457	1.57E-03
0.3333	0.15	14	0.429	1.58E-03
0.4167	0.13	19	0.371	1.36E-03
0.5	0.12	24	0.343	1.17E-03
0.5833	0.11	29	0.314	1.04E-03
0.6667	0.1	34	0.286	9.63E-04
0.75	0.09	39	0.257	9.10E-04
0.8333	0.09	44	0.257	8.07E-04

Rising Head
SE1000B
Environmental Logger
03/15 10:21

Unit# 00869 Test# 0

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 30.40
Offset 0.15

Step# 0 03/08 12:37

Time (min)	Head (ft)	Time (sec)	H/Ho	K (cm/sec)
0	0			
0.0033	-0.02			
0.0066	-0.38			
0.0099	-0.69			
0.0133	-0.96			
0.0166	-0.49			
0.02	-0.2			
0.0233	-0.55			
0.0266	-0.75			
0.03	-0.11			
0.0333	-0.94			
0.05	-0.96			
0.0666	-0.81	1.0	0.844	4.46E-03
0.0833	-0.63	2.0	0.656	5.51E-03
0.1	-0.5	3.0	0.521	5.68E-03
0.1166	-0.41	4.0	0.427	5.57E-03
0.1333	-0.35	5.0	0.365	5.28E-03
0.15	-0.3	6.0	0.313	5.07E-03
0.1666	-0.26	7.0	0.271	4.88E-03
0.1833	-0.24	8.0	0.250	4.53E-03
0.2	-0.23	9.0	0.240	4.15E-03
0.2166	-0.21	10	0.219	3.97E-03
0.2333	-0.2	11	0.208	3.73E-03
0.25	-0.19	12	0.198	3.53E-03
0.2666	-0.18	13	0.188	3.37E-03
0.2833	-0.17	14	0.177	3.23E-03
0.3	-0.16	15	0.167	3.12E-03
0.3166	-0.16	16	0.167	2.93E-03
0.3333	-0.15	17	0.156	2.85E-03
0.4167	-0.13	22	0.135	2.38E-03
0.5	-0.12	27	0.125	2.01E-03
0.5833	-0.1	32	0.104	1.85E-03
0.6667	-0.09	37	0.094	1.67E-03
0.75	-0.09	42	0.094	1.47E-03
0.8333	-0.08	47	0.083	1.38E-03

0.9167	0.08	49	0.229	7.87E-04
1	0.08	54	0.229	7.14E-04
1.0833	0.08	59	0.229	6.54E-04
1.1667	0.07	64	0.200	6.57E-04
1.25	0.07	69	0.200	6.10E-04
1.3333	0.07	74	0.200	5.69E-04
1.4166	0.06	79	0.171	5.84E-04
1.5	0.06	84	0.171	5.49E-04
1.5833	0.05	89	0.143	5.72E-04
1.6667	0.06	94	0.171	4.90E-04
1.75	0.05	99	0.143	5.14E-04
1.8333	0.05	104	0.143	4.89E-04
1.9167	0.05	109	0.143	4.67E-04
2	0.05	114	0.143	4.46E-04
2.5	0.04	144	0.114	3.94E-04
3	0.04	174	0.114	3.26E-04
3.5	0.03	204	0.086	3.15E-04
4	0.04	234	0.114	2.42E-04
4.5	0.03	264	0.086	2.43E-04
5	0.03	294	0.086	2.18E-04
5.5	0.03	324	0.086	1.98E-04
6	0.03	354	0.086	1.81E-04
6.5	0.03	384	0.086	1.67E-04
7	0.03	414	0.086	1.55E-04
7.5	0.03	444	0.086	1.45E-04
8	0.03	474	0.086	1.35E-04
8.5	0.03	504	0.086	1.27E-04
9	0.03	534	0.086	1.20E-04
9.5	0.03	564	0.086	1.14E-04
10	0.03	594	0.086	1.08E-04
12	0.03	714	0.086	8.99E-05
14	0.03	834	0.086	7.70E-05
16	0.03	954	0.086	6.73E-05

END

Geometric Mean **2.45E-03**

0.9167	-0.07	52	0.073	1.32E-03
1	-0.06	57	0.063	1.27E-03
1.0833	-0.06	62	0.063	1.17E-03
1.1667	-0.06	67	0.063	1.08E-03
1.25	-0.05	72	0.052	1.07E-03
1.3333	-0.05	77	0.052	1.00E-03
1.4166	-0.05	82	0.052	9.42E-04
1.5	-0.04	87	0.042	9.55E-04
1.5833	-0.04	92	0.042	9.03E-04
1.6667	-0.04	97	0.042	8.56E-04
1.75	-0.04	102	0.042	8.14E-04
1.8333	-0.04	107	0.042	7.76E-04
1.9167	-0.03	112	0.031	8.09E-04
2	-0.03	117	0.031	7.74E-04
2.5	-0.03	147	0.031	6.16E-04
3	-0.02	177	0.021	5.72E-04
3.5	-0.01	207	0.010	5.76E-04
4	-0.01	237	0.010	5.03E-04

END

Geometric Mean **5.42E-03**

APPENDIX B

SOIL BORING LOGS

NFE Technologies, Inc.
Consulting Engineers
Civil Geotechnical
Inspection • Testing
Environmental

P.O. Box 374
Cary, NC 27512
1012 Trinity Road
Raleigh, NC 27607
(919) 851-9000
Fax: (919) 851-9800

RECEIVED
MAR 2 1 1994
MALCOLM PIRNIE
SRN
→ XC: SRN, JMW, PDP
→ XC: File 0759022 - Carlow
→ Original File - Do Not Punch
JOB
FILE 0759022

March 18, 1994

by overnight mail

Malcolm Pirnie, Inc.
11832 Rock Landing Road, Suite 400
Newport News, Virginia 23606

Attn: Mr. Steve Nesbitt

Re : **City of Durham Landfill Closure Plan**
NFE Project No. 94NCP020.

Gentlemen :

We are pleased to complete our scope of work on the above referenced project under your advice and supervision. We, therefore, are transmitting herewith our Final Geotechnical report, which includes the following:

- Boring location plan.
- Boring logs for 20 test pits and 1 deep boring.
- Laboratory test analysis and results.

We hope you will find this report to your entire satisfaction. However, if you have any questions or additional work to be done, please do not hesitate to contact us. We will be very delighted to furnish you such additional information or services.

We again thank you for awarding this opportunity to serve you and look forward to maintain a continuity of this relationship.

Very truly yours,
NFE Technologies, Inc.

Vinod 'Vinni' Goel, P.E.
President

Attachments: as above.

B: 94NG072.dur

NFE TECHNOLOGIES, INC.
P.O. Box 374 • Cary, North Carolina 27512-0374 • (919) 851-9000

RECORD OF SOIL EXPLORATION (BORING LOG)

Client: Malcolm Pirnie, Inc. **Boring No.** B-1
Project Name: Durham Landfill - City of Durham **Project No.** 94NCP020
Site Location: 2115 East Club Blvd. **County & State:** Durham, NC
Boring Location(Sta.) 100 feet in front of Monitoring Well DL-2 **Alignment:** N/A
Geologist: Paul Turner **Date Started:** 03.08.94 **Date Completed:** 03.08.94
Collar Elevation: 287 +/- **Drill Machine:** ATV **Drill Method:** Hollow Stem Auger
Total Depth: 34 Feet **Ground Water at:** 0 Hr. 7' at 24 Hr. 6.5'
Hammer Weight: 140 Lbs. **Hammer Drop:** 30 inches **Sampler Type:** Driven split spoon

Blow Count

Elev.	Depth Ft.	6"	6"	6"	Blows Per Foot (0 25 50 75 100)	sample no.	%age Recovery	GW	Log	Soil & Rock Description
287.0 (Approx)	-0.0									Topsoil
	-	3	3	4	7	S1	94			Moist brown fine sand mixed with some clayey silt
282	-5	2	3	5	8	S2	83			
	-	3	6	8	14	S3	94	▼		
277.0	-10.0	4	6	8	14	S4	94			Gray fine sand with some clayey silt
	-	7	7	6	13	S5				Fine grey sand
272	-15	1	1	21	22	S6				
	-	50	/.4		100+	S7	33			Burgundy mudstone (weathered)
267.0	-20.0	50	/.6			S8	33			Gray silty fine sand
	-	50	/.2			S9	17			Blue-grey sandy siltstone-Weathrd Rock
262	-25	50	/.3			S10	20			Burgandy to black claystone/mudstone - Weathered Rock
	-	50	/.2			S11	20			
	-30.0	50	/.2			S12	17			Blue-grey sandy siltstone - Weathered Rock
	-	50	/.3			S13	20			REFUSAL AT 34'
253.0	-34.0									

All elevations are approximate.

A:Durham2.Log

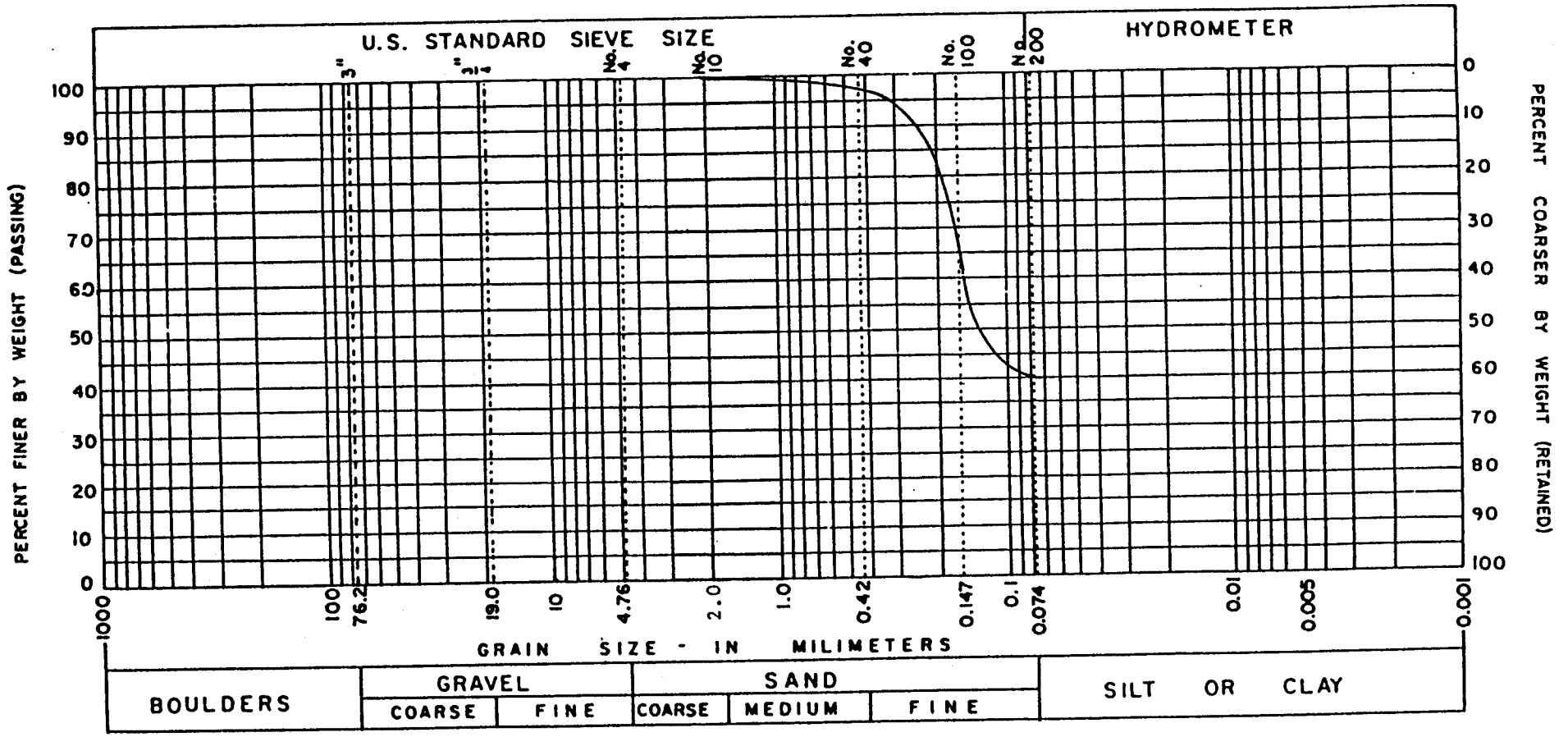
CITY OF DURHAM LANDFILL

LABORATORY TEST SUMMARY

BORING B-1

Boring	Depth	Moisture Content	Percent Fines	Liquid Limit	Plasticity Index	Classification
S-1	0.5 - 1.0	14.1	46	NP	NP	SM
S-2	3.5 - 5.0	23.4	60	58	41	CH
S-3	6.0 - 7.5	25.7				
S-8	20.0 - 20.5	17.5				
S-9	22.5 - 22.7	6.3				
S-8/S-9	20.0 - 22.7	-	41	NP	NP	SM

PROJECT: City of Durham Landfill		LOCATION: Durham, North Carolina	
BORING NO. B-1	SAMPLE NO. S-8 & S-9	DEPTH: 20.0 - 22.7	CONTRACT NO. 94-023



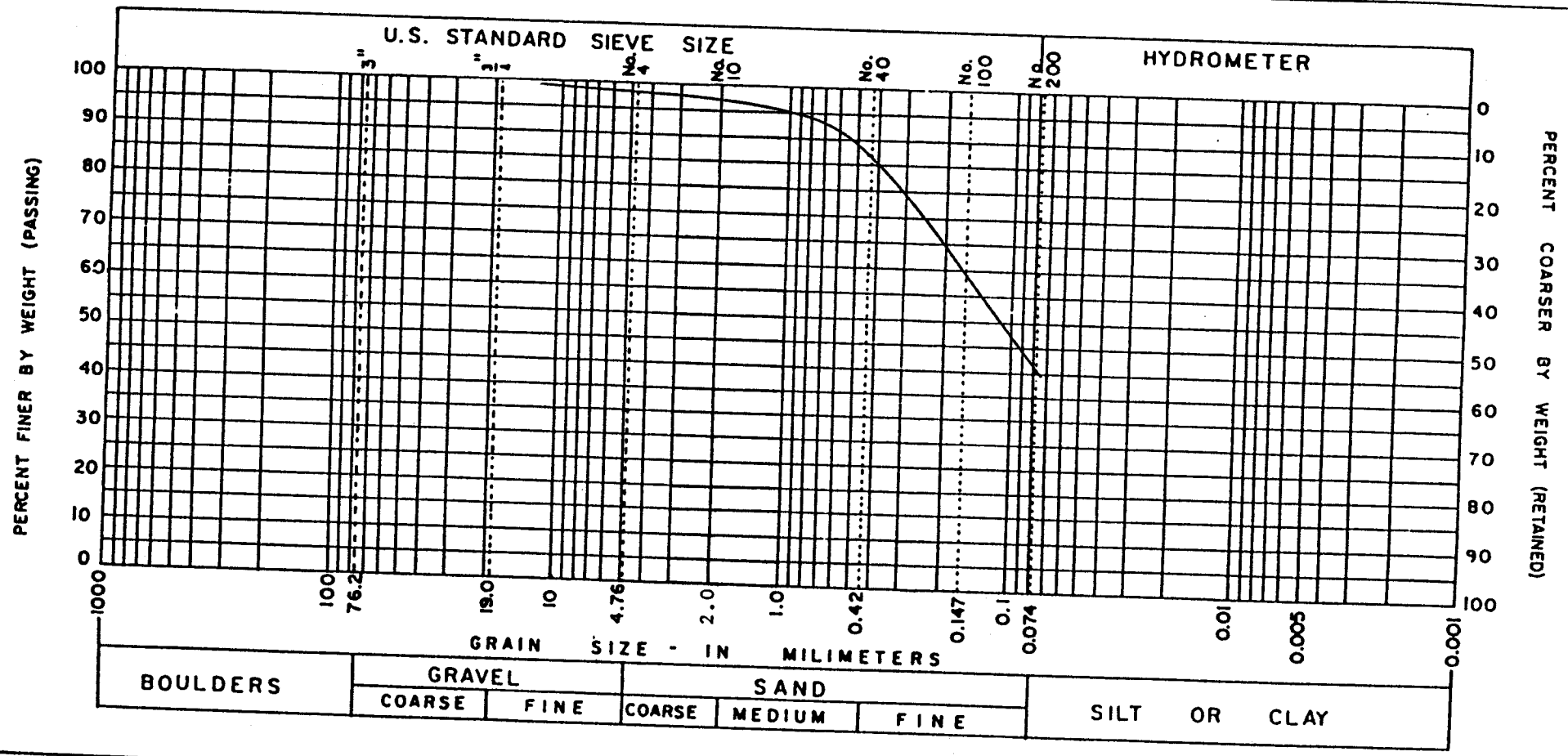
SAMPLE NO.	DEPTH	L.L.	P.I.	M.C.	USDA Class.	Soil Description
S-8	20.0-20.5	-	-	17.5	-	Gray silty fine sand
S-9	22.5-22.7	-	-	6.3		
						Unified Class - SM

NFE

GRAIN-SIZE DISTRIBUTION

TESTED BY: RMP	DATE: 3/17/94
CHECKED BY: PAD	SHEET No. 2 OF 2

PROJECT: City of Durham Landfill		LOCATION: Durham, North Carolina	
BORING NO. B-1	SAMPLE NO. S-1	DEPTH: 0.5-2.0	CONTRACT NO. 94-023



SAMPLE NO.	DEPTH	L.L.	P.I.	M.C.	USDA Class.	Soil Description
S-1	0.5-2.0	-	-	14.1	-	Brown silty fine sand
						Unified Class - SM

NFE

GRAIN-SIZE DISTRIBUTION

TESTED BY: RMP	DATE: 3/17/94
CHECKED BY: PAD	SHEET No. 1 OF 2

NFE TECHNOLOGIES, INC.

P.O. Box 374 • Cary, North Carolina 27512-0374 • (919) 851-9000

FAX TRANSMITTAL

Please deliver the following pages to: **Date:** 3/9 **1994**

Name: Steve Nesbitt
Company: Malcolm Pirnie, Inc.
Faxphone Number: 804 873-8723
Total Number of Pages (including this page): 2
This Information (X) Will be mailed. ( ) Will not be mailed.

No.	Information Transmitted
01	Boring Log for Monitoring Well DL-2.
02	
03	

Remarks:

Samples are being evaluated in the lab for approximate identification.

Please contact me if you have any questions.

From: Paul Turner

C:Faxtrans.nfe
Note: If there is a transmission error please call at (919) 851-9000

▶ XC: DWS, SRW, TBM

▶ FIG. 0759022-GM1 Cov

→ check Locations !

100 ft offset !

▶ What happened? I told Paul Turner to locate within ± 10 feet !

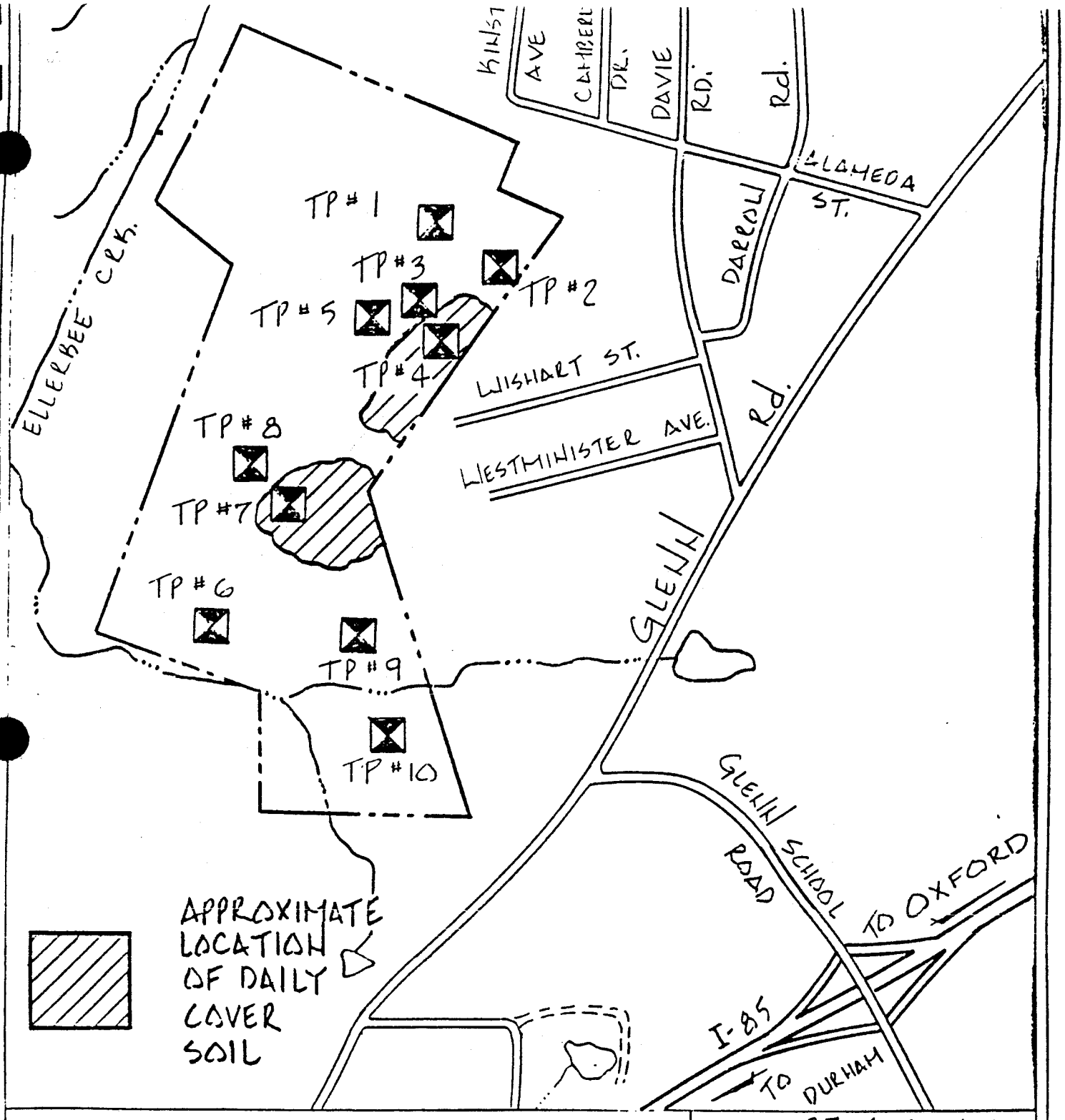
▶ This is Piedmont, is boring valid?

RECORD OF SOIL EXPLORATION (BORING LOG)

Client: Malcolm Pirnie, Inc. Boring No.
Project Name: Durham County Landfill Project No. 94NCP020
Site Location: [redacted] County & State: Durham, NC
Boring Location(Sta.) Offset: 0 Alignment:
Geologist: Paul Turner Date Started: 03.08.94 Date Completed: 03.08.94
Collar Elevation 179.2 Drill Machine: Acker Drill Method: Hollow Stem Auger
Total Depth: 34 Feet Ground Water at: 0 Hr. 7' at 24 Hr. 0'
Hammer Weight: 140 Lbs. Hammer Drop: 30 inches Sampler Type: Driven split spoon

Blow Count

Elev.	Depth Ft.	6"	6"	6"	Blows Per Foot 0 25 50 75 100	sample no.	%age Recovery	GW	Log	Soil & Rock Description
	-0.0									Topsoil
	-					S1	94			Moist brown fine sand grading to an orange-brown sandy silty clay
	-5					S2	83			
	-					S3	94	▼		
	-10.0					S4	94			Gray sandy clay
	-					S5				Fine grey sand
	-15					S6				
	-					S7	33			Burgandy claystone/ mudstone weathered
	-20.0					S8	33			
	-					S9	17			Blue-grey sandy siltstone; weathered
	-25					S10	20			Burgandy to black claystone/mudstone weathered
	-					S11	20			
	-30.0					S12	17			Blue-grey sandy siltstone; weathered
	-									REFUSAL AT 34'



SINCE 1881 F&R FROEHLING & ROBERTSON, INC.
MATERIALS TESTING & INSPECTION – ENGINEERS & CHEMISTS
CABLE ADDRESS – "FROEHLING"

DATE: 27 SEPT. '88
SCALE: NOT TO SCALE
DRWN: HJC

TEST PIT PLOT PLAN
CITY OF DURHAM LANDFILL EXPANSION
DURHAM, N.C.

DWG. NO. A-1

BORING LOG

FROEHLING & ROBERTSON, INC.

FULL SERVICE LABORATORIES • ENGINEERS & CHEMISTS
"OVER ONE HUNDRED YEARS OF SERVICE"
1881

Report No. P-66-292 DATE 9-8-88

Client: City of Durham, c/o Duane K. Stewart & Assocs., Inc., 3325 Chapel Hill Blvd., Durham, NC

Project: City of Durham Landfill Expansion, Durham, NC

Boring No.: TP-1 | Total Depth: 5.5 ft. | Elevation: 312.0 ft. ± | Location:

Type of Boring: Test Pit | Started: 9-8-88 | Completed: 9-8-88 | Case 580E Backhoe O.M. Lane Construction (DEM)

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Limits	Sample Depth (Feet)	Sample No.	REMARKS
312.0'	0.0'					
311.6'	0.4'	Grayish-brown silty fine to medium sandy TOPSOIL.		0.4	S-1	GROUNDWATER DATA
310.5'	1.5'	Brownish-yellow clayey fine to medium SAND to fine to medium sandy CLAY. (SC-CL)	LL=24 PI= 9 Wn=12.55	1.5	S-2	
309.0'	3.0'	Brownish-red and light gray and tan silty plastic CLAY. (CH)	LL=90 PI=52 Wn=21.97	3.0	S-3	
308.0'	4.0'	Tan and light gray silty plastic CLAY. (CH)	LL=66 PI=37 Wn=18.46	4.0	S-4	
306.5'	5.5'	Maroon and light gray SILT (Triassic Siltstone)				
		Digging Refusal at 5.5 feet.				

Scale 1" = 1.0'

No. of blows req'd. for a 140 lb. hammer dropping 30 in. to drive 2 in O.D., 1.375 in. I.D. sampler a total of 18 inches in three 6 in. increments. The sum of the last two increments of penetration is termed the standard penetration resistance, N.

Scale 1"=5' unless otherwise noted

FROEHLING & ROBERTSON, INC.
FULL SERVICE LABORATORIES • ENGINEERS & CHEMIS
"OVER ONE HUNDRED YEARS OF SERVICE"
1881

Report No. P-66-292 DATE 9-8-88

Client: City of Durham, c/o Duane K. Stewart & Assocs., Inc., 3325 Chapel Hill Blvd., Durham, NC

Project: City of Durham Landfill Expansion, Durham, NC

Boring No.: TP-2 | Total Depth: 6.0 ft. | Elevation: 330.0 ft. + | Location:

Type of Boring: Test Pit | Started: 9-8-88 | Completed: 9-8-88 | Case 580E Backhoe O.M. Lane Construction (DEM)

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Limits	Sample Depth (Feet)	Sample No.	REMARKS
330.0'	0.0'					
329.9'	0.1	Tan silty fine sandy TOPSOIL.		0.1	S-1	GROUNDWATER DATA
		Maroon and tan clayey SILT. (ML)		1.0		
328.0'	2.0'			2.0	S-2	
		Maroon silty CLAY to clayey SILT. (CL-ML) (Triassic Clay or Siltstone)		3.0		
			LL=40 PI=16 Wn=9.93			K = 3.95×10^{-8} cm/sec
				4.0	S-3	
				5.0		
324.0'	6.0'			6.0	S-4	
		Digging Refusal at 6.0 feet.				

Scale 1" = 1.0'

*No. of blows req'd for a 140 lb. hammer dropping 30 in. to drive 2 in O.D., 1.375 in. I.D. sampler a total of 18 inches in three 6 in. increments. The sum of the last two increments of penetration is termed the standard penetration resistance, N.

Scale 1"=5' unless otherwise noted

FULL SERVICE LABORATORIES • ENGINEERS & CHEMIST
"OVER ONE HUNDRED YEARS OF SERVICE"

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Report No. P-66-292 DATE 9-8-88

Client. City of Durham, c/o Duane K. Stewart & Assocs., Inc., 3325 Chapel Hill Blvd.,Durham,NC

Project. City of Durham Landfill Expansion, Durham, NC

Boring No: TP-3 | Total Depth: 5.0 ft. | Elevation: 325.0 ft. + | Location:

Type of Boring: Test Pit | Started: 9-8-88 | Completed: 9-8-88 | Case 580E Backhoe O.M. Lane Construction(DEM)

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Limits	Sample Depth (Feet)	Sample No.	REMARKS
325.0'	0.0'					GROUNDWATER DATA
		Tan silty fine to medium sandy TOPSOIL.		0.7	S-1	
324.3'	0.7'					
		Brownish-red silty plastic CLAY. (CH)	LL=62 PI=33 Wn=26.14	1.0		
323.0'	2.0'			2.0	S-2	
		Maroon and light gray clayey SILT. (ML)		3.0	S-3	
321.5'	3.5'			3.5		
		Light gray and maroon very fine sandy SILT. (Triassic Siltstone)		4.5		
320.0'	5.0'					
		Digging Refusal at 5.0 feet.				Scale 1" = 1.0'

No. of blows req'd. for a 140 lb. hammer dropping 30 in. to drive 2 in O.D., 1.375 in. I.D. sampler a total of 18 inches in three 6 in. increments. The sum of the last two increments of penetration is termed the standard penetration resistance, N.

Scale 1"=5' unless otherwise noted

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"OVER ONE HUNDRED YEARS OF SERVICE"
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Report No P-66-292 DATE 9-8-88

Client: City of Durham, c/o Duane K. Stewart & Assocs., Inc., 3325 Chapel Hill Blvd., Durham, NC

Project: City of Durham Landfill Expansion, Durham, NC

Boring No.: TP-4 | Total Depth: 5.0 ft. | Elevation: 349.0 ft. ± | Location:

Type of Boring: Test Pit | Started: 9-8-88 | Completed: 9-8-88 | Case 580E Backhoe O.M. Lane Construction (DEM)

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Limits	Sample Depth (Feet)	Sample No.	REMARKS
349.0'	0.0'					GROUNDWATER DATA
348.6'	0.4	Tan silty fine to medium sandy TOPSOIL.		0.4	S-1	
		Tan and reddish and yellowish-brown clayey medium to coarse SAND. (SC)		1.0		
347.0'	2.0			2.0	S-2	
		Light gray and tan clayey fine to coarse SAND to silty fine to coarse SAND. (SC-SM) (Weathered Rock Structure)	LL=35 PI=13	3.0		
346.0'	3.0		Wh=15.22	3.5	S-3	
		Maroon and light gray very fine sandy SILT. (Triassic Siltstone)		4.0		
				5.0	S-4	
343.5'	5.5					
		Digging Refusal at 5.5 feet.				

Scale 1" = 1.0'

*No. of blows req'd. for a 140 lb. hammer dropping 30 in. to drive 2 in O.D., 1.375 in. I.D. sampler a total of 18 inches in three 6 in. increments. The sum of the last two increments of penetration is termed the standard penetration resistance, N.

Scale 1"=5' unless otherwise noted

FULL SERVICE LABORATORIES • ENGINEERS & CHEMIS
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Report No. P-66-292 DATE 9-8-88

Client: City of Durham, c/o Duane K. Stewart & Assocs., Inc., 3325 Chapel Hill Blvd.,Durham,NC

Project: City of Durham Landfill Expansion, Durham, NC

Boring No.: TP-5	Total Depth: 4.5 ft.	Elevation: 317.0 ft. +	Location:
Type of Boring: Test Pit	Started: 9-8-88	Completed: 9-8-88	Case 580E Backhoe O.M. Lane Construction(DEM)

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Limits	Sample Depth (Feet)	Sample No.	REMARKS
317.0'						GROUNDWATER DATA
		Grayish-brown silty fine to medium sandy TOPSOIL.		0.9	S-1	
316.1'	0.9			1.0		
		Light gray and tan very fine sandy SILT with trace of clay seams. (ML)	LL=33 PI=NP Wn=11	1.25		K = 2.55×10^{-7} cm/sec
				2.0	S-2	
314.0'	3.0			3.0		
		Pale red and light gray fine to coarse SAND. (Triassic Siltstone)		4.0	S-3	
312.5'	4.5					
		Digging Refusal at 4.5 feet.				

Scale 1" = 1.0'

No. of blows req'd for a 140 lb. hammer dropping 30 in. to drive 2 in O.D., 1.375 in. I.D. sampler a total of 18 inches in three 6 in. increments. The sum of the last two increments of penetration is termed the standard penetration resistance, N.

Scale 1"=5' unless otherwise noted

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Report No P-66-292 DATE 9-7-88

Client: City of Durham, c/o Duane K. Stewart & Assocs., Inc., 3325 Chapel Hill Blvd.,Durham,NC

Project: City of Durham Landfill Expansion, Durham, NC

Boring No. TP-6 | Total Depth: 5.3 ft. | Elevation: 330.0 ft. + | Location:

Type of Boring: Test Pit | Started 9-7-88 | Completed: 9-7-88 | Case 580E Backhoe O.M. Lane Construction(DEM)

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Limits	Sample Depth (Feet)	Sample No.	REMARKS
330.0'	0.0'	Brownish-gray fine sandy silty TOPSOIL.		0.8	S-1	GROUNDWATER DATA
329.2'	0.8'	Yellow and tan sandy silty plastic CLAY. (CH)	LL=59 PI=31 Wn=22.56	1.0		
				2.0	S-2	
				3.0		
				4.0	S-2.1	
		Light gray and maroon Triassic Siltstone.		5.0	S-3	
324.7'	5.3'	Digging Terminated at 5.3 feet.				Scale 1" = 1.0'

*No. of blows req'd. for a 140 lb. hammer dropping 30 in. to drive 2 in O.D., 1.375 in. I.D. sampler a total of 18 inches in three 6 in. increments. The sum of the last two increments of penetration is termed the standard penetration resistance, N.

Scale 1"=5' unless otherwise noted

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"OVER ONE HUNDRED YEARS OF SERVICE"
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Report No P-66-292 DATE 9-7-88

Client: City of Durham, c/o Duane K. Stewart & Assocs., Inc., 3325 Chapel Hill Blvd., Durham, NC

City of Durham Landfill Expansion, Durham, NC

Boring No.: TP-7 | Total Depth: 8.0 ft. | Elevation: 340.0 ft. ± | Location:

Type of Boring: Test Pit | Started: 9-7-88 | Completed: 9-7-88 | Case 580E Backhoe O.M. Lane Construction (DEM)

Elevation 340.0'	Depth 0.0'	DESCRIPTION OF MATERIALS (Classification)	Limits	Sample Depth (Feet)	Sample No.	REMARKS
		Brownish-gray silty sandy TOPSOIL.				GROUNDWATER DATA
339.2'	0.8'			0.8	S-1	
		Tan and reddish-brown clayey medium to coarse SAND. (SC)		1.0		
				2.0	S-2	
				3.0		
				4.0	S-3	
				5.0		
334.0'	6.0'			6.0	S-4	
		Yellow and tan silty fine to medium SAND. (Triassic Sandstone)		7.0		
.0'	8.0'	Digging Refusal at 8.0 feet.				Scale 1" = 1.0'

o of blows req'd. for a 140 lb. hammer dropping 30 in. to drive 2 in O.D., 1.375 in. I.D. sampler a total of 18 inches in three 6 increments. The sum of the last two increments of penetration is termed the standard penetration resistance, N.

Scale 1"=5' unless otherwise noted

FRUEHLING & ROBERTSON, INC.
FULL SERVICE LABORATORIES • ENGINEERS & CHEMIST
"OVER ONE HUNDRED YEARS OF SERVICE"
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Report No P-66-292 DATE 9-7-88

Client: City of Durham, c/o Duane K. Stewart & Assocs., Inc., 3325 Chapel Hill Blvd., Durham, NC

Project: City of Durham Landfill Expansion, Durham, NC

Boring No. TP-8 | Total Depth: 6.5 ft. | Elevation: 311.0 ft. + | Location:

Type of Boring Test Pit | Started: 9-7-88 | Completed: 9-7-88 | Case 580E Backhoe O.M. Lane Construction (DEM)

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Limits	Sample Depth (Feet)	Sample No.	REMARKS
311.0'	0.0'					GROUNDWATER DATA
310.3'	0.7'	Light brownish-gray silty fine to medium sandy TOPSOIL.		0.7	S-1	
		Yellow and tan silty CLAY. (CL)		1.0		
309.0'	2.0'			2.0	S-2	
		Light gray maroon and tan silty plastic CLAY to clayey plastic SILT. (CH-MH)	LL=53 PI=25 Wn=21.77	3.0	S-3.1	
				4.0		
306.0'	5.0'			5.0	S-3	
		Maroon and light gray Triassic Silt or Claystone.		6.0		
304.5'	6.5'			6.5	S-4.1	
		Digging Refusal at 6.5 feet.				

Scale 1" = 1.0'

No. of blows required for a 140 lb hammer dropping 30 in. to drive 2 in O.D., 1.375 in. I.D. sampler a total of 18 inches in three 6 inch increments. The sum of the last two increments of penetration is termed the standard penetration resistance, N.

Scale 1"=5' unless otherwise noted

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Report No P-66-292 DATE 9-7-88

Client: City of Durham, c/o Duane K. Stewart & Assocs., Inc., 3325 Chapel Hill Blvd.,Durham,NC

Project: City of Durham Landfill Expansion, Durham, NC

Boring No.: TP-9 | Total Depth: 6.5 ft. | Elevation: 331.0 ft. + | Location:

Type of Boring: Test Pit | Started: 9-7-88 | Completed: 9-7-88 | Case 580E Backhoe O.M. Lane Construction(DEM)

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Limits	Sample Depth (Feet)	Sample No.	REMARKS
331.0'	0.0'					GROUNDWATER DATA
		Light brown silty fine to medium sandy TOPSOIL.		0.6	S-1	
330.4'	0.6					
		Reddish-brown silty CLAY to clayey SILT. (CL-ML)	LL=31 PI= 9 Wn=36.2	1.0		
				2.0	S-2	
328.0'	3.0			3.0		
		Maroon and light gray Triassic Siltstone.		4.0		
325.5'	5.5			5.5		
		White and maroon very fine sandy silty plastic CLAY to clayey plastic SILT (CH-MH)	LL=93 PI=53 Wn=12.28			
324.5'	6.5	(Triassic Silt or Claystone)		6.5	S-4	
		Digging Refusal at 6.5 feet.				

Scale 1" = 1.0'

No. of blows req'd for a 140 lb hammer dropping 30 in. to drive 2 in O.D., 1.375 in. I.D. sampler a total of 18 inches in three 6 in. increments. The sum of the last two increments of penetration is termed the standard penetration resistance, N.

Scale 1"=5' unless otherwise noted

Report No P-66-292 DATE 9-7-88

Client City of Durham, c/o Duane K. Stewart & Assocs., Inc., 3325 Chapel Hill Blvd., Durham, NC

Project City of Durham Landfill Expansion, Durham, NC

Boring No. TP-10 | Total Depth: 6.5 ft. | Elevation: 337.0 ft. + | Location:

Type of Boring: Test Pit | Started 9-7-88 | Completed: 9-7-88 | Case 580E Backhoe O.M. Lane Construction(DEM)

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Limits	Sample Depth (Feet)	Sample No.	REMARKS
337.0'	0.0'					GROUNDWATER DATA
336.6'	0.4'	Tan silty sandy TOPSOIL.		0.4	S-1	
		Yellow, tan and light gray silty CLAY. (CL)		1.0		
				2.0	S-2	
334.0'	3.0'			3.0		
		Light gray, maroon and tan silty plastic CLAY. (CH)		4.0	S-3	
332.5'	4.5'			4.5		
		Light gray and maroon very fine sandy SILT. (Triassic Siltstone)		5.0		
				6.0	S-4	
330.5'	6.5'					
		Digging Refusal at 6.5 feet.				Scale 1" = 1.0'

blows req'd for a 140 lb. hammer dropping 30 in. to drive 2 in O.D., 1.375 in. I.D. sampler a total of 18 inches in three 6 in. increments. The sum of the last two increments of penetration is termed the standard penetration resistance, N.

Scale 1"=5' unless otherwise noted

CITY OF DURHAM LANDFILL EXPANSION

REPORT OF LABORATORY TESTS

Test Pit No.	1	1	1	2
Sample No.	S-2	S-3	S-4	S-3
Depth (feet)	1.0-1.5	1.5-3.0	3.0-4.0	3.0-4.0
Sieve Analysis				
% Passing No. 4 Sieve	99.7	100.0	100.0	100.0
% Passing No. 10 Sieve	99.2	99.9	99.9	100.0
% Passing No. 30 Sieve	90.2	93.2	93.1	99.8
% Passing No. 40 Sieve	83.8	89.4	88.7	99.7
% Passing No. 60 Sieve	70.0	82.5	80.5	99.5
% Passing No. 200 Sieve	48.8	74.2	69.8	96.8
Atterberg Limits				
Liquid Limit	24	90	66	40
Plasticity Index	9	52	37	16
Natural Moisture Content				
	12.55	21.97	18.46	9.93
Maximum Density of Soils				
Optimum Moisture, %		24.6	18.2	14.1
Maximum Dry Density, pcf		92.9	101.5	117.1
Unified Soil Classification				
	SC-CL	CH	CH	CL-ML

CITY OF DURHAM LANDFILL EXPANSION

REPORT OF LABORATORY DATA

Test Pit	3	4	5	6
Sample No.	S-2	S-3	S-2	S-2.1
Depth (feet)	1.0-2.0	3.0-3.5	1.0-2.0	3.0-4.0
Sieve Analysis				
% Passing No. 4 Sieve	100.0	100.0	100.0	100.0
% Passing No. 10 Sieve	100.0	98.9	99.9	99.9
% Passing No. 30 Sieve	99.3	72.6	98.3	97.8
% Passing No. 40 Sieve	98.8	59.8	97.9	93.9
% Passing No. 60 Sieve	96.7	46.5	95.5	81.6
% Passing No. 200 Sieve	74.4	32.6	51.3	59.4
Atterberg Limits				
Liquid limit	62	35	35	59
Plasticity Index	33	13	NP	31
Natural Moisture Content				
	26.14	15.22	11.23	22.5
Maximum Density of Soils				
Optimum Moisture, %			13.7	22.9
Maximum Dry Density, pcf			110.6	99.2
Unified Soil Classification				
	CH	SC-SM	ML	CH

CITY OF DURHAM LANDFILL EXPANSION

REPORT OF LABORATORY TESTS

Test Pit No.	8	9	9
Sample No.	S-3.1	S-2	S-4
Depth (feet)	2.0-3.0	1.0-2.0	5.5-6.5
Sieve Analysis			
% Passing No. 4 Sieve	100.0	100.0	100.0
% Passing No. 10 Sieve	100.0	99.9	99.9
% Passing No. 30 Sieve	99.6	99.4	99.6
% Passing No. 40 Sieve	99.3	98.4	99.4
% Passing No. 60 Sieve	98.6	97.0	98.9
% Passing No. 200 Sieve	94.1	90.9	74.4
Atterberg Limits			
Liquid Limit	53	31	93
Plasticity Index	25	9	53
Natural Moisture Content			
	21.77	36.12	12.28
Maximum Density of Soils			
Optimum Moisture, %		25.6	
Maximum Dry Density, pcf		91.0	
Unified Soil Classification			
	CH-MH	CL-ML	CH-MH

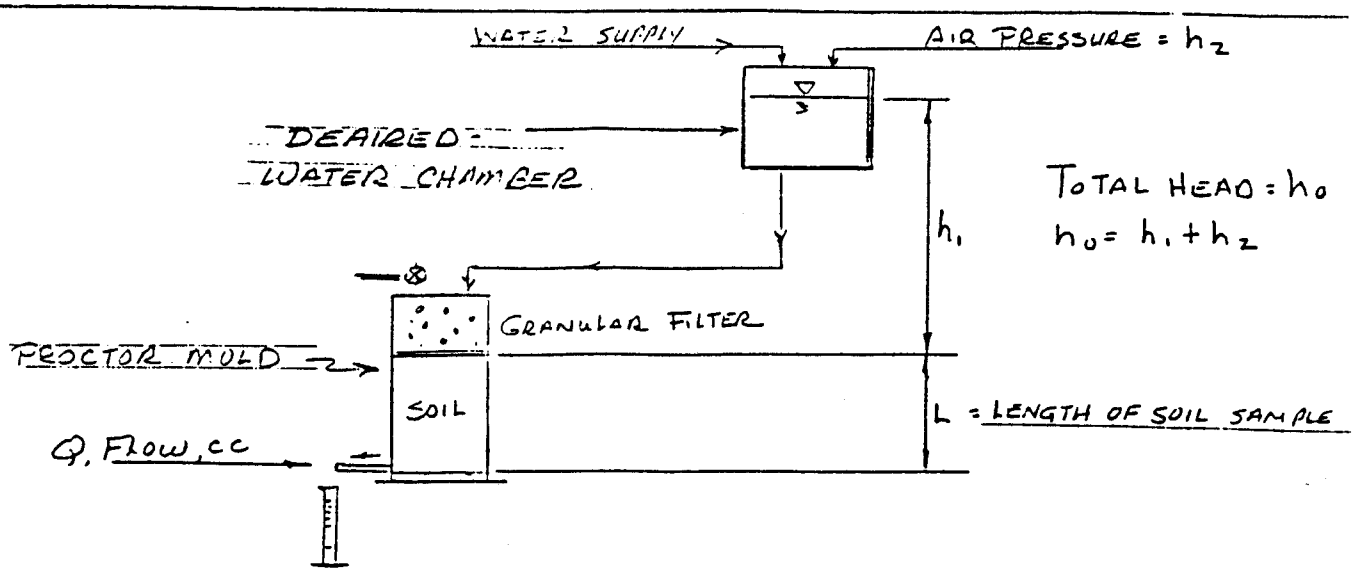
CITY OF DURHAM LANDFILL EXPANSION

REPORT OF LABORATORY DATA

Test Pit No.	1	2	5	6
Sample No.	S-3	S-3	S-2	S-2.1
Depth (ft.)	1.5-3.0	3.0-4.0	1.0-2.0	3.0-4.0
Unified Soil Classification	CH	CL-ML	ML	CH
Standard Proctor Test Results, ASTM D-698				
Maximum Dry Density (pcf)	92.9	117.1	110.6	99.2
Optimum Moisture (%)	24.6	14.1	13.7	22.9
Remolded Density, %	95.8	94.2	97.5	94.6
Porosity	0.89	0.35	0.36	0.79
Hydraulic Conductivity (cm/sec)	*	3.95×10^{-8}	2.55×10^{-7}	*
Liquid Limit	90	40	35	59
Plasticity Index	52	16	NP	31

* Constant Head Permeability Testing is currently in progress for these samples. Results should be available in approximately 1 week. (Permeability values on the order of 10^{-7} to 10^{-8} are anticipated.)

CONSTANT HEAD PERMEABILITY



COEFFICIENT OF PERMEABILITY, $k = \frac{Q \cdot L}{A \cdot h_o \cdot t}$ cm/sec

AREA = 81.07 cm^2; DIAMETER = 10.16 cm, LENGTH = 11.63 CM

VOL = 942.88 cm^3 WT of SOIL 1628.4 gm. MOISTURE 18.8 %

γ = 107.8 PCF, MAX. DRY DENSITY 110.6 PCF % DENSITY 97.5

n = 0.36 $W_{Opt.}$ = 13.7

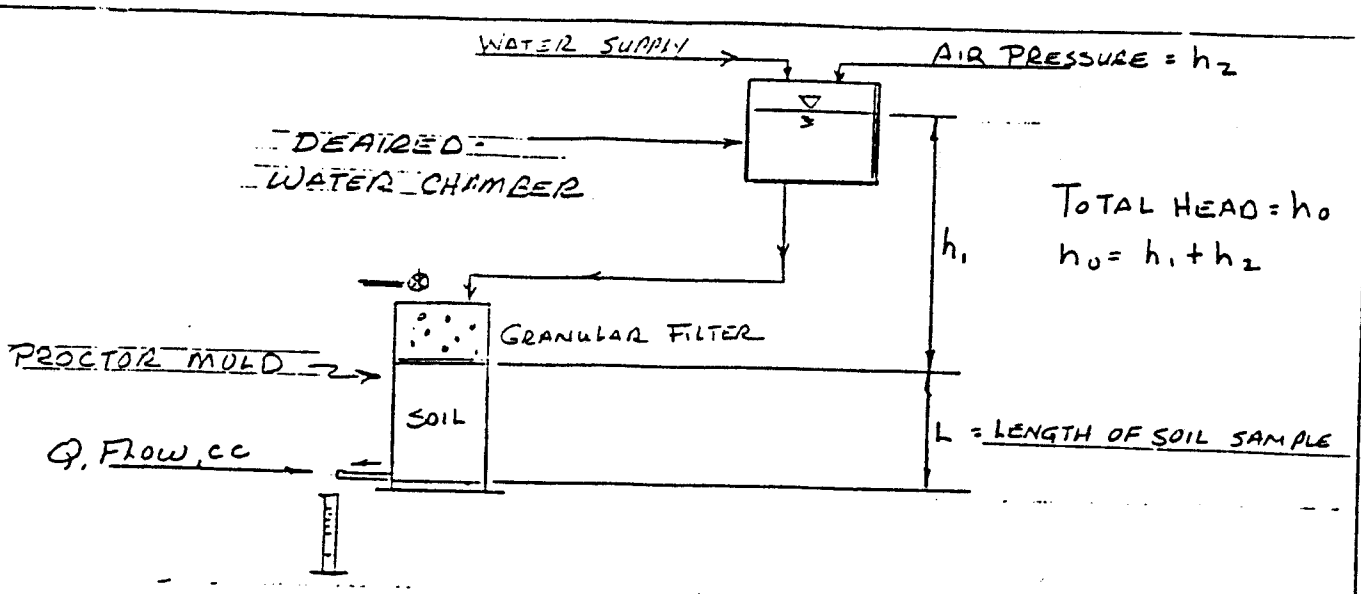
TEST NO.	C°	ELAPSED TIME (sec)	FLOW Q(cc)	PRESSURE HEAD h_1 cm	PRESSURE HEAD h_2 PSI	PRESSURE HEAD h_2 CM	PRESSURE HEAD h_o cm	$\frac{L}{A \cdot h_o}$	k cm/sec
1	22°	4680	4.8				562.56	0.0003	2.62×10^{-7}
2	22°	6060	6.2				562.56	0.0003	2.61×10^{-7}
3	23°	52,380	49.8				562.56	0.0003	2.42×10^{-7}
								Kave	2.55×10^{-7}

SINCE F&R 1881 FROEHLING & ROBERTSON, INC.
MATERIALS TESTING & INSPECTION - ENGINEERS & CHEMISTS
CABLE ADDRESS - "FROEHLING"

DATE: 9-22-88
SCALE: None
DRWN: DEM

PROJECT: City of Durham Landfill Expansion
LOCATION: Durham, NC Pit No. 5 SAMPLE NO. S-2
SOIL DESCRIPTION: Light gray and tan fine sandy SILT. (ML)

DWG. NO.



COEFFICIENT OF PERMEABILITY, $k = \frac{Q \cdot L}{A \cdot h_0 \cdot t}$ cm/sec

AREA = 81.07 cm^2; DIAMETER = 10.16 cm, LENGTH = 11.63 CM

VOL = 942.88 cm^3 WT of SOIL 1669.2 gm. MOISTURE 19.7 %

γ_d = 110.4 PCF, MAX. DRY DENSITY 117.1 PCF % DENSITY 94.2

n = 0.35 $w_{Opt.}$ = 14.1

TEST NO.	C°	ELAPSED TIME (sec)	FLOW Q(cc)	PRESSURE HEAD h_1 cm	h_2 PSI	h_2 cm	h_0 cm	$\frac{L}{A \cdot h_0}$	k cm/sec
1	23°	6240	1.1				597.72	0.0002	4.23×10^{-8}
2	23°	13800	2.2				597.73	0.0002	3.83×10^{-8}
3	23°	19680	3.1				597.72	0.0002	3.78×10^{-8}
								Kave	3.95×10^{-8}

SINCE F&R 1881 FROEHLING & ROBERTSON, INC.
MATERIALS TESTING & INSPECTION - ENGINEERS & CHEMISTS
CABLE ADDRESS - "FROEHLING"

DATE: 9-22-88
SCALE: None
DRWN: DEM

PROJECT: City of Durham Landfill Expansion
LOCATION: Durham, NC Pit No. 2 SAMPLE NO. S-3
SOIL DESCRIPTION: Maroon silty CLAY to clayey SILT. (CL-ML)

DWG. NO.

Club Blvd. Landfill Expansion

TAI and ASSOCIATES

P.O. Box 30691, Raleigh, N.C. 27622 (919) 782-9525

February 1, 1982

RECEIVED
OCT 11 1982
CITY OF DURHAM
SANITATION DIVISION

Mr. H. W. Pickett, Jr.
Director of General Services
City of Durham
101 City Hall Plaza
Durham, North Carolina 27701

Re: Landfill - 1982 Expansion
Durham, North Carolina
Tai Job No. 82-109-1

Dear Mr. Pickett:

As authorized, we have completed a subsurface exploration program for the referenced project. This program consisted of a site visit, the drilling of six soil borings, an analysis, and the preparation of this letter report to present the results of the program.

Field Exploration

The field testing program consisted of the drilling of six soil borings with Standard Penetration Tests (ASTM D-1586) at locations provided by the City of Durham. All borings were drilled to El 290 or slightly lower except for Boring B-1 where auger refusal or nonrippable rock was encountered at El 297.4. The location and descriptive logs of these six borings are attached to this report.

Laboratory Testing

The laboratory testing program consisted of the visual classification of all samples recovered in the borings. The color, consistency, soil type, origin, and N values etc. are shown on the attached six boring logs.

Site Conditions

Based on a topography map and our site visit, the proposed 1982 expansion site of the landfill consists of 30 acres of gently rolling land. The maximum and minimum site elevations are 348.5 and 280, respectively. The proposed landfill operation plan requires that the deepest excavation will be to El 290. This site is located immediately north of

the existing landfill operation and is bounded by streams on the west corner and the northeast side of the site.

Subsurface Materials

Based on the results of the six soil borings performed at the site, the subsurface materials at the site consist of primarily Triassic soil and weathered rock. The soil is mostly silt with varying degrees of fine sand and clay. In the general area of Boring B-5, a 2 foot layer of sandy material was found on the ground surface.

The weathered rock material is primarily Triassic siltstone and/or sandstone. In general, the siltstone weathers into silt and clayey silt while the sandstone weathers into sand and clayey sand. The material that can not be advanced by a power auger is called auger refusal or nonrippable rock. Boring B-1 encountered auger refusal rock at elevation 297.4, about 7.4 feet above the planned landfill excavation.

Groundwater was not encountered in any of the soil borings performed. The Durham Triassic Basin does not have a sizable aquifer and therefore, the concern of groundwater in the planning and design of a landfill is of less concern. It appears that the planned landfill excavation limit of El 290 is adequate from a groundwater consideration. Long-term observation of groundwater level and quality, if required, can be performed by piezometers installed along the perimeter of the landfill site.

Recommendations

Based on the above described information on the subsurface conditions, our recommendations concerning the landfill operation plan are as follows:

1. From a geotechnical engineering standpoint, the site investigated is suitable for the landfill expansion plan.

2. At each boring location, the estimated elevations related to earthwork activities are listed below:

		Elevations	
Boring No.	Exst. Ground Surface	Push by Dozer	Rippable
B-1	329.9'	320	297
B-2	311.0'	290-	

Boring No.	Exst. Ground Surface	Elevations Push by Dozer	Rippable
B-3	324.6'	312	290-
B-4	306.6'	292	287-
B-5	296.8'	287-	
B-6	301.3'	286-	

3. Excavation below the estimated elevation of rippable material will be very difficult and will require light blasting to remove the partially weathered rock.

4. Most of the material to be excavated should provide good borrow as daily and permanent cover material. The partially weathered rock or materials requiring heavy ripping will contain too many large size blocks of broken rock and will not be suitable for cover material.

Closure

We are pleased to have this opportunity to work with you on this project. Please let us know if you have any questions or if you need any additional information or services.

Very truly yours,

Tai and Associates

T. Danny Tai, PH.D., P.E.

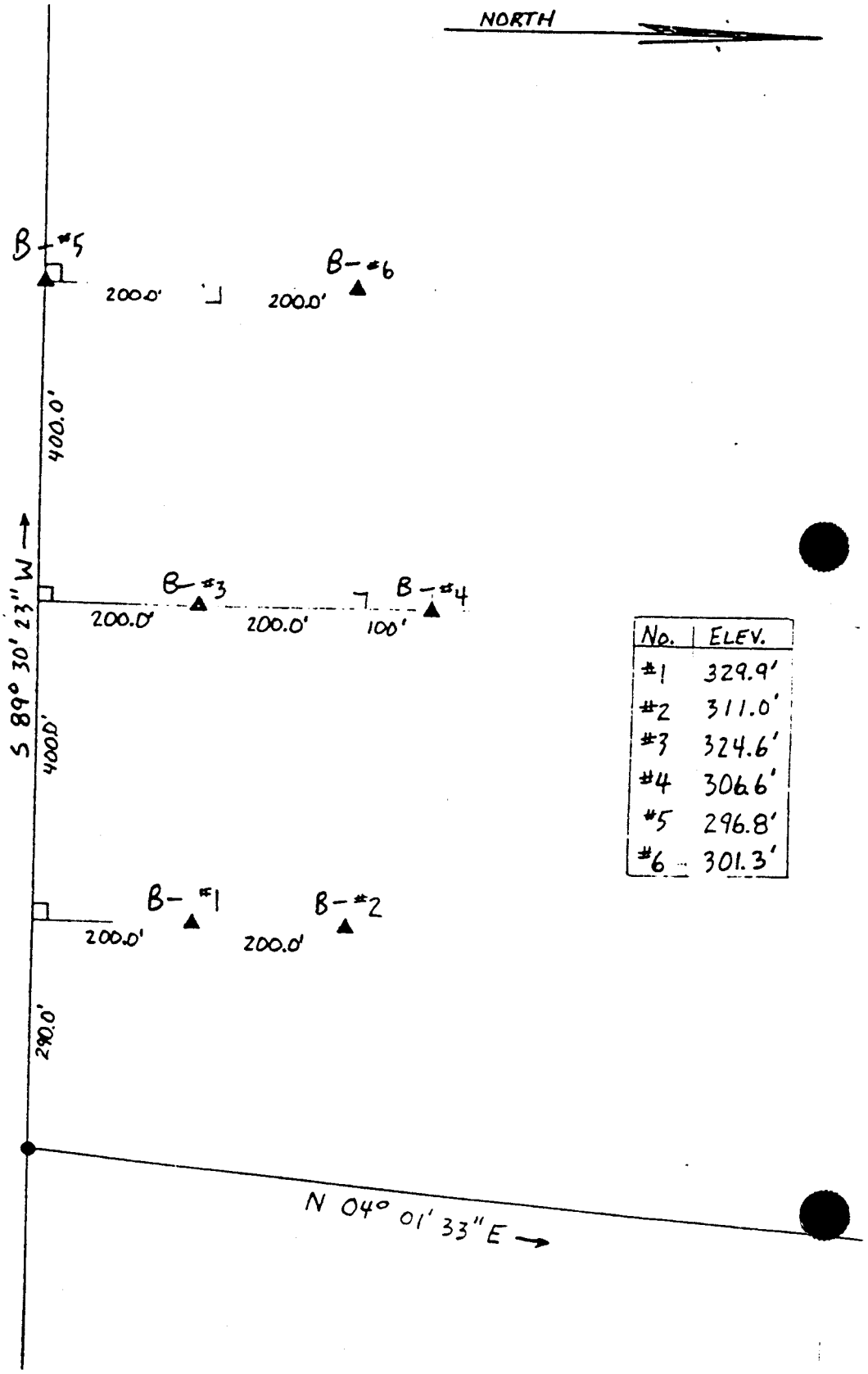
Attachments: 1. Boring Location Plan
2. Boring Logs (6)

TDT:mt

1-25-82
JWR

SKETCH OF TEST HOLE LOCATIONS AND ELEVATIONS

CITY TRACT # 1241



No.	ELEV.
#1	329.9'
#2	311.0'
#3	324.6'
#4	306.6'
#5	296.8'
#6	301.3'

TAI and ASSOCIATES

BORING B-1

PAGE 1 OF 1

PROJECT Landfill Site Study - Tract #1241

LOCATION Durham, North Carolina

DEPTH	DESCRIPTION	G.W.ELEV.	N VALUE (ASTM 1586) 10 20 50
3.0	Reddish brown, stiff, sandy SILT, some mica, residual soil		15
7.0	Brown, hard, sandy SILT, saprolite	325	70
		320	55
	Light brown clayey SAND to sandy SILT. Weathered siltstone	cave in 315	
		310	
		305	
29.2			
32.5	Partially weathered siltstone	300	
	Auger refusal at 32.5' Boring Terminated at 32.5'	295	

BORING LOG

TAI JOB NO. 82-109-1

DATE: 1-26-82

TAI and ASSOCIATES

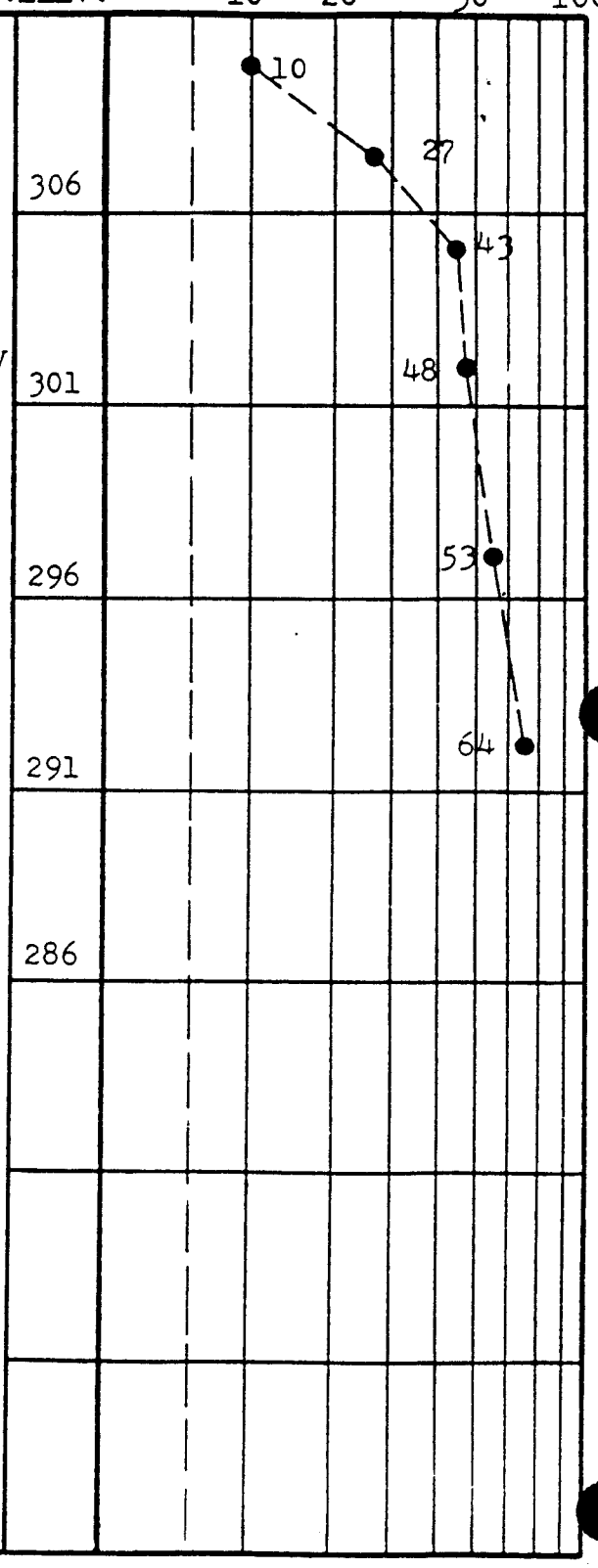
BORING B-2

PAGE 1 OF 1

PROJECT Landfill Site Study - Tract #1241

LOCATION Durham, North Carolina

DEPTH	DESCRIPTION	G.W.ELEV.
1.5	Light brown, stiff, silty SAND	
6.0	Tan, very stiff, sandy SILT; residual soil	
11.6	Grayish brown, hard, sandy SILT, saprolite	dry
21.0	Purple, very hard, sandy SILT, weathered siltstone	
	Boring terminated @ 21.0'	



BORING LOG

TAI JOB NO. 82-109-1

DATE: 1-27-82

TAI and ASSOCIATES

BORING B-3

PAGE 1 OF 1

PROJECT Landfill Site Study - Tract #1241

LOCATION Durham, North Carolina

DEPTH	DESCRIPTION	G.W.ELEV.	N VALUE (ASTM 1586 10 20 50)
	Light brown, very stiff, sandy SILT		320 — 15, 20
5.5			
	Multi colored, very stiff, silty SAND, residual soil		315 — 19, 23
11.4		dry	
	Purple, fine, sandy SILT, weathered siltstone		310, 305, 300, 295, 290
35.0			
	Boring terminated @ 35.0'		

BORING LOG

TAI JOB NO. 82-109-1

DATE: 1-26-82

TAI and ASSOCIATES

BORING B-4

PAGE 1 OF 1

PROJECT Landfill Site Study - Tract #1241

LOCATION Durham, North Carolina

DEPTH	DESCRIPTION	G.W.ELEV.	N VALUE (ASTM 1586) 10 20 50 100
	Multicolored, stiff to very stiff, sandy, micaceous SILT, residual soil	dry	302: 11, 27 / 297: 26, 29
11.3			
	Purple, sandy SILT, weathered siltstone		292: 50/4 / 287: 50/1
20.0			
	Boring terminated @ 20.0'		

BORING LOG

TAI JOB NO. 82-109-1

DATE: 1-28-82

TAI and ASSOCIATES

BORING B-5

PROJECT Landfill Site Study - Tract #1241

PAGE 1 OF 1

LOCATION Durham, North Carolina

DEPTH	DESCRIPTION	G.W.ELEV.	N VALUE (ASTM 1586) 10 20 50
2.0	Tan, loose, silty SAND		6
	Multicolored, very hard, sandy SILT, residual soil	292	36
10.0		dry 287	28
	Boring terminated at 10.0'		

BORING LOG

TAI JOB NO. 82-109-1

DATE: 1-28-82

TAI and ASSOCIATES

BORING B-6

PROJECT Landfill Site Study - Tract #1241

PAGE 1 OF 1

LOCATION Durham, North Carolina

DEPTH	DESCRIPTION	G.W.ELEV.	N VALUE (ASTM 1586) 10 20 50 100
	Light brown, very stiff, sandy, micaceous SILT, residual		19
5.2		296	34
	Purple, hard sand, SILT, saprolite		46
		291	56
15.0			
	Boring terminated at 15.0'	286	60

BORING LOG

TAI JOB NO. 82-109-1

DATE: 1-28-82

APPENDIX C

SOIL TESTING SERVICES

P. O. BOX 12015
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27709
TELEPHONE 919-544-1735

May 3, 1979

Wiggins Rimer and Associates
3024 Pickett Road
Durham, North Carolina 27707

Attention: Mr. Duane K. Stewart

RE: Durham Landfill Expansion
Durham, North Carolina
Job No. 79-135-AA

Gentlemen:

As authorized by Mr. Duane Stewart on March 12, 1979, we have completed the site exploration and analysis for the Durham Landfill Expansion located in northeast Durham, North Carolina. The purpose of this report is to describe the subsurface conditions encountered in the borings and to submit recommendations regarding expansion of the existing landfill. Reference is made to our previous report, "Proposed Jimmy Glenn Road Sanitary Landfill Site", September 17, 1973, (GEC Job No. 73-254-1-B). A copy of this report is attached for your information.

FIELD EXPLORATION

The field exploration consisted of 3 soil borings to a maximum depth of 21.0 feet below the existing ground surface and groundwater observations made in the boreholes at the times noted on the boring logs. The borings were located according to Mr. Stewart's instructions, and were located approximately by pacing. Soil samples were obtained at selected intervals by means of the Split Barrel Sampling Procedure, sealed, and returned to our laboratory for visual examination and

engineering classification. They will be retained for a period of sixty days from the date of this report, after which they will be discarded unless specific instructions as to their disposition are received.

SUBSURFACE CONDITIONS

In general, the subsurface conditions encountered during this exploration were similar to those encountered during the 1973 exploration. At our boring locations, typical subsurface conditions consist of a thin layer of topsoil overlying triassic silts, which in turn are underlain by saprolitic and weathered siltstone and sandstone. Dense materials having blow counts greater than 50 blows per foot were typically encountered at depths of 10 to 15 feet. Boring C-3 was atypical in that dense material was not encountered at the boring termination depth of 21 feet. The logs of the borings and their approximate locations are appended to this report.

Groundwater was not encountered in the C series borings at the time of their completion. However, fluctuations in groundwater level may be expected due to variations in rainfall, temperature, and other factors that may not have been evident at the times our measurements were made. A better description of groundwater conditions may be obtained from the 1973 report.

RECOMMENDATIONS

This exploration and analysis was performed for the expansion of the existing Durham Landfill, for which a report including recommendations was submitted to the city of Durham on September 17, 1973. It is our understanding that expansion is to take place east and southeast of the existing landfill operation. The borings performed during the present exploration confirmed the findings of the previous report and

its recommendations. However, the subsurface conditions and proper procedures may be confirmed by observations during the existing landfill operations.

An idea of the ease with which soil may be excavated can be derived from the results of the standard penetration test. Blow counts up to 75 blows per foot are generally indicative of material that may be excavated with pans or moderate size front end loaders; blow counts in excess of 75 blows per foot are indicative of materials that may be excavated with a D8 dozer properly equipped with a single tooth ripper. Materials that refuse advancement of the auger generally require rock excavation methods such as blasting or presplitting

Additional recommendations pertaining to soil suitability for landfill cover, groundwater and surface water control, and the monitoring of groundwater quality at nearby wells remain the same as stated in the 1973 report.

GENERAL COMMENTS

This report has been prepared for the purpose of providing recommendations for the expansion of the Durham Landfill located northeast of Durham, North Carolina. The information and recommendations reported herein are presented to assist the engineer in the design of this project. In the event there are any significant changes in the plans or location of the landfill expansion from the concepts previously outlined, the conclusions and recommendations contained in this report shall not be considered valid unless these changes have been reviewed and our conclusions and recommendations reaffirmed or appropriately modified, in writing, by the writer or other authorized representative of this firm. The General Conditions included in the appendix are an integral part of this report.

There is a possibility that variations in soil conditions will be encountered during construction. It is recommended that this firm be retained to provide periodic, on-site construction review during the earthwork phase of this project.

The foregoing report has been prepared under the supervision of and is submitted by

Ernest F. Parker, Jr., P.E.

T. Danny Tai, Ph.D., P.E.

SOIL TESTING SERVICES OF CAROLINA, INC.

Sheet 1 of 1

PROJECT	TOTAL DEPTH	SURFACE ELEVATION	BORING NO.
Durham Landfill Expansion Durham, North Carolina	16.0 FT. DATUM		C-1

SIZE & TYPE OF BIT	JOB NO.	WATER TABLE DATA — DEPTH BELOW SURFACE	
6" Cutter Head	79-135-AA	None @ 0 HRS. ____ @ ____ HRS.	DATE STARTED 4/26/79
DRILLING METHOD: Hollow Stem Auger	DRILLER: Fetty	____ @ ____ HRS. AFTER BAILING	DATE COMPLETED 4/26/79

DEPTH In Feet	CLASSIFICATION	Sample No.	From To	Blows/Ft. ASTM D1586-58T	REMARKS
	TOPSOIL and ROOTMAT.				
	Reddish brown and tan SILT with some local very fine sand.	1	2.5' 3.5'	12	
5		2	5.0' 6.0'	34	
	SILTSTONE SAPROLITE, appears in a disturbed sample as reddish brown and tan silt with some local very fine sand.	3	7.5' 8.5'	31	
10		4	10.0' 11.0'	38	
15		5	15.0' 16.0'	63	
	*				* WEATHERED SILTSTONE, appears in a disturbed sample as purple-tan fine sandy silt.
	BORING TERMINATED 16.0'.				
20					
25					
30					
35					

Sheet 1 of 1

PROJECT
Durham Landfill Expansion
Durham, North Carolina

TOTAL DEPTH 15.5 FT.
DATUM

SURFACE ELEVATION

BORING NO. C-2

SIZE & TYPE OF BIT: 6" Cutter Head
JOB NO.: 79-135-AA
DRILLING METHOD: Hollow Stem Auger
DRILLER: Fetty

WATER TABLE DATA — DEPTH BELOW SURFACE
None @ 0 HRS. ____ @ ____ HRS.
____ @ ____ HRS. AFTER BAILING

DATE STARTED 4/26/79
DATE COMPLETED 4/26/79

DEPTH In Feet	CLASSIFICATION	Sample No.	From To	Blows/Ft. ASTM D1586-58T	REMARKS
	TOPSOIL				
5	Reddish brown and tan SILT with local traces of clay and fine sand.	1	2.5' 3.5'	7	
		2	5.0' 6.0'	19	
		3	7.5' 8.5'	26	
10	WEATHERED SANDSTONE, appears in a disturbed sample as a lightly cemented tan silty fine sand with a trace of mica.	4	10.0' 11.0'	55	
15		5	15.0' 15.5'	60/.5	
	BORING TERMINATED 15.5'.				
20					
25					
30					
35					

PROJECT	TOTAL DEPTH	SURFACE ELEVATION	BORING NO.
Durham Landfill Expansion Durham, North Carolina	21.0 FT. DATUM		C-3

SIZE & TYPE OF BIT	JOB NO.	WATER TABLE DATA — DEPTH BELOW SURFACE	
6" Cutter Head	79-135-AA	Cave-In 12.0' @ 0 HRS. ____ @ ____ HRS. ____ @ ____ HRS. AFTER BAILING	DATE STARTED 4/26/79 DATE COMPLETED 4/26/79
DRILLING METHOD: Hollow Stem Auger	DRILLER: Fetty		

DEPTH In Feet	CLASSIFICATION	Sample No.	From To	Blows/Ft. ASTM D1586-58T	REMARKS
	Yellow and grey mottled CLAYEY FINE to MEDIUM SAND.	1	2.5' 3.5'	13	
5		2	5.0' 6.0'	20	
	Brown, tan, and grey SILT with some fine sand and local traces of clay.	3	7.5' 8.5'	21	
10		4	10.0' 11.0'	18	
15	Tan SILTY FINE SAND with a trace to some clay.	5	15.0' 16.0'	15	
20		6	20.0' 21.0'	11	
	BORING TERMINATED 21.0'.				
25					
30					
35					

APPENDIX C

WELL CONSTRUCTION LOGS

WELL RECORD
DE-1

DIVISION OF ENVIRONMENTAL MANAGEMENT
P. O. Box 27687 — RALEIGH, N.C. 27611 919-733-2020

DRILLING CONTRACTOR Law Engineering REG. NO. 332 WELL CONSTRUCTION PERMIT NO. 31-0274

WM-00

1. WELL LOCATION: (Show sketch of the location below)

Nearest Town: Durham, North Carolina County: Durham

2115 E. Club Blvd. Quadrangle No.
(Road, Community or Subdivision and Lot No.)

2. OWNER: City of Durham, North Carolina

3. ADDRESS: 101 City Hall Plaza, Durham, NC

4. TOPOGRAPHY: ~~xxxxxxxx~~ slope ~~xxxxxxxx~~ (circle one)

5. USE OF WELL: Groundwater monitoring DATE: 04-18-85

6. DOES THIS WELL REPLACE AN EXISTING WELL? No

7. TOTAL DEPTH: 80' RIG TYPE OR METHOD: wash w/clear water

8. FORMATION SAMPLES COLLECTED: YES ____ NO X

9. CASING:

	Depth		Inside Dia.	Wall thick. or weight/ft.	type
From	0	to 68 ft	2.047"	Sch. 40	PVC

10. GROUT:

	Depth		Material	Method
From	0	to 64 ft	Cement	Pumped

11. SCREEN:

	Depth		Dia.	Type & Opening
From	68	to 78 ft	2.047"	PVC Sch. 40
	273	to 263		Slot .010

12. GRAVEL:

	Depth		Size	Material
From	66	to 80 ft	#78m	Gravel

13. WATER ZONES (depth): 66'

14. STATIC WATER LEVEL: 68' ft. ~~xxxxx~~ below top of casing
Casing is 2 ft. above land surface ELEV: 341

15. YIELD (gpm): N/A METHOD OF TESTING: N/A

16. PUMPING WATER LEVEL: N/A ft.
after ____ hours at ____ gpm.

17. CHLORINATION: Type N/A Amount ____

18. WATER QUALITY: N/A TEMPERATURE (°F) ____

19. PERMANENT PUMP: Date Installed N/A
Type ____ Capacity ____ (gpm) HP ____
Make ____ Intake Depth ____
Airline Depth ____

20. HAS THE OWNER BEEN PROVIDED A COPY OF THIS RECORD AND INFORMED OF THE DEPARTMENTS REQUIREMENTS AND RECOMMENDATIONS? Yes

21. REMARKS

I do hereby certify that this well was constructed in accordance with N.C. Well Construction Regulations and Standards and that this well record is true and exact.

Stanley J. Kaywood 4-23-85
SIGNATURE OF CONTRACTOR OR AGENT DATE

DRILLING LOG

DEPTH FROM	TO	FORMATION DESCRIP
		Samples not obtained

If additional space is needed, use back of f

LOCATION SKETCH
(Show distance to numbered roads, or other map reference po

See Attached Map
per Barr, Palmer & Associates

DTW 34.52 = 306.48 ft. Elev

Casing @ 341 ft

GW-1 Revised 10/1/80

Submit original to Division of Environmental Management and copy to well ow

TYPE II MONITORING WELL INSTALLATION RECORD

JOB NAME City of Durham, N.C. Landfill — JOB NUMBER J47185-0756

WELL NUMBER DL-1 — INSTALLATION DATE 04-18-85

LOCATION 2115 East Club Blvd., Sanitary Landfill (See attached map)

GROUND SURFACE ELEVATION 341' — REFERENCE POINT ELEVATION

GRANULAR BACKFILL MATERIAL #78m Gravel — SLOT SIZE .010

SCREEN MATERIAL PVC sch .40 — SCREEN DIAMETER 2.047 I.D.

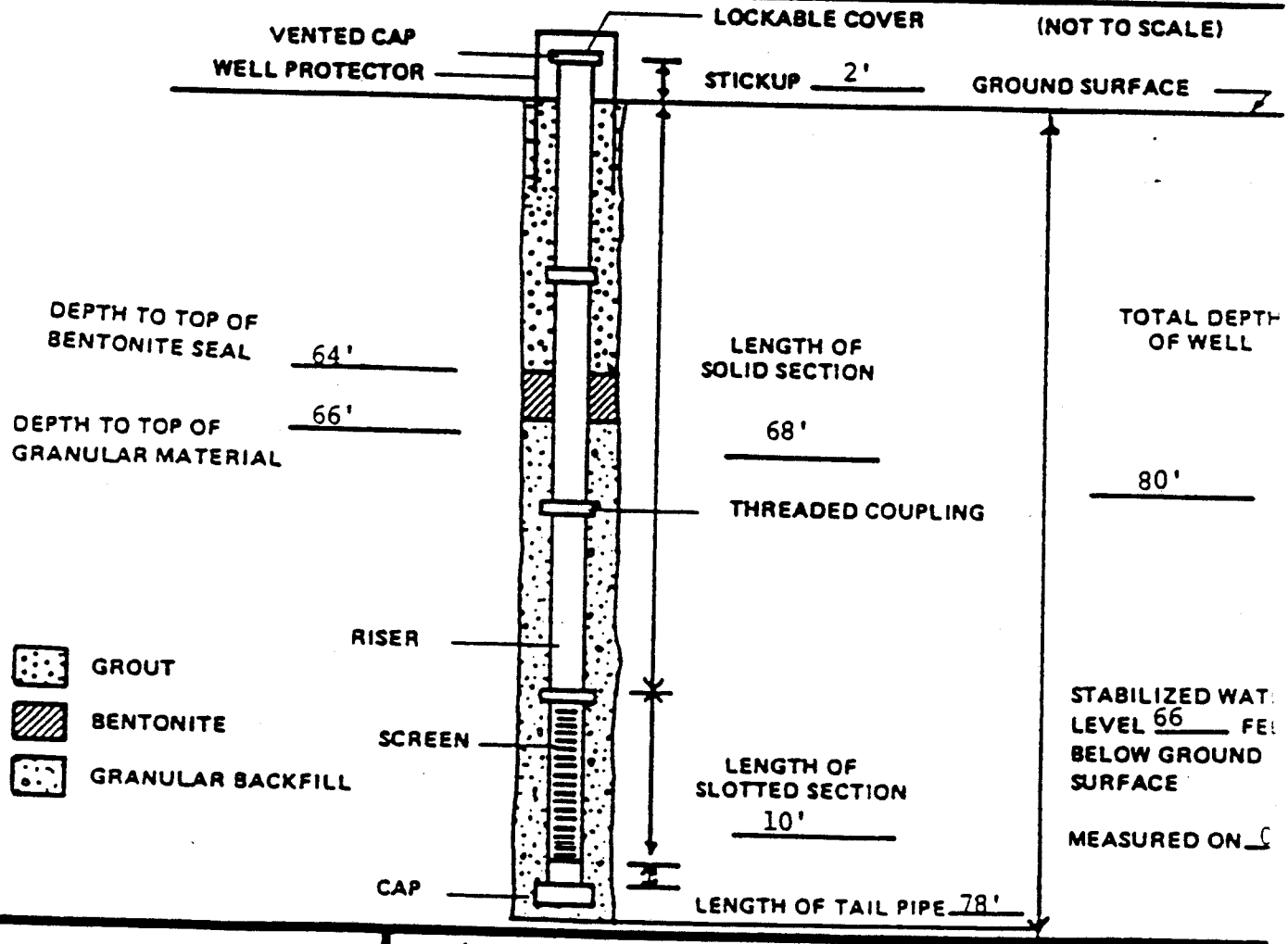
RISER MATERIAL PVC sch .40 — RISER DIAMETER 2.047 I.D.

DRILLING TECHNIQUE Wash w/ clear water — DRILLING CONTRACTOR LETCO

BOREHOLE DIAMETER 4" — LAW ENGINEERING FIELD REPRESENTATIVE J. Bayles, Sr.

LOCK BRAND — SIZE/MODEL

KEY CODE/COMBINATION



LAW ENGINEERING TESTING COMPANY

TYPE II MONITORING WELL INSTALLATION RECORD

FIGURE 2

NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES & COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT
P. O. Box 27687 — RALEIGH, N.C. 27611 919-733-2020

WELL RECORD DL-2

DRILLING CONTRACTOR Law Engineering REG. NO. 332 WELL CONSTRUCTION PERMIT NO. 31-0274-WM-0037

1. WELL LOCATION: (Show sketch of the location below)

Nearest Town: Durham, North Carolina County: Durham

2115 E. Club Blvd. Quadrangle No. _____

(Road, Community or Subdivision and Lot No.)

2. OWNER: City of Durham, North Carolina

3. ADDRESS: 101 City Hall Plaza, Durham, NC

4. TOPOGRAPHY: ~~XXXX~~ valley ~~XXXXXXXXXXXXXXXX~~ circle one)

5. USE OF WELL: Groundwater Monitoring DATE: 04-19-85

6. DOES THIS WELL REPLACE AN EXISTING WELL? No

7. TOTAL DEPTH: 20' RIG TYPE OR METHOD: Wash w/ clear water

8. FORMATION SAMPLES COLLECTED: YES ____ NO X

9. CASING:

	Depth		Inside Dia.	Wall thick. or weight/ft.	type
From 0	to 8	ft	2.047"	sch .40	PVC

10. GROUT:

	Depth		Material	Method
From 0	to 6	ft	Cement	Pumped

11. SCREEN:

	Depth		Dia.	Type & Opening
From 8	to 18	ft	2.047"	PVC sch .40
				Slot .010

12. GRAVEL:

	Depth		Size	Material
From 7	to 20	ft	#78m	Gravel

13. WATER ZONES (depth): 8'

14. STATIC WATER LEVEL: 10 ft. ~~XXXX~~ below top of casing

Casing is 2 ft. above land surface ELEV: 290

15. YIELD (gpm): N/A METHOD OF TESTING: N/A

16. PUMPING WATER LEVEL: N/A ft.

after _____ hours at _____ gpm.

17. CHLORINATION: Type N/A Amount _____

18. WATER QUALITY: N/A TEMPERATURE (°F) _____

19. PERMANENT PUMP: Date Installed N/A

Type _____ Capacity _____ (gpm) HP _____

Make _____ Intake Depth _____

Airline Depth _____

20. HAS THE OWNER BEEN PROVIDED A COPY OF THIS RECORD AND INFORMED OF THE DEPARTMENTS REQUIREMENTS AND RECOMMENDATIONS? Yes

21. REMARKS _____

I do hereby certify that this well was constructed in accordance with N.C. Well Construction Regulations and Standards and that this well record is true and exact.

Stanley J. Harward 4-23-85

SIGNATURE OF CONTRACTOR OF AGENT DATE

DRILLING LOG

DEPTH FROM	TO	FORMATION DESCRIPTION
		Samples not obtained

If additional space is needed, use back of form

LOCATION SKETCH
(Show distance to numbered roads, or other map reference points)

See Attached Map

TYPE II MONITORING WELL INSTALLATION RECORD

JOB NAME City of Durham, N.C. Landfill — JOB NUMBER J47185-0756

WELL NUMBER DL-2 — INSTALLATION DATE 04-19-85

LOCATION 2115 E. Club Blvd. Sanitary Landfill (See Attached Map)

GROUND SURFACE ELEVATION 290' — REFERENCE POINT ELEVATION

GRANULAR BACKFILL MATERIAL #73m Gravel — SLOT SIZE .010

SCREEN MATERIAL PVC sch .40 — SCREEN DIAMETER 2.047" I.D.

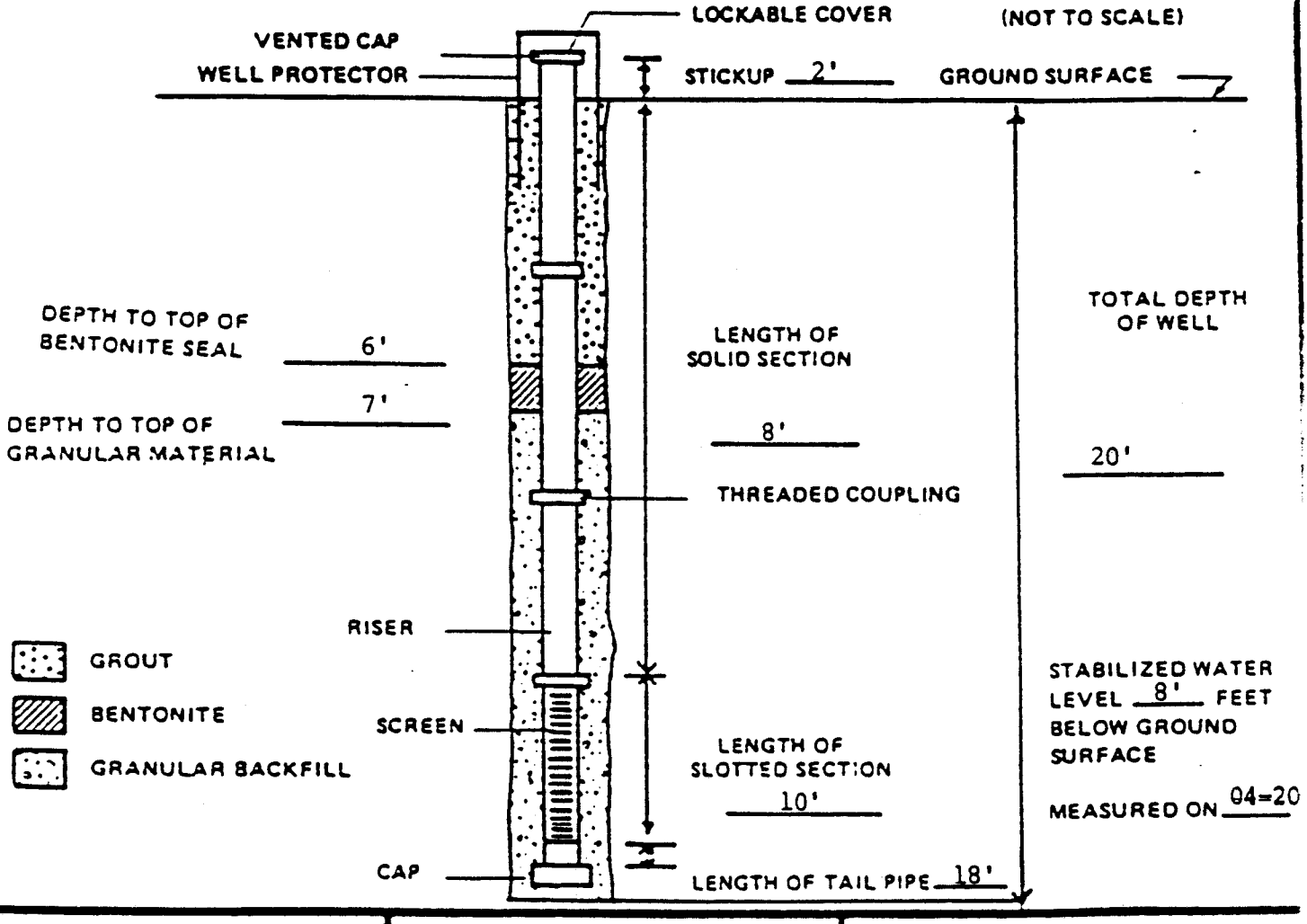
RISER MATERIAL PVC sch .40 — RISER DIAMETER 2.047" I.D.

DRILLING TECHNIQUE Wash w/clear water — DRILLING CONTRACTOR LETCO

BOREHOLE DIAMETER 4" — LAW ENGINEERING FIELD REPRESENTATIVE J. Bayles, Sr.

LOCK BRAND — SIZE/MODEL

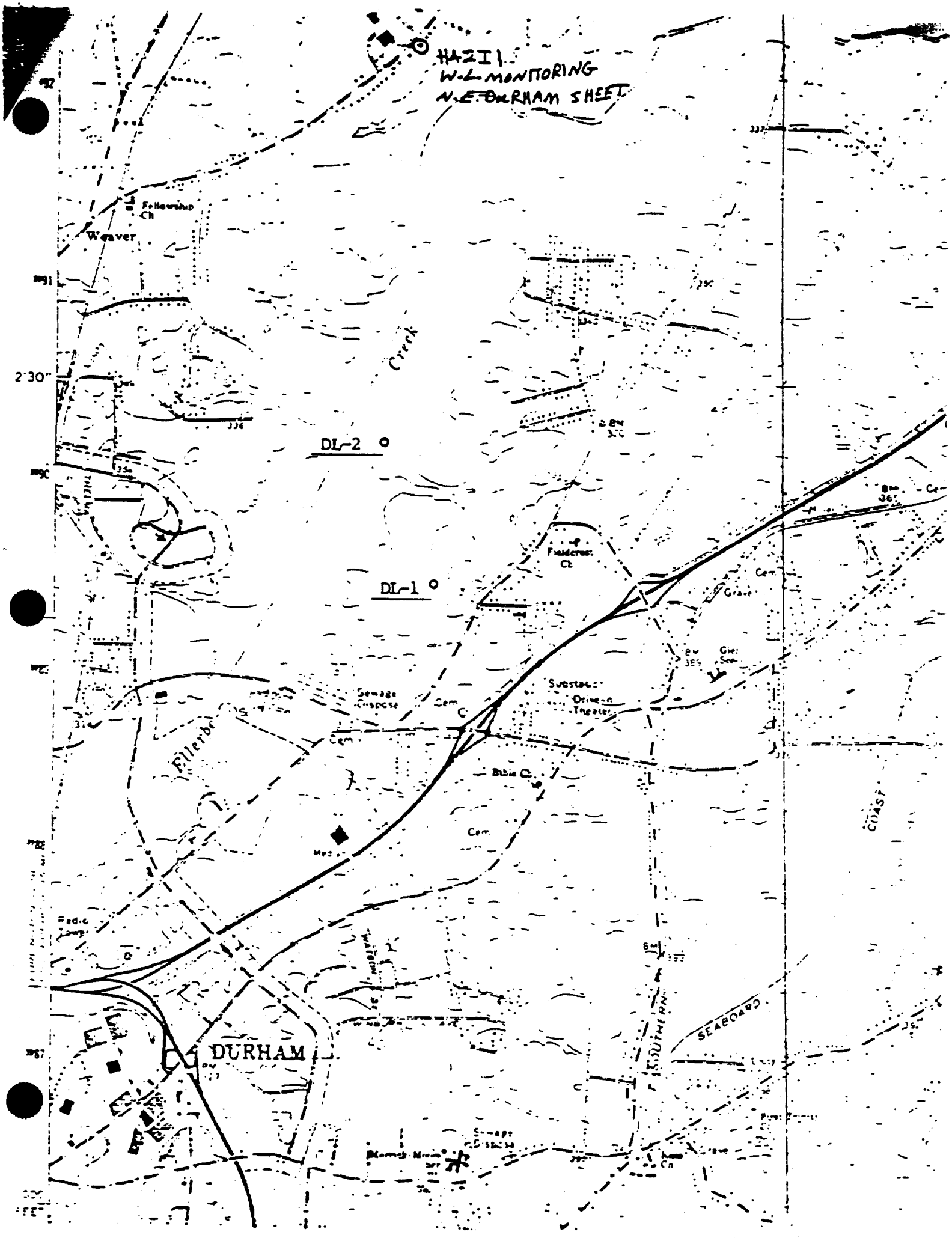
KEY CODE/COMBINATION



LAW ENGINEERING TESTING COMPANY

TYPE II MONITORING WELL INSTALLATION RECORD

FIGURE 2


HAZI 1
W.L. MONITORING
N.E. DURHAM SHEET
Fellowship Ch
Weaver
Creek
2'30"
DL-2
DL-1
Fieldcrest Ch
Sewage Disposal
Cem
Substation
Drive-in Theater
Ellerbe
Bible Ch
Radio Tower
DURHAM
SOUTHERN
SEABOARD
COAST
Sewage Disposal

NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH, N.C. 27611, PHONE (919) 733-6083

FOR OFFICE USE ONLY
Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc ____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

MW-3

DRILLING CONTRACTOR Froehling & Robertson, Inc.

DRILLER REGISTRATION NUMBER 421

STATE WELL CONSTRUCTION PERMIT NUMBER: 31-0274-WM-0081

WELL LOCATION: (Show sketch of the location below)

Nearest Town: Durham

County: Durham County

2115 E. Club Boulevard
(Road, Community, or Subdivision and Lot No.)

OWNER City of Durham

ADDRESS 101 City Hall Plaza
(Street or Route No.)

Durham, NC 27701 27701
City or Town State Zip Code

DATE DRILLED 11-9-88 USE OF WELL Monitoring

TOTAL DEPTH 25 CUTTINGS COLLECTED ☐ Yes ☒ No

DOES WELL REPLACE EXISTING WELL? ☐ Yes ☒ No

STATIC WATER LEVEL: 8'-4" FT. ☐ above ☐ below TOP OF CASING.

TOP OF CASING IS 2.0 FT. ABOVE LAND SURFACE.

YIELD (gpm): N/A METHOD OF TEST _____

WATER ZONES (depth): _____

CHLORINATION: Type N/A Amount _____

CASING:

	Depth From	To	Ft.	Diameter	Wall Thickness or Weight/Ft.	Material
	0	13		2	Sch. 40	PVC

GROUT:

	Depth From	To	Ft.	Material	Method
	0	6		cement/sand	gravity

SCREEN:

	Depth From	To	Ft.	Diameter		Slot Size		Material
	13	23		2	in.	0.01	in.	PVC
					in.		in.	
					in.		in.	

GRAVEL PACK:

	Depth From	To	Ft.	Size	Material
	8	25		8-16	sand

REMARKS: _____

Depth From	To	DRILLING LOG Formation Description
0.0'	0.5'	- Brown fibrous topsoil.
0.5'	2.0'	- Loose, tan silty sand (alluvium). (SM)
2.0'	6.5'	- Soft, gray silty Clay. (CH)
6.5'	8.0'	- Firm, light gray and tan silty clay. (CL)
8.0'	11.0'	- Stiff, light gray and tan silty sandy clay. (CL-SC)
11.0'	16.0'	- Medium dense, brown silty fine to medium sand. (SM)
16.0'	25.0'	Very dense, light gray silt sand - Triassic sandstone.
		Boring terminated at 25.0'.

13 + 10 = 23

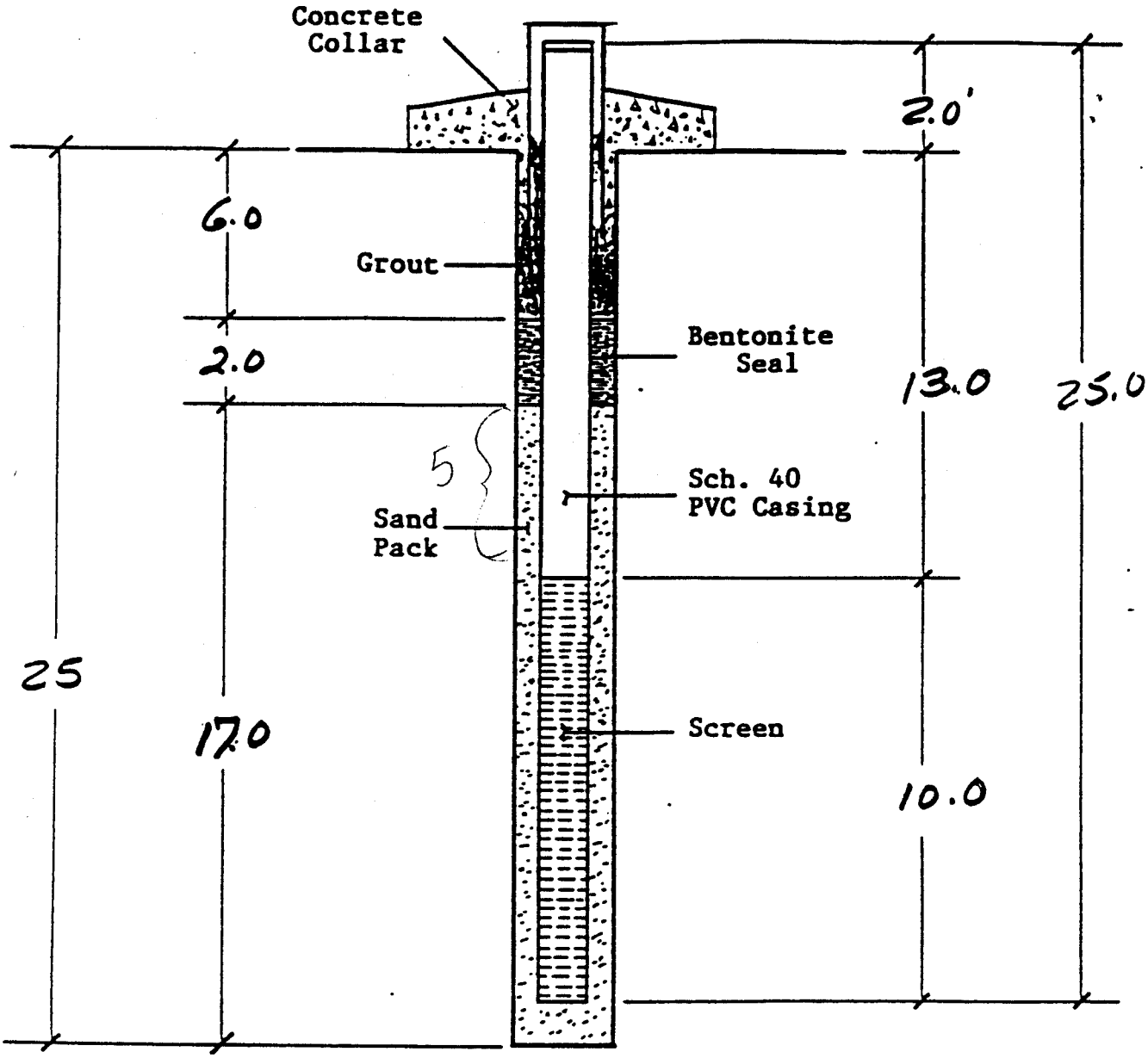
If additional space is needed use back of form.

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Paul J. Ruben 11-10-88

WELL NO. MW-3



Note: GWL @ 8'4" Below top of PVC CASING (Recharges immediately after pumping)

SINCE F&R 1881 FROEHLING & ROBERTSON, INC.
MATERIALS TESTING & INSPECTION – ENGINEERS & CHEMISTS
CABLE ADDRESS – "FROEHLING"

DATE: 11-9-88
SCALE:
DRWN:

SCHEMATIC OF WELL CONSTRUCTION
CITY OF DURHAM LANDFILL

DWG. NO.

Form No. 899

BORING LOG

SINCE 1881

FROEHLING & ROBERTSON, INC.
FULL SERVICE LABORATORIES • ENGINEERS & CHEMISTS
"OVER ONE HUNDRED YEARS OF SERVICE"

Report No. P-66-313 DATE 11-9-88

Client: City of Durham, Durham, NC

Project: Landfill Site, 2115 E. Club Boulevard, Durham, NC

Boring No.: MW-3 | Total Depth: 25.0 ft. | Elevation: | Location:

Type of Boring: 3.25" I.D. HSA | Started: 11-9-88 | Completed: 11-9-88 | Driller: W. Dew

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	N	Sample No.	REMARKS
	0.0'						
	0.5'	Brown fibrous topsoil.	WOT				
	2.0'	Loose, tan silty SAND (alluvium). (SM)	1 2	1.5	3	S-1	GROUNDWATER DATA
				2.0			6 ft. at 24 hours
		Soft, gray silty CLAY. (CH)	3 1 2	3.5	3	S-2	
			1 2 2	5.0	4	S-3	WOT = Weight of Tools
	6.5'			6.0			
	8.0'	Firm, light gray and tan silty CLAY. (CL)	3 4 4	7.5	8	S-4	
		Stiff, light gray and tan silty sandy CLAY. (CL-SC)		8.5			
	11.0'		4 6 5	10.0	11	S-5	
		Medium dense, brown silty fine to medium SAND. (SM)		13.5			
	16.0'		5 5 4	15.0	9	S-6	
		Very dense, light gray silty SAND - Triassic sandstone.	50	18.5 18.6	50/1"	S-7	
	25.0'		50	23.5 23.6	50/1"	S-8	
		Boring terminated at 25.0 feet.					

NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH,N.C. 27611, PHONE (919) 733-3083

FOR OFFICE USE ONLY
Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc ____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

MW-4

DRILLING CONTRACTOR Froehling & Robertson, Inc.

DRILLER REGISTRATION NUMBER 421

STATE WELL CONSTRUCTION PERMIT NUMBER: 31-0274-WM-0081

WELL LOCATION: (Show sketch of the location below)

Nearest Town: Durham
2115 E. Club Boulevard
(Road, Community, or Subdivision and Lot No.)

County: Durham County

OWNER City of Durham

ADDRESS 101 City Hall Plaza
(Street or Route No.)

Durham, NC 27701
City or Town State Zip Code

DATE DRILLED 11-8-88 USE OF WELL Monitoring

TOTAL DEPTH _____ CUTTINGS COLLECTED ☐ Yes ☒ No

DOES WELL REPLACE EXISTING WELL? ☐ Yes ☒ No

STATIC WATER LEVEL: 10 FT. ☐ above ☐ below TOP OF CASING.

TOP OF CASING IS 2 FT. ABOVE LAND SURFACE.

YIELD (gpm): N/A METHOD OF TEST _____

WATER ZONES (depth): _____

CHLORINATION: Type N/A Amount _____

CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From	0	To 10.5 Ft.	2	Sch. 40	PVC
From		To Ft.			
From		To Ft.			

GROUT:

	Depth		Material	Method
From	0	To 4 Ft.	cement/sand	gravity
From		To Ft.		

SCREEN:

	Depth		Diameter	Slot Size	Material
From	10.5	To 20.0 Ft.	2 in.	0.01 in.	PVC
From		To Ft.	in.	in.	
From		To Ft.	in.	in.	

GRAVEL PACK:

	Depth		Size	Material
From	8	To 23 Ft.	8-16	sand
From		To Ft.		

REMARKS. _____

Depth From	Depth To	DRILLING LOG Formation Description
0.0'	1.5'	Brown organic silty topsoil with fibers.
1.5'	4.0'	Firm, light gray and tan silt clay with fine sand (CL).
4.0'	7.5'	Dense, light tan silty sand (weathered rock structure).
7.5'	23.0'	Very dense, brown silty sand Triassic sandstone.
		Boring terminated at 23.0 ft.

If additional space is needed use back of form.

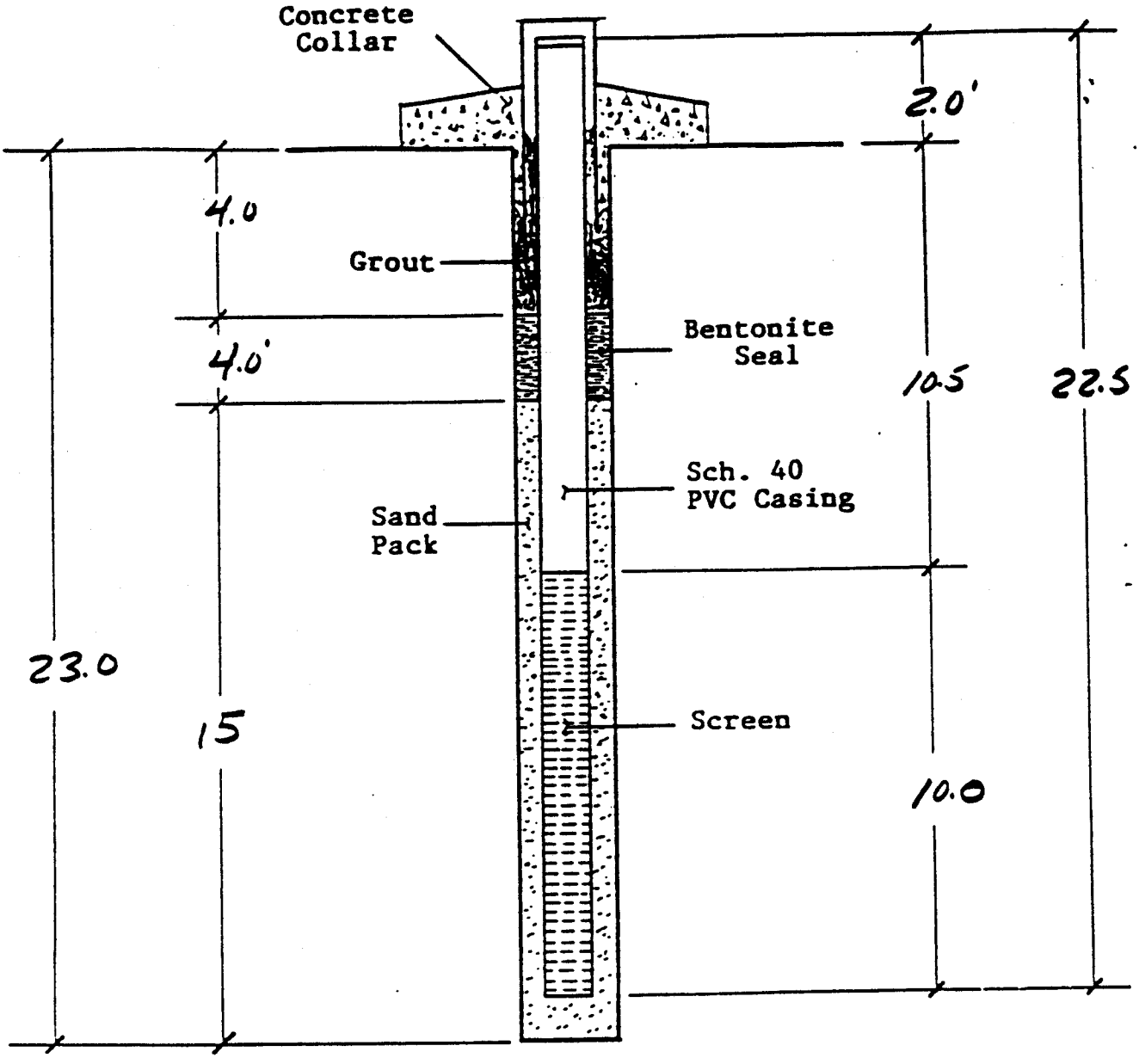
LOCATION SKETCH

(Show direction and distance from at least two State Roads, or other map reference points)

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Ray T. Whitaker 11-18-88

WELL NO. MW-4



NOTE: GWL 12'-6" below TOP OF PVC CASING after pumping

SINCE 1881 F&R FROEHLING & ROBERTSON, INC.
MATERIALS TESTING & INSPECTION – ENGINEERS & CHEMISTS
CABLE ADDRESS – "FROEHLING"

DATE: 11-8-88
SCALE:
DRWN:

SCHEMATIC OF WELL CONSTRUCTION
CITY OF DURHAM LANDFILL

DWG. NO.

Form No. 500

BORING LOG

SINCE 1881

FROEHLING & ROBERTSON, INC.

FULL SERVICE LABORATORIES • ENGINEERS & CHEMISTS

"OVER ONE HUNDRED YEARS OF SERVICE"

Report No. P-66-313 DATE 11-8-88

Client	City of Durham, Durham, NC		
Project	Landfill Site, 2115 E. Club Boulevard, Durham, NC		
Boring No. MW-4	Total Depth 23.0 ft.	Elevation:	Location:
Type of Boring 3.25" I.D. HSA	Started: 11-8-88	Completed: 11-8-88	Driller: W. Dew

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	N	Sample No.	REMARKS
	0.0'						
	1.5'	Brown ogranic silty topsoil with fibers.	1/12 1	1.5	1	S-1	GROUNDWATER DATA
		Firm, light gray and tan silty clay with fine sand. (CL)		2.0			
	4.0'		1 2 3	3.5	5	S-2	8.0 ft. at 24 hours
		Dense, light tan silty SAND - weathered rock structure.	5 13 32	5.0	45	S-3	
				6.0			
	7.5'		47 62	6.8	100+	S-4	
			50	8.3 8.5	50/3"	S-5	
			50	13.5 13.7	50/2"	S-6	SNR
		Very dense, brown silty sand - Triassic sandstone.					
			50	18.5 18.7	50/2"	S-7	SNR
							SNR - Sample not recovered
	23.0'						
		Boring terminated at 23.0 feet.					

TGM

BAIN, PALMER & ASSOCIATES, INC.

MONITORING WELL INSTALLATION SKETCH

Project DURHAM LANDFILL

Surveyed by BAIN, PALMER & ASSOC., INC.

Surveyed from TBM, ASSUME 343 FT. EL.

Elevation of concrete pad reference point (bolt) 340.53 FT.

Elevation of top of well pipe 343.21 FT.

Approximate elevation of land surface 340.53 FT.

Well Number P-1

Constructed on 12/21/93

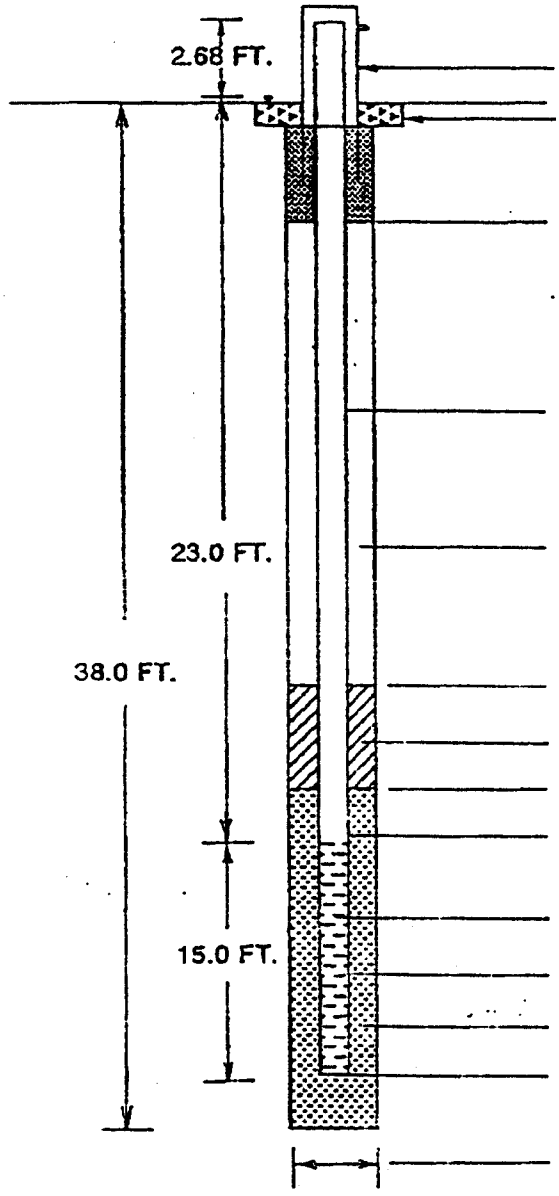
Depth to water measured from top of well pipe 14.81 FT.

Water level elevation 328.40 FT.

Water level taken on 1/10/94

NOTE: Drawing not to scale.

DRAFT



Protective casing dimensions	4X4X48 IN.
Concrete pad dimensions	22X22X3.5 IN.
Thickness of surface seal	3 FT.
Type of surface seal	CONCRETE
I.D. of riser pipe	2 IN.
Type of riser pipe	SCH. 40 PVC
Type of backfill	CEMENT
Elevation of top of seal	321.53 FT.
Type of seal	BENTONITE
Top elevation of filter pack	319.53 FT.
Top elevation of screen	317.53 FT.
Size of screen openings	0.010 IN.
Well screen diameter	2 IN.
Type of filter pack	CLEAN SAND
Bottom elevation of well	302.53 FT.
Diameter of borehole	8 IN.

BAIN, PALMER & ASSOCIATES, INC.
Environmental Consultants

Client Durham Landfill — Boring No. P-1
Project Durham Landfill — Driller Trigon Engineering
Total Depth 38.0 ft. — Elevation 340.53 ft. — Boring Type & Size H. S. Auger Tricone
Date Started 12/20/93 — Date Ended 12/21/93 — Logged By James M. Allen
Depth to Water 12.13 ft. — Date Measured 1/10/94 — Water Level Elevation 328.40

DEPTH (FEET)	ELEVATION FT AMSL	BLOWS PER 6 IN.	PERCENT RECOVERY	UNIFIED CLASS.	LITHOLOGIC DESCRIPTION	REMARKS
	339				DRAFT	
2						
	337	3 8 12 13	75	ML	SILT with some VERY FINE SAND, soft-to-stiff, gray tan, dry.	
4						
	335					
6						
	333					
8						
		18 43 50	75	ML	SILT with some VERY FINE SAND, very stiff-to-hard, gray-to-reddish brown, dry.	
	331					50 Blow counts for 4.0".
10						
	329					
12						
14.8' DTW ▼	327	28 50	70	ML	Same as above.	50 Blow counts for 4.0".
14						
	325					
16						
	323				DRAFT	
18						
		30 50	70	ML	Same as above, hard.	
	321					50 Blow counts for 4.0".
20						

BAIN, PALMER & ASSOCIATES, INC.
Environmental Consultants

Client Durham Landfill — Boring No. P-1
Project Durham Landfill — Driller Trigon Engineering
Total Depth 38.0 ft. — Elevation 340.53 ft. — Boring Type & Size H. S. Auger Tricone
Date Started 12/20/93 — Date Ended 12/21/93 — Logged By James M. Allen
Depth to Water 12.13 ft. — Date Measured 1/10/94 — Water Level Elevation 328.40

DEPTH (FEET)	ELEVATION FT AMSL	BLOWS PER 6 IN.	PERCENT RECOVERY	UNIFIED CLASS.	LITHOLOGIC DESCRIPTION	REMARKS
22	319				DRAFT	
24	317	50	33	SM	SAND with some SILT, hard, tan, dry.	50 Blow counts for 3.0".
26	315					
28	313					
30	311	50	50	SM	Same as above.	50 Blow counts for 1.0".
32	309					
34	307	50	50	SM	Same as above.	50 Blow counts for 4.0".
36	305					
38	303					Boring Terminated at 38.0 ft.
40	301					Set Well at 38.0 ft.

DRAFT

BAIN, PALMER & ASSOCIATES, INC.

MONITORING WELL INSTALLATION SKETCH

Project DURHAM LANDFILL

Surveyed by BAIN, PALMER & ASSOC., INC.

Surveyed from TBM, ASSUME 343 FT. EL.

Elevation of concrete pad reference point (bolt) 339.93 FT.

Elevation of top of well pipe 342.21 FT.

Approximate elevation of land surface 339.93 FT.

Well Number P-2

Constructed on 12/17/93

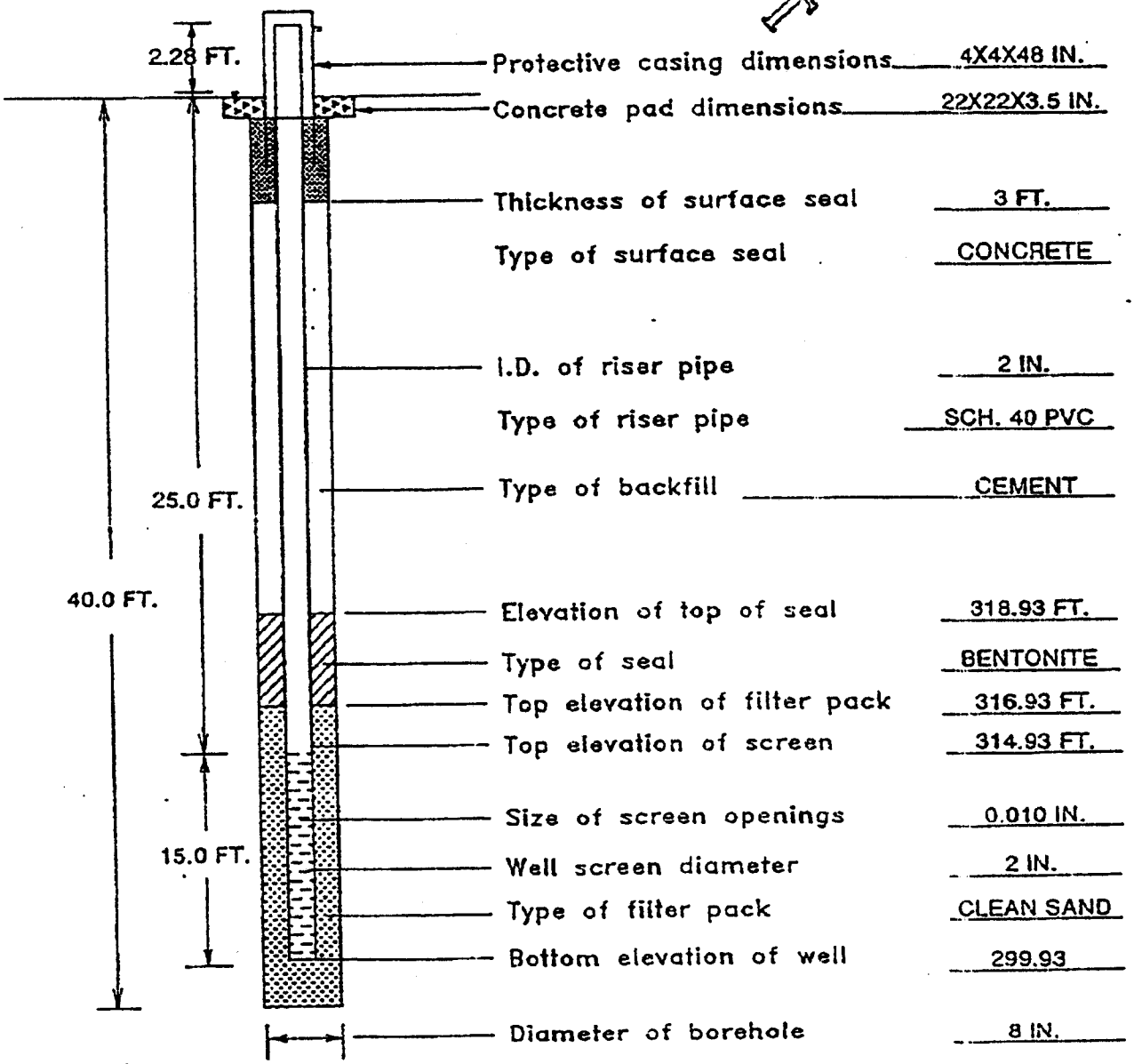
Depth to water measured from top of well pipe 32.12 FT.

Water level elevation 310.09 FT.

Water level taken on 1/10/94

NOTE? Drawing not to scale.

DRAFT



BAIN, PALMER & ASSOCIATES, INC.
Environmental Consultants

Client Durham Landfill — Boring No. P-2
Project Durham Landfill — Driller Trigon Engineering
Total Depth 40.0 ft. — Elevation 339.93 ft. — Boring Type & Size 4.25 H.S. Auger
Date Started 12/16/93 — Date Ended 12/17/93 — Logged By James M. Allen
Depth to Water 29.84 ft. — Date Measured 1/10/94 — Water Level Elevation 310.09

DEPTH (FEET)	ELEVATION FT AMSL	BLOWS PER 6 IN.	PERCENT RECOVERY	UNIFIED CLASS.	LITHOLOGIC DESCRIPTION	REMARKS
					DRAFT	
2	338					
4	336	6 9 10	65	ML	SILT with some VERY FINE SAND, firm-to-stiff, orange red with gray steaks, dry.	
6	334					
8	332					
10	330	8 15 26 32	100	ML	SILT with some VERY FINE SAND, stiff-to-very stiff, burgundy brown with tan weathering and gray stain, micaceous, dry.	
12	328					
14	326	19 35 50	83	ML	Same as above.	50 Blow counts for 6".
16	324					
18	322	33 50	100	ML	Same as above.	50 Blow counts for 4.0".
20	320					

DRAFT

BAIN, PALMER & ASSOCIATES, INC.
Environmental Consultants

Client Durham Landfill — Boring No. P-2
Project Durham Landfill — Driller Trigon Engineering
Total Depth 40.0 ft. — Elevation 339.93 ft. — Boring Type & Size 4.25 H.S. Auger
Date Started 12/16/93 — Date Ended 12/17/93 — Logged By James M. Allen
Depth to Water 29.84 ft. — Date Measured 1/10/94 — Water Level Elevation 310.09

DEPTH (FEET)	ELEVATION FT AMSL	BLOWS PER 6 IN.	PERCENT RECOVERY	UNIFIED CLASS.	LITHOLOGIC DESCRIPTION	REMARKS
22	318				DRAFT	
24	316	36 50	75	SM	FINE SAND and SILT, hard, burgundy brown, dry.	50 Blow counts for 2.0".
26	314					
28	312	50	75	SM	Same as above	50 Blow counts for 4.0".
30	310					
32	308					
34	306	50	25	SM	Same as above.	50 Blow counts for 2.0".
36	304					
38	302	50	25	SM	VERY FINE SAND and SILT, hard, greenish burgundy, dry.	50 Blow counts for 4.0".
40	300					

32.12 DTW

DRAFT

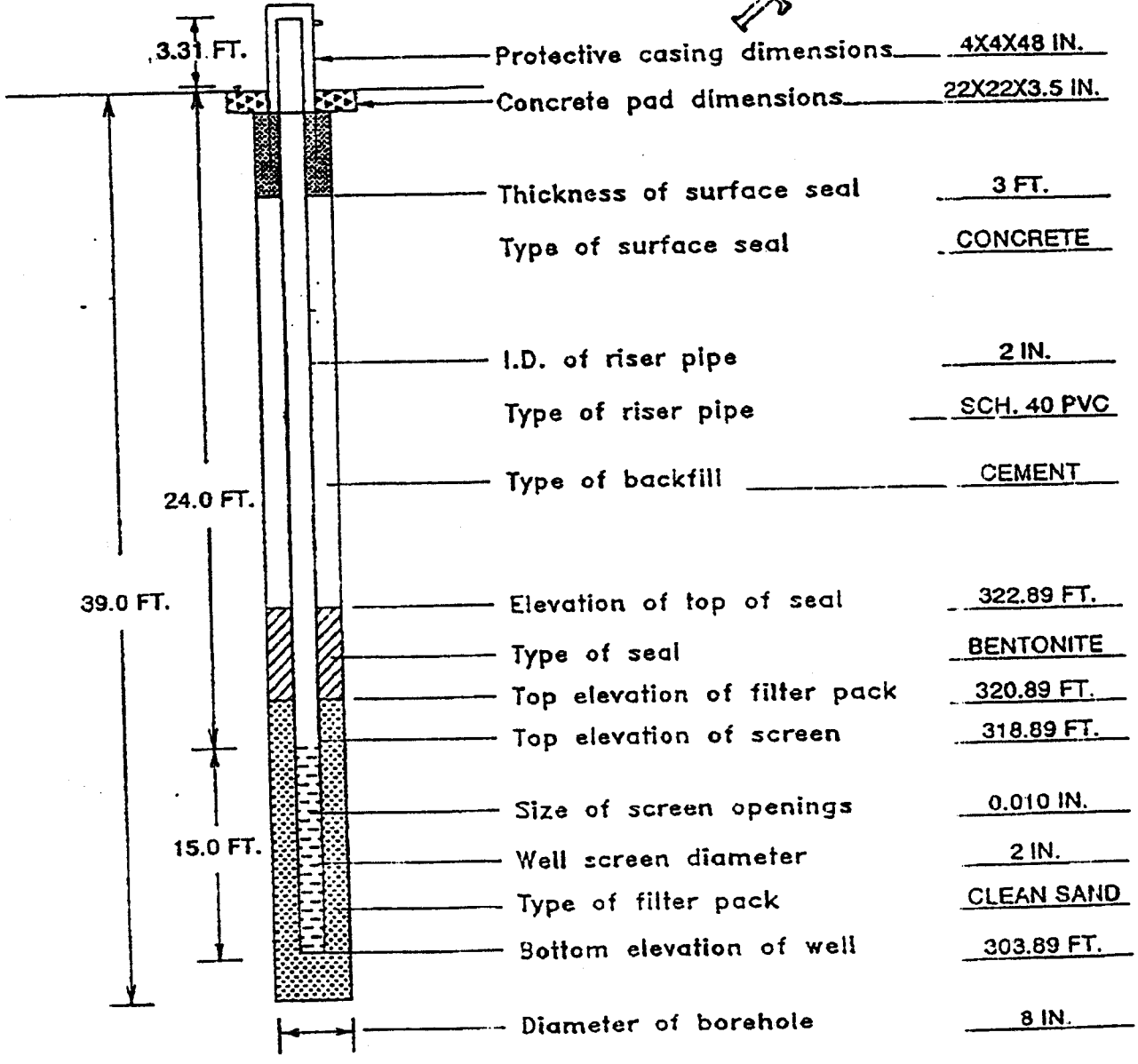
BAIN, PALMER & ASSOCIATES, INC.

MONITORING WELL INSTALLATION SKETCH

Project DURHAM LANDFILL
Surveyed by BAIN, PALMER & ASSOC., INC.
Surveyed from TBM, ASSUME 343 FT. EL.
Elevation of concrete pad reference point (bolt) 342.89 FT.
Elevation of top of well pipe 346.20 FT.
Approximate elevation of land surface 342.89 FT.

Well Number P-3
Constructed on 12/21/93
Depth to water measured from top of well pipe 31.96 FT.
Water level elevation 314.24 FT.
Water level taken on 1/10/94
NOTE: Drawing not to scale.

DRAFT



Protective casing dimensions 4X4X48 IN.
Concrete pad dimensions 22X22X3.5 IN.
Thickness of surface seal 3 FT.
Type of surface seal CONCRETE
I.D. of riser pipe 2 IN.
Type of riser pipe SCH. 40 PVC
Type of backfill CEMENT
Elevation of top of seal 322.89 FT.
Type of seal BENTONITE
Top elevation of filter pack 320.89 FT.
Top elevation of screen 318.89 FT.
Size of screen openings 0.010 IN.
Well screen diameter 2 IN.
Type of filter pack CLEAN SAND
Bottom elevation of well 303.89 FT.
Diameter of borehole 8 IN.

BAIN, PALMER & ASSOCIATES, INC.

Environmental Consultants

Client Durham Landfill Boring No. P-3

Project Durham Landfill Driller Trigon Engineering

Total Depth 39.0 ft. Elevation 342.89 ft. Boring Type & Size 4.25 H.S. Auger

Date Started 12/17/93 Date Ended 12/18/93 Logged By James M. Allen

Depth to Water 28.65 ft. Date Measured 1/10/94 Water Level Elevation 314.24

DEPTH (FEET)	ELEVATION FT AMSL	BLOWS PER 6 IN.	PERCENT RECOVERY	UNIFIED CLASS.	LITHOLOGIC DESCRIPTION	REMARKS
2	339				DRAFT	
4	337	10 15 17 26	92	ML	SILT with some VERY FINE SAND, stiff-to-very stiff, orange tan, micaceous, dry.	
6	335					
8	333					
10	331	19 32 40 50	86	ML	SILT with some VERY FINE SAND, very stiff-to-hard, burgundy brown, micaceous, dry.	50 Blow counts for 3.0".
12	329					
14	327	22 50	83	ML	Same as above.	50 Blow counts for 6.0".
16	325					
18	323					
20	321	26 32 19 50	100	ML	Same as above, hard.	50 Blow counts for 2.0".

DRAFT

BAIN, PALMER & ASSOCIATES, INC.
Environmental Consultants

Client Durham Landfill — Boring No. P-3
Project Durham Landfill — Driller Trigon Engineering
Total Depth 39.0 ft. — Elevation 342.89 ft. — Boring Type & Size 4.25 H.S. Auger
Date Started 12/17/93 — Date Ended 12/18/93 — Logged By James M. Allen
Depth to Water 28.65 ft. — Date Measured 1/10/94 — Water Level Elevation 314.24

DEPTH (FEET)	ELEVATION FT AMSL	BLOWS PER 6 IN.	PERCENT RECOVERY	UNIFIED CLASS.	LITHOLOGIC DESCRIPTION	REMARKS
					DRAFT	
22	319					
		50			SILT with some VERY FINE SAND, hard, burgundy brown, micaceous, dry.	50 Blows counts for 4.0".
24	317		50	ML		
26	315					
28	313					
		50			Same as above.	50 Blows counts for 3.0".
30	311		67	ML		
32	309					
		50			Same as above, green weathering.	50 Blows counts for 5.0".
34	307		60	ML		
36	305					
38	303				DRAFT	
		50			Same as above, Reddish brown to maroon.	50 Blows counts for 3.0". Boring Terminated at 39.0 ft.
40	301		67	ML		

JTW 31.96

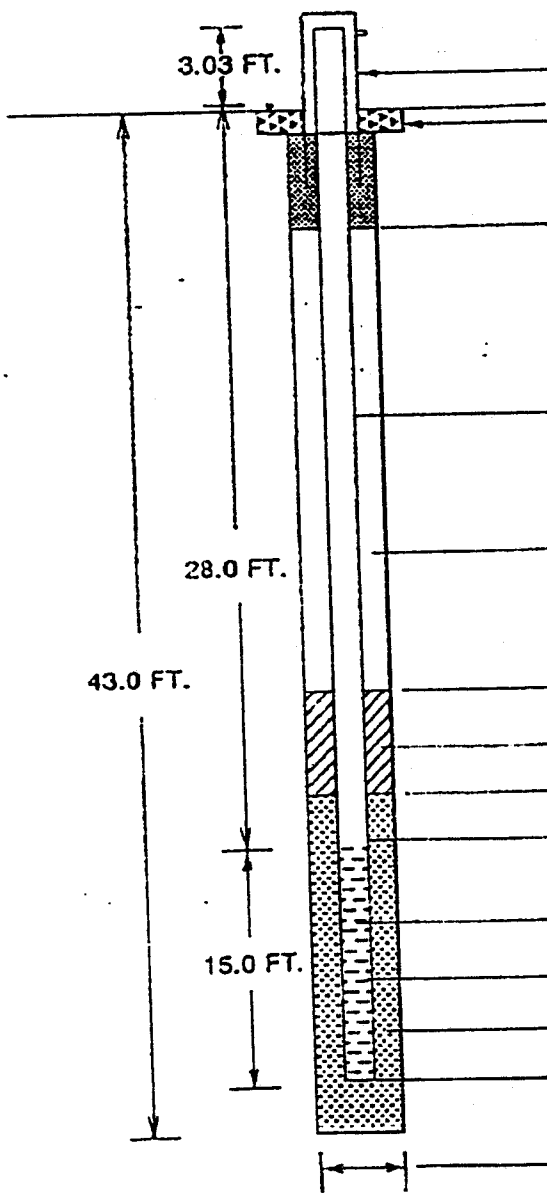
BAIN, PALMER & ASSOCIATES, INC.

MONITORING WELL INSTALLATION SKETCH

Project DURHAM LANDFILL
Surveyed by BAIN, PALMER & ASSOC., INC.
Surveyed from TBM, ASSUME 343 FT. EL.
Elevation of concrete pad reference point (bolt) 339.71 FT.
Elevation of top of well pipe 342.74 FT.
Approximate elevation of land surface 339.71 FT.

Well Number P-4
Constructed on 1/3/94
Depth to water measured from top of well pipe 22.60 FT.
Water level elevation 320.14 FT.
Water level taken on 1/10/94
NOTE: Drawing not to scale.

DRAFT



Protective casing dimensions	4X4X48 IN.
Concrete pad dimensions	22X22X3.5 IN.
Thickness of surface seal	3 FT.
Type of surface seal	CONCRETE
I.D. of riser pipe	2 IN.
Type of riser pipe	SCH 40 PVC
Type of backfill	CEMENT
Elevation of top of seal	318.21 FT.
Type of seal	BENTONITE
Top elevation of filter pack	315.96 FT.
Top elevation of screen	311.71 FT.
Size of screen openings	0.010 IN.
Well screen diameter	2 IN.
Type of filter pack	CLEAN SAND
Bottom elevation of well	296.71 FT.
Diameter of borehole	6 IN.

BAIN, PALMER & ASSOCIATES, INC.
Environmental Consultants

Client Durham Landfill — Boring No. P-4
Project Durham Landfill — Driller Trigon Engineering
Total Depth 43 ft. ft. — Elevation 339.71 ft. — Boring Type & Size 5.9375 Tricone
Date Started 12/23/93 — Date Ended 1/03/94 — Logged By Julia I. Almy
Depth to Water 19.57 ft. — Date Measured 1/10/94 — Water Level Elevation 320.14

DEPTH (FEET)	ELEVATION FT AMSL	BLOWS PER 6 IN.	PERCENT RECOVERY	UNIFIED CLASS.	LITHOLOGIC DESCRIPTION	REMARKS
					DRAFT	
2	338					
4	336	4 9 11 12	60	SM	FINE to MEDIUM GRAINED SAND with silt, stiff, gray and orange, dry, saprolite.	
6	334					
8	332					
10	330	8 9 15 19	60	SM	FINE SAND and SILT, stiff, brown, orange with black, dry, saprolite.	
12	328					
14	326	12 9 13 19	90	ML	13.0–14.5 ft., SILT and CLAY, stiff, gray, dry, saprolite. 14.5–15.0 ft., FINE SAND and SILT with little clay stiff, red, dry.	
16	324					
18	322	50			DRAFT SILT and FINE SAND, stiff, micaceous, gray, dry.	50 Blow counts for 5.0".
20	320		100	ML		

BAIN, PALMER & ASSOCIATES, INC.
Environmental Consultants

Client Durham Lanafill Boring No. P-4
Project Durham Landfill Driller Trigon Engineering
Total Depth 43 ft. ft. Elevation 339.71 ft. Boring Type & Size 5.9375 Tricone
Date Started 12/23/93 Date Ended 1/03/94 Logged By Julia I. Almy
Depth to Water 19.57 ft Date Measured 1/10/94 Water Level Elevation 320.14

DEPTH (FEET)	ELEVATION FT AMSL	BLOWS PER 6 IN.	PERCENT RECOVERY	UNIFIED CLASS.	LITHOLOGIC DESCRIPTION	REMARKS
22	318				DRAFT	
24	316	50	100	ML	SILT and FINE SAND, hard, micaceous, dark red-brown, dry.	50 Blow counts for 3.0".
26	314					
28	312	50	100	ML	SILT and FINE SAND, hard, gray, dry, saprolite.	50 Blow counts for 4.0".
30	310					
32	308					
34	306	50	100	ML	Same as above also dark red-brown with relict structure.	50 Blow counts 3.0".
36	304					
38	302	50	100	ML	SILT and FINE SAND, hard, micaceous, gray and red-brown with relict structure, damp, saprolite.	50 Blow counts for 5.0".
40	300					

DRAFT

DTW 34.92

BAIN, PALMER & ASSOCIATES, INC.
Environmental Consultants

Client Durham Landfill — Boring No. P-4
Project Durham Landfill — Driller Trigon Engineering
Total Depth 43 ft. ft. — Elevation 339.71 ft. — Boring Type & Size 5.9375 Tricone
Date Started 12/23/93 — Date Ended 1/03/94 — Logged By Julia L. Almy
Depth to Water 19.57 ft. — Date Measured 1/10/94 — Water Level Elevation 320.14

DEPTH (FEET)	ELEVATION FT AMSL	BLOWS PER 6 IN.	PERCENT RECOVERY	UNIFIED CLASS.	LITHOLOGIC DESCRIPTION	REMARKS
42	298				DRAFT	
44	296	50	100	ML	Same as above, but not as stiff.	Boring Terminated at 43.0 ft.. Well Set at 43.0 ft..
46	294					
48	292					
50	290					
52	288					
54	286					
56	284					
58	282					
60	280					

DRAFT

4

CITY OF DURHAM SANITARY LANDFILL
CLOSURE AND POST-CLOSURE PLAN

CITY OF DURHAM, NORTH CAROLINA

APRIL 1994

MALCOLM PIRNIE, INC.

11832 Rock Landing Drive, Suite 400
Newport News, Virginia 23606

0759-022-340

Transition Plan Amendment
January 1995

2.0 CLOSURE

2.1 CLOSURE ACTIVITIES

Closure of the landfill will consist of several activities to be undertaken after filling to final waste grades has occurred:

- Installation of erosion and sediment control and storm water management features.
- Fine grading of intermediate cover.
- Installation of final cap system.
- Installation of the gas management system.
- Seeding, fertilizing and mulching of final grades.

2.2 FINAL CAP

The proposed final cap is shown on Figures 1 and 2. Figure 1 indicates the landfill may be readily subdivided into Pre- and Post October 9, 1991 areas.

Areas of the landfill which stopped receiving waste by October 9, 1991 will be provided with a final cap comprised of at least 24-inches of soil.

Areas which continued to receive waste past October 9, 1991 (including both existing areas and the proposed area of interim filling to accommodate waste until closure), will be provided with a final cap comprised of an 18-inch thick infiltration layer and 6-inch thick vegetative support layer. The infiltration layer will be comprised of low permeability soil which has a permeability less than or equal to 1×10^{-7} cm/sec. Based upon boring logs included in the Water Quality Monitoring Plan, we believe this meets or exceeds the requirement that the infiltration layer have a permeability less than or equal to the permeability of the in-situ subsoils which underlie the landfill. The landfill is not provided with any bottom liner system and relies upon natural attenuation of the native subsoils.

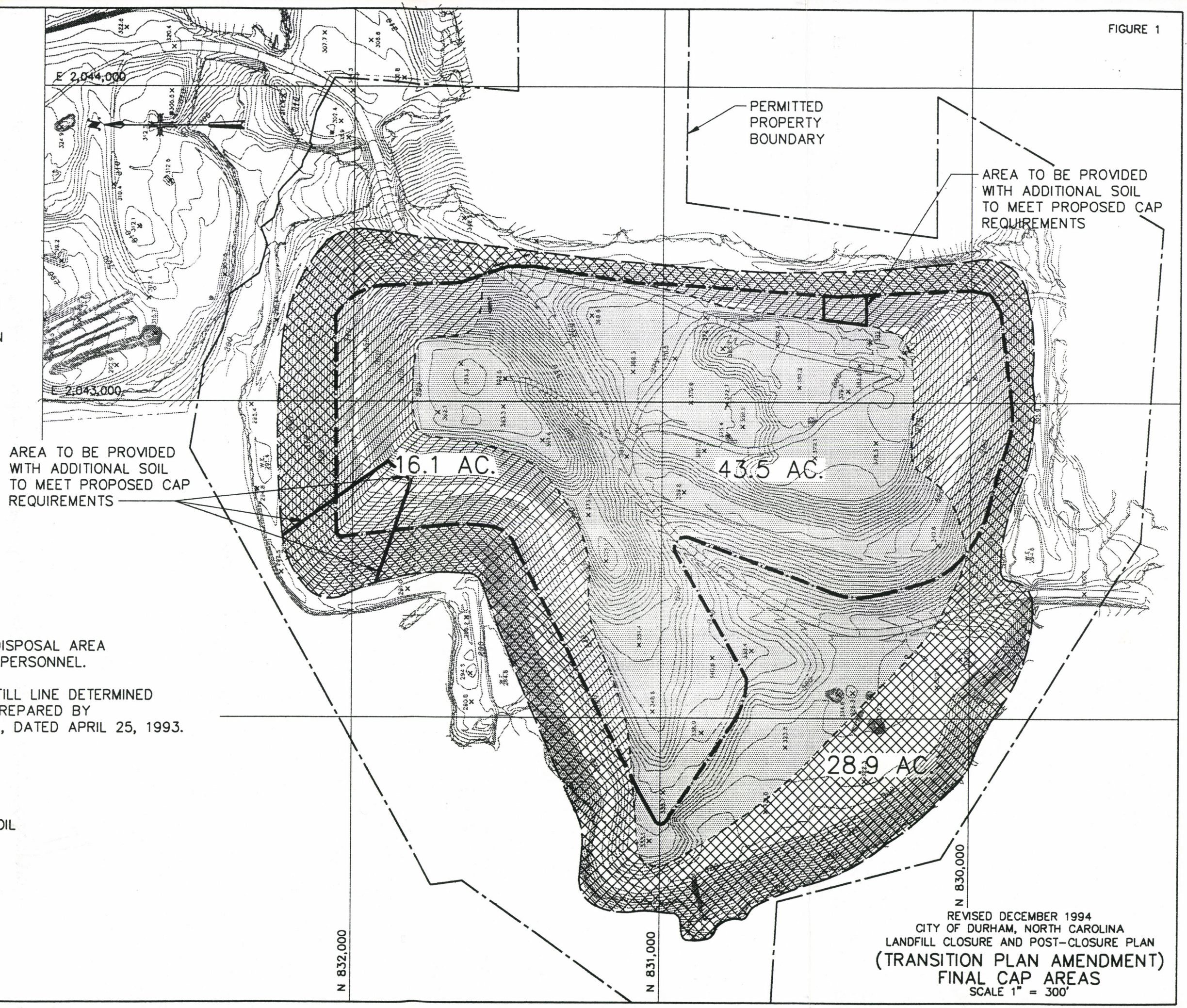
Existing Conditions

Results of a test pit investigation used to confirm existing cap conditions are summarized in Table 2-1 and Appendix A.

FIGURE 1

LEGEND:

- APPROXIMATE LIMITS OF WASTE
- LIMITS OF INTERIM FILLING
- APPROXIMATE LIMIT OF FILLING ON OCTOBER 9, 1991
- CAP SYSTEM 1
- CAP SYSTEM 2
- CAP SYSTEM 2, EXISTING COVER SOILS MEET PERMEABILITY REQUIREMENTS FOR INFILTRATION LAYER



NOTES:

1. APPROXIMATE LIMITS OF EXISTING DISPOSAL AREA DETERMINED BY CITY OPERATIONS PERSONNEL.
2. PRE AND POST OCTOBER 9, 1991 FILL LINE DETERMINED FROM EXISTING PERMIT DRAWING PREPARED BY DUANE K. STEWART & ASSOC. INC., DATED APRIL 25, 1993.
3. CAP SYSTEM 1 CONSISTS OF:
   - 2'-0" COVER SOIL
4. CAP SYSTEM 2 CONSISTS OF:
   - 6" VEGETATIVE SUPPORT SOIL
   - 18" INFILTRATION LAYER

MALCOLM PIRNIE

REVISED DECEMBER 1994
CITY OF DURHAM, NORTH CAROLINA
LANDFILL CLOSURE AND POST-CLOSURE PLAN
(TRANSITION PLAN AMENDMENT)
FINAL CAP AREAS
SCALE 1" = 300'

TABLE 2-1

SUMMARY OF EXISTING CAP INVESTIGATION

Test Pit No.	Existing Cap Thickness (feet)	Permeability (cm/sec)	Notes
1	2.0	2.8×10^{-7}	Post-October 1991
2	2.2		Post-October 1991
3	1.5	1.9×10^{-7}	Post-October 1991
4	3.2		Pre-October 1991
5	2.8		Pre-October 1991
6	2.2		Pre-October 1991
7	>5.0		Pre-October 1991
8	>5.0		Pre-October 1991
9	4.3		Pre-October 1991
10	4.0		Pre-October 1991
11	2.0		Pre-October 1991
12	3.0		Pre-October 1991
13	>3.6		Pre-October 1991
14	1.5		Pre-October 1991
15	4.2		Pre-October 1991
16	3.0		Pre-October 1991
17	3.5	2.8×10^{-8}	Post-October 1991
18	2.5		Pre-October 1991
19	5.0	9.3×10^{-8}	Post-October 1991
20	>4.0		Post-October 1991

Pre-October 1991

The results confirm that Pre-October, 1991 fill areas are currently provided with at least 2-feet of final cover, with the exception of one area (Test Pit 14) located along the northwest corner of the landfill. This localized area between adjacent test pit locations will be regraded and provided with additional final earth cover material sufficient to result in 2 feet of cover. All other Pre-October 1991 areas are deemed to have satisfied the final cap requirements and will be closed in their existing condition.

Post-October 1991

Hydraulic conductivity measurements via laboratory permeability on undisturbed shelby tube indicates that existing cover soils in areas which continued to receive waste after October 1991, have a mean permeability of approximately 1×10^{-7} cm/s.

In addition, the investigation results confirm the Post-October, 1991 fill area is currently provided with an infiltration layer of at least 18-inch thickness, with the exception of one area (Test Pit 3) located at the south-east corner of the landfill. This localized area between adjacent test pits locations will be regraded and provided with additional thickness of low permeability soil sufficient to result in 18 inches placed in accordance with Specification Section 02250 - Low Permeability Soil contained in Appendix B.

Closure Criteria

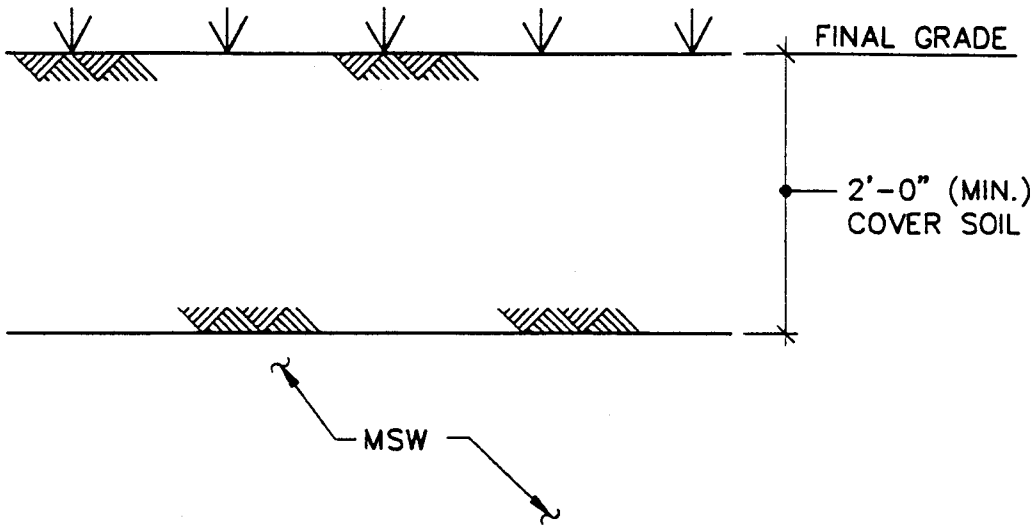
The cap systems have been designed to provide post-settlement final grades with slopes of a minimum 5 percent and a maximum of 25 percent, to provide proper storm water runoff control and reduce erosion. Some localized areas currently have existing slopes which exceed 25 percent. These areas are closed and appear stable. The closure plan does not intend any regrading of these previously closed areas.

The construction of the cap system infiltration layer will be in accordance with the Low Permeability Soil Specification Section 02250, included in Appendix B. This specification has been developed to comply with Rule .1624(b) (8) of the NCDEHNR Solid Waste Rules.

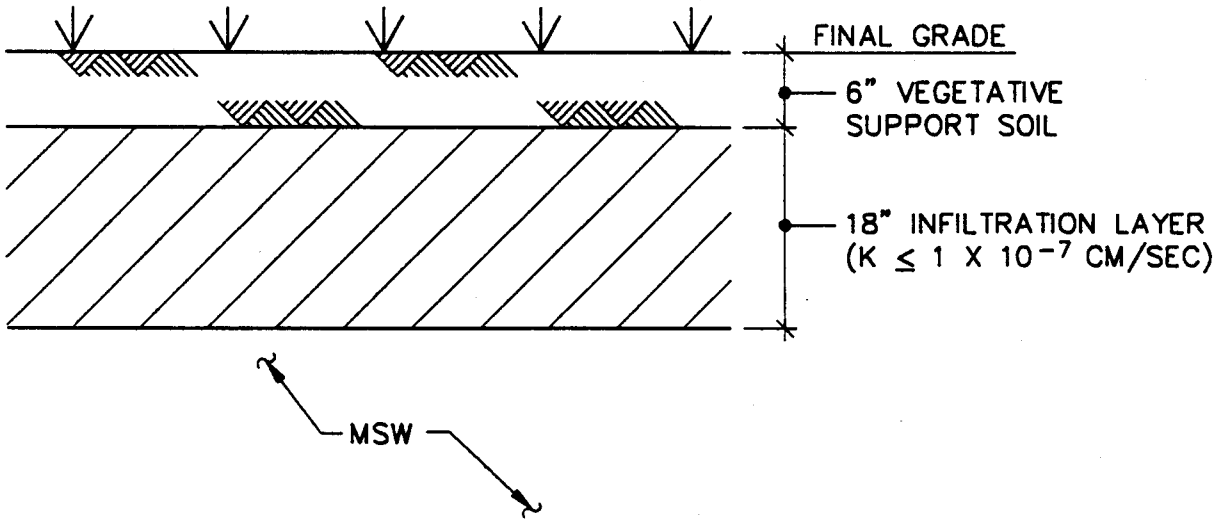
Construction Quality Assurance (CQA)

A CQA plan will be prepared in accordance with Rule .1621, prior to construction of the final cap and closure systems. Upon completion of construction, a CQA report will be submitted to the NCDEHNR in accordance with the requirements of Rule .1624(b) (15). The CQA report will include a certification that construction of the final cap and closure systems were completed in accordance with the CQA Plan.

FIGURE 2



CAP SYSTEM 1
(PRE-OCTOBER 9, 1991)



CAP SYSTEM 2
(POST-OCTOBER 9, 1991)

NOTES:

1. PRE-OCTOBER 9, 1991 AREAS ARE THOSE AREAS WHERE FILLING CEASED ON OR PRIOR TO OCTOBER 9, 1991.

2. POST-OCTOBER 9, 1991 AREAS ARE THOSE AREAS WHERE FILLING CONTINUED AFTER OCTOBER 9, 1991.

MALCOLM PIRNIE

APRIL 1994
CITY OF DURHAM, NORTH CAROLINA
LANDFILL CLOSURE AND POST-CLOSURE PLAN
FINAL CAP DETAILS
NOT TO SCALE

4846 : 0759022000\C:\WORK\DURHAM\FIGURE SCALE: 1:1i 04/06, 1994 at 07:57

2.3 ESTIMATE OF CLOSURE AREA

The estimated landfill areas to be closed utilizing the various cap systems are summarized on Figure 1. The figure indicates the estimated landfill area remaining to be closed after final anticipated limits of filling is approximately 43 acres. This comprises the limits of proposed interim filling. This area will be closed in accordance with current NCDEHNR closure requirements and provided with a final cap system as previously described. Existing cap over the remaining area, outside the limits of disturbance, is deemed in conformance with regulatory requirements for closure. In addition, the entire landfill footprint, defined as the limits of waste, comprising approximately 89 acres, will be provided with an active gas extraction system including blower, flare and extraction wells. In addition, the City is currently reviewing the feasibility of a gas recovery system where extracted landfill gas would be utilized in an adjacent wastewater treatment plant.

2.4 INVENTORY OF WASTES

Upon completion of waste filling, estimated to be December 31, 1997, the landfill will have received and disposed of an estimated 4.9 million tons of municipal solid waste. Actual closure and maximum waste volume will be determined by the availability of disposal capacity of an alternative site. The estimated fill-out date was governed by the anticipated completion of the City's proposed MSW transfer station. Detailed calculation of the estimated maximum waste inventory is summarized below.

ESTIMATED MAXIMUM INVENTORY OF WASTE CALCULATION			
Total Airspace (cy)	**MSW (cy)**	**Cover Soil (cy)**	**Capacity (tons)**
8,856,510	6,642,380	2,214,130	3,819,370

Assumptions:

1. Waste to cover ratio is 3:1 by volume.
2. In-place density of compacted waste is 1,150 pcy.
3. Base grade at average elevation 300 amsl, over entire limits of waste.

2.5 CLOSURE SCHEDULE

The table below summarizes the anticipated closure schedule for the facility. The estimated closure dates are preliminary and will be impacted by actual filling rates and other factors. The actual closure dates will be provided to the NCDEHNR as they occur.

In accordance with Rule .1627(c), prior to beginning closure, a notice of intent to close the landfill will be placed in the operating record. Within 30 days after final receipt of waste, closure activities will begin and within 180 days of beginning closure activities, closure activities will be completed. Following closure, the NCDEHNR will be notified of closure certification and a notation of closure will be recorded on the deed. Certification shall be signed by the City's Project Engineer. Notation on the deed shall notify potential purchaser that the land has been used as a landfill and that its use is restricted under the Closure Plan approved by the Section.

SUMMARY OF ANTICIPATED CLOSURE SCHEDULE	
Activity	**Date**
Submit Transition Plan	April 9, 1994
Re-Submit Transition Plan	December 1, 1994
Preparation of Closure Construction Documents Complete	December 1, 1997
Final Receipt of Waste	January 1, 1998
Notice of Intent to NCDEHNR	January 1, 1998
Award Construction Contract	February 1, 1998
Initiate Closure Action	February 1, 1998
Closure Completion	August 1998
Notification of Certification to NCDEHNR	August 1998
Recording of Closure	August 1998

2.6 LOCAL CHARACTERIZATION STUDY

A Local Characterization Study was performed in accordance with Rule .1629(b)(2)(A). Results of the characterization study are summarized on Plate 1 and in the following paragraphs.

Water Supply Intakes

The Local Characterization Study shows the location of possible potable water supply intakes. Street addresses were identified by cross-referencing street map locations with the City of Durham water distribution system. Approximately 80 street addresses were identified which are not provided with service connections to the City's water distribution system. Those addresses, although presently not confirmed, represent potential potable water supply intakes.

Underground Utility Lines

The underground utility lines located within the study area included water and sewer mains along main collector roads and residential streets. These utilities were identified by City of Durham Engineering Department and maps. These utility lines were verified by performing a window survey throughout the area.

Private Residences

A total of approximately 170 existing private residences and businesses were identified in the Local Characterization Study area. Approximately 35 residences and businesses are located on Glenn Road, Bundy Avenue, and Colclough Avenue within 300 to 1,500 feet of the facility boundary. The remaining private residences and businesses are located in excess of 1,000 feet from the permitted property boundary.

Sources of Contamination

Three potential mappable sources of contamination were identified as indicated in Table 2-2 and 2-3. Appendix C summarizes the database search used to identify these sources. Two of the potential contaminant sources are believed to represent leaking underground storage tanks (LUST's), while the third location is simply registered as a large quantity waste generator and does not represent any known or suspected contamination.

2.7 INTERIM CAPACITY CALCULATION

The proposed interim capacity of the landfill from October 9, 1993 through December 31, 1997, the estimated final day of waste disposal, is approximately 880,000 tons. Results of the capacity calculation are summarized in Table 2-4.

TABLE 2-2

SUMMARY OF POTENTIAL CONTAMINANT SOURCES

Database	Proximity to Site (mile)		Total
	Property-¼	¼ to ½	
NPL	0	0	0
CERCLIS	0	0	0
TRI	0	0	0
RCRIS-TS	0	0	0
RCRIS-LG	0	0	0
RCRIS-SG	0	1	1
DOCKET	0	0	0
ERNS	0	0	0
FINDS	0	1	1
UST	0	1	1
LUST	0	2	2
SWF	0	0	0
TOTAL	**0**	**5**	**5**

Legend:

NPL	National Priority List
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
TRI	Toxic Release Inventory
RCRIS-TS	RCRA Information System - Treatment and Storage Units
RCRIS-LG	RCRA Information System - Large Quantity Generator
RCRIS-SG	RCRA Information System - Small Quantity Generator
DOCKET	USEPA Database of Sites with Pending/Previous Judicial Actions
ERNS	Emergency Response Notification System
FIND	Facility Index System
UST	Underground Storage Tank
LUST	Leaking Underground Storage Tank
SWF	Solid Waste Facility

TABLE 2-3

IDENTIFIED MAPPABLE SOURCES OF POTENTIAL CONTAMINATION

Facility Address	Source/ Database	Distance From Site (feet)	Direction From Site
Central Transport 2321 E. Club Boulevard Durham, NC 27704	LUST/UST	1,930	Southeast
Kennedy Auto Service 2300 E. Club Boulevard Durham, NC 27704	RCRIS-SG/ FINDS	1,930	Southeast
Citgo Food Mart 2407 E. Club Boulevard Durham, NC 27704	LUST	1,960	Southeast

Legend:

NPL	National Priority List
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
TRI	Toxic Release Inventory
RCRIS-TS	RCRA Information System - Treatment and Storage Units
RCRIS-LG	RCRA Information System - Large Quantity Generator
RCRIS-SG	RCRA Information System - Small Quantity Generator
DOCKET	USEPA Database of Sites with Pending/Previous Judicial Actions
ERNS	Emergency Response Notification System
FIND	Facility Index System
UST	Underground Storage Tank
LUST	Leaking Underground Storage Tank
SWF	Solid Waste Facility

TABLE 2-4

INTERIM CAPACITY CALCULATION

Period	MSW (tons)	MSW (cy)	Cover Soil (cy)	Total MSW and Cover Soil (cy)
October 9, 1993 - January 1, 1998	881,202	1,532,530	510,840	2,043,370

Assumptions:

1. Waste to cover ratio is 3:1 by volume.
2. In-place density of compacted waste is 1,150 pcy.
3. Annual MSW tonnage used for 1994 is 205,000 tpy, with an annual escalation of 1% per year thereafter.

2.8 COMPLIANCE REPORT

2.8.1 Location Restrictions

The following paragraphs address the facility's compliance with Rule .1622, paragraphs (1), (2), and (6).

Airport Safety

Rule .1622(1)(c) requires landfills located within 5,000 feet from any airport runway used by only piston-powered aircraft or within 10,000 feet from any runway used by turbine-powered aircraft to demonstrate the landfill does not pose a bird hazard to aircraft.

The landfill is **not** located within 5,000 feet of **any** airport runway. The nearest airports are the Lake Ridge Aero Park, Duke University North, Raleigh/Durham International, and Horace Williams located approximately 4.5, 5, 10, and 15 miles from the site, respectively. Figure 3 shows the location of these airports and approximate distance from the City of Durham Sanitary Landfill. Therefore, the facility is exempt from having to demonstrate that a bird hazard to aircraft does not exist.

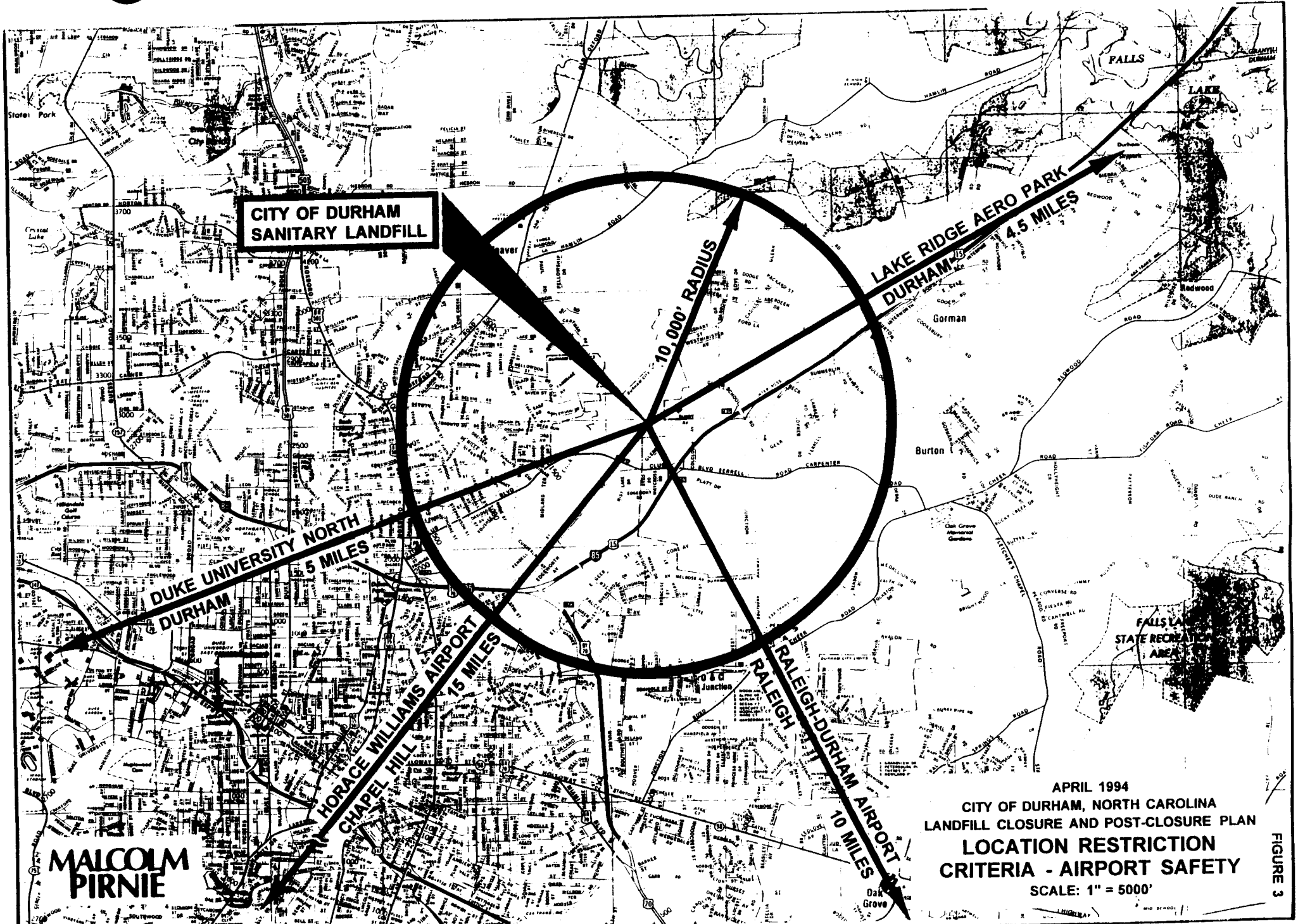
Floodplains

Initial observations and investigations of the landfill site indicated that portions of the landfill footprint appear to be within the 100-year floodplain of Ellerbee Creek.

A detailed topographic map of the landfill site was superimposed on the Federal Emergency Management Administration (FEMA) Flood Insurance Rate Map (Revised January 15, 1982) of Ellerbee Creek. Two portions of the current landfill footprint, with a combined total area of six acres, are within the historic 100-year floodplain as shown on the FEMA map. Historic ground surface elevations in the two areas were estimated based on current ground surface elevations in the floodplain adjacent to these areas.

An existing ridge of higher ground is shown on the FEMA map at the landfill site, which reduces the width of the 100-year floodplain by approximately one-third compared to the average floodplain width in this immediate area. The areas of impingement on the 100-year floodplain are located just upstream and downstream of this ridge. The flood plain storage lost due to the landfill impingement, based on these estimated elevations, is approximately 8.25 acre-feet.

Theoretical distribution of the 8.25 acre-feet of flood storage lost due to the landfill impingement over this upstream area would result in an increase in the peak flood elevation of less than 2-inches. The actual increase would be less due to the increase in



APRIL 1994
CITY OF DURHAM, NORTH CAROLINA
LANDFILL CLOSURE AND POST-CLOSURE PLAN
LOCATION RESTRICTION CRITERIA - AIRPORT SAFETY
SCALE: 1" = 5000'

FIGURE 3

FIGURE 4

AREA 4

PRIVATE RESIDENCE OR BUSINESS (TYP.)

MAPLEWOOD DRIVE

100 YEAR FLOOD WATER SURFACE ELEVATION (TYP.)

283

284

285

286

CITY OF DURHAM SANITARY LANDFILL

LIMITS OF WASTE

IMPINGMENT AREAS

BUNDY AVE

AREA 1

100 YEAR FLOODPLAIN

EAST CLUB BLVD.

CENTRAL TRANSPORT

MOBILE GAS STATION

NOTES:

1. 100 YEAR FLOOD PLAIN AND WATER SURFACE ELEVATIONS FROM FEDERAL EMERGENCY MANAGEMENT ADMINISTRATION FLOOD INSURANCE RATE MAP REVISED JANUARY 15, 1982.
2. TOPOGRAPHIC INFORMATION FROM CURRENT CITY OF DURHAM MAPPING DATED 1981 AND 1987.

MALCOLM PIRNIE

DECEMBER 1994

CITY OF DURHAM, NORTH CAROLINA

LANDFILL CLOSURE AND POST-CLOSURE PLAN

LOCATION RESTRICTION CRITERIA 100-YEAR FLOODPLAIN

SCALE: 1" = 400'

stream flow capacity that occurs as the flood elevation rises. We believe this increase in the flood staging for a 100-year event is negligible.

The resulting maximum possible flow velocity at the landfill toe was evaluated to determine the need for the installation of erosion control measures at the landfill toe. The overbank floodplain area between the landfill and the main channel of Ellerbee Creek is separated from the main creek channel by a linear dredge spoil pile along the edge of the main channel. The dredge spoil pile is broken at irregular intervals by cut-through areas which would allow flood flows to leave or reenter the main channel. The effect of this spoil pile is to effectively create an independent overbank floodplain channel to the east of the main Ellerbee Creek channel, between the main channel and the landfill toe. The maximum possible flow velocity in this overbank floodplain channel was analyzed based on the 100-year flood water surface elevations shown on the FEMA map and a conservative assumption of the roughness coefficient for the overbank floodplain area. The theoretical maximum possible velocity in the overbank floodplain area is approximately 1.0 feet per second. Actual velocities at the landfill toe should be less than this based on a typical stream velocity profile which predicts lower than average velocities along the stream bottom and edge and higher than average velocities on the surface at the center of the stream.

A velocity of 1.0 feet per second is an acceptable velocity for unprotected soils in existing channels, for all soil types, based on the listed maximum permissible velocities presented in Table 8.05d of the North Carolina Erosion and Sediment Control Planning and Design Manual, 1988 edition. Based upon the results of the floodplain analysis, we conclude the following:

- The landfill does not restrict the flow of the 100-year storm event.
- The impact of any impingement on the temporary water storage capacity is negligible.
- Resulting velocity at the toe of the slope is below that which may be expected to cause soil loss for unprotected soils and, consequently, does not represent any potential for washout of solid waste materials to occur. We do not believe any additional erosion control measures are necessary at the landfill toe within the limits of the 100-year floodplain.

Unstable Areas

The area encompassed by the landfill has been evaluated for stability. The following factors were considered:

- On-site or local soil conditions that may result in significant differential settling.
- On-site or local geologic or geomorphologic features.
- On-site or local human-made features or events (both surface and subsurface).

It was determined that the landfill area is not susceptible to conditions which would cause impairment of the integrity of some or all of the landfill structural components responsible for preventing releases from the landfill.

2.8.2 Compliance Record

Inspection and evaluation reports prepared by the NCDEHNR from May 1986 to August 1993 are included in Appendix D. The inspection records indicate overall very good performance. Localized instances of soil erosion were noted which has since been remedied by stabilizing existing final slopes with vegetative cover.

2.8.3 Water Quality/Explosive Gas Monitoring Data

Groundwater quality samples have been collected and analyzed from four wells around the landfill since 1989. Metals and Synthetic Organic Compounds (SOCs) in exceedance of Groundwater Standards have been detected in samples from some of the wells. The City is currently evaluating most recent groundwater quality monitoring data in conjunction with the NCDEHNR waste division and is evaluating the potential contamination of an existing upgradient well and its effect on the water quality monitoring plan. A separate water quality monitoring plan has been submitted and addresses historical groundwater quality in more detail.

2.9 CLOSURE COST ESTIMATE

The estimated capital cost estimate for closure of the City of Durham Sanitary Landfill is included in Appendix E. The estimated maximum total cost for landfill closure is estimated to be approximately $5,671,500 (in FY 1995 dollars). The City will demonstrate financial assurance for this amount in accordance with Rule .1628 requirements.

3.0 POST-CLOSURE

3.1 POST-CLOSURE CONTACT

The City of Durham is the owner, permit holder and operator of the facility. The primary contact person and address is:

Mr. Don Robinson
Acting Director Sanitation Department
City of Durham
101 City Hall Plaza
Durham, North Carolina 27201

Telephone: (919) 560-4185

3.2 MAINTENANCE PLAN

In accordance with Rule .1629(c)(1) and Rule .1627(d), post-closure care will be conducted for 30 years. The following sections describe post-closure maintenance procedures, equipment requirements and material needs for preventative and corrective maintenance of active landfill systems including:

- Groundwater and surface water monitoring
- Gas control
- Gas monitoring
- Final cover
- Storm water management

Anticipated preventive and corrective maintenance requirements of these systems are summarized in Table 3-1 and the following sections.

Groundwater Monitoring System

The groundwater monitoring system will be maintained so as to remain operational in accordance with Rules .1631 through .1637. The system, shown on the Site Plan Sheet,

TABLE 3-1

SUMMARY OF POST-CLOSURE MAINTENANCE

CLOSURE SYSTEM	*SYSTEM COMPONENT*	*MAINTENANCE PROCEDURES*	*FREQUENCY*
Groundwater Monitoring	▪ Monitoring Wells	▪ Development in conjunction with water quality monitoring.	▪ Semi-Annual
	▪ Protective Casing	▪ N/A	▪ N/A
	▪ Lock Mechanism	▪ Lubricate	▪ As Necessary
Gas Control	▪ Extraction Wells	▪ Repair as necessary	▪ Annually
	▪ Gas Blower	▪ Check shaft packing and seals, repair as necessary.	▪ Monthly
		▪ Check oil level, add oil as required.	▪ Monthly
		▪ Check belts or drive, adjust as required.	▪ Monthly
		▪ Lubricate all bearings and grease fittings.	▪ Semi-Annually
		▪ Clean motor.	▪ Semi-Annually
		▪ Change oil.	▪ Annually
	▪ Moisture Separator	▪ Drain moisture trap, clean out collected debris, as necessary.	▪ Monthly

TABLE 3-1
(Continued)

SUMMARY OF POST-CLOSURE MAINTENANCE

CLOSURE SYSTEM	*SYSTEM COMPONENT*	*MAINTENANCE PROCEDURES*	*FREQUENCY*
Gas Control (Continued)	▪ Waste Gas Burner	▪ Fill propane tank, as required. ▪ Drain condensate traps. ▪ Clean flame trap. ▪ Check gas piping for leaks.	▪ Monthly ▪ Monthly ▪ Semi-Annually ▪ Semi-Annually
	▪ Valves and Appurtenances	▪ Exercise components and repair as required.	▪ Annually
Gas Monitoring System	▪ PVC piping, bentonite seal, valve and concrete pad	▪ Repair as necessary.	▪ As neccessary
Cap	▪ Final Cover	▪ Erosion Repair ▪ Re-vegetation	▪ As necessary
Storm Water Drainage System	▪ Storm Water Detention Basins	▪ Repair localized erosion ▪ Clear debris and sediment	▪ Semi-annual ▪ As necessary when sediment reaches 85 percent clean out elevation
	▪ Ditches, Reverse Slope Benches, Diversion Berms, Chutes ▪ Culverts	▪ Repair localized erosion ▪ Remove sediment ▪ Regrade ▪ Revegetate ▪ Remove debris or obstructions ▪ Clean-out via high pressure wash	▪ As necessary ▪ Semi-annual ▪ Annual ▪ As necessary ▪ Semi-annual ▪ As necessary

Sheet 1 of the Operation Plan drawings, is comprised of permanent, low maintenance, PVC monitoring wells with dedicated bladder sampling pumps. These PVC wells do not contain any other active components and will be maintained by monitoring well development coincident with groundwater quality sampling throughout the post-closure period. No other preventive maintenance of this system is required. Groundwater monitoring wells which sustain damage or become unable to provide representative samples will be replaced as necessary. This may include decommissioning and appropriate abandonment of any non-functional wells. Materials and equipment anticipated for well installation and/or decommissioning abandonment includes standard geotechnical drilling rig equipped with hollow stem augers, tri-cone rotary drilling bit, bentonite slurry and tremie pump. Bladder pumps will be subject to corrective maintenance as necessary to maintain.

Gas Control

The proposed gas control is shown on the Gas Monitoring and Collection Sheet, Sheet 4 of the Operation Plan drawings. The following information summarizes the anticipated preventive and corrective maintenance activities to be performed through the duration of the post-closure period.

Extraction Wells

The extraction wells will consist of 3-inch diameter High Density Polyethylene (HDPE) pipe. Wells will be spaced relatively uniformly across the landfill topdeck. The wells will be capped at the bottom, perforated for gas accumulation, screened through the waste, and surrounded with open graded coarse aggregate.

Preventive maintenance includes only an annual inspection of the extraction wells to determine the condition of the well head, valve, and flexible pipe. Corrective maintenance would consist of replacement of well head components as needed.

Gas Blower

A blower is proposed to extract gas from the wells and deliver collected gas to the adjacent flare.

Preventive maintenance for the blower should include the following:

- Check shaft packing and seals monthly. Under normal operating conditions, seals generally last up to 3 years.
- Inspect impeller vanes every 2 years. Replace if worn or show evidence of corrosion.

- Replace impeller vanes after 6 years of operation.
- Lubricate all bearings and grease fittings every 6 months.
- Check oil level at site glass monthly. Add to fill line as needed.
- Change oil annually.
- Inspect bearings annually. Replace after 6 years of operation.
- Check condition of drive mechanism monthly. Adjust as needed.

Corrective measures consist of replacing or repairing components as needed according to the preventive maintenance duties listed above.

Moisture Separator

A cyclone separator is proposed to remove and collect any moisture. Gas drawn from the landfill by the blower passes through the separator in a spiral pattern, forcing moisture out and down to be collected and drained.

Preventive maintenance consists of monthly moisture trap drainage and annual inspection of the internals of the separator to observe for any corrosion.

No corrective maintenance is anticipated.

Waste Gas Burner

An automatic ignition gas burner is proposed to ignite and burn the collected gas. A propane tank is proposed for the ignition pilot light. The blower forces the collected gas up through the flare and is ignited by the propane pilot. The system also includes a flame trap and back pressure regulator. A control panel performs all control functions automatically.

Preventive maintenance duties consist of the following:

- Refill propane tank as needed.
- Drain condensate traps monthly.
- Disassemble and clean flame trap (gas piping) semi-annually.
- Check all gas piping for leaks semi-annually. Repair as needed.

Corrective maintenance consists of repair and replacement of worn parts, as a result of the preventive maintenance inspections described above.

The City is currently reviewing the feasibility of recovery of landfill gas for use in the adjacent wastewater treatment plant. If it is determined that recovery is feasible, this system would operate either in lieu of or in parallel to the above mentioned control system.

Valves and Appurtenances

Valves and appurtenances proposed as part of the gas collection and flaring system should be exercised on an annual basis. Any components identified as damaged, corroded, or leaking during scheduled inspections will be repaired or replaced as necessary.

Gas Monitoring System

The gas monitoring system is comprised of a series of perimeter gas monitoring probes. A detail of the gas monitoring probe is shown on Sheet 5 of the Operation Plan drawings. During inspections of the gas monitoring probes, any damage to the probe will be repaired or replaced. If the probe is unrepairable, a new probe will be constructed adjacent to the existing probe.

Final Cap System

Landfill surface maintenance will be performed as necessary over the entire post-closure period. Signs of erosion, settling, cracking or other site maintenance problems detected during routine site inspections will be corrected as soon as possible. Eroded areas will be repaired by backfilling and stabilizing the effected areas or by providing additional drainage feature systems to prevent future erosion where settlement results in ponding of surface water, the cap will be regraded and re-vegetated to eliminate the ponding. All large areas without vegetation in the final cover will be reseeded and fertilized, as necessary, but not less than once every year.

Storm Drainage System

Storm water drainage systems shown on Sheet 3 of the Operation Plan drawings and described in detail in The Operation Plan, are comprised of passive components, including storm water detention basins, outfall structures, ditches, sideslope chutes, and reverse slope benches.

Preventive maintenance of the storm water detention basins and outlet structures will occur semi-annually, during late summer and early spring, prior to and following fall and winter periods which typically experience much higher rainfall events, and as required after heavy precipitation events. Sediment removal will occur annually to ensure adequate

capacity and function. Spillways and outlet structures will be cleared of all loose debris on an as needed basis. Basin sideslopes will be uniformly graded to their original design slope on an annual basis to minimize sloughing and potential impacts on storage capacity and water quality.

Corrective maintenance, including repair and/or replacement of damaged structures, will occur as needed for satisfactory performance.

3.3 INSPECTION PLAN

The following section describes post-closure inspection procedures, frequency and recordkeeping associated with the post-closure care of the following landfill closure systems:

- Groundwater monitoring
- Gas collection and flare
- Gas monitoring
- Landfill cap
- Storm drainage including run-on/run-off control devices such as storm water detention basins, outlet structures, ditches, chutes and reverse slope benches

Inspection of the landfill facility closure systems will be conducted by City personnel to prevent and/or detect malfunction or damage to system components. The following information will be recorded in conjunction with each inspection activity:

- Date and time of inspection
- Name of inspector
- Observation made
- Data measurements (if any)
- Recommended corrective measure (if any)

Inspection procedures, frequency and rationale are summarized in Table 3-2 and the following sections.

Groundwater Monitoring System

The groundwater monitoring system will be inspected on a semi-annual basis in conjunction with post-closure groundwater quality monitoring activities. The integrity of each well will be verified by visual inspection and observation of damage (if any) to the well installation, riser pipe, protective casing, and lock mechanism.

Gas Control System

Inspection of the gas control system will be inspected on a regular basis as described in Table 3-2. Visual inspection will be made of the condition of the extraction wells, gas blower, moisture separator, waste gas flare, and valves and appurtenances. Specifically, inspection will be made for any evidence of malfunction, corrosion, and operation of any of these components.

Gas Monitoring System

Inspection of gas monitoring probes will be performed prior to each monitoring event. The inspection will include examination of the PVC pipe, bentonite seal and valve for physical damage. Probes will also be examined for accumulation of water above the bentonite seal. Any excess water will be removed.

Final Cover System

Inspection of final cover system components will occur semi-annually for the first 5 years and annually throughout the remaining post-closure period, corresponding with site monitoring and other preventive maintenance activities, or on an as-needed basis following heavy precipitation events. Integrity of the final cover system will be evaluated over the entire landfill surface by visual inspection and observation of damage related to soil loss via erosion, differential settlement and resulting ponding of surface water, sloughing of surficial materials along slopes due to inadequate drainage of cover system, consistency and adequacy of vegetative cover condition.

Storm Water Drainage System

Storm water system components will be inspected on a semi-annual basis in late summer and late winter, prior to anticipated seasons with typically high precipitation levels, and subsequent to heavy rainfall events. Integrity of the drainage system components, including detention basins, ditches, culverts, diversion berms, release structures and reverse slope benches, as well as miscellaneous sediment and erosion control devices, will be verified

TABLE 3-2

SUMMARY OF POST-CLOSURE INSPECTION

CLOSURE SYSTEM	*SYSTEM COMPONENT*	*INSPECTION PROCEDURE*	*FREQUENCY*
Groundwater Monitoring System	▪ Monitoring Wells - Riser Pipe - Protective Casing - Lock Mechanism	▪ Visual inspection of damage, corrosion.	▪ Semi-Annual
Gas Control	▪ Extraction Wells	▪ Visual inspection for possible damage.	▪ Annually
	▪ Gas Blower	▪ Check shaft packing and seals. ▪ Visual inspection of oil level. ▪ Visual inspection of drive mechanism. ▪ Measure pressure on either side. ▪ Check gages via pitot tube. ▪ Check bearings for wear. ▪ Check impeller vanes for wear.	▪ Monthly ▪ Monthly ▪ Monthly ▪ Monthly ▪ Monthly ▪ Annually ▪ Bi-Annually
	▪ Moisture Separator	▪ Inspect condensate drainage system. ▪ Internal inspection.	▪ Monthly ▪ Monthly ▪ Annually

TABLE 3-2
(Continued)

SUMMARY OF POST-CLOSURE INSPECTION

CLOSURE SYSTEM	*SYSTEM COMPONENT*	*INSPECTION PROCEDURE*	*FREQUENCY*
Gas Control (Continued)	▪ Waste Gas Burner	▪ Inspect propane tank status. ▪ Inspect gas piping for leaks. ▪ Inspect status of fire fighting equipment.	▪ Monthly ▪ Semi-Annually ▪ Semi-Annually
	▪ Valves and Appurtenances	▪ Inspect and exercise components for visable malfunction or leakage.	▪ Annually
Gas Monitoring Probe	▪ PVC Piping ▪ Bentonite Soil ▪ Valve	▪ Visual inspection of condition.	▪ Quarterly
Final Cover System	▪ Vegetation Cover ▪ Topsoil	▪ Visual inspection and observation of damage.	▪ Semi-Annual for first five years. ▪ Annual for remaining post-closure period or an as needed basis following heavy precipitation.

TABLE 3-2
(Continued)

SUMMARY OF POST-CLOSURE INSPECTION

CLOSURE SYSTEM	*SYSTEM COMPONENT*	*INSPECTION PROCEDURE*	*FREQUENCY*
Storm Water Drainage System	▪ Storm Water Detention Basins ▪ Ditches ▪ Culverts ▪ Chutes ▪ Release Structures ▪ Reverse Slope Benches ▪ Erosion and Sediment Control Devices	▪ Visual inspection and observation of damage.	▪ Semi-Annual

by visual inspection and observation of damage (if any) which would result or impact surface water flow and/or cause further soil loss or damage to structures. Specifically, visual inspection will be made for obstruction, accumulation of sediment or debris, vegetation stress, evidence of scour, erosion of channel lining and soils, as well as structural integrity and corrosion of release structures.

3.4 MONITORING PLAN

Post-closure monitoring activities and locations are shown on Table 3-3.

Post-closure activities will include monitoring of the following closure systems:

- Groundwater monitoring wells
- Storm water runoff
- Landfill gas

Groundwater Monitoring

Groundwater monitoring activities to be performed throughout the post-closure care period are summarized in the Water Quality Monitoring Plan. The plan indicates that groundwater monitoring wells will be monitored on a regular basis throughout the duration of the post-closure care period. These monitoring wells have been selected on the basis of their location relative to the landfill unit, and will be used to evaluate variations in groundwater quality and flow direction in the uppermost aquifer.

Landfill Gas Monitoring

Perimeter gas monitoring probes are shown on Sheet 4 of the Operations Drawings. All perimeter gas monitoring probes and structures will be monitored on a quarterly basis for percent lower explosive limit (percent LEL) and percent total volume (percent TV) of methane. All data will be recorded on a monitoring sheet and maintained on file at the landfill site.

In the event that any gas probe indicates a concentration of methane exceeding 25 percent LEL, contingency measures detailed in the Operations Plan will be taken to further evaluate the source of landfill gas and mitigate any detrimental effects.

TABLE 3-3

SUMMARY OF POST-CLOSURE MONITORING [1]

CLOSURE SYSTEM	*MONITORING LOCATION(S)*	*PARAMETERS*	*FREQUENCY*
Storm Water Management	▪ Storm Water Detention Basins	▪ Surface Water Quality	▪ Quarterly and/or following storm events for first year. ▪ Semi-annual basis after first year.
Gas Management	▪ Gas Monitoring Probes ▪ Buildings	▪ Methane Concentration (%LEL/%TV)	▪ Quarterly
[1] See Water Quality Monitoring Plan, for details of groundwater quality monitoring frequency and sampling protocol.			

3.5 POST-CLOSURE LAND USE

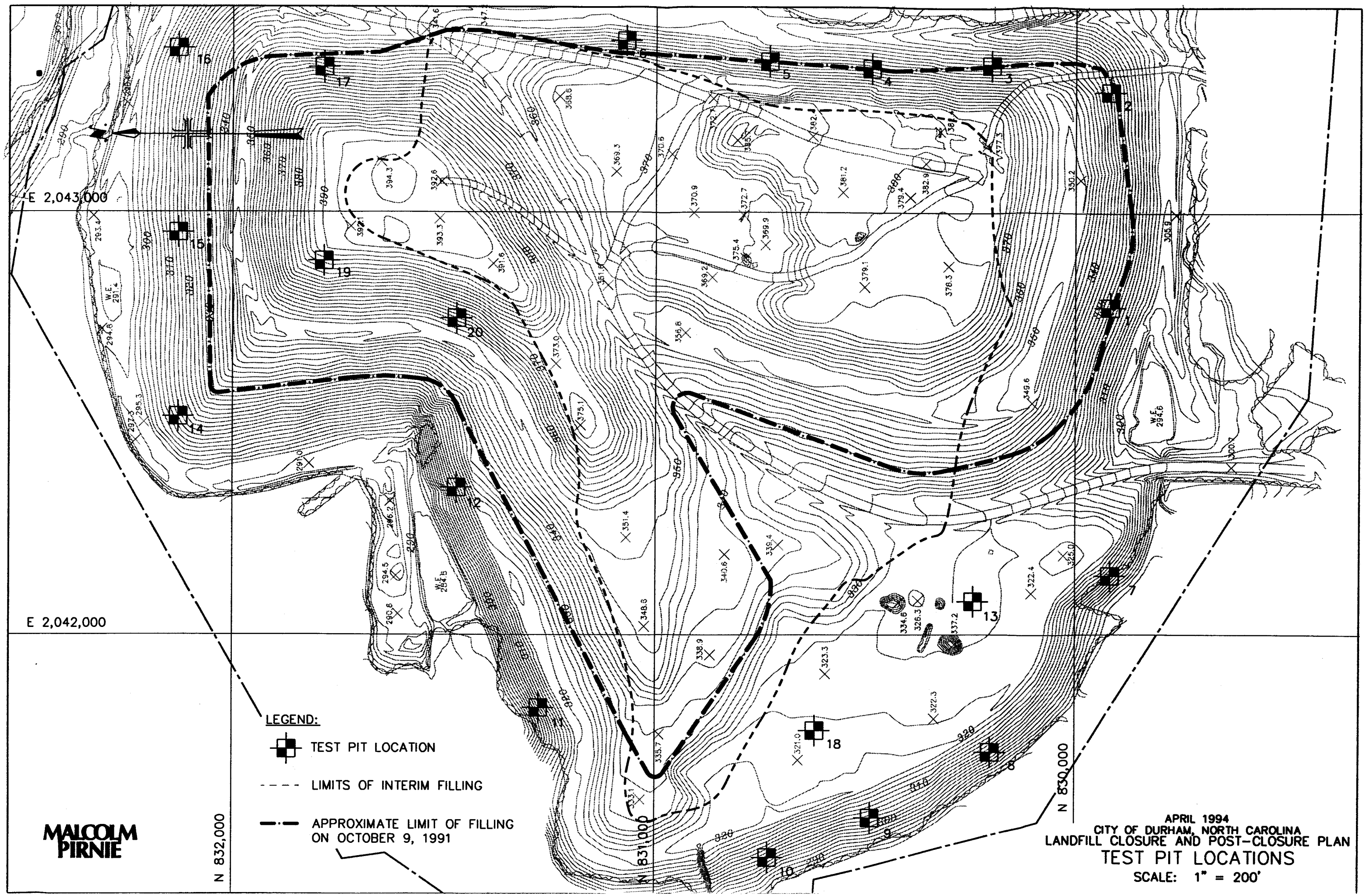
The City of Durham plans a passive use of the landfill during the post-closure period. No disturbance will be made to the integrity of the final cap, waste containment systems, or monitoring systems. Following completion of the post-closure care period, the City shall notify the Solid Waste Section that a certification, signed by a registered Professional Engineer, has been placed in the operating record. The certification will verify that post-closure care has been completed in accordance with the post-closure plan.

3.6 POST-CLOSURE COST ESTIMATE

The capital cost estimate for post-closure activities for the City of Durham Sanitary Landfill is included in Appendix F. The estimated maximum annual total post-closure cost is approximately $256,300 (in 1994 dollars). Given a 30-year post-closure period, the estimated present worth of post-closure care and maintenance throughout the maximum anticipated post-closure period at year 1996 is approximately $8,477,000 (in 1996 dollars). The City will provide financial assurance for this amount in accordance with one of the financial instruments outlined in Rule .1628.2

APPENDIX A

LANDFILL CAP INVESTIGATION


E 2,043,000
E 2,042,000
N 832,000
N 831,000
N 830,000
LEGEND:
TEST PIT LOCATION
LIMITS OF INTERIM FILLING
APPROXIMATE LIMIT OF FILLING ON OCTOBER 9, 1991
MALCOLM PIRNIE
APRIL 1994
CITY OF DURHAM, NORTH CAROLINA
LANDFILL CLOSURE AND POST-CLOSURE PLAN
TEST PIT LOCATIONS
SCALE: 1" = 200'

LABORATORY TEST RESULTS

CITY OF DURHAM LANDFILL

LABORATORY TEST SUMMARY

TEST PIT SAMPLES

Test Pit #	Hydraulic Conductivity (cm/sec)
1	2.8×10^{-7}
2	4.2×10^{-9}
3	1.9×10^{-7}
8	1.0×10^{-7}
11	6.2×10^{-7}
17	5.4×10^{-8}
19	9.3×10^{-8}
20	8.9×10^{-8}

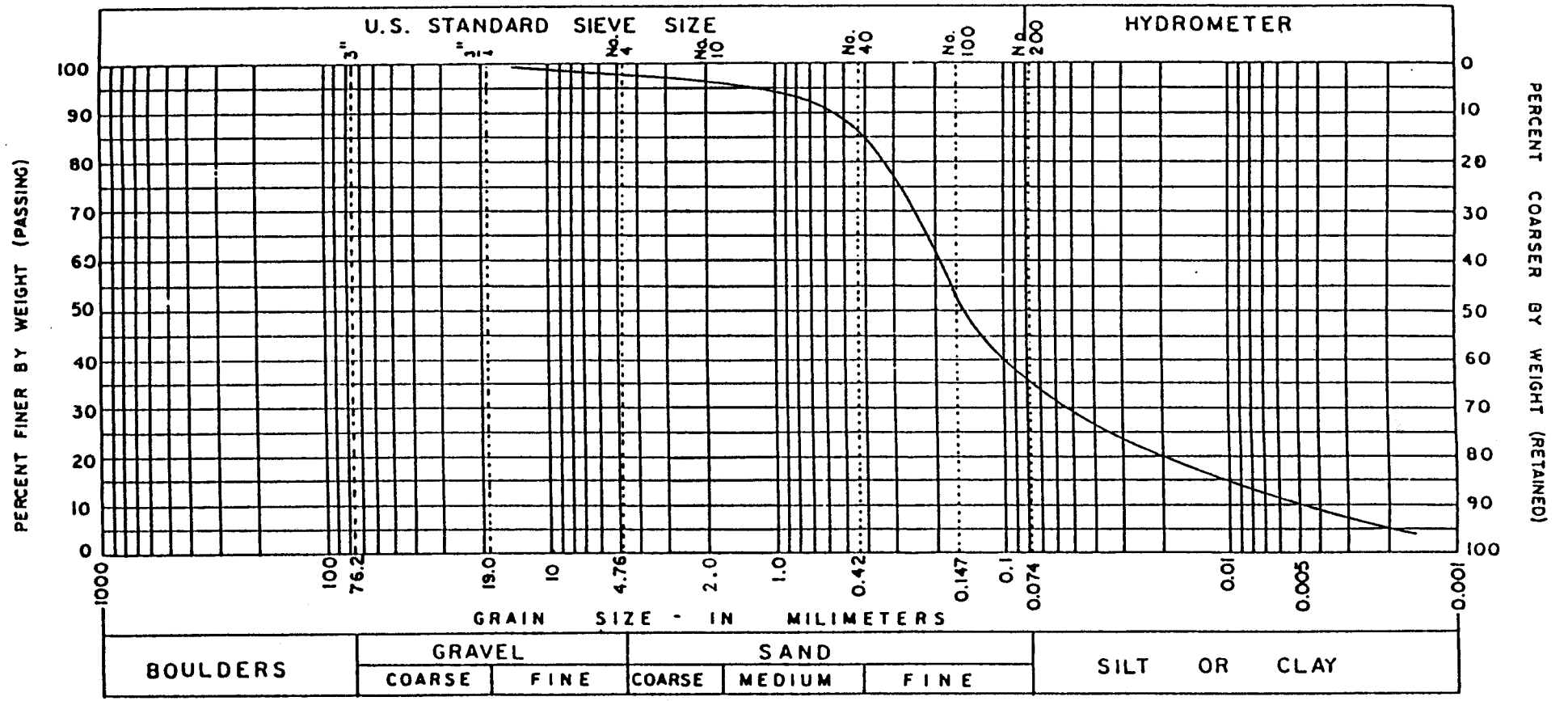
CITY OF DURHAM LANDFILL

LABORATORY TEST SUMMARY

TEST PIT SAMPLES

Test Pit #	Moisture Content (%)	Dry Unit Weight (pcf)
1	12.4	110.1
2	20.8	101.8
3	19.5	109.6
4	24.5	
5	13.2	
6	22.3	
7	20.5	
8	19.1	112.6
9	22.1	
10	18.1	
11	21.0	97.5
12	No Tube	
13	No Tube	
14	No Tube	
15	28.1	
16	No Tube	
17	20.0	107.8
18	No Tube	
19	12.4	125.4
20	19.0	107.0

PROJECT: City of Durham Landfill		LOCATION: Durham, North Carolina	
BORING NO. TP#1	SAMPLE NO. -	DEPTH: -	CONTRACT NO. 94-023



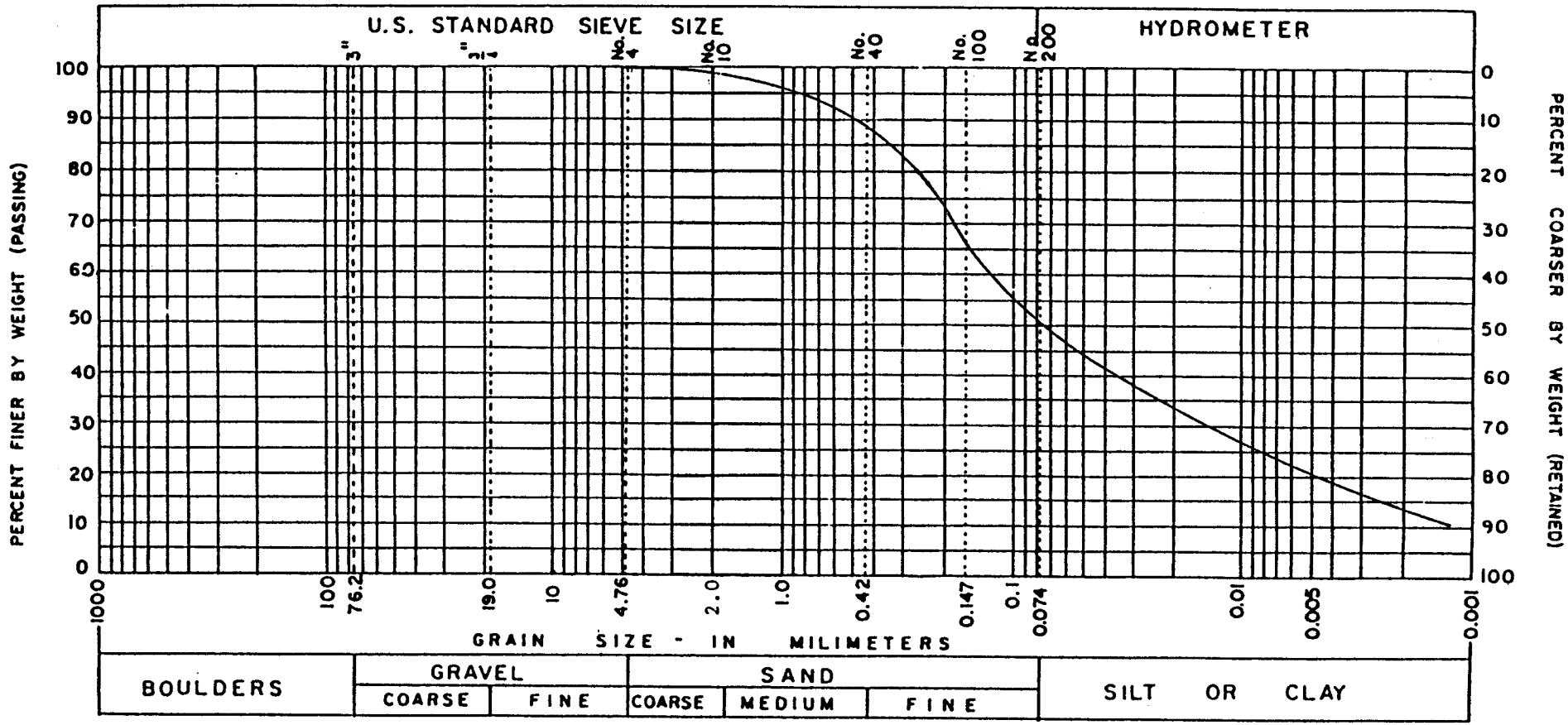
SAMPLE NO.	DEPTH	L.L.	P.I.	M.C.	USDA Class.	Soil Description
TP#1	-	30	10	12.4		Brown Clayey f-m SAND
						Unified Class - SC

NFE

GRAIN-SIZE DISTRIBUTION

TESTED BY: RMP	DATE: 3/3/94
CHECKED BY: PAD	SHEET No. 1 OF 10

PROJECT: City of Durham Landfill		LOCATION: Durham, North Carolina	
BORING NO. TP#2	SAMPLE NO. -	DEPTH: -	CONTRACT NO. 94-023



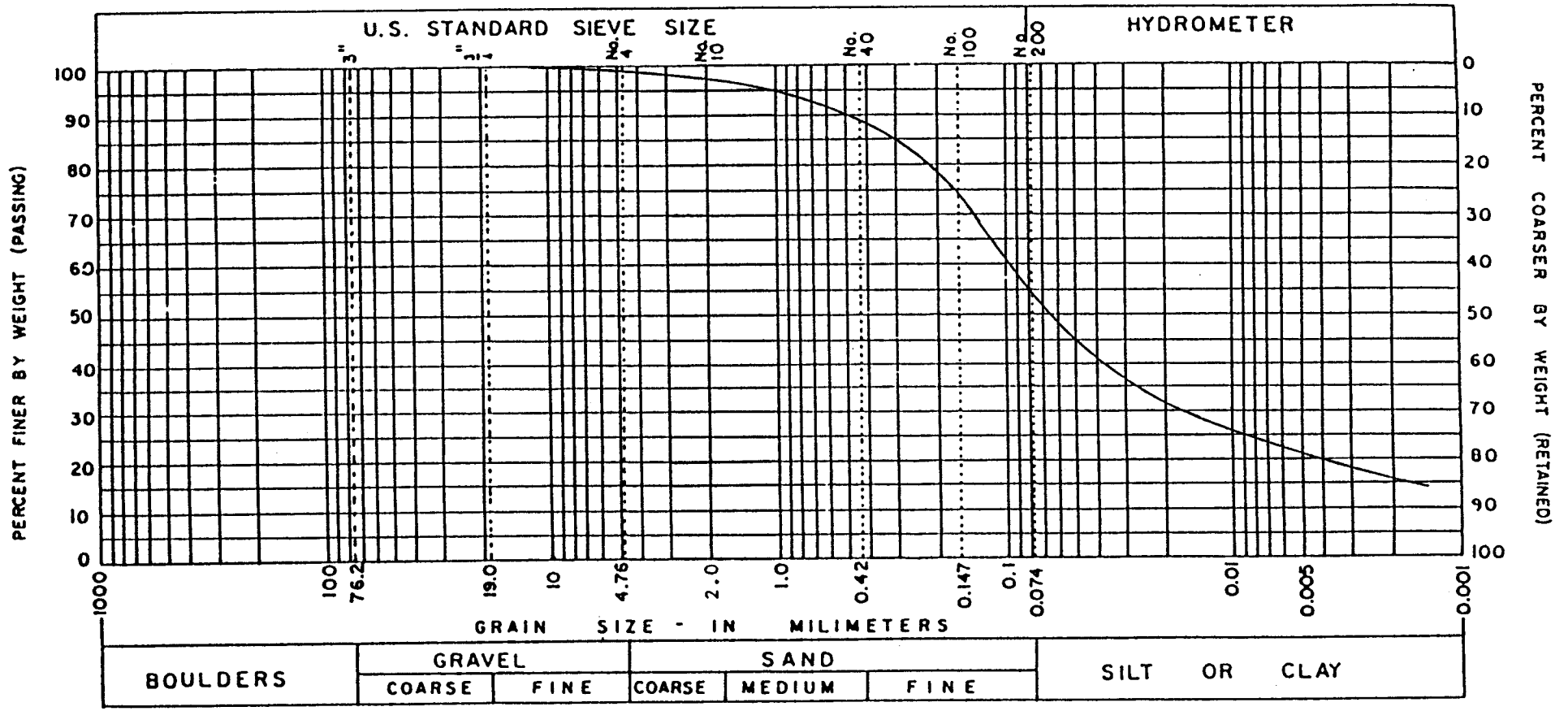
SAMPLE NO.	DEPTH	L.L.	P.I.	M.C.	USDA Class.	Soil Description
TP-# 2		32	13	20.8		Brown sandy clay
						Unified Class - CL

NFE

GRAIN-SIZE DISTRIBUTION

TESTED BY: RMP	DATE: 3/10/94
CHECKED BY: PAD	SHEET No. 2 OF 10

PROJECT: City of Durham Landfill		LOCATION: Durham, North Carolina	
BORING NO. TP#3	SAMPLE NO. -	DEPTH: -	CONTRACT NO. 94-023



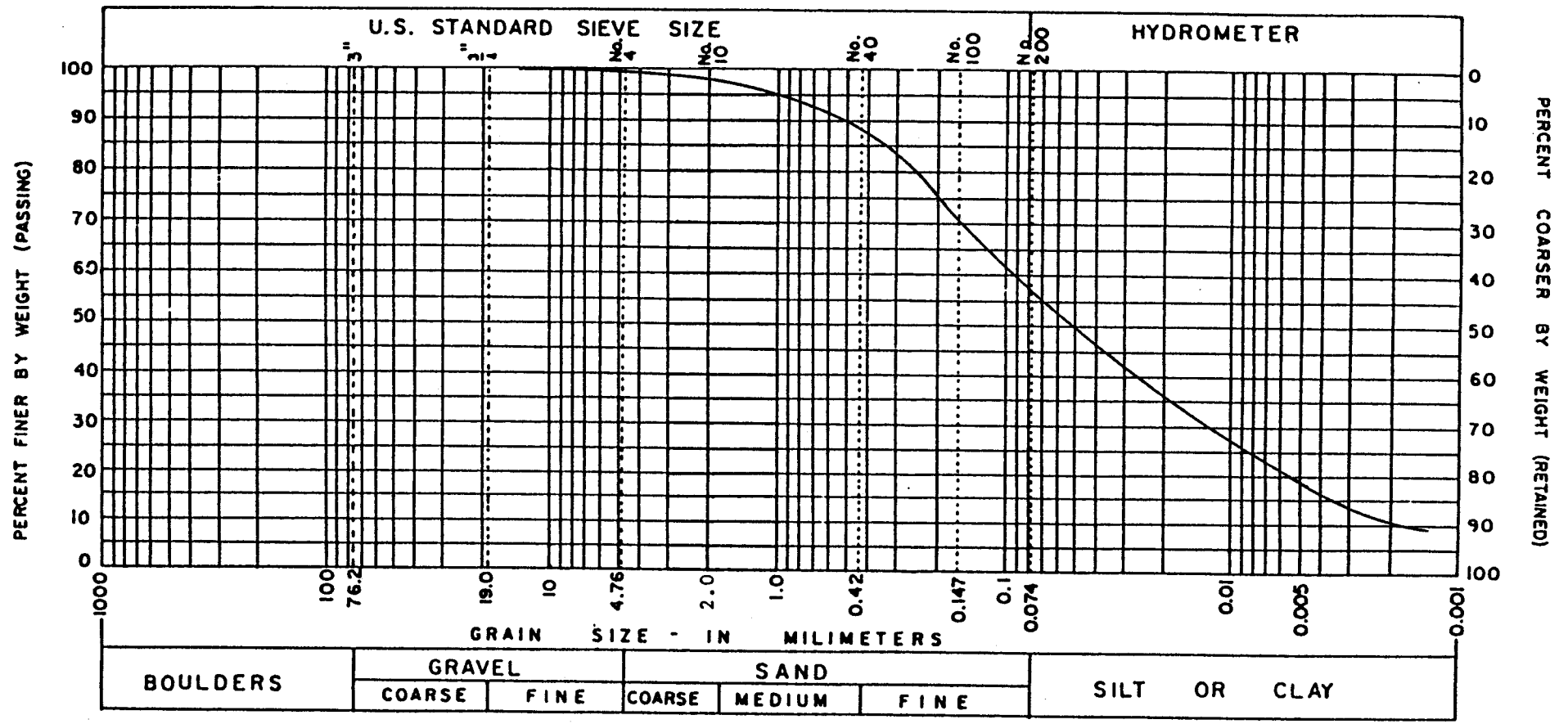
SAMPLE NO.	DEPTH	L.L.	P.I.	M.C.	USDA Class.	Soil Description
TP#3	-	32	15	19.5		Brown Sandy clay
						Unified Class - CL

NFE

GRAIN-SIZE DISTRIBUTION

TESTED BY: RMP	DATE: 3/3/94
CHECKED BY: PAD	SHEET No. 3 OF 10

PROJECT: City of Durham Landfill		LOCATION: Durham, North Carolina	
BORING NO. TP#6	SAMPLE NO. -	DEPTH: -	CONTRACT NO. 94-023



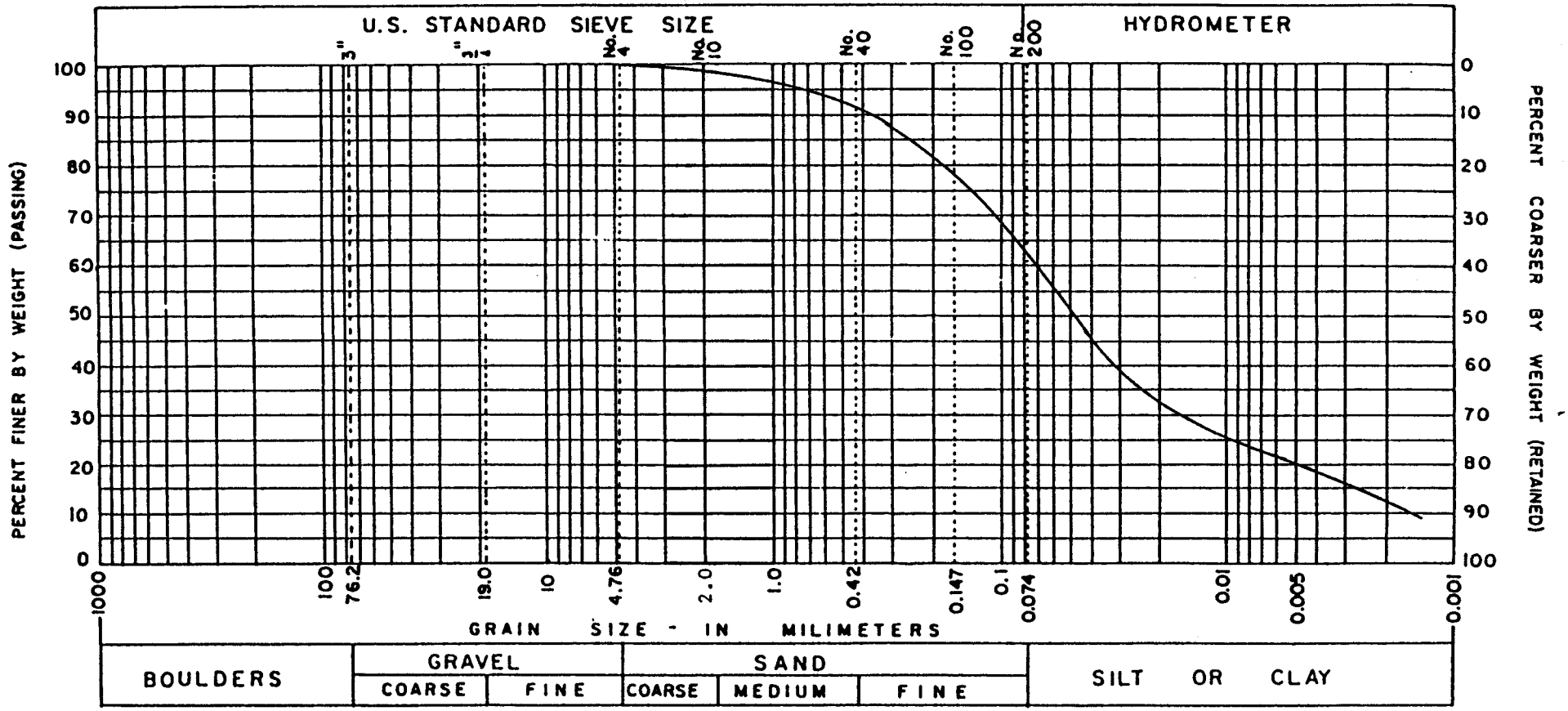
SAMPLE NO.	DEPTH	L.L.	P.I.	M.C.	USDA Class.	Soil Description
-	-	32	15	22.3	-	Brown sandy silty clay
						Unified Class - CL

NFE

GRAIN-SIZE DISTRIBUTION

TESTED BY: RMP	DATE: 3/16/94
CHECKED BY: PAD	SHEET No. 4 OF 10

PROJECT: City of Durham Landfill		LOCATION: Durham, North Carolina	
BORING NO. TP #8	SAMPLE NO. -	DEPTH: -	CONTRACT NO. 94-023



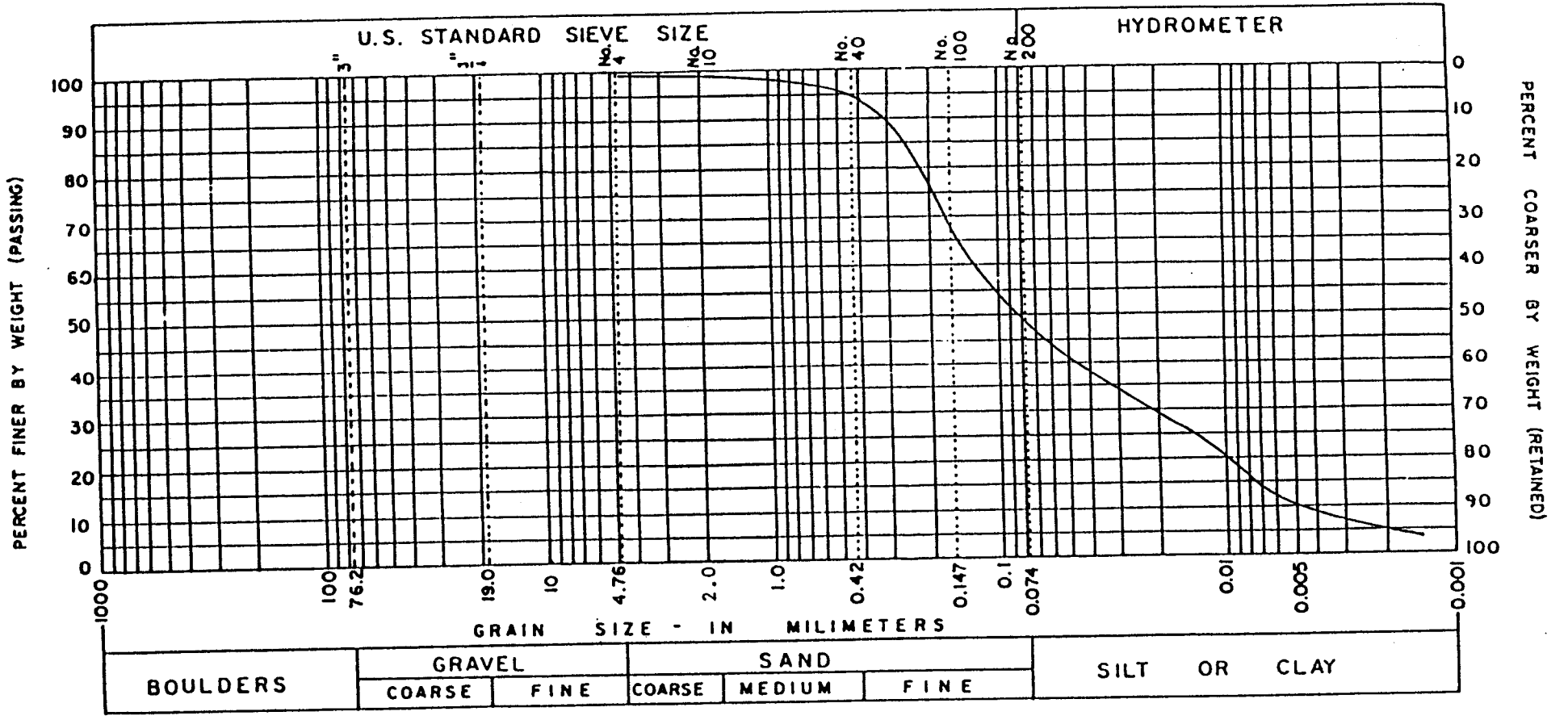
SAMPLE NO.	DEPTH	L.L.	P.I.	M.C.	USDA Class.	Soil Description
TP #8	-	32	11	19.1		Brown sandy clay
						Unified Class - CL

NFE

GRAIN-SIZE DISTRIBUTION

TESTED BY: RMP	DATE: 3/3/94
CHECKED BY: PAD	SHEET No. 5 OF 10

PROJECT: City of Durham Landfill		LOCATION: Durham, North Carolina	
BORING NO. TP #11	SAMPLE NO. -	DEPTH: -	CONTRACT NO. 94-023



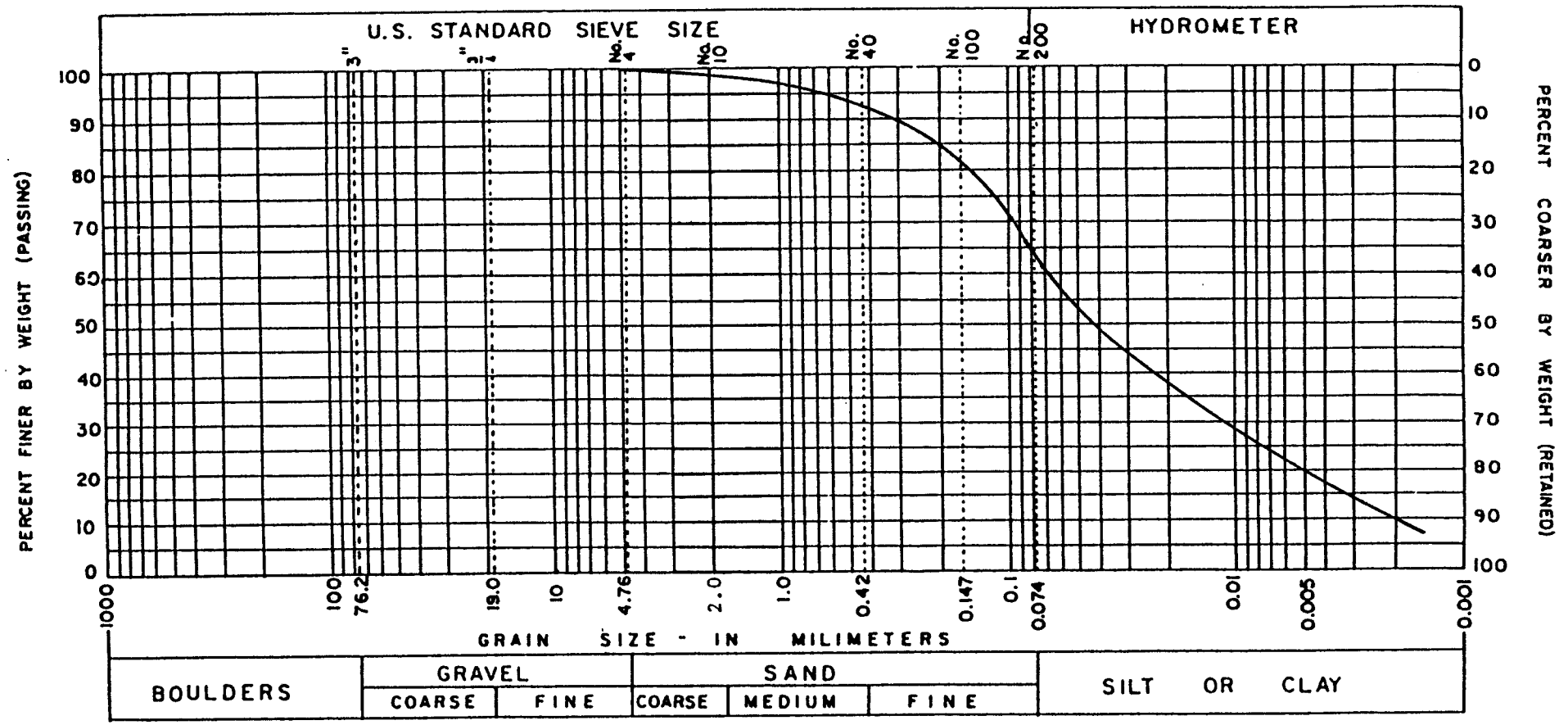
SAMPLE NO.	DEPTH	L.L.	P.I.	M.C.	USDA Class.	Soil Description
TP #11	-	36	12	21.0		Brown Silty CLAY and Fine Sand
						Unified Class - CL

NFE

GRAIN-SIZE DISTRIBUTION

TESTED BY: RMP	DATE: 3/3/94
CHECKED BY: PAD	SHEET No. 7 OF 10

PROJECT: City of Durham Landfill		LOCATION: Durham, North Carolina	
BORING NO. TP #15	SAMPLE NO. -	DEPTH: -	CONTRACT NO. 94-023



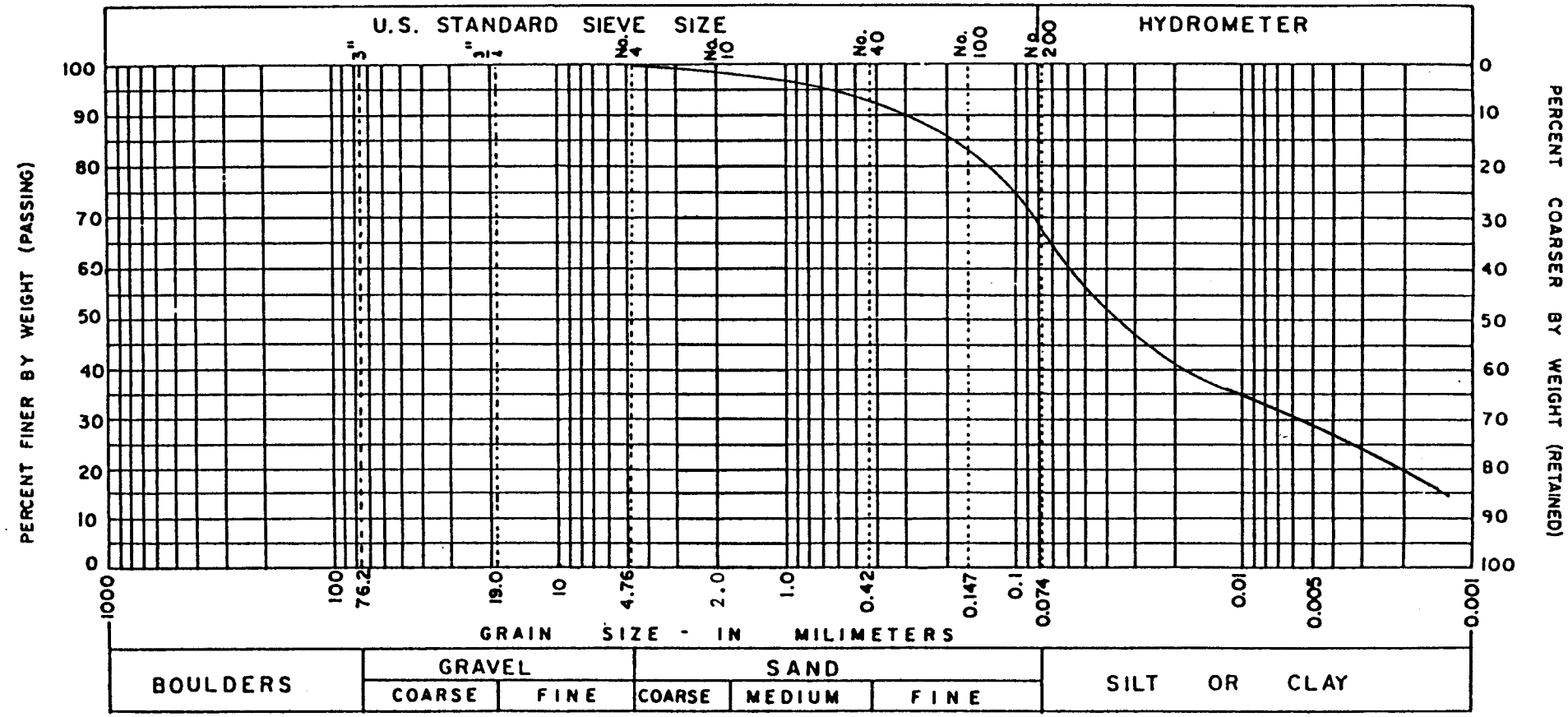
SAMPLE NO.	DEPTH	L.L.	P.I.	M.C.	USDA Class.	Soil Description
-	-	41	17	28.1	-	Tan silty clay, some Sand
						Unified Class - CL

NFE

GRAIN-SIZE DISTRIBUTION

TESTED BY: RMP	DATE: 3/10/94
CHECKED BY: PAD	SHEET No. 7 OF 10

PROJECT: City of Durham Landfill		LOCATION: Durham, North Carolina	
BORING NO. TP #17	SAMPLE NO. -	DEPTH: -	CONTRACT NO. 94-023



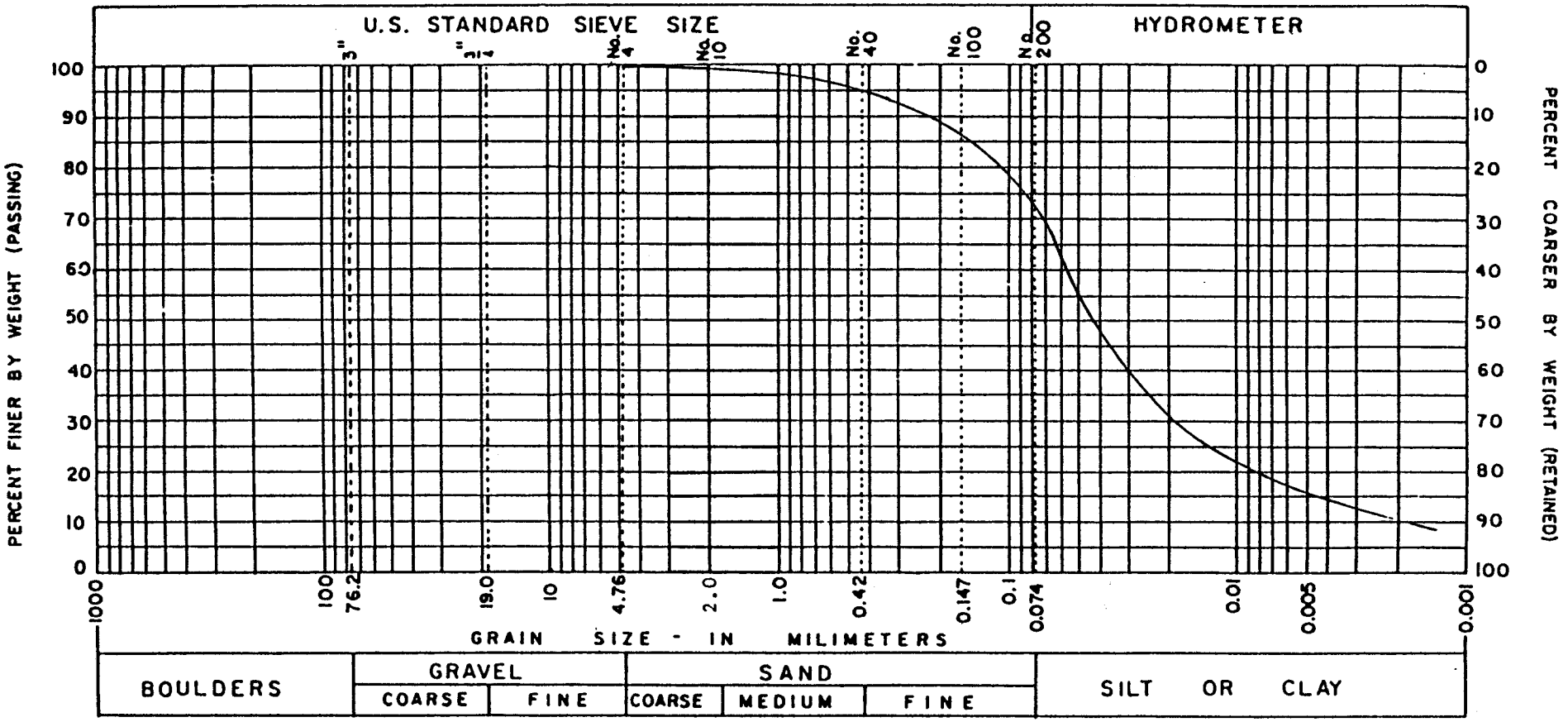
SAMPLE NO.	DEPTH	L.L.	P.I.	M.C.	USDA Class.	Soil Description
TP #17		35	15	20		Brown Sandy CLAY
						Unified Class - CL

NFE

GRAIN-SIZE DISTRIBUTION

TESTED BY: RMP	DATE: 3/3/94
CHECKED BY: PAD	SHEET No. 8 OF 10

PROJECT: City of Durham Landfill		LOCATION: Durham, North Carolina	
BORING NO. TP #19	SAMPLE NO. T-19	DEPTH: -	CONTRACT NO. 94-023



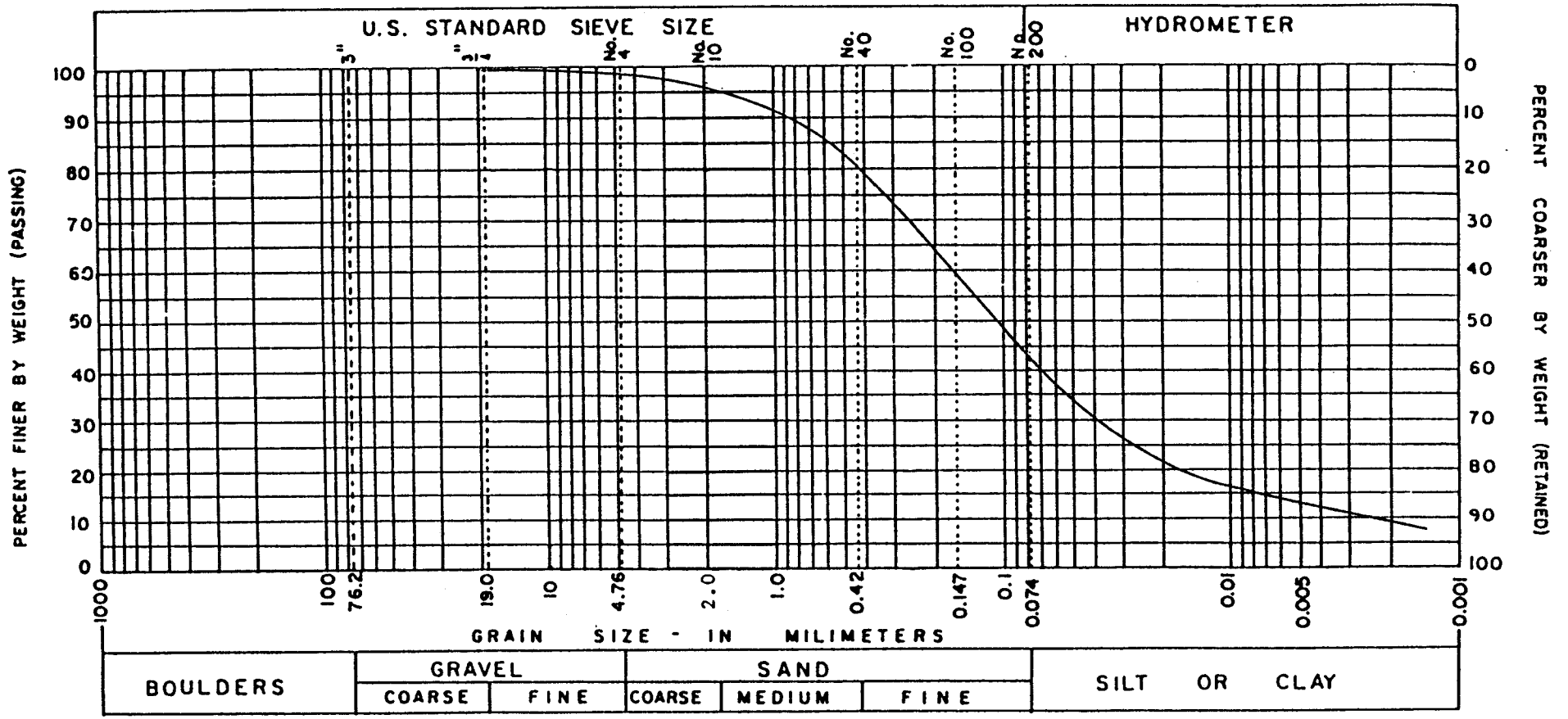
SAMPLE NO.	DEPTH	L.L.	P.I.	M.C.	USDA Class.	Soil Description
TP #19	-	31	11	12.4		Brown Silty CLAY, some Sand
						Unified Class - CL

NFE

GRAIN-SIZE DISTRIBUTION

TESTED BY: RMP	DATE: 3/3/94
CHECKED BY: PAD	SHEET No. 9 OF 10

PROJECT: City of Durham Landfill		LOCATION: Durham, North Carolina	
BORING NO. TP #20	SAMPLE NO. -	DEPTH: -	CONTRACT NO. 94-023



SAMPLE NO.	DEPTH	L.L.	P.I.	M.C.	USDA Class.	Soil Description.
TP#20	-	33	12	19.0		Brown clayey sand
						Unified Class - SC

NFE

GRAIN-SIZE DISTRIBUTION

TESTED BY: RMP	DATE: 3/10/94
CHECKED BY: PAD	SHEET No. 10 OF 10

NFE

TEST PIT LOGS

NFE TECHNOLOGIES, INC.

P.O. Box 374 • Cary, North Carolina 27512-0374 • (919) 851-9000

RECORD OF SOIL EXPLORATION (TEST PIT LOG)

Client: Malcolm-Pirnie, Inc. Newport News , Virginia **Boring No.** TP # 1
Project Name: City of Durham Landfill Closure Plan **Project No.** 94NCP020
Site Location: 2115 East Club Boulevard, Durham, N.C. **County & State:** DURHAM, NC
Boring Location(Sta.) Per Plan **Offset** 0.0 **Alignment:** See location Plan
Geologist: Paul Turner **Date Started:** 02.18.94 **Date Completed:** 02.18.94
Collar Elevation ___ **Drill Machine:** Backhoe and Steel track Bulldozer
Total Depth: Feet **Ground Water at: 0 Hr.** ___ **at 24 Hr.** Dry

Boring Log drawn by: Jenne Sowell, Geologist

Elev. in Feet	Depth Ft.	Sample No.	Groundwater	Log	Soil & Rock Description
	-0.0				Top Soil 3"
	-1.0				Brown clayey fine to medium sand
	-2.0				2'-0"
	-3.0				Landfill refuse encountered
	-4.0				
	-5.0				

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RECORD OF SOIL EXPLORATION (TEST PIT LOG)

Client: Malcolm-Pirnie, Inc. Newport News , Virginia **Boring No.** TP # 2
Project Name: City of Durham Landfill Closure Plan **Project No.** 94NCP020
Site Location: 2115 East Club Boulevard, Durham, N.C. **County & State:** DURHAM, NC
Boring Location(Sta.) Per Plan **Offset** 0.0 **Alignment:** See location Plan
Geologist: Paul Turner **Date Started:** 02.18.94 **Date Completed:** 02.18.94
Collar Elevation ____ **Drill Machine:** Backhoe and Steel track Bulldozer
Total Depth: Feet **Ground Water at: 0 Hr.** ____ **at 24 Hr.** Dry

Boring Log drawn by: Jenne Sowell, Geologist

Elev. in Feet	Depth Ft.	Sample No.	Groundwater	Log	Soil & Rock Description
	-0.0				Top Soil 3"
	-1.0				Brown sandy clay
	-2.0				2'-2"
	-3.0				Landfill refuse encountered
	-4.0				
	-5.0				

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RECORD OF SOIL EXPLORATION (TEST PIT LOG)

Client: Malcolm-Pirnie, Inc. Newport News , Virginia **Boring No.** TP # 3
Project Name: City of Durham Landfill Closure Plan **Project No.** 94NCP020
Site Location: 2115 East Club Boulevard, Durham, N.C. **County & State:** DURHAM, NC
Boring Location(Sta.) Per Plan **Offset** 0.0 **Alignment:** See location Plan
Geologist: Paul Turner **Date Started:** 02.18.94 **Date Completed:** 02.18.94
Collar Elevation ____ **Drill Machine:** Backhoe and Steel track Bulldozer
Total Depth: Feet **Ground Water at: 0 Hr.** ____ **at 24 Hr.** Dry

Boring Log drawn by: Jenne Sowell, Geologist

Elev. in Feet	Depth Ft.	Sample No.	Groundwater	Log	Soil & Rock Description
	-0.0				Top Soil 2"
	-1.0				Brown sandy clay 1'-6"
	-2.0				Landfill refuse encountered
	-3.0				
	-4.0				
	-5.0				

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RECORD OF SOIL EXPLORATION (TEST PIT LOG)

Client: Malcolm-Pirnie, Inc. Newport News , Virginia **Boring No.** TP # 4
Project Name: City of Durham Landfill Closure Plan **Project No.** 94NCP020
Site Location: 2115 East Club Boulevard, Durham, N.C. **County & State:** DURHAM, NC
Boring Location(Sta.) Per Plan **Offset** 0.0 **Alignment:** See location Plan
Geologist: Paul Turner **Date Started:** 02.18.94 **Date Completed:** 02.18.94
Collar Elevation ____ **Drill Machine:** Backhoe and Steel track Bulldozer
Total Depth: Feet **Ground Water at: 0 Hr.** ____ **at 24 Hr.** Dry

Boring Log drawn by: Jenne Sowell, Geologist

Elev. in Feet	Depth Ft.	Sample No.	Groundwater	Log	Soil & Rock Description
	-0.0				Top Soil 3"
	-1.0				Brown sandy silty clay
	-2.0				
	-3.0				3'-2"
	-4.0				Landfill refuse encountered
	-5.0				

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RECORD OF SOIL EXPLORATION (TEST PIT LOG)

Client: Malcolm-Pirnie, Inc. Newport News , Virginia **Boring No.** TP # 5
Project Name: City of Durham Landfill Closure Plan **Project No.** 94NCP020
Site Location: 2115 East Club Boulevard, Durham, N.C. **County & State:** DURHAM, NC
Boring Location(Sta.) **Offset** 0.0 **Alignment:**
Geologist: Paul Turner **Date Started:** 02.18.94 **Date Completed:** 02.18.94
Collar Elevation **Drill Machine:** Backhoe and Steel track Bulldozer
Total Depth: Feet **Ground Water at: 0 Hr.** **at 24 Hr.** Dry

Elev. in Feet	Depth Ft.	Sample No.	Groundwater	Log	Soil & Rock Description
	-0.0				Top Soil 4"
	-1.0				Brown sandy silty clay 2'-10"
	-3.0				Landfill refuse encountered
	-4.0				
	-5.0				

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RECORD OF SOIL EXPLORATION (TEST PIT LOG)

Client: Malcolm-Pirnie, Inc. Newport News , Virginia **Boring No.** TP #6
Project Name: City of Durham Landfill Closure Plan **Project No.** 94NCP020
Site Location: 2115 East Club Boulevard, Durham, N.C. **County & State:** DURHAM, NC
Boring Location(Sta.) Per Plan **Offset** 0.0 **Alignment:** See location Plan
Geologist: Paul Turner **Date Started:** 02.21.94 **Date Completed:** 02.21.94
Collar Elevation ____ **Drill Machine:** Backhoe and Steel track Bulldozer
Total Depth: Feet **Ground Water at: 0 Hr.** ____ **at 24 Hr.** Dry

Boring Log drawn by: Jenne Sowell, Geologist

Elev. in Feet	Depth Ft.	Sample No.	Groundwater	Log	Soil & Rock Description
	-0.0				Top Soil 2"
	-1.0				Brown sandy silty clay
	-2.0				Yellowish brown sandy silty clay 2'-2"
	-3.0				
	-4.0				
	-5.0				

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RECORD OF SOIL EXPLORATION (TEST PIT LOG)

Client: Malcolm-Pirnie, Inc. Newport News , Virginia **Boring No.** TP # 7
Project Name: City of Durham Landfill Closure Plan **Project No.** 94NCP020
Site Location: 2115 East Club Boulevard, Durham, N.C. **County & State:** DURHAM, NC
Boring Location(Sta.) Per Plan **Offset** 0.0 **Alignment:** See location Plan
Geologist: Paul Turner **Date Started:** 02.14.94 **Date Completed:** 02.1994
Collar Elevation ___ **Drill Machine:** Backhoe and Steel track Bulldozer
Total Depth: Feet **Ground Water at: 0 Hr.** ___ **at 24 Hr.** Dry

Boring Log drawn by: Jenne Sowell, Geologist

Elev. in Feet	Depth Ft.	Sample No.	Groundwater	Log	Soil & Rock Description
	-0.0				Top Soil 4"
	-1.0				Brown sandy clay 1'-8"
	-2.0				Mottled sandy clay
	-3.0				
	-4.0				
	-5.0				Bottom of hole 5'-0"

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RECORD OF SOIL EXPLORATION (TEST PIT LOG)

Client: Malcolm-Pirnie, Inc. Newport News , Virginia **Boring No.** TP # 8
Project Name: City of Durham Landfill Closure Plan **Project No.** 94NCP020
Site Location: 2115 East Club Boulevard, Durham, N.C. **County & State:** DURHAM, NC
Boring Location(Sta.) Per Plan **Offset** 0.0 **Alignment:** See location Plan
Geologist: Paul Turner **Date Started:** 02.14.94 **Date Completed:** 02.14.94
Collar Elevation ____ **Drill Machine:** Backhoe and Steel track Bulldozer
Total Depth: Feet **Ground Water at: 0 Hr.** ____ **at 24 Hr.** Dry

Boring Log drawn by: Jenne Sowell, Geologist

Elev. in Feet	Depth Ft.	Sample No.	Groundwater	Log	Soil & Rock Description
	-0.0				Top Soil 4"
	-1.0				Brown sandy clay 2'-0"
	-2.0 ←				Mottled sandy clay
	-3.0				
	-4.0				
	-5.0				Bottom of hole 5'-0"

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RECORD OF SOIL EXPLORATION (TEST PIT LOG)

Client: Malcolm-Pirnie, Inc. Newport News , Virginia **Boring No.** TP # 9
Project Name: City of Durham Landfill Closure Plan **Project No.** 94NCP020
Site Location: 2115 East Club Boulevard, Durham, N.C. **County & State:** DURHAM, NC
Boring Location(Sta.) Per Plan **Offset** 0.0 **Alignment:** See location Plan
Geologist: Paul Turner **Date Started:** 02.1594 **Date Completed:** 02.15.94
Collar Elevation ____ **Drill Machine:** Backhoe and Steel track Bulldozer
Total Depth: Feet **Ground Water at: 0 Hr.** ____ **at 24 Hr.** Dry

Boring Log drawn by: Jenne Sowell, Geologist

Elev. in Feet	Depth Ft.	Sample No.	Groundwater	Log	Soil & Rock Description
	-0.0				Top Soil 2"
	-1.0				Brown sandy clay 1'-5"
	-2.0				Mottled sandy clay
	-3.0				
	-4.0				Bottom of hole 4'-4"
	-5.0				

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RECORD OF SOIL EXPLORATION (TEST PIT LOG)

Client: Malcolm-Pirnie, Inc. Newport News , Virginia **Boring No.** TP # 10
Project Name: City of Durham Landfill Closure Plan **Project No.** 94NCP020
Site Location: 2115 East Club Boulevard, Durham, N.C. **County & State:** DURHAM, NC
Boring Location(Sta.) Per Plan **Offset** 0.0 **Alignment:** See location Plan
Geologist: Paul Turner **Date Started:** 02.15.94 **Date Completed:** 02.15.94
Collar Elevation ____ **Drill Machine:** Backhoe and Steel track Bulldozer
Total Depth: Feet **Ground Water at: 0 Hr.** ____ **at 24 Hr.** ____

Boring Log drawn by: Jenne Sowell, Geologist

Elev. in Feet	Depth Ft.	Sample No.	Groundwater	Log	Soil & Rock Description
	-0.0				Top Soil 2"
	-1.0				Silty clay with fine sand 1'-4"
	-2.0				Brown silty clay
	-3.0				
	-4.0				Bottom of hole 4'-0"
	-5.0				

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RECORD OF SOIL EXPLORATION (TEST PIT LOG)

Client: Malcolm-Pirnie, Inc. Newport News , Virginia **Boring No.** TP # 11
Project Name: City of Durham Landfill Closure Plan **Project No.** 94NCP020
Site Location: 2115 East Club Boulevard, Durham, N.C. **County & State:** DURHAM, NC
Boring Location(Sta.) Per Plan **Offset** 0.0 **Alignment:** See location Plan
Geologist: Paul Turner **Date Started:** 02.18.94 **Date Completed:** 02.1494
Collar Elevation ____ **Drill Machine:** Backhoe and Steel track Bulldozer
Total Depth: Feet **Ground Water at: 0 Hr.** ____ **at 24 Hr.** Dry

Boring Log drawn by: Jenne Sowell, Geologist

Elev. in Feet	Depth Ft.	Sample No.	Groundwater	Log	Soil & Rock Description
	-0.0				Top Soil 3 1/2"
	-1.0				Brown silty clay with fine sand 2'-0"
	-2.0				Landfill refuse encountered
	-3.0				
	-4.0				
	-5.0				

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RECORD OF SOIL EXPLORATION (TEST PIT LOG)

Client: Malcolm-Pirnie, Inc. Newport News , Virginia **Boring No.** TP # 12
Project Name: City of Durham Landfill Closure Plan **Project No.** 94NCP020
Site Location: 2115 East Club Boulevard, Durham, N.C. **County & State:** DURHAM, NC
Boring Location(Sta.) Per Plan **Offset** 0.0 **Alignment:** See location Plan
Geologist: Paul Turner **Date Started:** 03.07.94 **Date Completed:** 03.07.94
Collar Elevation ___ **Drill Machine:** Backhoe and Steel track Bulldozer
Total Depth: Feet **Ground Water at: 0 Hr.** ____ **at 24 Hr.** Dry

Boring Log drawn by: Jenne Sowell, Geologist

Elev. in Feet	Depth Ft.	Sample No.	Groundwater	Log	Soil & Rock Description
	-0.0				Top Soil 3"
	-1.0				Brown clayey fine sand 2'-2"
	-2.0				Brown clayey sand 3'-0"
	-3.0				Landfill refuse encountered
	-4.0				
	-5.0				

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RECORD OF SOIL EXPLORATION (TEST PIT LOG)

Client: Malcolm-Pirnie, Inc. Newport News , Virginia **Boring No.** TP # 13
Project Name: City of Durham Landfill Closure Plan **Project No.** 94NCP020
Site Location: 2115 East Club Boulevard, Durham, N.C. **County & State:** DURHAM, NC
Boring Location(Sta.) Per Plan **Offset** 0.0 **Alignment:** See location Plan
Geologist: Paul Turner **Date Started:** 3.07.94 **Date Completed:** 03.07.94
Collar Elevation ____ **Drill Machine:** Backhoe and Steel track Bulldozer
Total Depth: Feet **Ground Water at: 0 Hr.** ____ **at 24 Hr.** ____

Boring Log drawn by: Jenne Sowell, Geologist

Elev. in Feet	Depth Ft.	Sample No.	Groundwater	Log	Soil & Rock Description
	-0.0				Top Soil 2"
	-1.0				Brown sandy clay 1'-0"
	-2.0				Yellowish orange medium to fine sand 2'-0"
	-3.0				Reddish brown sandy clay
	-4.0				Bottom of hole 3'-7"
	-5.0				

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RECORD OF SOIL EXPLORATION (TEST PIT LOG)

Client: Malcolm-Pirnie, Inc. Newport News , Virginia **Boring No.** TP #14
Project Name: City of Durham Landfill Closure Plan **Project No.** 94NCP020
Site Location: 2115 East Club Boulevard, Durham, N.C. **County & State:** DURHAM, NC
Boring Location(Sta.) Per Plan **Offset** 0.0 **Alignment:** See location Plan
Geologist: Paul Turner **Date Started:** 03.07.94 **Date Completed:** 03.07.94
Collar Elevation ____ **Drill Machine:** Backhoe and Steel track Bulldozer
Total Depth: Feet **Ground Water at: 0 Hr.** ____ **at 24 Hr.** Dry

Boring Log drawn by: Jenne Sowell, Geologist

Elev. in Feet	Depth Ft.	Sample No.	Groundwater	Log	Soil & Rock Description
	-0.0				Top Soil 1"
	-1.0				Brown silty clay with some sand
	-2.0				Bottom of hole 1'-6"
	-3.0				Landfill refuse encountered
	-4.0				
	-5.0				

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RECORD OF SOIL EXPLORATION (TEST PIT LOG)

Client: Malcolm-Pirnie, Inc. Newport News , Virginia **Boring No.** TP #15
Project Name: City of Durham Landfill Closure Plan **Project No.** 94NCP020
Site Location: 2115 East Club Boulevard, Durham, N.C. **County & State:** DURHAM, NC
Boring Location(Sta.) Per Plan **Offset** 0.0 **Alignment:** See location Plan
Geologist: Paul Turner **Date Started:** 02.21.94 **Date Completed:** 02.21.94
Collar Elevation ____ **Drill Machine:** Backhoe and Steel track Bulldozer
Total Depth: Feet **Ground Water at: 0 Hr.** ____ **at 24 Hr.** Dry

Boring Log drawn by: Jenne Sowell, Geologist

Elev. in Feet	Depth Ft.	Sample No.	Groundwater	Log	Soil & Rock Description
	-0.0				Top Soil 2 1/2"
	-1.0				Tan silty clay with some sand
	-2.0				
	-3.0				
	-4.0				4'-2"
	-5.0				Landfill refuse encountered

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RECORD OF SOIL EXPLORATION (TEST PIT LOG)

Client: Malcolm-Pirnie, Inc. Newport News , Virginia **Boring No.** TP # 16
Project Name: City of Durham Landfill Closure Plan **Project No.** 94NCP020
Site Location: 2115 East Club Boulevard, Durham, N.C. **County & State:** DURHAM, NC
Boring Location(Sta.) Per Plan **Offset** 0.0 **Alignment:** See location Plan
Geologist: Paul Turner **Date Started:** 02.21.94 **Date Completed:** 02.21.94
Collar Elevation ___ **Drill Machine:** Backhoe and Steel track Bulldozer
Total Depth: Feet **Ground Water at: 0 Hr.** ___ **at 24 Hr.** Dry

Boring Log drawn by: Jenne Sowell, Geologist

Elev. in Feet	Depth Ft.	Sample No.	Groundwater	Log	Soil & Rock Description
	-0.0				Top Soil 3"
	-1.0				Burgundy silty clay
	-2.0				
	-3.0				3'-0"
	-4.0				Landfill refuse encountered
	-5.0				

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RECORD OF SOIL EXPLORATION (TEST PIT LOG)

Client: Malcolm-Pirnie, Inc. Newport News , Virginia **Boring No.** TP # 17
Project Name: City of Durham Landfill Closure Plan **Project No.** 94NCP020
Site Location: 2115 East Club Boulevard, Durham, N.C. **County & State:** DURHAM, NC
Boring Location(Sta.) Per Plan **Offset** 0.0 **Alignment:** See location Plan
Geologist: Paul Turner **Date Started:** 02.18.94 **Date Completed:** 02. .94
Collar Elevation ___ **Drill Machine:** Backhoe and Steel track Bulldozer
Total Depth: Feet **Ground Water at: 0 Hr.** ___ **at 24 Hr.** Dry

Boring Log drawn by: Jenne Sowell, Geologist

Elev. in Feet	Depth Ft.	Sample No.	Groundwater	Log	Soil & Rock Description
	-0.0				Top Soil 2"
	-1.0				Brown sandy clay 1'-5"
	-2.0				Burgundy sandy clay
	-3.0				
	-4.0				Bottom of hole 4'-0"
	-5.0				

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RECORD OF SOIL EXPLORATION (TEST PIT LOG)

Client: Malcolm-Pirnie, Inc. Newport News , Virginia **Boring No.** TP # 18
Project Name: City of Durham Landfill Closure Plan **Project No.** 94NCP020
Site Location: 2115 East Club Boulevard, Durham, N.C. **County & State:** DURHAM, NC
Boring Location(Sta.) Per Plan **Offset** 0.0 **Alignment:** See location Plan
Geologist: Paul Turner **Date Started:** 3.07.94 **Date Completed:** 03.07.94
Collar Elevation ___ **Drill Machine:** Backhoe and Steel track Bulldozer
Total Depth: Feet **Ground Water at: 0 Hr.** ___ **at 24 Hr.** Dry

Boring Log drawn by: Jenne Sowell, Geologist

Elev. in Feet	Depth Ft.	Sample No.	Groundwater	Log	Soil & Rock Description
	-0.0				Top Soil 1"
	-				Tan sandy silty clay
	-				
	-				
	-1.0				1'-0"
	-				Dark gray sandy silty clay
	-				
	-				
	-2.0				
	-				Bottom of hole 2'-6"
	-				
	-				Landfill refuse encountered
	-3.0				
	-				
	-				
	-				
	-4.0				
	-				
	-				
	-				
	-5.0				
	-				

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RECORD OF SOIL EXPLORATION (TEST PIT LOG)

Client: Malcolm-Pirnie, Inc. Newport News , Virginia **Boring No.** TP # 19
Project Name: City of Durham Landfill Closure Plan **Project No.** 94NCP020
Site Location: 2115 East Club Boulevard, Durham, N.C. **County & State:** DURHAM, NC
Boring Location(Sta.) Per Plan **Offset** 0.0 **Alignment:** See location Plan
Geologist: Paul Turner **Date Started:** 02.18.94 **Date Completed:** 02. .94
Collar Elevation ___ **Drill Machine:** Backhoe and Steel track Bulldozer
Total Depth: Feet **Ground Water at: 0 Hr.** ___ **at 24 Hr.** Dry

Boring Log drawn by: Jenne Sowell, Geologist

Elev. in Feet	Depth Ft.	Sample No.	Groundwater	Log	Soil & Rock Description
	-0.0				Top Soil 4"
	-1.0				Brown silty clay with some sand
	-2.0				
	-3.0				3'-9"
	-4.0				Bluish gray silty clay with sand
	-5.0				Bottom of hole 5'-0"

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RECORD OF SOIL EXPLORATION (TEST PIT LOG)

Client: Malcolm-Pirnie, Inc. Newport News , Virginia **Boring No.** TP # 20
Project Name: City of Durham Landfill Closure Plan **Project No.** 94NCP020
Site Location: 2115 East Club Boulevard, Durham, N.C. **County & State:** DURHAM, NC
Boring Location(Sta.) Per Plan **Offset** 0.0 **Alignment:** See location Plan
Geologist: Paul Turner **Date Started:** 03.07.94 **Date Completed:** 03. 7.94
Collar Elevation ____ **Drill Machine:** Backhoe and Steel track Bulldozer
Total Depth: Feet **Ground Water at: 0 Hr.** ____ **at 24 Hr.** Dry

Boring Log drawn by: Jenne Sowell, Geologist

Elev. in Feet	Depth Ft.	Sample No.	Groundwater	Log	Soil & Rock Description
	-0.0				Top Soil 3"
	-1.0				Brown clayey sand
	-2.0				
	-3.0				
	-4.0 ←				Bottom of hole 4'
	-5.0				

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APPENDIX B

LOW PERMEABILITY SOIL SPECIFICATION SECTION 02250

SECTION 02250

LOW PERMEABILITY SOIL

PART 1 - GENERAL

1.1 Description

A. Scope:
   1. CONTRACTOR shall furnish all labor, material, tools, equipment, accessories, testing, and laboratory services necessary to excavate, transport, place, and compact the low permeability soil (clay) used as infiltration layer in cap construction. The low permeability soil shall be placed in the locations shown on the Drawings.

B. Definitions:
   1. Clay: In this specification, the low permeability soil used for construction shall hereinafter be called clay.
   2. Lift: A lift is defined as a constructed segment of a clay layer composed of clay materials placed to the specified thickness.

C. Related Sections:
   1. Section 02233, Excavation and Backfill.

1.2 REFERENCE STANDARDS

1. ASTM D2216, Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures.
2. ASTM D422, Particle-Size Analysis of Soils.
3. ASTM D4318, Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
4. ASTM D698, Laboratory Compaction Characteristics of Soil Using Standard Effort.
5. ASTM D2922, Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).
6. ASTM D5084, Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
7. ASTM D3017, Test Method for Water Content of Soil and Rock in Place by Nuclear Methods.

1.3 QUALITY ASSURANCE

A. Testing Laboratory:
   1. The services of a qualified testing laboratory, approved by the ENGINEER, shall be engaged by CONTRACTOR to make tests and determine the acceptability of the clay material. CONTRACTOR shall be responsible for coordinating and scheduling all testing with laboratory so as not to delay completion of the Work.

B. Material Evaluation:
   1. CONTRACTOR shall demonstrate suitability of clay material by performing the tests listed in paragraph 2.1.B.1 on representative samples of each clay source, soil type or stockpile to be used for the Work.
   2. CONTRACTOR shall determine the relationship between the saturated hydraulic conductivity and moisture content of laboratory compacted specimens for each clay source in accordance with the following:
      a. A minimum of 5 laboratory compacted specimens shall be prepared.
      b. Specimens shall be compacted in accordance with ASTM D 698 using Standard Proctor Effort (12,400 ft. - lbf/ft^3(600 $kN-m/m^3$)).
      c. Specimens shall be prepared over a range of moisture content suitable for determining the minimum saturated hydraulic conductivity of each clay source.
      d. Saturated hydraulic conductivity of each laboratory compacted specimen to be determined in accordance with ASTM D 5084, Method C, using a hydraulic gradient no greater than 10.
   3. CONTRACTOR shall determine an acceptable range of moisture content, in order to achieve a saturated hydraulic conductivity of no greater than 1×10^{-7} cm/sec for compacted clay soil.
   4. CONTRACTOR shall determine resulting Standard Proctor dry density (expressed as percent Standard Proctor maximum dry density) corresponding with the acceptable range of moisture content used to achieve a saturated hydraulic conductivity of no greater than 1×10^{-7} cm/sec.
   5. Material evaluation testing shall be completed and submitted for approval prior to incorporation into the work.
   6. CONTRACTOR shall provide sufficient lead time in order for ENGINEER to review test results for approval.

C. Test Pad Evaluation:
   1. General:
      a. CONTRACTOR shall construct a 20-foot by 20-foot test pad for clay and demonstrate the proposed compaction equipment and method can achieve the specified saturated hydraulic conductivity, in accordance with the following:
         1) The CONTRACTOR shall use the equipment and methods proposed for the Work to construct the test pad.
         2) Adjust lift thickness, water content of clay, compactor weight, and number of passes of compacting equipment, to obtain the specified saturated hydraulic conductivity.
         3) Perform testing in accordance with paragraph 1.3.C.5., as necessary to demonstrate performance to satisfaction of ENGINEER.
   2. Equipment:
      a. The equipment to be used for the test pad shall be approved by the ENGINEER. The equipment will include as a minimum a dozer, a front-end loader with truck(s) or a scraper, a padfoot compactor, and a smooth drum compactor.
      b. The clay soil material will be placed on the test pad in thin, uniform loose lifts not exceeding 9 inches thickness. A small dozer will be used to help distribute the loose

material and level off the surface. After the loose material is placed on the test pad and uniformly distributed, it will be compacted with the compaction equipment proposed for use during full scale construction.

c. A smooth drum compactor will be used to compact the final surface of the test pad to produce an even working surface, to compact loose material and indentations left on the surface by the padfoot compactor, and to help seal the test to minimize moisture loss.

3. Materials:
   a. The test pad materials shall consist of a clay soil material obtained from approved source. Adequate moisture will be added to the clay soil to achieve compaction criteria. Test pad material shall be approved by the ENGINEER. The materials used in the test pad construction shall be the same as those used in the work.
   b. The CONTRACTOR shall use all means necessary to protect all prior work, as well as materials, and completed work of other sections. All attempts should be made to keep precipitation from coming in contract with the clay soil material after placement.
   c. No frozen material shall be used, and in-place material that becomes frozen to completion of compaction operations shall be removed.
4. Construction:
   a. Subgrade Preparation:
      1) The area within the limits of the test pad shall be cleared and grubbed of all trees, debris, brush, stumps, roots, and any other vegetation. Following clearing and grubbing, the area shall be stripped of topsoil.
      2) 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 a 2 percent grade. No standing water or excessive moisture shall be allowed on the surface of the subgrade.
      3) The surface shall be inspected by the ENGINEER prior to beginning construction of the test pad.
   b. Configuration: The test pad shall be constructed in a rectangular shape approximately 20 feet long by 20 feet wide. The test pad shall be constructed to a thickness of 2.0 feet in uniform, horizontal lifts.
   c. Compaction of Clay Soils:
      1) Clay soils hall be spaced into uniform loose lifts not exceeding 9 inches thickness prior to compaction
      2) Compacted lift thickness shall not exceed 6 inches.
      3) Soil moisture content shall be adjusted as necessary to obtain the specified saturated hydraulic conductivity.
      4) Clay shall be compacted with a minimum of 2 one-way passes using proposed construction equipment. Contractor shall determine number of passes required to satisfy compaction and hydraulic conductivity criteria.
      5) Contractor shall achieve a competent bond between each lift of material by scarifying upper 1 inch of previous lift prior to placement of subsequent lifts.

5. Inspection and Testing:
   a. CONTRACTOR shall perform quality control inspection and testing of the test pad in accordance with the following:

QUALITY CONTROL TESTING OF THE TEST PAD

Test	Testing Method	Min. Sampling Frequency	Acceptance Criteria
Soil Classification	USCS (ASTM D 2487-83)	One composite sample per lift	USCS classification of CL or CH
Particle Size Distribution	ASTM D 422-63	One composite sample per lift	100% < 2 in. 95 - 100% < 3/4 in. 85 - 100% < No. 4 Mesh 55 - 100% < No. 10 Mesh 30 - 95% < No. 200 Mesh 25 - 90% < 0.05 mm 25 - 50% < 0.002 mm
Atterberg Limits	ASTM D 4318-84	One composite sample per lift	PI $\geq$ 10 LL $\geq$ 30
Field Density (Nuclear)	ASTM D 2922-81	10 tests per lift	$\geq$90% Standard Proctor Maximum Dry Density
Field Moisture	ASTM D 3017-88 (Nuclear Method)	10 tests per lift	N/A
Lift Thickness	Field Measurement	10 measurements of loose and compacted lifts per 6 inch lift	Loose lifts $\leq$ 9 inches Compacted lifts $\leq$ 6 inches
Soil Moisture Content	ASTM D 2216-80	10 tests per test pad (4 on first lift)	N/A
Hydraulic Conductivity	ASTM D 5084-90	Minimum 1 per lift	Hydraulic conductivity $\leq 1 \times 10^{-7}$ cm/sec
Thin Walled Shelby Tube	ASTM D 1587	1 per hydraulic conductivity test	N/A

* Composites obtained at location of in-place density testing on test pad; in-place moisture testing performed at same location as in-place density testing.

   b. For the first and second lifts, perform the following activities:
      1) Measure the thickness of the loose lifts.
      2) Count the number of compactor passes and observe compactor coverage of the test pad.
      3) Perform a minimum of 10 nuclear gauge in-place density and moisture readings (ASTM D 2922-81 and ASTM D 3017-88), compute degree of compaction (e.g., in-place dry density divided by Standard Proctor maximum dry density); collect 4 additional soil samples for moisture content determination (ASTM D 2216-80).
      4) One composite sample for soil classification (ASTM D 2487-83).
      5) One composite sample for particle size distribution (ASTM D 422-63).
      6) One composite sample for Atterberg limits (ASTM D 4318-84).
      7) Repair holes left in the lift as a result of density testing and soil sample collection.

8) Continue in-place density testing and moisture content determination to enable development of a curve giving in-place dry density versus number of compactor passes for each lift thickness.

6. The CONTRACTOR shall collect six randomly located and undisturbed Shelby tube samples from the completed test pad. The samples shall be waxed to retain moisture and tested in the laboratory for the following:
   a. Density
   b. Particle size distribution (ASTM D 422-63)
   c. Atterberg limits (ASTM D 4318-84)
   d. Soil classification (ASTM D 2487-83)
   e. Soil Moisture Content (ASTM D 2216-80)
   f. Hydraulic Conductivity (ASTM D 5084, Method C)
7. Permeability Testing: The permeability of the test pad shall be assessed by the performance of laboratory hydraulic conductivity testing performed by the CONTRACTOR. The test shall meet the testing standards specified in ASTM D 5084 Method C.

1.4 PERMITS AND REGULATIONS

A. CONTRACTOR shall obtain all necessary permits for obtaining and hauling off-site material, if required.

B. CONTRACTOR shall perform Work in compliance with applicable requirements of governing authorities having jurisdiction.

1.5 SUBMITTALS

A. CONTRACTOR shall submit all material evaluation test results in accordance with paragraph 2.1.B.1. to ENGINEER for approval prior to placement and compaction of any clay material.

B. Test Pad Construction: The CONTRACTOR shall document activities of the test pad construction, monitoring and testing in a test pad summary report, which shall include but not be limited to:
   1. Record of the compactor type, configuration and weight.
   2. Record thickness of lifts prior to and after compaction.
   3. Record density versus number of compactor passes for each lift thickness.
   4. Repair of holes in the lift as a result of density testing and soil sample collection.
   5. Record the number of compactor passes which will provide the specified degree of compaction and permeability.
   6. Record the procedure to bond lifts.
   7. Results of moisture, in-place density and degree of compaction.
   8. Results of permeability testing and other soil properties tests performed on undisturbed samples.
   9. As-built drawing of the test pad and locations of all test samples for each lift.
   10. Cross section of the test pad showing number of lifts and lift thickness.
   11. Description of actual construction procedures.

C. Test Pad Evaluation: Submit test pad evaluation in accordance with the following:
   1. Submit results to ENGINEER for approval prior to placement and compaction of any clay material.
   2. Submit for approval a description of the type of equipment and method(s) proposed for construction and compaction of the clay material.

D. Construction Testing: Submit all construction testing results in accordance with the following:
   1. Submit moisture, density, thickness, and hydraulic conductivity test results upon completion of each lift for approval by ENGINEER. No successive lifts of clay material shall be placed prior to approval by ENGINEER of construction test results.
   2. Submit all construction testing results in a timely manner so as not to delay construction.
   3. Submit two copies of a topographic survey having a scale no less than 1" = 100', indicating the location of all construction testing, for each lift of clay material placed.

PART 2 - PRODUCTS

2.1 CLAY

A. Clay material shall be placed where shown and specified. Clay material shall be natural clay, free from excessive moisture, frost, stumps, roots, sod, muck, marl, vegetable matter, and stones exceeding 2 inches in greatest dimension. No frozen material shall be used at any time.

B. The following testing shall be performed:
   1. Material Evaluation Testing:
      a. Perform following material evaluation testing and submit for approval prior to placement of any materials.

Test	Test Method	Frequency	Acceptance Criteria
Unified Soil Classification	ASTM D 2487-83	1 per source	USCS Classification of CL or CH.
Particle Size Distribution	ASTM D 422-63	1 per source	100% < 2 in. 95-100% < 3/4 in. 85-100% < 3/8 in. 80-100% < No. 4 mesh 55-100% < No. 10 mesh 30-95% < No. 200 mesh 25-95% < 0.05 mm 25-50% < 0.002 mm
Atterberg Limits	ASTM D 4318-84	1 per source	PI ≥ 10, LL ≥ 30

Test	Test Method	Frequency	Acceptance Criteria
Moisture - Density Relationship	ASTM D 698-78	1 per source	N/A (Used to establish moisture/density relationship of soil.)
Moisture Content	ASTM D 2216	1 per sample, and as necessary to establish moisture-density and moisture-hydraulic conductivity relationship.	Moisture content meets criteria established by test pad.
Hydraulic-Conductivity	ASTM D 5084 Method C	5 per soil type, borrow source or stockpile sample. Minimum 1 sample per 2,500 cy of soil.	1 x 10^{-7} cm/sec.

2. Construction Testing:
   a. CONTRACTOR shall perform construction testing in accordance with the following:

Test	Test Method	Frequency	Acceptance Criteria
Unified Soil Classification	ASTM D 2487-83	1 per horizontal interval of 200 feet per 12-inch lift. (Minimum 1 test per 12-inch lift for any interval ≤ 200 feet.)	USCS Classification of CL or CH.
Particle Size Distribution	ASTM D 422-63	1 per 200 feet centers per 6-inch lift. (Minimum 1 test per 6-inch lift for any interval ≤ 200 feet.)	100% < 2 in. 95-100% < 3/4 in. 85-100% < 3/8 in. 80-100% < No. 4 mesh 55-100% < No. 10 mesh 30-95% < No. 200 mesh 25-95% < 0.05 mm 25-50% < 0.002 mm
Atterberg Limits	ASTM D 4318-84	1 per 200 feet centers per lift.	PI ≥ 10, LL ≥ 30
Thin-Walled (Shelby Tube) Sampling of Soils	ASTM D 1587	1 per 200 feet centers per 18-inch lift.	N/A

Test	Test Method	Frequency	Acceptance Criteria
Hydraulic Conductivity	ASTM D 5084-90	1 per 200 feet centers per 18-inch lift.	Hydraulic Conductivity ≤ 1 x 10^{-7} cm/sec.
Density by Nuclear Methods	ASTM D 2922-81	1 per 50 feet centers per 6-inch lift.	≥ 95% maximum standard proctor density at moisture content determined by field test pad and moisture/density "window" established by laboratory permeability testing.
Moisture Content by Nuclear Methods	ASTM D 3017-88	1 test per horizontal interval of 100 feet per 6-inch lift.	Visual observation that compacted lift does not exceed 6 inches. Final as-built survey verification of entire thickness placed.

C. CONTRACTOR shall obtain the written approval of ENGINEER for proposed clay material prior to delivery to site.

2.2 BENTONITE

A. CONTRACTOR shall provide a soil sealant material for sealing test holes due to shelby tubes and nuclear density compaction testing. The soil sealant material shall be free flowing high swelling granular sodium bentonite (also known as Wyoming Bentonite).

PART 3 - EXECUTION

3.1 GENERAL

A. Clay shall be placed in lifts as follows: First lift: 12-inch maximum prior to compaction. Second and successive lifts: 6-inch maximum after compaction to obtain the required thickness of the clay layer. In all cases, a minimum of two lifts shall be used to achieve final grades. Tamp or roll each lift of clay material to the required minimum saturated hydraulic conductivity not exceeding 1 x 10^{-7} cm/sec. for each lift of material. Successive lifts shall not be placed until the lift under construction has been thoroughly compacted, tested, and approved by ENGINEER. Scarify each lift to a minimum depth of one inch before placement of a subsequent lift.

B. Prepare and spread clay in a manner to assure uniform lift thickness after compaction.

C. Clay containing lumps, pockets or concentrations of rubble, debris, wood, or other organic matter shall not be placed.

D. All Shelby tube sample locations shall be backfilled and compacted with dry clay/bentonite mixture and compacted in-place with a tamping rod, Proctor Rammer, or hand tamper.

3.2 MOISTURE CONTROL

A. Control moisture content of clay to ensure proper compaction and minimum specified saturated hydraulic conductivity in accordance with the following:
   1. If, in the opinion of the ENGINEER, the material is too dry for satisfactory compaction, add sufficient water during rolling and tamping, at no additional cost to OWNER.
   2. If, in the opinion of ENGINEER, the material is too wet for satisfactory compaction, or compaction efforts may damage preceding layers of clay, temporarily stop work to allow the material to dry or replace material with suitable material at no additional cost to the OWNER. The CONTRACTOR may scarify or aerate the soils to promote drying as long as the underlying materials are not damaged.
   3. The placement or compaction of material will not be permitted during or immediately following rainfall or on top of standing water.
   4. Replace compacted material that is damaged in a manner acceptable to the ENGINEER at no additional cost to OWNER.
   5. Maintain the moisture content of the clay to prevent excessive drying or the formation of desiccation cracks. Any areas that become dry or show evidence of desiccation cracking shall be scarified to the full depth of the damaged clay, moistened and recompacted to the minimum required permeability.
   6. If, in the opinion of the ENGINEER, desiccation cracks on the non-sloped portion of the placed clay do not appear to be excessive (i.e., cracking of the surface), the effected area may be surface treated and all cracks filled with a clay/bentonite mixture.

C. No material shall be placed when free water is standing on the area to be covered.

D. No compaction of material will be permitted with free water on any portion of clay material to be compacted.

3.3 COMPACTION

A. Each lift of the clay layer shall be uniformly compacted to achieve a saturated hydraulic conductivity not exceeding 1×10^{-7} cm/sec.

B. Each layer of clay shall be tested for in-place density and moisture to ensure that the clay has been sufficiently compacted to achieve the specified requirements.

C. Whenever the sample fails to meet the required saturated hydraulic conductivity, the section of failure shall be localized, reconstructed and retested at no additional cost to the OWNER. If the clay again fails, further construction shall not occur until the source of the failure is defined, remediated and methods authorized.

D. If, in the opinion of the ENGINEER, the construction performance of the CONTRACTOR indicates that placed clay layers may not meet the requirements of this Section, additional testing may be performed by the ENGINEER.

E. Actions or items which shall be cause for retesting include, but are not limited to, the following:
   1. Improper equipment usage is recognized;
   2. Lift thickness is greater than specified;
   3. Clay fill is at improper moisture content;
   4. Less than specified number of roller passes were made;
   5. Compactor rollers that may not have used proper ballast or vibratory loadings;
   6. Fill materials differ substantially from those specified;
   7. The degree of compaction is doubtful.

3.4 FINISHED PRODUCT

A. The CONTRACTOR shall verify that:
   1. A Surveyor meeting the requirements of Section 01050 shall verify and record all lines and grades
   2. The in-place clay material meets:
      (a) a saturated hydraulic conductivity less than or equal to 1 x 10^{-7} cm/sec;
   3. The surface to be lined has been rolled and compacted so as to be free of irregularities, protrusions, loose soil, and abrupt changes in grade;
   4. There is no area excessively softened by high water content.

B. Avoid desiccation cracking of the clay soil surface. Any cracking which appears to the ENGINEER to contravene the integrity of the clay layer shall be scarified to the full depth of the crack, moistened and recompacted to the minimum requirements of this section. If, in the opinion of the ENGINEER, the desiccation cracks do not appear to be excessive (i.e., cracking of the surface only), the affected area can be surface treated and all cracks filled with a clay/bentonite mixture.

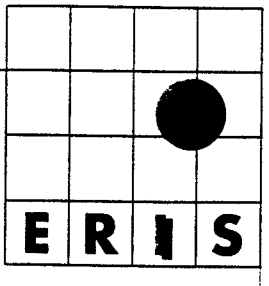
C. The CONTRACTOR shall prevent desiccation of the clay material. Typical methods used to minimize desiccation cracking include the placement of temporary plastic sheeting, tarps, misting, or adding additional temporary soil cover on the completed surface. To minimize repairs it is suggested that the CONTRACTOR place final topsoil cover on the clay as soon as clay placement and compaction is completed in an area.

+ + END OF SECTION + +

APPENDIX C

KNOWN OR POTENTIAL CONTAMINANT SOURCES

PDP



PERTAINING TO: DURHAM LANDFILL
CAMDEN AVENUE & E. CLUB BLVD.
DURHAM, NC 27704

ON BEHALF OF: MALCOLM PIRNIE-NEWPORT NEWS
11832 ROCK LANDING DR. #400
NEWPORT NEWS, VA 23606

PREPARED ON: 03/07/1994

REPORT NUMBER: 42111

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ENVIRONMENTAL RISK INFORMATION & IMAGING SERVICES
FEDERAL DATABASE DESCRIPTIONS

Feb 14, 1994

DATABASE	DECSRIPTION	DATE OF DATA
CERCLIS	Comprehensive Environmental Response, Compensation, And Liability Information System. The CERCLIS List Is A Compilation Of Known Or Suspected Uncontrolled Or Abandoned Hazardous Waste Sites. These Sites Have Either Been Investigated, Or Are Currently Under Investigation By The EPA For The Release, Or Threatened Release Of Hazardous Substances. Once A Site Is Placed In CERCLIS, It May Be Subjected To Several Levels Of Review And Evaluation And Ultimately Placed On The National Priorities List.	01/31/94
CIVIL ENFORCEMENT DOCKET	The Civil Enforcement Docket Is The U.S. Environmental Protection Agency's System For Tracking Civil Judicial Cases Filed On The Agency's Behalf By The Department Of Justice. This Report Contains Information On Cases From 1972 To The Present.	07/20/93
EMERGENCY RESPONSE NOTIFICATION SYS	Emergency Response Notification System. ERNS Is A National Computer Database System That Is Used To Store Information On The Sudden And/Or Accidental Release Of Hazardous Substances, Including Petroleum, Into The Environment. The ERNS Reporting System Contains Preliminary Information On Specific Releases, Including The Spill Location, The Substance Released, And The Responsible Party. Please Note That The Information In The ERNS Report Pertains Only To Those Releases That Occured During 1992.	12/30/92
FACILITY INDEX SYSTEM	Facility Index System. The Finds Report Is A Computerized Inventory Of All Facilities That Are Regulated Or Tracked By The U.S. Environmental Protection Agency. These Facilities Are Assigned An Identification Number Which Serves As A Cross-Reference For Other Databases In The EPA's Program System. Each Finds Record Indicates The EPA Program Office That Is Responsible For The Tracking Of The Facility.	06/15/93
NATIONAL PRIORITIES LIST	National Priorities List. The NPL Report, Also Known As The Superfund List, Is An EPA Listing Of Uncontrolled Or Abandoned Hazardous Waste Sites. The List Is Primarily Based On A Score That A Site Receives From The EPA's Hazardous Ranking System. These Sites Are Targeted For Possible Long-Term Remedial Action Under The Superfund Act.	01/31/94
NUCLEAR FACILITIES	Nuclear Power Facilities. The Nuclear Report Is A Comprehensive Listing Of	01/01/93

ENVIRONMENTAL RISK INFORMATION & IMAGING SERVICES
FEDERAL DATABASE DESCRIPTIONS

Feb 14, 1994

DATABASE	DECSRIPTION	DATE OF DATA
	All Licensed And Active Nuclear Power Plants In The United States.	
OPEN DUMPS REPORT	Open Dumps Report. The Resource Conservation And Recovery Act Defines The Term "Open Dump" To Mean "...Any Facility Or Site Where Solid Waste Is Disposed Of Which Is Not A Sanitary Landfill Which Meets The Criteria Promulgated Under Section 4004 And Which Is Not A Facility For The Disposal Of Hazardous Waste." Thus, Any Facility Which Fails To Comply With Any One Element Of The Criteria Is Considered To Be An Open Dump.	01/01/90
RCRIS LARGE QUANITY GENERATORS	Resource Conservation And Recovery Information System - Large Quantity Generators. The RCRIS_LG Report Contains Information Pertaining To Facilities That Either Generate More Than 1000kg Of Hazardous Waste Per Month Or Meet Other Applicable Requirements Of The Resource Conservation And Recovery Act.	08/03/93
RCRIS SMALL QUANITY GENERATORS	Resource Conservation And Recovery Information System - Small Quantity Generators. The RCRIS_SG Report Contains Information Pertaining To Facilities That Either Generate Between 100kg And 1000kg Of Hazardous Waste Per Month Or Meet Other Applicable Requirements Of The Resource Conservation And Recovery Act.	08/03/93
RCRIS TREATMENT, STORAGE & DISPOSAL	Resource Conservation And Recovery Information System - Treatment, Storage, And Disposal Facilities. The RCRIS_TS Report Contains Information Pertaining To Facilities That Either Treat, Store, Or Dispose Of Hazardous Waste.	08/03/93
TOXIC RELEASE INVENTORY	Toxic Release Inventory System Of 1991. The TRI Report Contains Information On The Industrial Release And/Or Transfer Of Toxic Chemicals As Reportable Under Title III Of The Superfund Amendments And Reauthorization Act Of 1986 (Sara Title III).	12/31/91

ENVIRONMENTAL RISK INFORMATION & IMAGING SERVICES
STATE DATABASE DESCRIPTIONS

Feb 3, 1994

STATE	DATABASE	DECSRIPTION	DATE OF DATA
NC	LUST INCIDENT REPORT	The North Carolina LUST Incident Report Is A Comprehensive Listing Of All Reported Leaking Underground Storage Tanks Within The State Of North Carolina.	03/01/92
NC	PETROLEUM UST DATA LISTING	The North Carolina Petroleum UST Data Listing Contains Summary Information Pertaining To Registered Underground Storage Tanks Located Within The State Of North Carolina.	11/10/93
NC	SOLID WASTE FACILITY LIST	The North Carolina Solid Waste Facility List Is A Comprehensive Listing Of All Permitted Solid Waste Landfills Operating Within The State Of North Carolina.	10/04/93

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- Database Report
  - Statistical Profile
  - Database Records
- Related Maps
  - Digital Custom Plotted Map
  - Sanborn Fire Insurance Map(s)
  - Topographical Map(s)

Statistical Profile

The statistical profile is an at-a-glance numeric summary of the databases searched for your ERIIS Report.

Database Records

The detailed federal and state database information indicates potential and actual environmental threats within the study radius. These records are sorted by their distance from the study site.

Digital Custom Map

The digital custom map is cross referenced with the database records. The cross-in-circle in the center of the map represents the study site. The red circles represent distances from the study site. The plottable sites in the report are distinguished on the map by symbols of different shape and color.

Sanborn Fire Insurance Maps

The ERIIS collection of historical Sanborn Fire Insurance Maps covers 14,000 cities and towns. These maps may indicate prior use of the study site. If no maps are available for the study site, a notice to that effect is included. This notice should serve as evidence of due diligence.

Topographical Map

USGS topographical maps show natural and man-made features as well as the shape and elevation of the terrain. The 7.5 minute quad maps are produced at a scale of 1:24,000, or one inch represents 2,000 feet.

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ERIIS RADIUS STATISTICAL PROFILE
State: NC

ERIIS Report #42111 Mar 7, 1994

Site: DURHAM LANDFILL
CAMDEN AVENUE & E. CLUB BLVD.
DURHAM, NC 27704

Latitude: 36.031316
Longitude: -78.856716

Database	Radius (Mi)	Property	Property-1/4	1/4-1/2	1/2-1	>1	TOTAL
NPL	.3787	NO	0	0			0
CERCLIS	.3787	NO	0	0			0
TRI	.3787	NO	0	0			0
RCRIS_TS	.3787	NO	0	0			0
RCRIS_LG	.3787	NO	0	0			0
RCRIS_SG	.3787	NO	0	1			1
DOCKET	.3787	NO	0	0			0
ERNS	.3787	NO	0	0			0
FINDS	.3787	NO	0	1			1
NUCLEAR		NR	NR	NR	NR	NR	0
OPENDUMP		NR	NR	NR	NR	NR	0
UST	.3787	NO	0	1			1
LUST	.3787	NO	0	2			2
SWF	1	NO	0	0	0		0
			0	5	0	0	5

Selection of PROPERTY records requires an accurate street address in the ERIIS job order.

A blank radius count indicates that the database was not searched by this radius per client instructions.

NR in a radius count indicates that the database cannot be reported by this search criteria due to insufficient and/or inaccurate addresses reported by a federal/state agency.

ERIIS DATABASE DESCRIPTIONS

Database: CERCLIS **Date:** 01/31/1994
Source Agency: US Environmental Protection Agency
Office Of Solid Waste And Emergency Response
Phone: 202/260-2131
Description: Comprehensive Environmental Response, Compensation, And Liability Information System.
The CERCLIS List Is A Compilation Of Known Or Suspected Uncontrolled Or Abandoned Hazardous Waste Sites. These Sites Have Either Been Investigated, Or Are Currently Under Investigation By The EPA For The Release, Or Threatened Release Of Hazardous Substances. Once A Site Is Placed In CERCLIS, It May Be Subjected To Several Levels Of Review And Evaluation And Ultimately Placed On The National Priorities List.

Database: DOCKET **Date:** 07/20/1993
Source Agency: US Environmental Protection Agency
Office Of Enforcement
Phone: 202/260-2614
Description: The Civil Enforcement Docket Is The U.S. Environmental Protection Agency's System For Tracking Civil Judicial Cases Filed On The Agency's Behalf By The Department Of Justice. This Report Contains Information On Cases From 1972 To The Present.

Database: ERNS **Date:** 12/30/1992
Source Agency: US Environmental Protection Agency
Office Of Solid Waste And Emergency Response
Phone: 202/260-7731
Description: Emergency Response Notification System.
ERNS Is A National Computer Database System That Is Used To Store Information On The Sudden And/Or Accidental Release Of Hazardous Substances, Including Petroleum, Into The Environment. The ERNS Reporting System Contains Preliminary Information On Specific Releases, Including The Spill Location, The Substance Released, And The Responsible Party. Please Note That The Information In The ERNS Report Pertains Only To Those Releases That Occured During 1992.

Database: FINDS **Date:** 06/15/1993
Source Agency: US Environmental Protection Agency
Office Of Information Resources Management
Phone: 202/260-4465
Description: Facility Index System.
The Finds Report Is A Computerized Inventory Of All Facilities That Are Regulated Or Tracked By The U.S. Environmental Protection Agency. These Facilities Are Assigned An Identification Number Which Serves As A Cross-Reference For Other Databases In The EPA's Program System. Each Finds Record Indicates The EPA Program Office That Is Responsible For The Tracking Of The Facility.

Database: NPL **Date:** 01/31/1994
Source Agency: US Environmental Protection Agency
Office Of Solid Waste And Emergency Response
Phone: 202/260-3046
Description: National Priorities List.
The NPL Report, Also Known As The Superfund List, Is An EPA Listing Of Uncontrolled Or Abandoned Hazardous Waste Sites. The List Is Primarily Based On A Score That A Site Receives From The EPA's Hazardous Ranking System. These Sites Are Targeted For Possible Long-Term Remedial Action Under The Superfund Act.

Database: NUCLEAR **Date:** 01/01/1993
Source Agency: US Nuclear Regulatory Commission
Permits Section
Phone: 301/492-7000
Description: Nuclear Power Facilities.
The Nuclear Report Is A Comprehensive Listing Of All Licensed And Active Nuclear Power Plants In The United States.

ERIIS DATABASE DESCRIPTIONS

Database: OPENDUMP
Source Agency: US Environmental Protection Agency
Office Of Solid Waste And Emergency Response
Phone: 202/260-4687
Date: 01/01/1990
Description: Open Dumps Report.
The Resource Conservation And Recovery Act Defines The Term "Open Dump" To Mean "...Any Facility Or Site Where Solid Waste Is Disposed Of Which Is Not A Sanitary Landfill Which Meets The Criteria Promulgated Under Section 4004 And Which Is Not A Facility For The Disposal Of Hazardous Waste." Thus, Any Facility Which Fails To Comply With Any One Element Of The Criteria Is Considered To Be An Open Dump.

Database: RCRIS_LG
Source Agency: US Environmental Protection Agency
Office Of Solid Waste And Emergency Response
Phone: 202/260-2603
Date: 08/03/1993
Description: Resource Conservation And Recovery Information System - Large Quantity Generators.
The RCRIS_LG Report Contains Information Pertaining To Facilities That Either Generate More Than 1000kg Of Hazardous Waste Per Month Or Meet Other Applicable Requirements Of The Resource Conservation And Recovery Act.

Database: RCRIS_SG
Source Agency: US Environmental Protection Agency
Office Of Solid Waste And Emergency Response
Phone: 202/260-2603
Date: 08/03/1993
Description: Resource Conservation And Recovery Information System - Small Quantity Generators.
The RCRIS_SG Report Contains Information Pertaining To Facilities That Either Generate Between 100kg And 1000kg Of Hazardous Waste Per Month Or Meet Other Applicable Requirements Of The Resource Conservation And Recovery Act.

Database: RCRIS_TS
Source Agency: US Environmental Protection Agency
Office Of Solid Waste And Emergency Response
Phone: 202/260-2603
Date: 08/03/1993
Description: Resource Conservation And Recovery Information System - Treatment, Storage, And Disposal Facilities.
The RCRIS_TS Report Contains Information Pertaining To Facilities That Either Treat, Store, Or Dispose Of Hazardous Waste.

Database: TRI
Source Agency: US Environmental Protection Agency
Office Of Pollution Prevention And Toxics
Phone: 202/260-3757
Date: 12/31/1991
Description: Toxic Release Inventory System Of 1991.
The TRI Report Contains Information On The Industrial Release And/Or Transfer Of Toxic Chemicals As Reportable Under Title III Of The Superfund Amendments And Reauthorization Act Of 1986 (Sara Title III).

Database: LUST
Source Agency: NC Dept. Of Env. Health & Natural Res.
Underground Storage Tank Unit
Phone: 919/733-8486
Date: 03/01/1992
Description: The North Carolina LUST Incident Report Is A Comprehensive Listing Of All Reported Leaking Underground Storage Tanks Within The State Of North Carolina.

Database: UST
Source Agency: NC Dept. Of Env. Health & Natural Res.
Underground Storage Tank Unit
Phone: 919/733-1308
Date: 11/10/1993
Description: The North Carolina Petroleum UST Data Listing Contains Summary

ERIIS DATABASE DESCRIPTIONS

Information Pertaining To Registered Underground Storage Tanks Located Within The State Of North Carolina.

Database: SWF
Date: 10/04/1993
Source Agency: NC Dept. Of Env. Health & Natural Res.
Solid Waste Section
Phone: 919/733-0692
Description: The North Carolina Solid Waste Facility List Is A Comprehensive Listing Of All Permitted Solid Waste Landfills Operating Within The State Of North Carolina.

ERIIS SUMMARY OF RADIUS SITES

Mar 7, 1994

ERIIS ID.	FACILITY/ADDRESS	DATABASE	DISTANCE FROM SITE	DIRECTION FROM SITE	MAP ID
5000807	CENTRAL TRANSPORT 2321 E. CLUB BLVD. DURHAM, NC 27704-3536 COUNTY: DURHAM	LUST	0.366 MI	SOUTHWEST	807
37008001787	KENNEDY AUTO SERVICE 2300 E CLUB BLVD DURHAM, NC 27704-3537 COUNTY: DURHAM	RCRIS_SG	0.366 MI	SOUTHWEST	1787
37003005232	KENNEDY AUTO SERVICE 2300 E CLUB BLVD DURHAM, NC 27704-3537 COUNTY: DURHAM	FINDS	0.366 MI	SOUTHWEST	5232
37005000811	CITGO FOOD MART 2407 E. CLUB BLVD. DURHAM, NC 27704-3540 COUNTY: DURHAM	LUST	0.371 MI	SOUTHWEST	811
37010016351	CENTRAL TRANSPORT, INC. 2321 E CLUB BLVD DURHAM, NC 27704-3536	UST	0.374 MI	SOUTHWEST	6351

ERIIS Report #42111

ERIIS ENVIRONMENTAL DATA REPORT
RESOURCE CONSERVATION AND RECOVERY INFORMATION SYSTEM
(RCRIS - SMALL QUANTITY GENERATORS - RADIUS SITES)

Mar 7, 1994

ERIIS ID / EPA ID	FACILITY	ADDRESS	NO. REPORTED WASTES CODES / RCRA COMPLIANT (Y/N) / FACILITY ACTIVITIES	DISTANCE FROM SITE	DIRECTION FROM SITE	MAP ID
37008001787 NCD982128274	KENNEDY AUTO SERVICE	2300 E CLUB BLVD DURHAM, NC 27704-3537 COUNTY: DURHAM	0 Y SM QTY GEN	0.366 MILES	SOUTHWEST	1787

REPORTED WASTE CODES

ERIIS Report #42111

ERIIS ENVIRONMENTAL DATA REPORT
FACILITY INDEX SYSTEM
(FINDS - CERCLIS SITES)

Mar 7, 1994

ERIIS ID / EPA ID	FACILITY	FACILITY ADDRESS	SIC CODES	UPDATE	PROGRAM CODES/ REPORT IDS
37003005232 NCD982128274	KENNEDY AUTO SERVICE DISTANCE FROM SITE: 0.366 MILES DIRECTION FROM SITE: SOUTHWEST	2300 E CLUB BLVD DURHAM, NC 27704-3537		10/07/92	01 NCD982128274

PROGRAM CODES: 01 - RCRIS 02 - PCS 03 - AIRS 04 - FATES 05 - CERCLIS 06 - FTTS/NCDB 07 - DOCKET 08 - CONTR LIST 09 - CRIMDOCK
11 - FFIS 13 - CICS 14 - STATE 15 - PADS 16 - RCRA-J 17 - TRIS 18 - CUS

ERIIS ID / EPA ID	FACILITY	ADDRESS	NO. REPORTED WASTES CODES / RCRA COMPLIANT (Y/N) / FACILITY ACTIVITIES
37008000711 NCD980803815	NC DEPT OF TRANS DIV. 5	GUESS ROAD DURHAM, NC 27704 COUNTY: DURHAM	0 Y SM QTY GEN
	REPORTED WASTE CODES		
37008000919 NCD981759582	COOPER KENWORTH, INC.	I-85 NORTH @ RED MILL EXIT DURHAM, NC 27704 COUNTY: DURHAM	0 Y SM QTY GEN
	REPORTED WASTE CODES		
37008001558 NCD982098402	HARLAN LAWS CORPORATION	US 70 AT NC 98 INTERCHANGE DURHAM, NC 27704 COUNTY: DURHAM	1 Y SM QTY GEN
	REPORTED WASTE CODES F005		
37008000922 NCD981759889	DURHAM PUBLIC SCHOOLS	RR 5 BOX 58 DURHAM, NC 27704-9508 COUNTY: DURHAM	1 Y SM QTY GEN
	REPORTED WASTE CODES D001		

ERIIS ID / EPA ID	FACILITY	FACILITY ADDRESS	NPL STATUS / INCIDENT CATEGORY
37001000730 NCD986171064	COLJOHN MECHANICS	MIAMI BLVD. DURHAM, NC COUNTY: DURHAM	NOT ON THE NPL BLANK

SITE EVENT(S)	COMPLETE DATE	ACTION PRIORITY
DISCOVERY	05/19/89	BLANK
PRELIMINARY ASSESSMENT	04/02/90	BLANK
SCREENING SITE INSPECTION	10/16/92	NO FURTHER ACTION

DESCRIPTION: DISC. BY FIT DURING 10/88 SITE RECON AT RTP.

ERIIS ID / EPA ID	FACILITY	FACILITY ADDRESS	NPL STATUS / INCIDENT CATEGORY
37001000732 NCD986171080	GLIDDEN PAINT	WECK DRIVE DURHAM, NC COUNTY: DURHAM	NOT ON THE NPL BLANK

SITE EVENT(S)	COMPLETE DATE	ACTION PRIORITY
DISCOVERY	05/19/89	BLANK
PRELIMINARY ASSESSMENT	04/02/90	NO FURTHER ACTION

DESCRIPTION: NUS DISC. DURING 10/88 SITE RECON. ON RTP SITES.

ERIIS LIST OF STREETS IN THE RADIUS

ERIIS Report #42111

Mar 7, 1994

STREET NAME

Camden Ave
E Club Blvd
Colclough Ave
Glenn Road
Mist Lake Dr
Syko Road

ERIIS GEOCODING

All sites on the Digital Custom Plotted Map and/or reported within the study radii are "point geocoded", i.e., each site is assigned a latitude/longitude value based on the actual location of the reported address. ERIIS point geocodes sites through a combination of address correction data processing, cross-database indexing, and proprietary geocoding software methods. The results are well worth the effort; point geocoding is simply the most accurate means of site location available today.

It is also the most demanding. Sites cannot be point geocoded if they do not have an accurate or complete street address. A facility listed at "Maple Avenue", for example, is not specific enough to point geocode. Similarly, although "451 Maple Avenue" appears to be both complete and accurate, the ERIIS geocoding system first scans Maple Avenue and finds that the valid address ranges are from 1500-6500. Because addresses such as these cannot be point geocoded, they can neither be plotted on the digital map nor reported by distance/direction from the study site.

Unfortunately, many of the addresses collected by Federal and State environmental agencies look like the examples above; they are incomplete and/or inaccurate. Does this mean that potentially relevant environmental threats are simply left out of the ERIIS Report? Certainly not.

Secondary Search Sites

ERIIS has designed a proprietary secondary search logic that specifically scans those records that could not be point geocoded. This search is done using additional site-specific geographic information including ZIP code(s), city name(s), and county name(s). The results of the secondary search, listed on the following pages, provides an added measure of security found only in an ERIIS Report.

Street Names Within The Study Radius

These secondary search sites require further review to accurately assess their proximity to the study site. To facilitate this review, ERIIS includes in each report an alphabetical list of streets that fall within the largest of the report radii. This convenient reference tool can be used to quickly and accurately cross-check the addresses of these secondary search sites.

The ASTM Standard Practice For Environmental Site Assessments

As stated in the recently published **Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process** (E1527) by the American Society for Testing and Materials (ASTM):

> "For large databases with numerous facility records (such as RCRA hazardous waste generators and registered underground storage tanks), the records are not *practically reviewable* unless they can be obtained from the source agency in the smaller geographic area of zip code. (3.3.24)"

If your environmental assessment does not require a secondary search broader than ZIP code (i.e., using city and county names), ERIIS will customize your data search at no additional charge.

ERIIS Report #42111

ERIIS ENVIRON[illegible]AL DATA REPORT
NORTH CAROLINA LEAK[illegible]NDERGROUND STORAGE TANKS
(LUST - RADIUS SITES)

Mar 7, 1994

ERIIS ID	FACILITY	ADDRESS	COUNTY	POLLUTANT SOURCE POLLUTANT TYPE	MAP ID
37005000807	CENTRAL TRANSPORT DISTANCE FROM SITE: 0.366 MILES DIRECTION FROM SITE: SOUTHWEST	2321 E. CLUB BLVD. DURHAM, NC 27704	DURHAM	SOURCE UNKNOWN GASOLINE/DIESEL	807
37005000811	CITGO FOOD MART DISTANCE FROM SITE: 0.371 MILES DIRECTION FROM SITE: SOUTHWEST	2407 E. CLUB BLVD. DURHAM, NC 27704	DURHAM	LEAK-UNDERGROUND GASOLINE/DIESEL	811

ERIIS Report #42111

ERIIS ENVIRONMENTAL DATA REPORT
NORTH CAROLINA UNDERGROUND STORAGE TANKS
(UST - RADIUS SITES)

Mar 7, 1994

ERIIS ID / FACILITY ID	FACILITY / ADDRESS / CONTACT PHONE	OWNER / OWNER ADDRESS / OWNER PHONE	DISTANCE FROM SITE	DIRECTION FROM SITE	MAP ID
37010016351 0-032260	CENTRAL TRANSPORT, INC. 2321 E CLUB BLVD DURHAM, NC 27704-3536 (919) 688-4054	CENTRAL TRANSPORT, INC. 12225 STEPHENS WARREN, MI 48089 (313) 939-7000	0.374 MILES	SOUTHWEST	6351

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	DIESEL, DIESEL MIXTURE	10000	01/01/1964		CURRENTLY
2	DIESEL, DIESEL MIXTURE	8000	01/01/1964		CURRENTLY

ERIIS ENVIRONMENTAL DATA REPORT
EMERGENCY RESPONSE NOTIFICATION SYSTEM
(ERNS)

ERIIS Report #42111

Mar 7, 1994

ERIIS ID / REPORTNUMBER / SOURCE AGENCY	SPILL CITY, STATE, ZIP CODE / SPILL COUNTY	DISCHARGER NAME / ORGANIZATION / ADDRESS	SPILL DATE / MATERIAL(S) SPILLED / QUANTITY SPILLED	MEDIA AFFECTED: LAND	GRND WATER	AIR	WATER	FACILITY	WATER WAY AFFECTED
37002000270 132236 NATL. RESPONSE CTR	DURHAM, NC DURHAM	PUBLIC SERVICE OF N.C. 400 COX ROAD GASTONIA, NC 28053	08/17/92 NATURAL GAS	N	N	Y	N	N	NA

LOCATION: BULLICKS BARBQUE 3300 WORTHAM ST
DESCRIPTION: DISTRIBTION LINE/UNKNOWN
ACTION TAKEN: NONE

37002000457 151072 NATL. RESPONSE CTR	DURHAM, NC DURHAM	NOT REPORTED NOT REPORTED	12/30/92 OIL: DIESEL	N	N	N	N	N	PARKING LOT

LOCATION: TRIANGLE MALL INTERSECTION OF HWY 54
AND HWY 55
DESCRIPTION: COMPANY IS REMOVING PAVEMENT AND A DIESEL SHEEN IS ON THE PARKING LOT
ACTION TAKEN: NONE

ERIIS ENVIRONMENTAL DATA REPORT
FACILITY [illegible] SYSTEM
([illegible])

ERIIS Report #42111

Mar 7, 1994

ERIIS ID / EPA ID	FACILITY	FACILITY ADDRESS	SIC CODES	UPDATE	PROGRAM CODES/ REPORT IDS
37003000050 NCD000816383	NORTHROP ENVIRONMENTAL RESEARC	OLD HIGHWAY 70 DURHAM, NC 27704		01/30/82	01 NCD000816383
37003000220 NCD000866152	DURHAM ENO WTP	END OF WARD RD DURHAM, NC 27704	4952	09/20/89	02 NC0026336
37003003072 NCD980603815	NC DEPT OF TRANSPORTATION	GUESS RD DURHAM, NC 27704		10/07/92	01 NCD980603815
37003003220 NCD980804017	FREUDENBERG SPUNWEB	INDUSTRIAL DR DURHAM, NC 27704	2297	10/07/92	01 NCD980804017 03 3706300214
37003003534 NCD981473580	EXPERIMENTAL PATHOLOGY LABORAT	3908 PATRIOT CIR DURHAM, NC 27704	8071	10/07/92	01 NCD981473580
37003003748 NCD981759582	COOPER KENWORTH INC	I-85 NORTH @ RED MILL EXIT DURHAM, NC 27704		10/07/92	01 NCD981759582
37003004804 NCD982098402	HARLAN LAWS CORPORATION	US 70 AT NC 98 INTERCHANGE DURHAM, NC 27704	3993 1799	10/07/92	01 NCD982098402
37003004889 NCD982105827	NCNG - OMS #12	BRITANIA AVE DURHAM, NC 27704		02/19/92	01 NCD982105827 01 FLD982105827
37003010523 NCD986216646	DAYS INN	I85 & NCSR 1637 DURHAM, NC 27704		10/05/92	02 NC0024520
37003010539 NCD986216802	NELLO TEER	DENFIELD ST DURHAM, NC 27704		10/05/92	02 NC0066044
37003012210 NC6211837095	OMS 12	STADIUM DR DURHAM, NC 27704		11/15/91	11 NC-211837095
37003004864 NCD982103657	BATTEN COLLISION & PAINT CENTER	105 HARVEST RD DURHAM, NC 27704-5215	7532	10/07/92	01 NCD982103657 01 NCD982149270
37003003753 NCD981759889	DURHAM COUNTY SCHOOL BUS TRANS	RR 5 BOX 58 DURHAM, NC 27704-9508	8211	10/05/92	01 NCD981759889
37003005578 NCD982151847	RAEFORD MAYTON	RR 5 BOX 148 DURHAM, NC 27704-9515		06/27/90	01 NCD982151847

PROGRAM CODES: 01 - RCRIS 02 - PCS 03 - AIRS 04 - FATES 05 - CERCLIS 06 - FTTS/NCDB 07 - DOCKET 08 - CONTR LIST 09 - CRIMDOCK
11 - FFIS 13 - CICS 14 - STATE 15 - PADS 16 - RCRA-J 17 - TRIS 18 - CUS

ERIIS ENVIRONMENTAL DATA REPORT
FACILITY [redacted] SYSTEM
([redacted])

ERIIS Report #42111

Mar 7, 1994

ERIIS ID / EPA ID	FACILITY	FACILITY ADDRESS	SIC CODES	UPDATE	PROGRAM CODES/ REPORT IDS
37003006905 NCD986177384	COMMERCIAL REFINISHERS	RR 5 BOX 487 DURHAM, NC 27704-9529		10/01/90	01 NCD986177384
37003005577 NCD982151789	REDWOD BODY SHOP	RR 5 BOX 684 DURHAM, NC 27704-9550		11/15/91	01 NCD982151789

PROGRAM CODES: 01 - RCRIS 02 - PCS 03 - AIRS 04 - FATES 05 - CERCLIS 06 - FTTS/NCDB 07 - DOCKET 08 - CONTR LIST 09 - CRIMDOCK
11 - FFIS 13 - CICS 14 - STATE 15 - PADS 16 - RCRA-J 17 - TRIS 18 - CUS

ERIIS ID / FACILITY ID | FACILITY / ADDRESS / CONTACT PHONE | OWNER / OWNER ADDRESS / OWNER PHONE

37010010159 / 0-024105

SILK HOPE
SR 2352
SILK HOPE, NC 27704
(919) 477-7341

AT&T/ATTN:SUSAN LARY
1200 PEACHTREE ST/PROMENADE II-
ATLANTA, GA 30309
(404) 810-4807

TANK_ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	DIESEL, DIESEL MIXTURE	550	03/01/1966		CURRENTLY

37010016106 / 0-015885

FIRE GARAGE
CAMDEN AVENUE
DURHAM, NC 27704
(919) 683-4103

CITY OF DURHAM
101 CITY HALL PLAZA
DURHAM, NC 27701
(919) 683-4381

TANK_ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
FDM-D	DIESEL, DIESEL MIXTURE	2000	05/02/1971	11/18/1988	PERMANENTLY

37010016112 / 0-015324

NELLO L. TEER CO. (QUARRY SHO
DENFIELD STREET
DURHAM, NC 27704
(919) 447-2808

NELLO L. TEER COMPANY
211 WEST PARRISH STREET
DURHAM, NC 27701
(919) 682-6191

TANK_ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	FUEL OIL	3000	05/11/1960		CURRENTLY

37010016113 / 0-024582

NELLO L. TEER CO./DURHAM QUAR
DENFIELD STREET
DURHAM, NC 27704
(919) 447-7307

NELLO L. TEER COMPANY
211 WEST PARRISH STREET
DURHAM, NC 27701
(919) 682-6191

TANK_ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
	NOT REPORTED	0			

37010016114 / 0-012987

NELLO L. TEER COMPANY -TRUCK
DENFIELD STREET
DURHAM, NC 27704
(919) 477-2413

NELLO L. TEER COMPANY
211 W. PARRISH STREET
DURHAM, NC 27701
(919) 682-6191

TANK_ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
	NOT REPORTED	0			

37010016115 / 0-012984

NELLO L. TEER COMPANY DURHAM
DENFIELD STREET
DURHAM, NC 27704
(919) 477-2413

NELLO L. TEER COMPANY
211 W. PARRISH STREET
DURHAM, NC 27701
(919) 682-6191

TANK_ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
A	DIESEL, DIESEL MIXTURE	10000	01/01/1964	12/31/1988	PERMANENTLY
B	GASOLINE, GASOLINE MIXTURE	10000	01/01/1964	12/31/1988	PERMANENTLY
C	GASOLINE, GASOLINE MIXTURE	3000	01/01/1964	12/31/1988	PERMANENTLY
D	DIESEL, DIESEL MIXTURE	10000	10/11/1964	12/31/1988	PERMANENTLY
E-1	GASOLINE, GASOLINE MIXTURE	4000	01/01/1964	12/31/1988	PERMANENTLY
E-2	GASOLINE, GASOLINE MIXTURE	4000	01/01/1964	12/31/1988	PERMANENTLY

ERIIS ID / FACILITY ID | FACILITY / ADDRESS / CONTACT PHONE | OWNER / OWNER ADDRESS / OWNER PHONE

37010016118 / 0-016061

ALLEN MUFFLER SHOP
EAST HOLLOWAY STREET
DURHAM, NC 27704
(919) 688-1373

GWALTNEY OIL & GAS CO., INC.
706 EAST MARKHAM AVENUE
DURHAM, NC 27701
(919) 688-1373

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
	NOT REPORTED	0			

37010016125 / 0-029618

RJ'S
GLENN SCHOOL RD/I-85
DURHAM, NC 27704

RJ'S
GLENN SCHOOL RD/I-85
DURHAM, NC 27704

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
	NOT REPORTED	0			

37010016148 / 0-016065

WHITLEY'S FINA
I-85 & CLUB BLVD
DURHAM, NC 27704

GWALTNEY OIL & GAS CO., INC.
PO BOX 99
MEBANE, NC 27302

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
	NOT REPORTED	0			

37010016149 / 0-016413

PHILLIPS 66 COMPANY #024083
I-85 & GLEN SCHOOL
DURHAM, NC 27704
(919) 661-6600

PHILLIPS 66 COMPANY
686 ADAMS BLDG ATTN: AL ABEYTA
BARTLESVILLE, OK 74004
(918) 661-7012

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
0400477	GASOLINE, GASOLINE MIXTURE	6000	04/06/1967		TEMPORARILY
0400482	FUEL OIL	560	04/06/1967		TEMPORARILY
0400488	DIESEL, DIESEL MIXTURE	560	04/06/1967		TEMPORARILY
040074	FUEL OIL	6000	04/06/1967		TEMPORARILY

37010016151 / 0-016175

INTERSTATE B P
I-85 AND EAST CLUB BOULEVARD
DURHAM, NC 27704
(919) 682-7330

M.M. FOWLER, INC.
600 GULF STREET
DURHAM, NC 27702
(919) 596-8246

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	GASOLINE, GASOLINE MIXTURE	5000	02/26/1963		CURRENTLY
2	GASOLINE, GASOLINE MIXTURE	5000	02/26/1963		CURRENTLY
3	GASOLINE, GASOLINE MIXTURE	10000	02/22/1978		CURRENTLY
4	GASOLINE, GASOLINE MIXTURE	5000	02/26/1963		CURRENTLY
5	DIESEL, DIESEL MIXTURE	550	02/26/1963	12/09/1988	PERMANENTLY

37010016153 / 0-015010

COOPER KENWORTH INC.
I-85 NORTH -SYC RD
DURHAM, NC 27704
(919) 682-5481

COOPER KENWORTH INC.
I-85 NORTH -SYC RD
DURHAM, NC 27704
(919) 682-5481

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	DIESEL, DIESEL MIXTURE	1000	04/28/1979	01/07/1993	PERMANENTLY

ERIIS ID / FACILITY ID | FACILITY / ADDRESS / CONTACT PHONE | OWNER / OWNER ADDRESS / OWNER PHONE

37010016177 / 0-015911

GREEN GARBAGE SERVICE
ROUTE 5, BOX 221-B REDWOOD ROAD
DURHAM, NC 27704
(919) 688-9552

GREEN'S GARBAGE SERVICE, INC.
ROUTE 5, BOX 221-B REDWOOD ROAD
DURHAM, NC 27704
(919) 688-9552

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	GASOLINE, GASOLINE MIXTURE	2000	05/08/1976		CURRENTLY

37010016178 / 0-003931

DURHAM CO. SCHOOL
ROUTE 5, BOX 58-A / HAMLIN ROAD
DURHAM, NC 27704
(919) 688-1373

GWALTNEY OIL & GAS CO., INC.
706 EAST MARKHAM AVENUE
DURHAM, NC 27701
(919) 688-1373

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
	NOT REPORTED	0			

37010016187 / 0-015304

DAVID H. LADD TRUCKING INC.
RT 6 BOX 33-B
DURHAM, NC 27704
(919) 477-5827

DAVID H. LADD
8590 CHARLIE STOVALL RD
ROXBORO, NC 27573
(919) 477-5827

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	DIESEL, DIESEL MIXTURE	10000	04/10/1975	12/21/1992	PERMANENTLY
2	DIESEL, DIESEL MIXTURE	8000	04/10/1975	12/21/1992	PERMANENTLY
3	GASOLINE, GASOLINE MIXTURE	1000	04/10/1975	12/21/1992	PERMANENTLY

37010016192 / 0-033141

OMS #12
STADIUM DRIVE
DURHAM, NC 27704

NC ARMY NATIONAL GUARD
4105 REEDY CREEK RD
RALEIGH, NC 27607

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	FUEL OIL	9999	01/01/1964		CURRENTLY
2	FUEL OIL	3500	01/01/1964		CURRENTLY

37010016198 / 0-016063

JAY'S AUTO REPAIR
WAKE FOREST HIGHWAY
DURHAM, NC 27704
(919) 563-5585

GWALTNEY OIL & GAS CO., INC.
706 E MARKHAM AVE
DURHAM, NC 27702
(919) 563-5585

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
	NOT REPORTED	0			

37010016220 / 0-001634

TROUT & RIGGS CONST. CO., INC
108 BRITANIA AVENUE
DURHAM, NC 27704
(919) 477-9856

TROUT & RIGGS CONST. CO., INC.
108 BRITANIA AVENUE
DURHAM, NC 27704
(919) 477-9856

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
001	GASOLINE, GASOLINE MIXTURE	2000	04/18/1979	04/30/1988	PERMANENTLY
002	GASOLINE, GASOLINE MIXTURE	550	04/20/1971	07/01/1979	PERMANENTLY

ERIIS ID / FACILITY ID	FACILITY / ADDRESS / CONTACT PHONE	OWNER / OWNER ADDRESS / OWNER PHONE
37010016230 0-025594	RENTAL TOOLS & GAS OIL CO. 1129 E. GREER ST. DURHAM, NC 27704 (919) 682-1153	RENTAL TOOLS & GAS OIL CO. 1129 E. GREER ST. DURHAM, NC 27704 (919) 682-1153

TANK_ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	DIESEL, DIESEL MIXTURE	3000	09/22/1984		CURRENTLY

ERIIS ID / FACILITY ID	FACILITY / ADDRESS / CONTACT PHONE	OWNER / OWNER ADDRESS / OWNER PHONE
37010016235 0-024321	ORGANIZATIONAL MAINTENANCE 12 BRITANIA AVE DURHAM, NC 27704 (919) 477-6509	NC ARMY NATIONAL GUARD 4105 REEDY CREEK ROAD RALEIGH, NC 27607 (919) 733-3770

TANK_ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	GASOLINE, GASOLINE MIXTURE	4000	05/04/1951		CURRENTLY
2	DIESEL, DIESEL MIXTURE	2000	04/28/1974		

ERIIS ID / FACILITY ID	FACILITY / ADDRESS / CONTACT PHONE	OWNER / OWNER ADDRESS / OWNER PHONE
37010016328 0-015593	LANDFILL 2115 CLUB BOULEVARD DURHAM, NC 27704 (919) 683-4505	CITY OF DURHAM 101 CITY HALL PLAZA DURHAM, NC 27701 (919) 683-4505

TANK_ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	DIESEL, DIESEL MIXTURE	5000	05/02/1982		CURRENTLY

ERIIS ID / FACILITY ID	FACILITY / ADDRESS / CONTACT PHONE	OWNER / OWNER ADDRESS / OWNER PHONE
37010016348 0-015943	CONVENIENT FOOD MART 228 ANGIER AVENUE DURHAM, NC 27704 (919) 723-9982	PACE OIL COMPANY, INC. P.O. BOX 15047/150 STRATFORD CT. WINSTON-SALEM, NC 27113 (919) 723-9982

TANK_ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	GASOLINE, GASOLINE MIXTURE	4000	06/30/1975		CURRENTLY
2	GASOLINE, GASOLINE MIXTURE	4000	06/30/1975		CURRENTLY

ERIIS ID / FACILITY ID	FACILITY / ADDRESS / CONTACT PHONE	OWNER / OWNER ADDRESS / OWNER PHONE
37010016414 0-003095	LEE,S COUNTRY STORE 3009 EAST GREER STREET DURHAM, NC 27704 (919) 688-1634	A. LEE GREEN, JR. ROUTE 5, BOX 188 CLARK RD. DURHAM, NC 27704 (919) 682-6959

TANK_ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
	NOT REPORTED	0			

ERIIS ID / FACILITY ID	FACILITY / ADDRESS / CONTACT PHONE	OWNER / OWNER ADDRESS / OWNER PHONE
37010016448 0-033426	DRAPER CORPORATION 3333 INDUSTRIAL DRIVE DURHAM, NC 27704 (919) 471-1581	DRAPER CORPORATION 3333 INDUSTRIAL DRIVE DURHAM, NC 27704 (919) 471-1581

TANK_ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	GASOLINE, GASOLINE MIXTURE	3000	07/02/1975		CURRENTLY

ERIIS ID / FACILITY ID	FACILITY / ADDRESS / CONTACT PHONE	OWNER / OWNER ADDRESS / OWNER PHONE
37010016449 0-019621	C-MART #1 3407 E. CLUB BLVD. DURHAM, NC 27704	GWALTNEY OIL & GAS CO., INC. PO BOX 99 MEBANE, NC 27302 (919) 563-5585

ERIIS ID
FACILITY ID

FACILITY
ADDRESS
CONTACT PHONE

OWNER
OWNER ADDRESS
OWNER PHONE

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	GASOLINE, GASOLINE MIXTURE	8000	08/10/1987		CURRENTLY
2	GASOLINE, GASOLINE MIXTURE	8000	08/10/1987		CURRENTLY
3	GASOLINE, GASOLINE MIXTURE	8000	08/10/1987		CURRENTLY
4	KEROSENE, KEROSENE MIXTURE	2000	08/10/1987		CURRENTLY

37010016451
0-016756

DURHAM PRODUCTS
3427 INDUSTRIAL DRIVE
DURHAM, NC 27704
(919) 471-4488

DURHAM PRODUCTS
3427 INDUSTRIAL DRIVE
DURHAM, NC 27704
(919) 471-4488

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	GASOLINE, GASOLINE MIXTURE	10000	02/26/1981	10/21/1988	PERMANENTLY
2	GASOLINE, GASOLINE MIXTURE	8000	02/26/1981	10/21/1988	PERMANENTLY

37010016475
0-015490

CIRCLE K #8222
3801 DUKE STREET @ HORTON ROAD
DURHAM, NC 27704
(804) 499-8281

CIRCLE K FOOD STORES
500 S FAULKENBURG RD.
TAMPA, FL 33619

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	GASOLINE, GASOLINE MIXTURE	12000	04/21/1982		CURRENTLY
2	GASOLINE, GASOLINE MIXTURE	12000	04/21/1982		CURRENTLY
3	GASOLINE, GASOLINE MIXTURE	12000	04/21/1982		CURRENTLY

37010016556
0-015052

RIVERVIEW CHEVRON
5202 ROXBORO ROAD
DURHAM, NC 27704
(301) 563-5185

CHEVRON
5202 ROXBORO RD
DURHAM, NC 27712

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	GASOLINE, GASOLINE MIXTURE	6000	04/07/1970		CURRENTLY
2	GASOLINE, GASOLINE MIXTURE	6000	04/07/1970		CURRENTLY
3	GASOLINE, GASOLINE MIXTURE	6000	04/07/1970		CURRENTLY
4	DIESEL, DIESEL MIXTURE	1000	04/03/1985		CURRENTLY

37010016559
0-016391

ENO BP SERVICE
5292 ROXBORO ROAD
DURHAM, NC 27704
(919) 471-8243

M.M. FOWLER, INC.
600 GULF STREET
DURHAM, NC 27703
(919) 596-8246

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	GASOLINE, GASOLINE MIXTURE	6000	02/25/1965		CURRENTLY
2	GASOLINE, GASOLINE MIXTURE	6000	02/25/1965		CURRENTLY
3	GASOLINE, GASOLINE MIXTURE	10000	02/22/1977		CURRENTLY
4	GASOLINE, GASOLINE MIXTURE	6000	02/25/1965		CURRENTLY
5	DIESEL, DIESEL MIXTURE	550	02/25/1965	11/16/1988	PERMANENTLY

37010019140
0-023114

MARGARETTSVILLE
NORTHAMPTON CO.
MARGARETTSVILLE, NC 27704
(919) 477-7341

AT&T/ATTN:SUSAN LARY
1200 PEACHTREE ST/PROMENADE II-
ATLANTA, GA 30309
(404) 810-4807

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	KEROSENE, KEROSENE MIXTURE	3000	03/01/1966	01/16/1990	PERMANENTLY

ERIIS ID / FACILITY ID | FACILITY / ADDRESS / CONTACT PHONE | OWNER / OWNER ADDRESS / OWNER PHONE

37010019340 / 0-023115

HILLSBORO
SR #1129
HILLSBORO, NC 27704
(919) 477-7341

AT&T
128 WEST HARGETT ST.
RALEIGH, NC 27601
(404) 810-4807

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	KEROSENE, KEROSENE MIXTURE	3500	03/01/1966		CURRENTLY

37010023548 / 0-016748

ELLERBEE R.T.
COUNTY RD. 1310
ELLERBEE, NC 27704
(919) 477-7341

AT&T/ATTN:SUSAN LARY
1200 PEACHTREE ST/PROMENADE II-
ATLANTA, GA 30309
(404) 810-4807

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	DIESEL, DIESEL MIXTURE	6000	02/28/1972	10/30/1992	PERMANENTLY

37010016164 / 0-015878

N.C. DEPT. OF TRANSPORTATION
PO BOX 15580
DURHAM, NC 27704-0580
(919) 683-4348

CITY OF DURHAM
101 CITY HALL PLAZA
DURHAM, NC 27701
(919) 683-4381

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	DIESEL, DIESEL MIXTURE	5000	05/15/1948	06/01/1986	PERMANENTLY

37010016306 / 0-002508

FIRE TRAINING ACADEMY
2008 E CLUB BLVD
DURHAM, NC 27704-3414
(919) 683-4181

CITY OF DURHAM
101 CITY HALL PLAZA
DURHAM, NC 27701
(919) 683-4100

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
001	DIESEL, DIESEL MIXTURE	10000	05/01/1978	11/23/1992	PERMANENTLY

37010016309 / 0-015881

FIRE STATION #9
2012 E CLUB BLVD
DURHAM, NC 27704-3414
(919) 683-4271

CITY OF DURHAM
101 CITY HALL PLAZA
DURHAM, NC 27701
(919) 683-4381

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
FD-9G	GASOLINE, GASOLINE MIXTURE	9250	05/02/1971	05/25/1989	PERMANENTLY

37010016186 / 0-012947

CATSBURG COUNTRY STORE
RR 5 BOX 1
DURHAM, NC 27704-9501
(919) 477-6897

HENDLEY OIL CO
813 ELLIS RD
DURHAM, NC 27703
(919) 477-6897

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	GASOLINE, GASOLINE MIXTURE	1000	01/01/1964	03/22/1990	PERMANENTLY
2	GASOLINE, GASOLINE MIXTURE	550	01/01/1964	03/21/1990	PERMANENTLY

37010016185 / 0-015461

CHEEK RD. GROCERY
RR 5 BOX 481
DURHAM, NC 27704-9529
(919) 493-7674

JERRY HINESLEY
815 STALLINGS RD.
DURHAM, NC 27704
(919) 493-7674

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS

ERIIS ENVIRONMENTAL DATA REPORT
NORTH CAROLINA UNDERGROUND STORAGE TANKS
(U[redacted])

ERIIS Report #42111

Mar 7, 1994

ERIIS ID
FACILITY ID

FACILITY
ADDRESS
CONTACT PHONE

OWNER
OWNER ADDRESS
OWNER PHONE

TANK ID	PRODUCT	CAPACITY	DATE INSTALLED	DATE REMOVED	STATUS
1	GASOLINE, GASOLINE MIXTURE	8000	04/21/1978		CURRENTLY
2	GASOLINE, GASOLINE MIXTURE	4000	04/21/1978		CURRENTLY
3	GASOLINE, GASOLINE MIXTURE	1000	04/23/1971		CURRENTLY
4	GASOLINE, GASOLINE MIXTURE	1000	04/23/1971	06/01/1978	PERMANENTLY

ERIIS ENVIRONMENTAL DATA REPORT
NORTH CAROLINA LEAKING UNDERGROUND STORAGE TANKS
(LUST)

ERIIS Report #42111

Mar 7, 1994

ERIIS ID	FACILITY	ADDRESS	COUNTY	POLLUTANT SOURCE POLLUTANT TYPE
37005000791	AMOCO-OXFORD RD.	OXFORD RD. DURHAM, NC	DURHAM	LEAK-UNDERGROUND GASOLINE/DIESEL
37005000800	BURLINGTON INDUSTRIES	W. MAIN ST. DURHAM, NC	DURHAM	LEAK-UNDERGROUND GASOLINE/DIESEL
37005000805	CARPENTERS CHEVROLET	EAST MAIN ST. DURHAM, NC	DURHAM	LEAK-UNDERGROUND OTHER PETROLEUM PRODUCT(S)
37005000817	CRABTREES EXXON #4-4408	I-85 GUESS RD. DURHAM, NC	DURHAM	LEAK-UNDERGROUND GASOLINE/DIESEL
37005000822	DUKE UNIVERSITY INFIRMARY	BUCHANAN ST. DURHAM, NC	DURHAM	LEAK-UNDERGROUND GASOLINE/DIESEL
37005000827	DURHAM CO. HOSP-AMBULANCE FAC.	ROXBORO RD. DURHAM, NC	DURHAM	LEAK-UNDERGROUND GASOLINE/DIESEL
37005000832	DURHAM LAUNDRY CO.	GRESSON & WEST PEABODY ST. DURHAM, NC	DURHAM	LEAK-UNDERGROUND OTHER ORGANIC
37005000833	DURHAM ST. MAINTENANCE	ALSTON-GILBERT ST. DURHAM, NC	DURHAM	LEAK-UNDERGROUND GASOLINE/DIESEL
37005000848	GEORGIA ST. GTE SITE	GEORGIA ST. DURHAM, NC	DURHAM	SOURCE UNKNOWN GASOLINE/DIESEL
37005000852	GOLDEN POULTRY-LATTA	LATTA ST. DURHAM, NC	DURHAM	LEAK-UNDERGROUND HEATING OIL
37005000855	GULF STATION #24184	I-85 AND GUESS RD. DURHAM, NC	DURHAM	LEAK-UNDERGROUND GASOLINE/DIESEL
37005000860	IBM CORP.	RESEARCH TRIANGLE PARK DURHAM, NC	DURHAM	LEAK-UNDERGROUND OTHER ORGANIC
37005000861	IBM LANDFILL	RESEARCH TRIANGLE PARK DURHAM, NC	DURHAM	LANDFILL METALS
37005000875	LUTRAVIL CO.	ENO INDUSTRIAL PARK DURHAM, NC	DURHAM	LEAK-UNDERGROUND GASOLINE/DIESEL
37005000885	OXFORD COMMONS	SR 1004 & US 501 DURHAM, NC	DURHAM	LEAK-UNDERGROUND HEATING OIL
37005000893	READY MIXED CONCRETE CO.	HWY 55 DURHAM, NC	DURHAM	LEAK-UNDERGROUND GASOLINE/DIESEL
37005000894	RIVERVIEW 76	5000 TOXBORO RD. DURHAM, NC	DURHAM	LEAK-UNDERGROUND GASOLINE/DIESEL
37005000902	SUPREME FINISH CO.	FOUNTAIN ST. DURHAM, NC	DURHAM	INTENTIONAL DUMP METALS

ERIIS ID	FACILITY	ADDRESS	COUNTY	POLLUTANT SOURCE POLLUTANT TYPE
37005000903	SWARTZ SALVAGE YARD	HOLMAN ST. DURHAM, NC	DURHAM	LEAK-UNDERGROUND GASOLINE/DIESEL
37005000904	T. A. GRADY COMMUNITY CENTER	LAKELAND ST. DURHAM, NC	DURHAM	LEAK-UNDERGROUND HEATING OIL
37005000910	TRIANGLE SQUARE SHOPPING CNTR.	HWY 54 & HWY 55 DURHAM, NC	DURHAM	SOURCE UNKNOWN GASOLINE/DIESEL
37005000912	WAKE EMC	S. VIEW RD. DURHAM, NC	DURHAM	LEAK-UNDERGROUND GASOLINE/DIESEL
37005000915	WESTERN AUTO	US 15/501 DURHAM, NC	DURHAM	SPILL-SURFACE OTHER PETROLEUM PRODUCT(S)
37005002253	CHRISTIAN PROPERTY	507 GROUCHO LANE DURHAM, NC	ORANGE	LEAK-UNDERGROUND GASOLINE/DIESEL
37005002285	US 70 RIGHT OF WAY	US 70 & SR 571 DURHAM, NC	ORANGE	LEAK-UNDERGROUND OTHER PETROLEUM PRODUCT(S)

ERIIS ID / PERMIT NO.	FACILITY	FACILITY ADDRESS	FACILITY CONTACT / CONTACT PHONE	CONTACT ADDRESS
37018000011 32-05	B & B TOPSOIL MINE	HAMLIN ROAD DURHAM, NC COUNTY: DURHAM	FRANCES D ANDREWS (919) 477-6328	RT 5 BOX 53 DURHAM, NC 27704
	TYPE OF FACILITY: YARD WASTE PROCESSING FACILITY			
37018000061 32-04	DURHAM YARD WASTE FACILITY	EAST CLUB BLVD DURHAM, NC COUNTY: DURAHAM	NANCY CLAYTON (919) 560-4185	CITY OF DURHAM DURHAM, NC 27701
	TYPE OF FACILITY: YARD WASTE PROCESSING FACILITY			
37018000253 32-F	FOGLEMAN LANDFILL	RED MILL ROAD DURHAM, NC COUNTY: DURHAM	JAMES KENT FOGLEMAN (919) 683-3256	RT 5 BOX 170 DURHAM, NC 27704
	TYPE OF FACILITY: LAND CLEARING AND INERT DEBRIS LANDFILL			
37018000062 32-01	DURHAM CITY OF	S R 1636 NC COUNTY: DURHAM	NANCY CLAYTON (919) 560-4185	101 CITY HALL PLAZA DURHAM, NC 27701
	TYPE OF FACILITY: MUNICIPAL SOLID WASTE OR INDUSTRIAL WASTE LANDFILL			
37018000273 32-G	HOOVER ROAD LANDFILL	HOOVER ROAD NC COUNTY: DURHAM	ONSLOW PAINTER (919) 383-1577	PO BOX 2508 DURHAM, NC 27715
	TYPE OF FACILITY: LAND CLEARING AND INERT DEBRIS LANDFILL			
37018000357 32-E	LATTA EARL J INC	EAST CLUB BLVD NC COUNTY: DURHAM	EARL J LATTA (919) 477-8167	PO BOX 2508 DURHAM, NC 27715
	TYPE OF FACILITY: LAND CLEARING AND INERT DEBRIS LANDFILL			

FINDS DESCRIPTION

AIRS (Aerometric Information Retrieval System) - The AIRS system contains detailed information pertaining to over 85,000 sites which submit air emissions reports. Developed under the Clean Air Act, this database also maintains data on compliance status and enforcement actions.

CERCLIS (Comprehensive Environmental Cleanup Liability Information System) - This system contains information on over 38,000 sites that have been identified as hazardous, or potentially hazardous, and may require cleanup. Information included in this database is provided by both state and federal sources.

CICIS (Chemicals in Commerce Information System) - The CICIS database is responsible for the tracking of hazardous chemicals that are listed in the Toxic Substances Control Act (TSCA). Data elements include the manufacturer's name and address, CAS registry number, chemical prefaced name, and any possible synonyms.

CONTR LIST (Contractor List) - The CONTR LIST is an inventory of companies that are barred from conducting business with the EPA due to violations of environmental laws or statutes.

CRIMDOCK (Criminal Docket System) - The CRIMDOCK is a comprehensive automated system for tracking criminal enforcement actions. CRIMDOCK handles data for all environmental statutes and tracks enforcement actions from the initial stages of investigation through conclusion.

CUS (Chemical Update System) - CUS is used to track facilities which manufacture or import specific toxic chemicals in excess of 10,000 pounds per year.

DOCKET - A national system containing all pertinent information regarding a civil or administrative enforcement action taken by the EPA, or state agency, against violators of environmental laws or statutes.

FATES (FIFRA and TSCA Enforcement System) - The FATES database contains records of FIFRA and TSCA inspections and enforcement proceedings, registration data for pesticide producing establishments and annual pesticide production reports, state grant-in-aid program and accomplishment data, and program and financial status of TSCA inspection contracts.

FTTS (FIFRA and TSCA Tracking System) - The FTTS system contains information regarding Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and Toxic Substances Control Act (TSCA) legislation. This database also contains selected data concerning pesticide producers.

FFIS (Federal Facility Information System) - FFIS is an index of selected federally owned facilities. It is a monitoring and tracking tool for the Office of Federal Facilities Enforcement. Its main purpose is to monitor pollution abatement programs for federal facilities worldwide.

NCDB (National Compliance Database) - The NCDB was used to support the implementation of the Federal Insecticide, Fungicide and, Rodenticide Act (FIFRA) and the Toxic Substances Control Act (TSCA). The system is also used to track the inspections of approximately 17,000 chemical facilities.

PADS (PCB Activity Database System) - The PADS database contains information on sites where there is known contamination of polychlorinated biphenols.

PCS (Permit Compliance System) - PCS contains information pertaining to over 76,000 facilities that are permitted to discharge waste into bodies of surface water. Also, this system stores selective summaries of information for facilities with National Pollution Discharge Elimination System (NPDES) permits.

RCRA-J (Resource Conservation Recovery Act - Medical Waste) - This database is used to track medical waste under the stipulations of the Medical Waste Tracking Act (MWTA) of 1988. Data for this system is obtained from regulated communities through incinerator reports.

RCRIS (Resource Conservation Recovery Act Information System) - This report identifies and tracks hazardous waste from the point of generation to the point of disposal. Sites listed in the RCRIS database are those which comply with the regulations stipulated in the Resource Conservation Recovery Act.

STATE (State Regulated Facilities) - The STATE system is responsible for maintaining records for those facilities that are not required to register with any type of federal agency. The information on this database is quite varied due to the differing state environmental laws and statutes.

TRI (Toxic Release Inventory) - All facilities which manufacture, process, or import toxic chemicals in quantities in excess of 25,000 pounds per year are required to register with the EPA under Section 313 of the Superfund Amendments and Reauthorization Act (SARA Title III) of 1986. Data contained in the TRI system covers approximately 20,000 sites and 75,000 chemical releases.

EPA HAZARDOUS WASTE NUMBERS -- HAZARDOUS WASTE DESCRIPTION

D001 -- A solid waste that exhibits the characteristic of ignitability, but is not listed as a hazardous waste in Subpart D.

D002 -- A solid waste that exhibits the characteristic of corrosivity, but is not listed as a hazardous waste in Subpart D.

D003 -- A solid waste that exhibits the characteristic of reactivity, but is not listed as a hazardous waste in Subpart D.

EPA HW #	CAS #	COMMON CHEMICAL NAME
D004	7740-38-2	ARSENIC
D005	7740-39-3	BARIUM
D006	7440-43-9	CADMIUM
D007	7440-47-3	CHROMIUM
D008	7439-92-1	LEAD
D009	7439-97-6	MERCURY
D010	7782-49-2	SELENIUM
D011	7440-22-4	SILVER
D012	72-20-8	ENDRIN
D013	58-89-9	LINDANE
D014	72-43-5	METHOXYCHLOR
D015	8001-35-2	TOXAPHENE
D016	94-75-7	2,4-D
D017	93-72-1	2,4,5-TP(SILVEX)
D018	71-39-2	BENZENE
D019	56-23-5	CARBON TETRACHLORIDE
D020	57-74-9	CHLORDANE
D021	108-90-7	CHLOROBENZENE
D022	67-66-3	CHLOROFORM
D023	95-48-7	O-CRESOL
D024	108-39-4	M-CRESOL
D025	106-44-5	P-CRESOL
D026		CRESOL
D027	106-46-7	1,4-DICHLOROBENZENE
D028	107-06-2	1,2-DICHLOROETHANE
D029	75-35-4	1,1-DICHLOROETHYLENE
D030	121-14-2	2,4-DINITROTOLUENE
D031	76-44-8	HEPTACHLOR (AND ITS EPOXIDE)
D032	118-74-1	HEXACHLOROBENZENE
D033	87-68-3	HEXACHLOROBUTADIENE
D034	67-72-1	HEXACHLOROETHANE
D035	78-93-3	METHYL ETHYL KETONE
D036	98-95-3	NITROBENZENE
D037	87-86-5	PENTACHLOROPHENOL
D038	110-86-1	PYRIDINE
D039	127-18-4	TETRACHLOROETHYLENE
D040	79-01-6	TRICHLOROETHYLENE
D041	95-95-4	2,4,5-TRICHLOROPHENOL
D042	88-06-2	2,4,6-TRICHLOROPHENOL
D043	75-01-4	VINYL CHLORIDE

EPA HAZARDOUS WASTE NUMBERS -- HAZARDOUS WASTE DESCRIPTION

F001 -- The following spent halogenated solvents used in degreasing: Tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride, and chlorinated fluorocarbons; all spent solvent mixtures/blends used in degreasing containing, before use, a total of ten percent or more (by volume) of one or more of the above halogenated solvents or those solvents listed in F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.

F002 -- The following spent halogenated solvents: Tetrachloroethylene, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, chlorobenzene, 1,1,2-trichloroethane; all spent solvent mixtures/blends containing, before use, a total of ten percent or more (by volume) of one or more of the above halogenated solvents or those listed in F001, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.

F003 -- The following spent non-halogenated solvents: Xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol; all spent solvent mixtures/blends containing, before use, only the above spent non-halogenated solvents; and all spent solvent mixtures/blends containing, before use, one or more of the above non-halogenated solvents, and, a total of ten percent or more (by volume) of one or more of those solvents listed in F001, F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.

F004 -- The following spent non-halogenated solvents: Cresols and cresylic acid, and nitrobenzene: all spent solvent mixtures/blends containing, before use, a total of ten percent or more (by volume) of one or more of the above non-halogentaed solvents or those solvents listed in FOO1, FOO2, and FOO5; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.

F005 -- The following spent non-halogenated solvents: Toluene, methyl ethyl ketone, carbon disulfide, isobutanol, pyridine, benzene, 2-ethoxyethanol, and 2-nitropropane; all spent solvent mixtures/blends containing, before use, a total of ten percent or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in FOO1, F002, or FOO4; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.

F006 -- Wastewater treatment sludges from electroplating operations except from the following processes: (1) Sulfuric acid anodizing of aluminum; (2) tin plating on carbon steel; (3) zinc plating (segregated basis) on carbon steel; (4) aluminum or zinc-aluminum plating on carbon steel; (5) cleaning/stripping associated with tin, zinc and aluminum plating on carbon steel; and (6) chemical etching and milling of aluminum.

F007 -- Spent cyanide plating bath solutions from electroplating operations.

F008 -- Plating bath residues from the bottom of plating baths from electroplating operations where cyanides are used in the process.

EPA HAZARDOUS WASTE NUMBERS -- HAZARDOUS WASTE DESCRIPTION

F009 -- Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used in the process.

F010 -- Quenching bath residue from oil baths from metal heat treating operations where cyanides are used in the process.

F011 -- Spent cyanide solutions from salt bath pot cleaning from metal heat treating operations.

F012 -- Quenching wastewater treatment sludges from metal heat treating operations where cyanides are used in the process.

F019 -- Wastewater treatment sludges from the chemical conversion coating of aluminum.

F020 -- Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tri- or tetrachlorophenol, or of intermediates used to produce their pesticide derivatives. (This listing does not include wastes from the production of hexachlorophene from highly purified 2,4,5-trichlorophenol.)

F021 -- Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of pentachlorophenol, or of intermediates used to produce its derivatives.

F022 -- Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tetra-, penta-, or hexachlorobenzenes under alkaline conditions.

F023 -- Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production of materials on equipment previously used for the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tri- and tetrachlorophenols. (This listing does not include wastes from equipment used only for the production or use of hexachlorophene from highly purified 2,4,5- trichlorophenol.)

F024 -- Wastes, including but not limited to, distillation residues, heavy ends, tars, and reactor clean-out wastes from the production of chlorinated aliphatic hydrocarbons, having carbon content from one to five, utilizing free radical catalyzed processes. (This listing does not include light ends, spent filters and filter aids, spent dessicants, wastewater, wastewater treatment sludges, spend catalysts, and wastes listed in §261.32.)

F026 -- Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production of materials on equipment previously used for the manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tetra-, penta-, or hexachlorobenzene under alkaline conditions.

F027 -- Discarded unused formulations containing tri-, tetra-, or pentachlorophenol or discarded unused formulations containing compounds derived from these chlorophenols. (This listing does not include formulations containing hexachlorophene synthesized from prepurified 2,4,5-trichlorophenol as the sole component.)

EPA HAZARDOUS WASTE NUMBERS -- HAZARDOUS WASTE DESCRIPTION

F028 -- Residues resulting from the incineration or thermal treatment of soil contaminated with EPA Hazardous Waste Nos. F020, F021, F022, F023, F026, and F027.

K001 -- Bottom sediment sludge from the treatment of wastewaters from wood preserving processes that use creosote and/or pentachlorophenol.

K002 -- Wastewater treatment sludge from the production of chrome yellow and orange pigments.

K003 -- Wastewater treatment sludge from the production of molybdate orange pigments.

K004 -- Wastewater treatment sludge from the production of zinc yellow pigments.

K005 -- Wastewater treatment sludge from the production of chrome green pigments.

K006 -- Wastewater treatment sludge from the production of chrome oxide greenpigments (anhydrous and hydrated).

K007 -- Wastewater treatment sludge from the production of iron blue pigments.

K008 -- Oven residue from the production of chrome oxide green pigments.

K009 -- Distillation bottoms from the production of acetaldehyde from ethylene.

K010 -- Distillation side cuts from the production of acetaldehyde from ethylene.

K011 -- Bottom stream from the wastewater stripper in the production of acrylonitrile.

K013 -- Bottom stream from the acetonitrile column in the production of acrylonitrile.

K014 -- Bottoms from the acetonitrile purification column in the production of acrylonitrile.

K015 -- Still bottoms from the distillation of benzyl chloride.

K016 -- Heavy ends or distillation residues from the production of carbon tetrachloride.

K017 -- Heavy ends (still bottoms) from the purification column in the production of epichlorohydrin.

K018 -- Heavy ends from the fractionation columnn in ethyl chloride production.

K019 -- Heavy ends from the distillation of ethylene dichloride in ethylene dichloride production.

K020 -- Heavy ends from the distillation of vinly chloride in vinly chloride monomer production.

K021 -- Aqueous spend antimony catalyst waste from fluoromethane production.

K022 -- Distillation bottom tars from the production of phenol/acetone from cumene.

K023 -- Distillation light ends from the production of phthalic anhydride from naphthalene.

EPA HAZARDOUS WASTE NUMBERS -- HAZARDOUS WASTE DESCRIPTION

K024 -- Distillation bottoms from the production of phthalic anhydride from naphthalene.

K025 -- Distillation bottoms from the production of nitrobenxene by the nitration of benzene.

K026 -- Stripping still tails from the production of methyl ethyl pyridines.

K027 -- Centrifuge and distillation residues from toluene diisocyanate production.

K028 -- Spent catalyst from the hydrochlorinator reactor in the production of 1,1,1-trichloroethane.

K029 -- Wastes from the product steam stripper in the production of 1,1,1-trichloroethane.

K030 -- Column bottoms or heavy ends from the combined production of trichloroethtlene and perchloroethtlene.

K031 -- By-product salts generated in the production of MSMA and cacodylic acid.

K032 -- Wastewater treatment sludge from the production of chlordane.

K033 -- Wastewater and scrub water from the chlorination of cyclopentadiene in the production of chlordane.

K034 -- Filter solids from the filtration of hexachlorocyclopentadiene in the prodution of chlordane.

K035 -- Wastewater treatment sludges generated in the production of creosote.

K036 -- Still bottoms from toluene reclamation distillation in the production of disulfoton.

K037 -- Wastewater treatment sludges from the production of disulfoton,

K038 -- Wastewater from the washing and stripping of phorate production.

K039 -- Filter cake from the filtration of diethylphosphorodithioic acid in the productionof phorate.

K040 -- Wastewater treatment sludge from the production of phorate.

K041 -- Wastewater treatment sludge from the production of toxaphene.

K071 -- Brine purification muds from the mercury cell process in chlorine production, where separatelty prepurified brine is not used.

K073 -- Chlorinated hydrocarbon waste from the purification step of the diaphragm cell process using graphite anodes in chlorine production.

K083 -- Distillation bottoms from aniline production.

EPA HAZARDOUS WASTE NUMBERS -- HAZARDOUS WASTE DESCRIPTION

K085 -- Distillation or fractionation column bottoms from the production of chlorobenzenes.

K093 -- Distillation light ends from the production of phthalic anhydride from ortho-xylene.

K095 -- Distillation bottoms from the production of 1,1,1-trichloroethane.

K096 -- Heavy ends from the heavy ends column from the production of 1,1,1-trichloroethane.

K097 -- Vacuum stripper discharge from the chlordane chlorinator in the production of chlordane.

K098 -- Untreated process wastewater from the production of toxaphene.

K103 -- Process residues from aniline extraction from the production of aniline.

K104 -- Combined wastewater streams generated from nitrobenzene/aniline production,

K105 -- Separated aqueous stream from the reactor product washing step in the production of chlorobenzenes.

K106 - Wastewater treatment sludge from the mercury cell process in chlorine production.

K111 - Product washwaters from the production of dinitrotoluene via nitration of toluene.

K112 -- Reaction by-product water from the drying column in the production of toluenediamine via hydrogenation of dinitrotoluene.

K113 -- Condensed liquid light ends from the purification of toluenediamine in the production of toluenediamine via hydrogenation of dinitrotoluene.

K114 -- Vicinals from the purification of toluenediamine in the production of toluenediamine via hydrogenation of dinitrotoluene.

K115 -- Heavy ends from the purification of toluenediamine in the production of toluenediamine via hydrogenation of dinitrotoluene.

K116 -- Organic condensate from the solvent recovery column in the production of toluene diisocyanate via phosgenation of toluenediamine.

K117 -- Wastewater from the reactor vent gas scrubber in the production of ethylene dibromide via bromination of ethene.

K118 -- Spent absorbent solids from purification of ethylene dibromide in the production of ethylene dibromide via bromination of ethene.

K136 -- Still bottoms from the purification of ethylene dibromide in the production of ethylene dibromide via bromination of ethene.

EPA HAZARDOUS WASTE NUMBERS -- COMMON CHEMICAL NAME

EPA HW #	CAS #	COMMON CHEMICAL NAME
F027	88-06-2	2,4,6-TRICHLOROPHENOL
F027	58-90-2	2,3,4,6-TETRACHLOROPHENOL
F027	95-95-4	2,4,5-TRICHLOROPHENOL
F027	87-86-5	PENTACHLOROPHENOL
F027	93-76-5	2,4,5-TRICHLOROPHENOXYACETIC ACID
F027	93-72-1	SILVEX
P002	591-08-28	1-ACETYL-2-THIOUREA
P003	107-02-88	ACROLEIN
P001	81-81-2	WARFARIN
P004	309-00-28	ALDRIN
P005	107-18-68	ALLYL ALCOHOL
P006	20859-73-8	ALUMINUM PHOSPHIDE
P007	2763-96-4	MUSCIMOL
P008	504-24-58	PYRIDINE, 4-AMINO
P010	7778-39-4	ARSENIC ACID
P011	1303-28-2	ARSENIC PENTOXIDE, SOLID
P012	1327-53-3	ARSENIC TRIOXIDE, SOLID
P013	542-62-18	BARIUM CYANIDE, SOLID
P014	108-98-58	PHENYL MERCAPTAN
P015	7440-41-7	BERYLLIUM
P016	542-88-18	BIS(CHLOROMETHYL)ETHER
P017	598-31-28	BROMOACETONE
P018	357-57-38	BRUCINE
P020	88-85-7	DINOSEB
P021	592-01-88	CALCIUM CYANIDE, SOLID
P022	75-15-0	CARBON DISULFIDE
P023	107-20-08	CHLOROACETALDEHYDE
P024	106-47-88	P-CHLOROANILINE
P026	5344-82-1	1-(0-CHLOROPHENYL) THIOUREA
P027	542-76-78	3-CHLOROPROPIONITRILE
P028	100-44-78	BENZYL CHLORIDE
P029	544-92-38	CUPROUS CYANIDE
P030	57-12-5	CYANIDES (SOLUBLE SALTS AND COMPLEXES)
P031	460-19-58	CYANOGEN
P033	506-77-48	CYANOGEN CHLORIDE, INHIBITED
P034	131-89-58	4,6-DINITRO-0-CYCLOHEXYLPHENOL
P036	696-28-68	DICHLOROPHENYLARSINE
P037	60-57-1	DIELDRIN
P038	692-42-28	DIETHYLARSINE
P039	298-04-48	DISULFOTON
P040	297-97-28	THIONAZIN
P041	311-45-58	DIETHYL P-NITROPHENYL PHOSPHATE
P042	51-43-4	EPINEPHRINE
P043	55-91-4	ISOFLUROPHATE
P044	60-51-5	DIMETHOATE
P045	39196-18-4	THIOFANOX
P046	122-09-88	ALPHA, ALPHA-DIMETHYLPHENETHYLAMINE
P047	534-52-18	DINITRO-ORTHO-CRESOL

EPA HAZARDOUS WASTE NUMBERS -- COMMON CHEMICAL NAME

EPA HW #	CAS #	COMMON CHEMICAL NAME
P048	51-28-5	2,4-DINITROPHENOL
P049	541-53-78	2,4-DITHIOBIURET
P050	115-29-78	ENDOSULFAN
P051	72-20-8	ENDRIN
P054	151-56-48	ETHYLENEIMINE
P056	7782-41-4	FLUORINE
P057	640-19-78	FLUORACETAMIDE
P058	62-74-8	SODIUM FLUOROACETATE
P059	76-44-8	HEPTACHLOR
P060	465-73-68	ISODRIN
P062	757-58-48	HEXAETHYL TETRAPHOSPHATE
P063	74-90-8	HYDROGEN CYANIDE, ANHYDROUS, STABILIZED
P064	624-83-98	METHYL ISOCYANATE
P065	628-86-48	MERCURY FULMINATE
P066	16752-77-5	METHOMYL
P067	75-55-8	PROPYLENE IMINE
P068	60-34-4	METHYL HYDRAZINE
P069	75-86-5	ACETONE CYANOHYDRIN
P071	298-00-08	METHYL PARATHION
P072	86-88-4	THIOUREA, 1-NAPHTHALENYL-(ANTU)
P073	13463-39-3	NICKEL CARBONYL
P074	557-19-78	NICKEL CYANIDE
P075	54-11-5	NICOTINE
P076	10102-43-9	NITRIC OXIDE
P077	100-01-68	P-NITROANILINE
P078	10102-44-0	NITROGEN DIOXIDE
P081	55-63-0	NITROGLYCERIN
P082	62-75-9	N-NITROSODIMETHYLAMINE
P084	4549-40-0	N-NITROSOMETHYLVINYLAMINE
P085	152-16-98	SCHRADAN
P087	20816-12-0	OSMIUM TETROXIDE
P088	145-73-38	ENDOTHAL
P089	56-38-2	PARATHION
P092	62-38-4	PHENYLMERCURIC ACETATE
P093	103-85-58	PHENYLTHIOUREA
P094	298-02-28	PHORATE
P095	75-44-5	PHOSGENE
P096	7803-51-2	PHOSPHINE
P097	52-85-7	FAMPHUR
P098	151-50-88	POTASSIUM CYANIDE
P099	506-61-68	POTASSIUM SILVER CYANIDE
P100	107-12-08	ETHYL CYANIDE
P101	107-12-08	PROPIONITRILE
P102	107-19-78	PROPARGYL ALCOHOL
P103	630-10-48	SELENOUREA
P104	506-64-98	SILVER CYANIDE
P105	26628-22-8	SODIUM AZIDE (NA(N3))

EPA HAZARDOUS WASTE NUMBERS -- COMMON CHEMICAL NAME

EPA HW #	CAS #	COMMON CHEMICAL NAME
P106	143-33-98	SODIUM CYANIDE (NA(CN))
P108	57-24-9	STRYCHNINE
P109	3689-24-5	SULFOTEP
P110	78-00-2	TETRAETHYL LEAD
P111	107-49-38	TETRAETHYL PYROPHOSPHATE
P112	509-14-88	TETRANITROMETHANE
P113	1314-32-5	THALLIC OXIDE
P114	12039-52-0	SELENIOUS ACID, DITHALLIUM(1 +) SALT
P115	7446-18-6	THALLOUS SULFATE
P116	79-19-6	THIOSEMICARBAZIDE
P119	7803-55-6	AMMONIUM METAVANADATE
P120	1314-62-1	VANADIUM PENTOXIDE
P121	557-21-18	ZINC CYANIDE
P122	1314-84-7	ZINC PHOSPHIDE
P123	8001-35-2	TOXAPHENE
U001	75-07-0	ACETALDEHYDE
U002	67-64-1	ACETONE
U003	75-05-8	ACETONITRILE
U004	98-86-2	ACETOPHENONE
U005	53-96-3	2-ACETYLAMINOFLUORENE
U006	75-36-5	ACETYL CHLORIDE
U007	79-06-1	ACRYLAMIDE
U008	79-10-7	ACRYLIC ACID
U009	107-13-18	ACRYLONITRILE, INHIBITED
U010	50-07-7	MITOMYCIN C
U011	61-82-5	AMITROLE
U012	62-53-3	ANILINE
U014	492-80-88	C.I. SOLVENT YELLOW 34
U015	115-02-68	AZASERINE
U016	225-51-48	BENZ[C]ACRIDINE
U017	98-87-3	BENZAL CHLORIDE
U018	56-55-3	BENZ[A]ANTHRACENE
U019	71-43-2	BENZENE
U020	98-09-9	BENZENESULFONYL CHLORIDE
U021	92-87-5	BENZIDINE
U022	50-32-8	BENZO[A]PYRENE
U023	98-07-7	BENZOIC TRICHLORIDE
U024	111-91-18	BIS(2-CHLOROETHOXY)METHANE
U025	111-44-48	2,2'-DICHLOROETHYL ETHER
U026	494-03-18	CHLORNAPHAZINE
U027	108-60-18	BIS(2-CHLOROISOPROPYL)ETHER
U028	117-81-78	DI-(2-ETHYLHEXYL)PHTHALATE
U029	74-83-9	METHYL BROMIDE
U030	101-55-38	4-BROMOPHENYL PHENYL ETHER
U031	71-36-3	N-BUTYL ALCOHOL
U032	13765-19-0	CALCIUM CHROMATE
U033	353-50-48	CARBONIC DIFLUORIDE
U034	75-87-6	ACETALDEHYDE, TRICHLORO-

EPA HAZARDOUS WASTE NUMBERS -- COMMON CHEMICAL NAME

EPA HW #	CAS #	COMMON CHEMICAL NAME
U035	305-03-38	CHLORAMBUCIL
U036	57-74-9	CHLORDANE
U037	108-90-78	CHLOROBENZENE
U038	510-15-68	CHLOROBENZILATE
U039	59-50-7	4-CHLORO-M-CRESOL
U041	106-89-88	EPICHLOROHYDRIN
U042	110-75-88	2-CHLOROETHYL VINYL ETHER
U043	75-01-4	VINYL CHLORIDE
U044	67-66-3	CHLOROFORM
U045	74-87-3	METHYL CHLORIDE
U046	107-30-28	CHLOROMETHYL METHYL ETHER
U047	91-58-7	BETA-CHLORONAPHTHALENE
U048	95-57-8	0-CHLOROPHENOL
U049	3165-93-3	4-CHLORO-O-TOLUIDINE HYDROCHLORIDE
U050	218-01-98	1,2-BENZPHENANTHRENE
U051	8021-39-4	WOOD CREOSOTE
U052	1319-77-3	CRESOL
U053	4170-30-3	CROTONALDEHYDE
U055	98-82-8	CUMENE
U056	110-82-78	CYCLOHEXANE
U057	108-94-18	CYCLOHEXANONE
U058	50-18-0	CYCLOPHOSPHAMIDE
U059	20830-81-3	DAUNOMYCIN
U060	72-54-8	1,1-DICHLORO-2,2-BIS (P-CHLOROPHENYL)ETHANE
U061	50-29-3	DICHLORODIPHENYLTRICHLOROETHANE
U062	2303-16-4	DIALLATE
U063	53-70-3	DIBENZ(A,H)ANTHRACENE
U064	189-55-98	DIBENZO(A,I)PYRENE
U066	96-12-8	1,2-DIBROMO-3-CHLOROPROPANE
U067	106-93-48	ETHYLENE DIBROMIDE
U068	74-95-3	METHYLENE BROMIDE
U069	84-74-2	DIBUTYL PHTHALATE
U070	95-50-1	0-DICHLOROBENZENE, LIQUID
U071	541-73-18	M-DICHLOROBENZENE
U072	106-46-78	P-DICHLOROBENZENE
U073	91-94-1	3,3'-DICHLOROBENZIDINE
U074	764-41-08	1,4-DICHLORO-2-BUTENE (I,T)
U075	75-71-8	DICHLORODIFLUOROMETHANE
U076	75-34-3	1,1-DICHLOROETHANE
U077	107-06-28	ETHYLENE DICHLORIDE
U078	75-35-4	VINYLIDENE CHLORIDE
U079	156-60-58	TRANS-1,2-DICHLOROETHYLENE
U080	75-09-2	DICHLOROMETHANE
U081	120-83-28	2,4-DICHLOROPHENOL
U082	87-65-0	2,6-DICHLOROPHENOL
U083	78-87-5	PROPYLENE DICHLORIDE
U084	542-75-68	1,3-DICHLOROPHENOL

EPA HAZARDOUS WASTE NUMBERS -- COMMON CHEMICAL NAME

EPA HW #	CAS #	COMMON CHEMICAL NAME
U085	1464-53-5	2,2-BIOXIRANE
U086	1615-80-1	1,2-DIETHYLHYDRAZINE
U087	3288-58-2	0,0-DIETHYL S-METHYL DITHIOPHOSPHATE
U088	84-66-2	DIETHYL PHTHALATE
U089	56-53-1	DIETHYLSTILBESTROL
U090	94-58-6	DIHYDROSAFROLE
U091	119-90-48	3,3'-DIMETHOXYBENZIDINE
U092	124-40-38	DIMETHYLAMINE, ANHYDROUS
U093	60-11-7	4-DIMETHYLAMINOAZOBENZENE
U094	57-97-6	7,12-DIMETHYLBENZ(A)ANTHRACENE
U095	119-93-78	3,3'-DIMETHYLBENZIDINE
U096	80-15-9	CUMENE HYDROPEROXIDE
U097	79-44-7	DIMETHYLCARBAMOYL CHLORIDE
U099	540-73-88	1,2-DIMETHYLHYDRAZINE
U101	105-67-98	2,4-XYLENOL
U102	131-11-38	DIMETHYL PHTHALATE
U103	77-78-1	DIMETHYL SULFATE
U105	121-14-28	2,4-DINITROTOLUENE
U106	606-20-28	2,6-DINITROTOLUENE
U107	117-84-08	DIOCTYL PHTHALATE
U108	123-91-18	1,4-DIOXANE
U109	122-66-78	1,2-DIPHENYLHYDRAZINE
U110	142-84-78	DIPROPYLAMINE
U111	621-64-78	N-NITROSODI-N-PROPYLAMINE
U112	141-78-68	ETHYL ACETATE
U113	140-88-58	ETHYL ACRYLATE
U114	111-54-68	ETHYLENEBIS(DITHIOCARBAMIC ACID)
U115	75-21-8	ETHYLENE OXIDE
U116	96-45-7	ETHYLENE THIOUREA
U117	60-29-7	ETHYL ETHER
U118	97-63-2	ETHYL METHACRYLATE
U119	62-50-0	ETHYL METHANESULFONATE
U120	206-44-08	FLUORANTHENE
U121	75-69-4	FLUOROTRICHLOROMETHANE
U122	50-00-0	FORMALDEHYDE GAS
U123	64-18-6	FORMIC ACID
U124	110-00-98	FURAN
U125	98-01-1	FURFURAL
U126	765-34-48	GLYCIDALDEHYDE
U127	118-74-18	HEXACHLOROBENZENE
U128	87-68-3	HEXACHLOROBUTADIENE
U129	58-89-9	LINDANE
U130	77-47-4	HEXACHLOROCYCLOPENTADIENE
U131	67-72-1	HEXACHLOROETHANE
U132	70-30-4	HEXACHLOROPHENE
U133	302-01-28	HYDRAZINE, ANHYDROUS

EPA HAZARDOUS WASTE NUMBERS -- COMMON CHEMICAL NAME

EPA HW #	CAS #	COMMON CHEMICAL NAME
U134	7664-39-3	HYDROGEN FLUORIDE SOLUTION
U134	7664-39-3	HYDROGEN FLUORIDE
U135	7783-06-4	HYDROGEN SULFIDE
U136	75-60-5	CACODYLIC ACID
U137	193-39-58	INDENO(1,2,3-CD)PYRENE
U138	74-88-4	METHYL IODIDE
U139	9004-66-4	IRON DEXTRAN COMPLEX
U140	78-83-1	ISOBUTYL ALCOHOL
U141	120-58-18	ISOSAFROLE
U142	143-50-08	CHLORDECONE
U143	303-34-48	LASIOCARPINE
U144	301-04-28	LEAD ACETATE
U145	7446-27-7	LEAD PHOSPHATE
U146	1335-32-6	LEAD SUBACETATE
U147	108-31-68	MALEIC ANHYDRIDE
U148	123-33-18	MALEIC HYDRAZIDE
U149	109-77-38	MALONONITRILE
U150	148-82-38	MELPHALAN
U151	7439-97-6	MERCURY
U152	126-98-78	METHACRYLONITRILE
U153	74-93-1	METHYL MERCAPTAN
U154	67-56-1	METHYL ALCOHOL
U155	91-80-5	METHAPYRILENE
U156	79-22-1	METHYL CHLOROFORMATE
U157	56-49-5	3-METHYLCHOLANTHRENE
U158	101-14-48	4,4'-METHYLENEBIS(2-CHLOROBENZENAMINE)
U159	78-93-3	METHYL ETHYL KETONE
U160	1338-23-4	2-BUTANONE PEROXIDE
U161	108-10-18	METHYL ISOBUTYL KETONE
U162	80-62-6	METHYL METHACRYLATE, INHIBITED
U163	70-25-7	N-METHYL-N'-NITRO-N-NITROSOGUANIDINE
U164	56-04-2	METHYLTHIOURACIL
U165	91-20-3	NAPHTHALENE
U166	130-15-48	1,4-NAPHTHOQUINONE
U167	134-32-78	ALPHA-NAPHTHYLAMINE
U168	91-59-8	BETA-NAPHTHYLAMINE
U169	98-95-3	NITROBENZENE, LIQUID
U170	100-02-78	P-NITROPHENOL
U171	79-46-9	2-NITROPROPANE
U172	924-16-38	N-NITROSODI-N-BUTYLAMINE
U173	1116-54-7	N-NITROSODIETHANOLAMINE
U174	55-18-5	ETHANAMINE,N-ETHYL-N-NITROSO-
U176	759-73-98	N-NITROSO-N-ETHYLUREA
U177	684-93-58	N-NITROSO-N-METHYLUREA
U178	615-53-28	N-NITRO-N-METHYLURETHANE
U179	100-75-48	N-NITROSOPIPERIDINE
U180	930-55-28	N-NITROSOPYRROLIDINE
U181	99-55-8	5-NITRO-O-TOLUIDINE

EPA HAZARDOUS WASTE NUMBERS -- COMMON CHEMICAL NAME

EPA HW #	CAS #	COMMON CHEMICAL NAME
U182	123-63-78	PARALDEHYDE
U183	608-93-58	PENTACHLOROBENZENE
U184	76-01-7	PENTACHLOROETHANE
U185	82-68-8	PENTACHLORONITROBENZENE
U186	504-60-98	1,3-PENTADIENE
U187	62-44-2	PHENACETIN
U188	108-95-28	PHENOL
U189	1314-80-3	PHOSPHOROUS PENTASULFIDE
U190	85-44-9	PHTHALIC ANHYDRIDE
U191	109-06-88	2-PICOLINE
U192	23950-58-5	PRONAMIDE
U193	1120-71-4	PROPANE SULTONE
U194	107-10-88	PROPYLAMINE
U196	110-86-18	PYRIDINE
U197	106-51-48	QUINONE
U200	50-55-5	RESERPINE
U201	108-46-38	RESORCINOL
U202	81-07-2	SACCHARIN
U203	94-59-7	SAFROLE
U204	7783-00-8	SELENIOUS ACID
U205	7488-56-4	SELENIUM DISULFIDE
U206	18883-66-4	STREPTOZOTOCIN
U207	95-94-3	1,2,4,5-TETRACHLOROBENZENE
U208	630-20-68	1,1,1,2-TETRACHLOROETHANE
U209	79-34-5	1,1,2,2-TETRACHLOROETHANE
U210	127-18-48	TETRACHLOROETHYLENE
U211	56-23-5	CARBON TETRACHLORIDE
U212	58-90-2	2,3,4,6-TETRACHLOROPHENOL
U213	109-99-98	TETRAHYDROFURAN
U214	563-68-88	THALLIUM ACETATE
U215	6533-73-9	THALLOUS CARBONATE
U216	7791-12-0	THALLIUM CHLORIDE
U217	10102-45-1	THALLIUM NITRATE
U218	62-55-5	THIOACETAMIDE
U219	62-56-6	THIOUREA
U220	108-88-38	TOLUENE
U221	25376-45-8	TOLUENEDIAMINE
U222	636-21-58	O-TOLUIDINE HYDROCHLORIDE
U223	26471-62-5	TOLUENE DIISOCYANATE (MIXED ISOMERS)
U225	75-25-2	BROMOFORM
U226	71-55-6	METHYL CHLOROFORM
U227	79-00-5	1,1,2-TRICHLOROETHANE
U228	79-01-6	TRICHLOROETHYLENE
U230	88-06-2	2,4,6-TRICHLOROPHENOL
U232	93-76-5	2,4,5-T ACID
U233	93-72-1	SILVEX (2,4,5-TP)
U234	99-35-4	1,3,5-TRINITROBENZENE

EPA HAZARDOUS WASTE NUMBERS -- COMMON CHEMICAL NAME

EPA HW #	CAS #	COMMON CHEMICAL NAME
U235	126-72-78	TRIS
U236	72-57-1	TRYPAN BLUE
U237	66-75-1	URACIL MUSTARD
U238	51-79-6	URETHANE
U239	95-47-6	O-XYLENE
U239	106-42-38	P-XYLENE
U239	108-38-38	M-XYLENE
U239	1330-20-7	XYLENE (MIXED ISOMERS)
U239	95-47-6	BENZENE, O-DIMETHYL-
U239	106-42-38	BENZENE, P-DIMETHYL-
U239	108-38-38	BENZENE, M-DIMETHYL-
U240	94-75-7	2,4-DICHLOROPHENOXYACETIC ACID
U242	87-86-5	PENTACHLOROPHENOL
U243	1888-71-7	HEXACHLOROPROPENE
U244	137-26-88	THIRAM
U246	506-68-38	CYANOGEN BROMIDE
U247	72-43-5	METHOXYCHLOR
U248	506-68-38	CYANOGEN BROMIDE
U249	1314-84-7	ZINC PHOSPHIDE (CONC. < = 10%)
U328	95-53-4	O-YOLUIDINE
U353	106-49-08	P-TOLUIDINE
U359	110-80-58	2-ETHOXYETHANOL

Order Form

Environmental Risk Information & Imaging Services
1421 Prince Street, Suite 230
Alexandria, VA 22314
(703) 836-0402
1 - (800) 989-0402
FAX (703) 836-0468

E R I S

ERIIS Job #: _____ Cust #: _____

Date: _____ Time: _____ AM _____ PM

Job: _____ of _____ Written By: _____ Acct. Rep: _____

1. Product Check the box next to the ERIIS product(s) you would like to order:

ERIIS Report

- ☐ Federal/State data, digitized site map, Sanborn Maps, topographical map
- ☐ Federal/State data, digitized site map, topographical map
- ☐ Federal/State data, Sanborn Maps, topographical map
- ☐ Federal/State data, topographical map
- ☐ ERIIS QuickZip Report
- ☐ Custom Polygon or Corridor Report

- ☐ Sanborn Map (ordered separately)
- ☐ Historical Topo Map
- ☐ Land Ownership Map
- ☐ Aerial Photograph
- ☐ Wetlands Map
- ☐ Land Use Map
- ☐ Soil Map
- ☐ Hydrologic Map
- ☐ Geologic Map
- ☐ Other Map (specify in Special Instructions below)

2. Radius Check the box next to the RADIUS desired for your study site's research area:

☐ ASTM Radius Report ☐ One-mile Radius (all data) ☐ Other "Radius" (specify below)

3. Service And Delivery Check the box next to SERVICE and DELIVERY desired:

Requested Service:

- ☐ 5 business days no charge
- ☐ 3 business days $45
- ☐ 2 business days $75
- ☐ 1 business day $125
- ☐ FAX — per page: $2

Requested Delivery:

- ☐ First Class Mail (no charge)
- ☐ FedEx (enter Acct. #): _____
- ☐ UPS (enter Acct. #): _____
- ☐ Airborne (enter Acct. #): _____

4. Site Information Enter the information about your study site below:

Site Street Address: _____

_____

_____

City: _____ State: _____ Zip: _____ County: _____

☐ Map showing site attached ☐ Nearby crossroads: _____

5. Customer Delivery Information Enter shipping and billing information for your order below:

Company Name: _____

Ship To (PERSON NAME): _____ P.O./Job #: _____

Shipping Address: _____

City: _____ State: _____ Zip: _____

Phone: (_____) _____ - _____ FAX: (_____) _____ - _____

Bill To (PERSON NAME): _____

Billing Address: _____

City: _____ State: _____ Zip: _____

This order form and all payments due hereunder shall be governed by the terms and conditions on the reverse side hereof. By virtue of placing this order, customer confirms that said terms and conditions on the reverse side hereof have been read and accepted on its behalf. Jobs cancelled after 48 hours will be invoiced.

6. Additional Information/Special Instructions: (attach legal property description if known)

ORDER FORM
TERMS AND CONDITIONS

Scope

The following Agreement sets forth the terms and conditions that apply to the Order Form on the reverse side hereof for the reports and/or maps and graphics (hereinafter called the "Reports") issued by ERIIS (hereinafter called the "Company"). By placing such Order, the Customer agrees to be bound by the terms and conditions set forth below. The Company shall deliver to the Customer a Report in standardized format, unless otherwise specifically agreed, including printed material comprising an assembly of data (the "Data") which is proprietary to the Company and/or various third parties who supply such Data to the Company (the "Data Suppliers").

Delivery

The Company will use reasonable efforts to deliver the Reports to the Customer at the locations indicated on the applicable Order Form on or before the date requested (the "Request Date") on the applicable Order Form, but the Company shall not be liable for any delay in delivery. Unless otherwise specified on such Order Form, delivery shall be by first-class mail and the Company shall pay the cost of shipping the Reports; provided however, that the Company may, at its option, use any other form of delivery which provides reasonably equivalent service. At the Customer's option, and by prior written notice contained in the applicable Order Form, the Customer may request alternative forms of delivery, e.g., overnight courier, Express Mail or via any other delivery service; provided that, in such event, the cost of delivery of the Reports shall be borne by the Customer.

Price, Payment of Charges

The price shall be that set forth on the Order Form, provided that such price may be amended from time to time by the Company in accordance with changes in the Company's ordinary pricing policies only after notice to the Customer who may, upon receipt of such notice, have 48 hours to cancel such order. Payment shall be made to the Company by the Customer upon receipt of the invoice. Any additional orders from the Customer will be accepted only on a pre-paid cash basis as long as any such payments are overdue. Overdue payments will be subject to a late payment charge of 1-1/2% for each month or part of a month that such payment is overdue, but not greater than the highest amount permitted by applicable law.

Changes in Data

The Company reserves the right to make changes in the Data included in a Report for any reason, including without limitation, changes in Data Supplied by any Data Supplier. If the Company determines that it is not commercially feasible to continue publishing any Data in the Report, the Company may terminate this Agreement as to such Data and refund to the Customer a pro rata portion of any pre-paid charge for such Report.

Customer Use Restrictions

The Data and the Report may be used only in the operation of the Customer's business in connection with an investigation of a property or entity as set forth on the applicable Order Form. The Report and the Data contained in such Report may be used only by the Customer for the specific engagement, and may not be reproduced or made available to other parties either through reproduction by photocopy or by transfer into machine- readable or electronic form or video tape or disc or any similar means or forms which now or hereafter exist and may not be used on any systems of the Customer or shared through any networking, terminal access, downloading, internal timesharing or similar arrangement otherwise. Upon receipt of an updated or corrected copy of any Report or Data, the Customer shall promptly cease all use of any prior copies of that Report or Data.

Proprietary Rights in Data

The Customer acknowledges that the Data comprises proprietary information which has been developed, selected and arranged by the Company and the Data Suppliers through the applications of methods and standards of judgment and involving the expenditure of considerable work, time and money. The Customer also acknowledges that the Data comprises works of authorship which are protected under the United States Copyright Law and the Berne Copyright Convention. The Data shall remain the exclusive property of the Company or of the Data Suppliers, as applicable, and the Customer shall have no rights therein except as expressly provided hereby. The Data may not be transferred, sold or in any manner commercially exploited. The Customer agrees to ensure that all copyright notices and restrictions on use remain attached to the Report or Data. The Customer agrees to take reasonable security measures to prevent the unauthorized duplication, distribution or use of the Data or any part thereof. The Customer is not authorized to reverse compile or reverse assemble the Data or Report or otherwise attempt to reveal or to duplicate the programming techniques and structures used in the Data or Report.

Support

The Company will respond by telephone to the Customer's reasonable inquiries regarding the use of the Reports or Data, and problems encountered in connection therewith. The Company shall provide such telephone assistance to the Customer during normal business hours, from 9:00 a.m. to 5:00 p.m. Eastern Time at its main business telephone number. In the event of problems with the Report or Data, the Company may, in its sole discretion, elect to develop a corrected or revised version of the Report or Data. While the Company will use reasonable efforts to respond to the Customer's inquiries, the Company undertakes no responsibility to resolve any problems or to correct any inaccuracies or defects in the Report or Data, except as expressly provided herein.

Infringement

The Company shall indemnify the Customer with respect to all losses or damages incurred by the Customer, including reasonable attorneys' fees, as a result of any claim against the Customer that the Report or Data furnished by the Company and used by the Customer strictly in accordance with this Agreement infringes any copyright or proprietary right of any third party, provided that (i) the Customer gives the Company prompt written notice thereof and (ii) the Company is given the opportunity, at its option, to control the defense of such claim or to have such defense controlled by the Data Supplier concerned.

Warranties

The information contained in the Report will be obtained from publicly available data sources and other secondary sources of information produced by entities other than the Company. Although reasonable care has been taken by the Company in compiling the information contained in the Report, the Company disclaims any and all liability for any errors, omissions or inaccuracies in this information. THIS REPORT DOES NOT CONSTITUTE A LEGAL OR PROFESSIONAL OPINION AND IS NOT AN ENVIRONMENTAL RISK AUDIT OR ASSESSMENT. THE DATA AND REPORTS ARE PROVIDED "AS IS." THE COMPANY MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHATSOEVER WITH RESPECT TO THE DATA OR THE REPORTS INCLUDING, BUT NOT LIMITED TO, THE WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OR OF MERCHANTABILITY, NOR ARE SUCH REPRESENTATIONS OR WARRANTIES TO BE IMPLIED WITH RESPECT TO THE DATA OR REPORTS FURNISHED AND THE COMPANY ASSUMES NO RESPONSIBILITY WITH RESPECT TO THE CUSTOMERS' USE THEREOF. THE COMPANY SHALL HAVE NO LIABILITY, IN CONTRACT, TORT OR OTHERWISE, FOR ANY INACCURACY OR DEFECT OR OMISSION IN THE REPORTS OR DATA OR ANY OTHER MATTER RELATED TO THIS ORDER. IN NO EVENT SHALL THE COMPANY, ITS OFFICERS, EMPLOYEES OR DATA SUPPLIERS HAVE ANY LIABILITY FOR LOST PROFITS OR FOR ANY OTHER INDIRECT, SPECIAL, INCIDENTAL, CONSEQUENTIAL, EXEMPLARY OR PUNITIVE DAMAGES. Each Report is valid only for the geographical parameters and as of the date specified on the cover page of such Report, and any alteration or deviation from the description, or any subsequent use, will require a new Report. In the case of any Data obtained from a Data Supplier,the Company will advise the Data Supplier of any inaccuracies reported to it, but can take no responsibility for the accuracy or completeness of the Data provided to the Customer under this Agreement.

Limitation of Liability

EXCEPT AS EXPRESSLY PROVIDED IN SECTION 8, THE COMPANY SHALL HAVE NO LIABILITY, IN CONTRACT, TORT OR OTHERWISE, FOR ANY INACCURACY OR DEFECT IN THE REPORTS OR DATA, OR ANY OTHER MATTER RELATED TO THIS AGREEMENT. IN NO EVENT SHALL THE COMPANY OR ANY DATA SUPPLIER HAVE ANY LIABILITY FOR LOST PROFITS OR FOR ANY OTHER INDIRECT, SPECIAL, INCIDENTAL, CONSEQUENTIAL, EXEMPLARY OR PUNITIVE DAMAGES.

Indemnification by the Customer

Except for matters covered by the Company's indemnification in Section 8, the Customer shall indemnify and defend the Company and hold it harmless from and against any loss, damage or expense, including reasonable attorneys' fees , arising out of any claim by any third party which is based upon or in any way related to the Customer's possession and use of the Report or the Data or any alteration of such Report or Data in a manner inconsistent with the provisions of Section 5.

Miscellaneous

Taxes

The amounts payable under this Agreement are in addition to all local, state or federal sales, use, excise, or personal property or other similar taxes or duties, and any such taxes shall be assumed and paid by the Customer except those taxes based on the net income of the Company.

Severability

The terms and conditions of this Agreement are severable. If any condition of this Agreement is deemed to be illegal or unenforceable under any rule of law, all other terms shall remain in force. Further, the term or condition which is held to be illegal or unenforceable shall remain in effect as far as possible in accordance with the intention of the parties.

Entire Agreement; Modification and Waiver

This Agreement, together with the applicable Order Form, is the complete and exclusive statement of the Agreement between the parties, supersedes all prior proposals and understandings, oral or written, relating to the subject matter of this Agreement and may be amended only by a writing executed by the Company and the Customer. Failure by either party to enforce any provision of this Agreement shall not be deemed a waiver of that provision or of any other provision of this Agreement.

Force Majeure

The Company shall not be responsible for any delay or failure in performance resulting from acts beyond its control.

Governing Law

This Agreement shall be governed by the internal laws of the State of New York without reference to principles of conflicts of laws.

APPENDIX D

NCDEHNR INSPECTION REPORTS

Good - Dry
WEATHER CONDITIONS

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES
INSPECTION FOR SANITARY LANDFILLS

32-01
PERMIT NUMBER

NAME OF SITE	COUNTY
City of Durham	Durham
LOCATION	**SIGNATURE OF PERSON(S) RECEIVING REPORT**
Glenn Rd.	Billy W. Smith

SIR: AN INSPECTION OF YOUR LAND DISPOSAL SITE HAS BEEN MADE THIS DATE AND YOU ARE NOTIFIED OF THE VIOLATIONS, IF ANY, MARKED BELOW WITH A CROSS (X).

(1) PLAN AND PERMIT REQUIREMENTS
- ___ (a) Construction plans shall be approved and followed.
- ___ (b) Specified monitoring and reporting requirements shall be met.

(2) SPREADING AND COMPACTING REQUIREMENTS
- ___ (a) Solid waste shall be restricted into the smallest area feasible.
- ___ (b) Solid waste shall be compacted as densely as practical into cells.

(3) COVER REQUIREMENTS
- ___ (a) Solid waste shall be covered after each day of operation, with a compacted layer of at least six inches of suitable cover or as specified by the division.
- ___ (b) Areas which will not have additional wastes placed on them for 12 months or more shall be covered with a minimum of one foot of intermediate cover.
- ___ (c) After final termination of disposal operations at the site or a major part thereof or upon revocation of a permit, the area shall be covered with at least two feet of suitable compacted earth.

(4) EROSION CONTROL REQUIREMENTS
- ___ (a) Adequate erosion control measures shall be practiced to prevent silt from leaving the site.
- X (b) Adequate erosion control measures shall be practiced to prevent excessive on-site erosion.

(5) DRAINAGE CONTROL REQUIREMENTS
- ___ (a) Surface water shall be diverted from the operational area.
- ___ (b) Surface water shall not be impounded over or in waste.
- ___ (c) Completed areas shall be adequately sloped to allow surface water runoff in a controlled manner.

(6) VEGETATION REQUIREMENTS
- ___ (a) Within six months after final termination of disposal operations at the site on a major part thereof or upon revocation of a permit, the area shall be stabilized with native grasses.
- ___ (b) Temporary seeding will be utilized as necessary to stabilize the site.

(7) WATER PROTECTION REQUIREMENTS
- ___ (a) The separation distance of four (4) feet between waste and water table shall be maintained unless otherwise specified by the division in the permit.
- ___ (b) Solid waste shall not be disposed of in water.
- ___ (c) Leachate shall be contained on site or properly treated prior to discharge. An NPDES permit may be required prior to the discharge of leachate to surface waters.

(8) ACCESS AND SECURITY REQUIREMENTS
- ___ (a) The site shall be adequately secured by means of gates, chains, berms, fences, and other security measures approved by the division, to prevent unauthorized entry.
- ___ (b) An attendant shall be on duty at the site at all times while it is open for public use to ensure compliance with operational requirements.
- ___ (c) The access road to the site shall be of all-weather construction and maintained in good condition.
- ___ (d) Dust control measures shall be implemented where necessary.

(9) SIGN REQUIREMENTS
- ___ (a) Signs providing information on dumping procedures, the hours during which the site is open for public use, the permit number and other pertinent information shall be posted at the site entrance.
- ___ (b) Signs shall be posted stating that no hazardous or liquid waste can be received without written permission from the division.
- ___ (c) Traffic signs or markers shall be provided as necessary to promote an orderly traffic pattern to and from the discharge area and to maintain efficient operating conditions.

(10) SAFETY REQUIREMENTS
- ___ (a) Open burning of solid waste is prohibited.
- ___ (b) Equipment shall be provided to control accidental fires or arrangements shall be made with the local fire protection agency to immediately provide fire-fighting services when needed.
- ___ (c) Fires that occur at a sanitary landfill shall be reported to the division within 24 hours and a written notification shall be submitted within 15 days.
- ___ (d) The removal of solid waste from a sanitary landfill is prohibited unless the owner/operator approves and the removal is not performed on the working face.
- ___ (e) Barrels and drums shall not be disposed of unless they are empty and perforated sufficiently to ensure that no liquid or hazardous waste is contained therein.

(11) WASTE ACCEPTANCE AND DISPOSAL REQUIREMENTS
- ___ (a) A site shall only accept those solid wastes which it is permitted to receive.
- ___ (b) No hazardous, liquid, or infectious waste shall be accepted or disposed of in a sanitary landfill except as may be approved by the division.
- ___ (c) Spoiled foods, animal carcasses, abattoir waste, hatchery waste and other animal waste delivered to the disposal site shall be covered immediately.
- ___ (d) Asbestos waste that is packaged in accordance with 40 CFR 61, as amended through January 1, 1985, may be disposed of separate and apart from other solid wastes at the bottom of the working face or in an area not contiguous with other disposal areas, in either case, in virgin soil. Separate areas shall be clearly marked so that asbestos is not exposed by future land-disturbing activities. The waste shall be covered immediately with soil in a manner that will not cause airborne conditions. Copies of 40 CFR 61 may be obtained and inspected at the Solid and Hazardous Waste Management Branch, Division of Health Services, P. O. Box 2091, Raleigh, NC, 27602.

(12) MISCELLANEOUS REQUIREMENTS
- ___ (a) Effective vector control measures shall be applied to control flies, rodents, and other insects or vermin when necessary.
- ___ (b) Appropriate methods such as fencing and diking shall be provided within the area to confine solid waste subject to be blown by the wind. At the conclusion of each day of operation, any windblown material resulting from the operation shall be collected and returned to the area by the owner or operator.

RECEIVED
HAZARDOUS WASTE MANAGEMENT BRANCH
MAY 10 1986

REMARKS: Slopes must be repaired and seeded to prevent on-site erosion. Blowing paper along access road needs better control. Sediment basin needs clean out at rear of site

DATE: 5-7-86 NAME: Billy W. Mayes
Solid and Hazardous Waste Management Branch

DHS 1709 (Revised 4/85)
Solid & Hazardous Waste Management Branch (Review 4/86) (white — Raleigh Office yellow — Facility green — Preparer)

Weather Conditions

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES

Permit Number

INSPECTION FORM FOR SANITARY LANDFILLS

Name of Site

County

Location

Signature of Person(s) Receiving Report

SIR: An inspection of your land disposal site has been made this date and you are notified of the violations, if any, marked below with a cross (X).

1. PLAN REQUIREMENTS
   - ____ Site plan approved
   - ____ Construction plans approved
   - ____ Plans being followed
2. SPREADING & COMPACTING
   - ____ Waste restricted to the smallest area practicable
   - ____ Waste properly compacted
3. COVER REQUIREMENTS
   - ____ Six inches daily cover
   - ____ Two foot final cover
   - ____ One foot intermediate cover
4. DRAINAGE CONTROLLED
   - ____ On-site erosion
   - ____ Off-site siltation
   - ____ Erosion control devices
   - ____ Seeding of completed areas
   - ____ Temporary seeding
5. WATER PROTECTION
   - ____ Off-site leaching
   - ____ Waste placed in water
   - ____ Surface water impounded
   - ____ Monitoring wells installed
6. ACCESS
   - ____ Attendant on duty
   - ____ Access controls
   - ____ All weather road
   - ____ Dust controlled
7. BURNING
   - ____ Evidence of burning
   - ____ Fire control equipment available
8. SPECIAL WASTES
   - ____ Spoiled food, animal carcasses, abattoir waste, hatchery waste, etc., covered immediately
9. UNAUTHORIZED WASTES ACCEPTED WITHOUT WRITTEN PERMISSION
   - ____ Type _____
10. VECTOR CONTROL
    - ____ Effective control measures
11. MISCELLANEOUS
    - ____ Blowing material controlled
    - ____ Proper signs posted

REMARKS: _____

DATE _____ NAME _____

Solid & Hazardous Waste Management Branch

DHS FORM 1709 (7/82)
Solid & Hazardous Waste Management Branch

Weather Conditions

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES

Permit Number

INSPECTION FORM FOR SANITARY LANDFILLS

Name of Site

County

Location

Signature of Person(s) Receiving Report

SIR: An inspection of your land disposal site has been made this date and you are notified of the violations, if any, marked below with a cross (X).

1. PLAN REQUIREMENTS
   - ____ Site plan approved
   - ____ Construction plans approved
   - ____ Plans being followed

2. SPREADING & COMPACTING
   - ____ Waste restricted to the smallest area practicable
   - ____ Waste properly compacted

3. COVER REQUIREMENTS
   - ____ Six inches daily cover
   - ____ Two foot final cover
   - ____ One foot intermediate cover

4. DRAINAGE CONTROLLED
   - ____ On-site erosion
   - ____ Off-site siltation
   - ____ Erosion control devices
   - ____ Seeding of completed areas
   - ____ Temporary seeding

5. WATER PROTECTION
   - ____ Off-site leaching
   - ____ Waste placed in water
   - ____ Surface water impounded
   - ____ Monitoring wells installed

6. ACCESS
   - ____ Attendant on duty
   - ____ Access controls
   - ____ All weather road
   - ____ Dust controlled

7. BURNING
   - ____ Evidence of burning
   - ____ Fire control equipment available

8. SPECIAL WASTES
   - ____ Spoiled food, animal carcasses, abattoir waste, hatchery waste, etc., covered immediately

9. UNAUTHORIZED WASTES ACCEPTED WITHOUT WRITTEN PERMISSION
   - ____ Type _____

10. VECTOR CONTROL
   - ____ Effective control measures

11. MISCELLANEOUS
   - ____ Blowing material controlled
   - ____ Proper signs posted

REMARKS: _____

DATE _____ NAME _____
Solid & Hazardous Waste Management Branch

DHS FORM 1709 (7/82)
Solid & Hazardous Waste Management Branch

Ronald H. Levine, M.D., M.P.H.
STATE HEALTH DIRECTOR

DIVISION OF HEALTH SERVICES
P.O. Box 2091
Raleigh, N.C. 27602-2091

September 13, 1983

MEMORANDUM

TO: O. W. Strickland, Head
Solid & Hazardous Waste Management Branch

FROM: LDP ct Larry D. Perry, Waste Management Specialist
Solid & Hazardous Waste Management Branch

SUBJECT: Durham City Landfill violation correction compliance inspection

On Thursday, September 8, 1983, the Durham City Landfill was inspected with reference to 6" daily cover violations. The landfill was checked on Sept. 1, 1983, and found to have had no daily cover applied in about two weeks because of machinery breakdown. At this time, the excuse for no replacement machinery being brought in was supposedly the slow process of getting appropriations for machine rental through the city manager's office. A week was given to obtain equipment or to make necessary repairs. On September 8, the situation had not changed--still no daily cover. Thus, with the permission of this office, a compliance deadline of September 12 was set after which an administrative penalty would be imposed.

An inspection on September 12 revealed that rental equipment had been brought in and the garbage had been about 80 percent covered by 1 p.m. of that date. The machinery had been hauling cover material Saturday, Sunday, and Monday morning.

LDP:ct

Weather Conditions

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES

Permit Number

INSPECTION FORM FOR SANITARY LANDFILLS

Name of Site

County

Location

Signature of Person(s) Receiving Report

SIR: An inspection of your land disposal site has been made this date and you are notified of the violations, if any, marked below with a cross (X).

1. PLAN REQUIREMENTS
   - ____ Site plan approved
   - ____ Construction plans approved
   - ____ Plans being followed

2. SPREADING & COMPACTING
   - ____ Waste restricted to the smallest area practicable
   - ____ Waste properly compacted

3. COVER REQUIREMENTS
   - ____ Six inches daily cover
   - ____ Two foot final cover
   - ____ One foot intermediate cover

4. DRAINAGE CONTROLLED
   - ____ On-site erosion
   - ____ Off-site siltation
   - ____ Erosion control devices
   - ____ Seeding of completed areas
   - ____ Temporary seeding

5. WATER PROTECTION
   - ____ Off-site leaching
   - ____ Waste placed in water
   - ____ Surface water impounded
   - ____ Monitoring wells installed

6. ACCESS
   - ____ Attendant on duty
   - ____ Access controls
   - ____ All weather road
   - ____ Dust controlled

7. BURNING
   - ____ Evidence of burning
   - ____ Fire control equipment available

8. SPECIAL WASTES
   - ____ Spoiled food, animal carcasses, abattoir waste, hatchery waste, etc., covered immediately

9. UNAUTHORIZED WASTES ACCEPTED WITHOUT WRITTEN PERMISSION
   - ____ Type _____

10. VECTOR CONTROL
    - ____ Effective control measures

11. MISCELLANEOUS
    - ____ Blowing material controlled
    - ____ Proper signs posted

REMARKS: _____

DATE 11-22-82

NAME _____
Solid & Hazardous Waste Management Branch

DHS FORM 1709 (7/82)
Solid & Hazardous Waste Management Branch

Weather Conditions

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES

Permit Number 32-[illegible]

INSPECTION FORM FOR SANITARY LANDFILLS

Name of Site [illegible] County [illegible]

Location [illegible] Signature of Person(s) Receiving Report [illegible]

SIR: An inspection of your land disposal site has been made this date and you are notified of the violations, if any, marked below with a cross (X).

1. PLAN REQUIREMENTS
   - ____ Site plan approved
   - ____ Construction plans approved
   - ____ Plans being followed
2. SPREADING & COMPACTING
   - ____ Waste restricted to the smallest area practicable
   - ____ Waste properly compacted
3. COVER REQUIREMENTS
   - ____ Six inches daily cover
   - ____ Two foot final cover
   - ____ One foot intermediate cover
4. DRAINAGE CONTROLLED
   - ____ On-site erosion
   - ____ Off-site siltation
   - X Erosion control devices
   - ____ Seeding of completed areas
   - ____ Temporary seeding
5. WATER PROTECTION
   - ____ Off-site leaching
   - ____ Waste placed in water
   - ____ Surface water impounded
   - ____ Monitoring wells installed
6. ACCESS
   - ____ Attendant on duty
   - ____ Access controls
   - ____ All weather road
   - ____ Dust controlled
7. BURNING
   - ____ Evidence of burning
   - ____ Fire control equipment available
8. SPECIAL WASTES
   - ____ Spoiled food, animal carcasses, abattoir waste, hatchery waste, etc., covered immediately
9. UNAUTHORIZED WASTES ACCEPTED WITHOUT WRITTEN PERMISSION
   - ____ Type _____
10. VECTOR CONTROL
    - ____ Effective control measures
11. MISCELLANEOUS
    - ____ Blowing material controlled
    - ____ Proper signs posted

REMARKS: [illegible] can [illegible] be hauled.

DATE 3-28-84 NAME [illegible]
Solid & Hazardous Waste Management Branch

DHS FORM 1709 (7/82)
Solid & Hazardous Waste Management Branch

[illegible]
Weather Conditions

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES

[illegible]
Permit Number

INSPECTION FORM FOR SANITARY LANDFILLS

[illegible] of Durham
Name of Site

Durham
County

[illegible] Rd.
Location

[illegible]
Signature of Person(s) Receiving Report

SIR: An inspection of your land disposal site has been made this date and you are notified of the violations, if any, marked below with a cross (X).

1. PLAN REQUIREMENTS
   - ____ Site plan approved
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   - ____ Plans being followed

2. SPREADING & COMPACTING
   - ____ Waste restricted to the smallest area practicable
   - ____ Waste properly compacted

3. COVER REQUIREMENTS
   - ____ Six inches daily cover
   - ____ Two foot final cover
   - ____ One foot intermediate cover

4. DRAINAGE CONTROLLED
   - ____ On-site erosion
   - ____ Off-site siltation
   - ____ Erosion control devices
   - ____ Seeding of completed areas
   - ____ Temporary seeding

5. WATER PROTECTION
   - ____ Off-site leaching
   - ____ Waste placed in water
   - ____ Surface water impounded
   - ____ Monitoring wells installed

6. ACCESS
   - ____ Attendant on duty
   - ____ Access controls
   - ____ All weather road
   - ____ Dust controlled

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JUN 26
SOLID & HAZARDOUS WASTE MANAGEMENT BRANCH

7. BURNING
   - ____ Evidence of burning
   - ____ Fire control equipment available

8. SPECIAL WASTES
   - ____ Spoiled food, animal carcasses, abattoir waste, hatchery waste, etc., covered immediately

9. UNAUTHORIZED WASTES ACCEPTED WITHOUT WRITTEN PERMISSION
   - ____ Type _____

10. VECTOR CONTROL
    - ____ Effective control measures

11. MISCELLANEOUS
    - ____ Blowing material controlled
    - ____ Proper signs posted

REMARKS: Site in satisfactory condition. [illegible] need seeding this fall. Sediment basins are being cleaned out.

DATE 6-25-84

NAME Bill [illegible] Morris
Solid & Hazardous Waste Management Branch

DHS FORM 1709 (7/82)
Solid & Hazardous Waste Management Branch

Good
Weather Conditions

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES

32-01
Permit Number

INSPECTION FORM FOR SANITARY LANDFILLS

City of Durham — Durham
Name of Site — County

Glenn Rd.
Location

Signature of Person(s) Receiving Report

SIR: An inspection of your land disposal site has been made this date and you are notified of the violations, if any, marked below with a cross (X).

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   - ____ Site plan approved
   - ____ Construction plans approved
   - ____ Plans being followed

2. SPREADING & COMPACTING
   - ____ Waste restricted to the smallest area practicable
   - ____ Waste properly compacted

3. COVER REQUIREMENTS
   - ____ Six inches daily cover
   - ____ Two foot final cover
   - ____ One foot intermediate cover

4. DRAINAGE CONTROLLED
   - ____ On-site erosion
   - ____ Off-site siltation
   - ____ Erosion control devices
   - ____ Seeding of completed areas
   - ____ Temporary seeding

5. WATER PROTECTION
   - ____ Off-site leaching
   - ____ Waste placed in water
   - ____ Surface water impounded
   - ____ Monitoring wells installed

6. ACCESS
   - ____ Attendant on duty
   - ____ Access controls
   - ____ All weather road
   - ____ Dust controlled

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SEP 5 1984
SOLID & HAZARDOUS WASTE MANAGEMENT BRANCH

7. BURNING
   - ____ Evidence of burning
   - ____ Fire control equipment available

8. SPECIAL WASTES
   - ____ Spoiled food, animal carcasses, abattoir waste, hatchery waste, etc., covered immediately

9. UNAUTHORIZED WASTES ACCEPTED WITHOUT WRITTEN PERMISSION
   - ____ Type _____

10. VECTOR CONTROL
   - ____ Effective control measures

11. MISCELLANEOUS
   - ____ Blowing material controlled
   - ____ Proper signs posted

REMARKS: Site in good condition - Sediment basins have been cleaned out.

DATE 9-5-84 NAME _____
Solid & Hazardous Waste Management Branch

DHS FORM 1709 (7/82)
Solid & Hazardous Waste Management Branch

Good
Weather Conditions

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES

P 32-01
Permit Number

INSPECTION FORM FOR SANITARY LANDFILLS

City of Durham — Durham
Name of Site — County

Glenn Rd.
Location

Billy Smith
Signature of Person(s) Receiving Report

SIR: An inspection of your land disposal site has been made this date and you are notified of the violations, if any, marked below with a cross (X).

1. PLAN REQUIREMENTS
   - ____ Site plan approved
   - ____ Construction plans approved
   - ____ Plans being followed

2. SPREADING & COMPACTING
   - ____ Waste restricted to the smallest area practicable
   - ____ Waste properly compacted

3. COVER REQUIREMENTS
   - ____ Six inches daily cover
   - ____ Two foot final cover
   - ____ One foot intermediate cover

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   - ____ On-site erosion
   - ____ Off-site siltation
   - ____ Erosion control devices
   - ____ Seeding of completed areas
   - ____ Temporary seeding

5. WATER PROTECTION
   - ____ Off-site leaching
   - ____ Waste placed in water
   - ____ Surface water impounded
   - ____ Monitoring wells installed

6. ACCESS
   - ____ Attendant on duty
   - ____ Access controls
   - ____ All weather road
   - ____ Dust controlled

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OCT 26 1984

7. BURNING
   - ____ Evidence of burning
   - ____ Fire control equipment available

8. SPECIAL WASTES
   - ____ Spoiled food, animal carcasses, abattoir waste, hatchery waste, etc., covered immediately

9. UNAUTHORIZED WASTES ACCEPTED WITHOUT WRITTEN PERMISSION
   - ____ Type _____

10. VECTOR CONTROL
   - ____ Effective control measures

11. MISCELLANEOUS
   - ____ Blowing material controlled
   - ____ Proper signs posted

REMARKS: Site in very good condition.

DATE 10-25-84

NAME Bill H. Morris
Solid & Hazardous Waste Management Branch

DHS FORM 1709 (7/82)
Solid & Hazardous Waste Management Branch

Wet
Weather Conditions

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES

P
32-01
Permit Number

INSPECTION FORM FOR SANITARY LANDFILLS

City of Durham — Durham
Name of Site — County

Glenn Rd.
Location

Billy Smith
Signature of Person(s) Receiving Report

SIR: An inspection of your land disposal site has been made this date and you are notified of the violations, if any, marked below with a cross (X).

1. PLAN REQUIREMENTS
   - ____ Site plan approved
   - ____ Construction plans approved
   - ____ Plans being followed

2. SPREADING & COMPACTING
   - ____ Waste restricted to the smallest area practicable
   - ____ Waste properly compacted

3. COVER REQUIREMENTS
   - X Six inches daily cover
   - ____ Two foot final cover
   - ____ One foot intermediate cover

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   - ____ On-site erosion
   - ____ Off-site siltation
   - ____ Erosion control devices
   - ____ Seeding of completed areas
   - ____ Temporary seeding

5. WATER PROTECTION
   - ____ Off-site leaching
   - ____ Waste placed in water
   - ____ Surface water impounded
   - ____ Monitoring wells installed

6. ACCESS
   - ____ Attendant on duty
   - ____ Access controls
   - ____ All weather road
   - ____ Dust controlled

BURNING
   - ____ Evidence of burning
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   - ____ Spoiled food, animal carcasses, abattoir waste, hatchery waste, etc., covered immediately

9. UNAUTHORIZED WASTES ACCEPTED WITHOUT WRITTEN PERMISSION
   - ____ Type _____

10. VECTOR CONTROL
   - ____ Effective control measures

11. MISCELLANEOUS
   - ____ Blowing material controlled
   - ____ Proper signs posted

REMARKS: Working face in back needs daily cover.

DATE 1-8-85

NAME Billy W. Morris
Solid & Hazardous Waste Management Branch

DHS FORM 1709 (7/82)
Solid & Hazardous Waste Management Branch

Good
WEATHER CONDITIONS

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES
INSPECTION FOR SANITARY LANDFILLS

32-01
PERMIT NUMBER

NAME OF SITE	COUNTY
City of Durham	Durham
LOCATION: SR 1636	SIGNATURE OF PERSON(S) RECEIVING REPORT: [signature]

SIR: AN INSPECTION OF YOUR LAND DISPOSAL SITE HAS BEEN MADE THIS DATE AND YOU ARE NOTIFIED OF THE VIOLATIONS, IF ANY, MARKED BELOW WITH A CROSS (X).

(1) PLAN AND PERMIT REQUIREMENTS
- (a) Construction plans shall be approved and followed.
- (b) Specified monitoring and reporting requirements shall be met.

(2) SPREADING AND COMPACTING REQUIREMENTS
- X (a) Solid waste shall be restricted into the smallest area feasible.
- X (b) Solid waste shall be compacted as densely as practical into cells.

(3) COVER REQUIREMENTS
- X (a) Solid waste shall be covered after each day of operation, with a compacted layer of at least six inches of suitable cover or as specified by the division.
- (b) Areas which will not have additional wastes placed on them for 12 months or more shall be covered with a minimum of one foot of intermediate cover.
- (c) After final termination of disposal operations at the site or a major part thereof or upon revocation of a permit, the area shall be covered with at least two feet of suitable compacted earth.

(4) EROSION CONTROL REQUIREMENTS
- (a) Adequate erosion control measures shall be practiced to prevent silt from leaving the site.
- X (b) Adequate erosion control measures shall be practiced to prevent excessive on-site erosion.

(5) DRAINAGE CONTROL REQUIREMENTS
- (a) Surface water shall be diverted from the operational area.
- X (b) Surface water shall not be impounded over or in waste.
- X (c) Completed areas shall be adequately sloped to allow surface water runoff in a controlled manner.

(6) VEGETATION REQUIREMENTS
- (a) Within six months after final termination of disposal operations at the site on a major part thereof or upon revocation of a permit, the area shall be stabilized with native grasses.
- (b) Temporary seeding will be utilized as necessary to stabilize the site.

(7) WATER PROTECTION REQUIREMENTS
- (a) The separation distance of four (4) feet between waste and water table shall be maintained unless otherwise specified by the division in the permit.
- (b) Solid waste shall not be disposed of in water.
- (c) Leachate shall be contained on site or properly treated prior to discharge. An NPDES permit may be required prior to the discharge of leachate to surface waters.

(8) ACCESS AND SECURITY REQUIREMENTS
- (a) The site shall be adequately secured by means of gates, chains, berms, fences, and other security measures approved by the division, to prevent unauthorized entry.
- (b) An attendant shall be on duty at the site at all times while it is open for public use to ensure compliance with operational requirements.
- (c) The access road to the site shall be of all-weather construction and maintained in good condition.
- (d) Dust control measures shall be implemented where necessary.

(9) SIGN REQUIREMENTS
- (a) Signs providing information on dumping procedures, the hours during which the site is open for public use, the permit number and other pertinent information shall be posted at the site entrance.
- (b) Signs shall be posted stating that no hazardous or liquid waste can be received without written permission from the division.
- (c) Traffic signs or markers shall be provided as necessary to promote an orderly traffic pattern to and from the discharge area and to maintain efficient operating conditions.

(10) SAFETY REQUIREMENTS
- (a) Open burning of solid waste is prohibited.
- (b) Equipment shall be provided to control accidental fires or arrangements shall be made with the local fire protection agency to immediately provide fire-fighting services when needed.
- (c) Fires that occur at a sanitary landfill shall be reported to the division within 24 hours and a written notification shall be submitted within 15 days.
- (d) The removal of solid waste from a sanitary landfill is prohibited unless the owner/operator approves and the removal is not performed on the working face.
- X (e) Barrels and drums shall not be disposed of unless they are empty and perforated sufficiently to ensure that no liquid or hazardous waste is contained therein.

(11) WASTE ACCEPTANCE AND DISPOSAL REQUIREMENTS
- (a) A site shall only accept those solid wastes which it is permitted to receive.
- (b) No hazardous, liquid, or infectious waste shall be accepted or disposed of in a sanitary landfill except as may be approved by the division.
- (c) Spoiled foods, animal carcasses, abattoir waste, hatchery waste, and other animal waste delivered to the disposal site shall be covered immediately.
- (d) Asbestos waste that is packaged in accordance with 40 CFR 61, as amended through January 1, 1985, may be disposed of separate and apart from other solid wastes at the bottom of the working face or in an area not contiguous with other disposal areas, in either case, in virgin soil. Separate areas shall be clearly marked so that asbestos is not exposed by future land-disturbing activities. The waste shall be covered immediately with soil in a manner that will not cause airborne conditions. Copies of 40 CFR 61 may be obtained and inspected at the Solid and Hazardous Waste Management Branch, Division of Health Services, P. O. Box 2091, Raleigh, NC, 27602.

RECEIVED
SOLID & HAZARDOUS WASTE MANAGEMENT BRANCH
JAN 12 0 1987

(12) MISCELLANEOUS REQUIREMENTS
- (a) Effective vector control measures shall be applied to control flies, rodents, and other insects or vermin when necessary.
- X (b) Appropriate methods such as fencing and diking shall be provided within the area to confine solid waste subject to be blown by the wind. At the conclusion of each day of operation, all windblown material resulting from the operation shall be collected and returned to the area by the owner or operator.

REMARKS: this site can not properly operate without [redacted] a continually functional elevated scrapper (pan)

DATE: 1/14/87 NAME: Dexter R Matthews Terry Fix Dover
Solid and Hazardous Waste Management Branch

[illegible] (Revised 4/85)
Solid & Hazardous Waste Management Branch (Review 4/86) (white — Raleigh Office yellow — Facility green — Preparer)

Good
WEATHER CONDITIONS

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES
INSPECTION FOR SANITARY LANDFILLS

32-01
PERMIT NUMBER

NAME OF SITE	COUNTY
City of Durham	Durham
LOCATION	SIGNATURE OF PERSON(S) RECEIVING REPORT
SR 1636	Billy Smith

SIR: AN INSPECTION OF YOUR LAND DISPOSAL SITE HAS BEEN MADE THIS DATE AND YOU ARE NOTIFIED OF THE VIOLATIONS, IF ANY, MARKED BELOW WITH A CROSS (X).

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- (b) Solid waste shall be compacted as densely as practical into cells.

(3) COVER REQUIREMENTS
- ___ (a) Solid waste shall be covered after each day of operation, with a compacted layer of at least six inches of suitable cover or as specified by the division.
- (b) Areas which will not have additional wastes placed on them for 12 months or more shall be covered with a minimum of one foot of intermediate cover.
- (c) After final termination of disposal operations at the site or a major part thereof or upon revocation of a permit, the area shall be covered with at least two feet of suitable compacted earth.

(4) EROSION CONTROL REQUIREMENTS
- (a) Adequate erosion control measures shall be practiced to prevent silt from leaving the site.
- (b) Adequate erosion control measures shall be practiced to prevent excessive on-site erosion.

(5) DRAINAGE CONTROL REQUIREMENTS
- (a) Surface water shall be diverted from the operational area.
- (b) Surface water shall not be impounded over or in waste.
- (c) Completed areas shall be adequately sloped to allow surface water runoff in a controlled manner.

(6) VEGETATION REQUIREMENTS
- (a) Within six months after final termination of disposal operations at the site on a major part thereof or upon revocation of a permit, the area shall be stabilized with native grasses.
- (b) Temporary seeding will be utilized as necessary to stabilize the site.

(7) WATER PROTECTION REQUIREMENTS
- (a) The separation distance of four (4) feet between waste and water table shall be maintained unless otherwise specified by the division in the permit.
- (b) Solid waste shall not be disposed of in water.
- (c) Leachate shall be contained on site or properly treated prior to discharge. An NPDES permit may be required prior to the discharge of leachate to surface waters.

(8) ACCESS AND SECURITY REQUIREMENTS
- (a) The site shall be adequately secured by means of gates, chains, berms, fences, and other security measures approved by the division, to prevent unauthorized entry.
- (b) An attendant shall be on duty at the site at all times while it is open for public use to ensure compliance with operational requirements.
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(9) SIGN REQUIREMENTS
- ___ (a) Signs providing information on dumping procedures, the hours during which the site is open for public use, the permit number and other pertinent information shall be posted at the site entrance.
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- ___ (a) Open burning of solid waste is prohibited.
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(12) MISCELLANEOUS REQUIREMENTS
- ___ (a) Effective vector control measures shall be applied to control flies, rodents, and other insects or vermin when necessary.
- ___ (b) Appropriate methods such as fencing and diking shall be provided within the area to confine solid waste subject to be blown by the wind. At the conclusion of each day of operation, any windblown material resulting from the operation shall be collected and returned to the area by the owner or operator.

REMARKS: _____

DATE: 6/1/87 NAME: David R. Mattson
Solid and Hazardous Waste Management Branch

DHS-___ Revised 4-85)
Solid & Hazardous Waste Management Branch (Review 4/86) (white — Raleigh Office yellow — Facility green — Preparer)

Rain
WEATHER CONDITIONS

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES
INSPECTION FOR SANITARY LANDFILLS

32-01
PERMIT NUMBER

NAME OF SITE	COUNTY
City of Durham	Durham
LOCATION	**SIGNATURE OF PERSON(S) RECEIVING REPORT**
SR 1636	Billy Smith OPM

SIR: AN INSPECTION OF YOUR LAND DISPOSAL SITE HAS BEEN MADE THIS DATE AND YOU ARE NOTIFIED OF THE VIOLATIONS, IF ANY, MARKED BELOW WITH A CROSS (X).

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(12) MISCELLANEOUS REQUIREMENTS
- ___ (a) Effective vector control measures shall be applied to control flies, rodents, and other insects or vermin when necessary.
- ___ (b) Appropriate methods such as fencing and diking shall be provided within the area to confine solid waste subject to be blown by the wind. At the conclusion of each day of operation, all windblown material resulting from the operation shall be collected and returned to the area by the owner or operator.

REMARKS: Rework southwest corner of phase four to keep water is not impounded over waste

DATE: 8/31/87 NAME: Debbie Matthews
Solid and Hazardous Waste Management Branch

DHS 1709 (Revised 4/85)
Solid & Hazardous Waste Management Branch (Review 4/86) (white — Raleigh Office yellow — Facility green — Preparer)

Good
WEATHER CONDITIONS

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES
INSPECTION FOR SANITARY LANDFILLS

32-01
PERMIT NUMBER

NAME OF SITE	COUNTY
City of Durham	Durham
LOCATION	**SIGNATURE OF PERSON(S) RECEIVING REPORT**
SR 1636	X [illegible]

SIR: AN INSPECTION OF YOUR LAND DISPOSAL SITE HAS BEEN MADE THIS DATE AND YOU ARE NOTIFIED OF THE VIOLATIONS, IF ANY, MARKED BELOW WITH A CROSS (X).

(1) PLAN AND PERMIT REQUIREMENTS
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(3) COVER REQUIREMENTS
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- ___ (b) Areas which will not have additional wastes placed on them for 12 months or more shall be covered with a minimum of one foot of intermediate cover.
- ___ (c) After final termination of disposal operations at the site or a major part thereof or upon revocation of a permit, the area shall be covered with at least two feet of suitable compacted earth.

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- ___ (a) Within six months after final termination of disposal operations at the site on a major part thereof or upon revocation of a permit, the area shall be stabilized with native grasses.
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(7) WATER PROTECTION REQUIREMENTS
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(10) SAFETY REQUIREMENTS
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(12) MISCELLANEOUS REQUIREMENTS
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REMARKS: Rework corner of closed area to prevent impoundment of water. Divert surface water from area currently being closed to sediment basin or install sedimentation control devices

DATE: 11/3/87 NAME: [signature]
Solid and Hazardous Waste Management Branch

DHS 1709 (Revised 4/85)
Solid & Hazardous Waste Management Branch (Review 4/86) (white — Raleigh Office yellow — Facility green — Preparer)

11-16
SS

Good
WEATHER CONDITIONS

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES
INSPECTION FOR SANITARY LANDFILLS

32-01
PERMIT NUMBER

NAME OF SITE	COUNTY
City of Durham	Durham
LOCATION: SR 1636	SIGNATURE OF PERSON(S) RECEIVING REPORT: Alexander L Jones

SIR: AN INSPECTION OF YOUR LAND DISPOSAL SITE HAS BEEN MADE THIS DATE AND YOU ARE NOTIFIED OF THE VIOLATIONS, IF ANY, MARKED BELOW WITH A CROSS (X).

(1) PLAN AND PERMIT REQUIREMENTS
- (a) Construction plans shall be approved and followed.
- (b) Specified monitoring and reporting requirements shall be met.

(2) SPREADING AND COMPACTING REQUIREMENTS
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REMARKS: Incorporate WW treatment sludge within final cover of area to be closed as soon as possible and limit acceptance of any additional sludge until needed

DATE: 2/9/88 NAME: [signature]
Solid and Hazardous Waste Management Branch

DHS 1709 (Revised 4/85)
Solid & Hazardous Waste Management Branch (Review 4/86) (white — Raleigh Office yellow — Facility green — Preparer)

Rain
WEATHER CONDITIONS

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES
INSPECTION FOR SANITARY LANDFILLS

RECEIVED JUN 09 1988 SOLID WASTE SECTION

32-01
PERMIT NUMBER

NAME OF SITE: Durham (City of)
COUNTY: Durham
LOCATION: SR 1636
SIGNATURE OF PERSON(S) RECEIVING REPORT: [signature]

SIR: AN INSPECTION OF YOUR LAND DISPOSAL SITE HAS BEEN MADE THIS DATE AND YOU ARE NOTIFIED OF THE VIOLATIONS, IF ANY, MARKED BELOW WITH A CROSS (X).

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REMARKS: Provide erosion control devices in asbestos area; metal pile must be moved (i.e. recycled or landfilled)

DATE: 6-3-88 NAME: Debbie Bratton
Solid and Hazardous Waste Management Branch

ENTERED

DHS 1709 (Revised 4/85)
Solid & Hazardous Waste Management Branch (Review 4/86) (white — Raleigh Office yellow — Facility green — Preparer)

Local
WEATHER CONDITIONS

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES
INSPECTION FOR SANITARY LANDFILLS

I.F.W. 32-01
PERMIT NUMBER

NAME OF SITE	COUNTY
City of Durham	Durham
LOCATION	SIGNATURE OF PERSON(S) RECEIVING REPORT
SR 1636	

RECEIVED SEP 1988 SOLID WASTE BRANCH

SIR: AN INSPECTION OF YOUR LAND DISPOSAL SITE HAS BEEN MADE THIS DATE AND YOU ARE NOTIFIED OF THE VIOLATIONS, IF ANY, MARKED BELOW WITH A CROSS (X).

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REMARKS: (A-1-88) Provide measures (i.e. slope drain at the S.E. corner w.w.t. of landfill for erosion control; sludge must be applied as specified in the waste determination approval; rebark bank at asbestos area for stabilization.

DATE: 8-16-88 NAME: Debbie C Matthews
Solid and Hazardous Waste Management Branch

SEP 21 1988

DHS 1709 (Revised 4/85)
Solid & Hazardous Waste Management Branch (Review 4/86) (white — Raleigh Office yellow — Facility green — Preparer)

Cloud
WEATHER CONDITIONS

T.F.V.

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES
INSPECTION FOR SANITARY LANDFILLS

32-01
PERMIT NUMBER

RECEIVED
NOV 28 1988
SOLID WASTE BRANCH

NAME OF SITE	COUNTY
City of Durham	Durham
LOCATION	SIGNATURE OF PERSON(S) RECEIVING REPORT
SR 1636	

SIR: AN INSPECTION OF YOUR LAND DISPOSAL SITE HAS BEEN MADE THIS DATE AND YOU ARE NOTIFIED OF THE VIOLATIONS, IF ANY, MARKED BELOW WITH A CROSS (X).

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REMARKS: Solid waste must receive 6" of daily cover; plans for construction of sediment basin in northeastern corner of landfill should be implemented in the near future

DATE: 11-21-88 NAME: Dexter L Matthews
Solid and Hazardous Waste Management Branch

JAN 13 1989

DHS 1709 (Revised 4/85)
Solid & Hazardous Waste Management Branch (Review 4/86) (white — Raleigh Office yellow — Facility green — Preparer)

Good
WEATHER CONDITIONS

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES
INSPECTION FOR SANITARY LANDFILLS

32-01
PERMIT NUMBER

NAME OF SITE	COUNTY
City of Durham	Durham
LOCATION	**SIGNATURE OF PERSON(S) RECEIVING REPORT**
SR 1636	X

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- X (a) Solid waste shall be covered after each day of operation, with a compacted layer of at least six inches of suitable cover or as specified by the division.
- ___ (b) Areas which will not have additional wastes placed on them for 12 months or more shall be covered with a minimum of one foot of intermediate cover.
- ___ (c) After final termination of disposal operations at the site or a major part thereof or upon revocation of a permit, the area shall be covered with at least two feet of suitable compacted earth.

(4) EROSION CONTROL REQUIREMENTS
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- ___ (a) Within six months after final termination of disposal operations at the site on a major part thereof or upon revocation of a permit, the area shall be stabilized with native grasses.
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- ___ (a) The separation distance of four (4) feet between waste and water table shall be maintained unless otherwise specified by the division in the permit.
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(8) ACCESS AND SECURITY REQUIREMENTS
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- ___ (c) The access road to the site shall be of all-weather construction and maintained in good condition.
- ___ (d) Dust control measures shall be implemented where necessary.

RECEIVED
FEB 06 1989
SOLID WASTE SECTION

(9) SIGN REQUIREMENTS
- ___ (a) Signs providing information on dumping procedures, the hours during which the site is open for public use, the permit number and other pertinent information shall be posted at the site entrance.
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(10) SAFETY REQUIREMENTS
- ___ (a) Open burning of solid waste is prohibited.
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- ___ (c) Fires that occur at a sanitary landfill shall be reported to the division within 24 hours and a written notification shall be submitted within 15 days.
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(12) MISCELLANEOUS REQUIREMENTS
- ___ (a) Effective vector control measures shall be applied to control flies, rodents, and other insects or vermin when necessary.
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REMARKS: Contaminated soils approved for disposal at this landfill may not be transported to the City Demolition Landfill

MAR 02 1989

DATE: 2-2-89 NAME: Dexter Matthews
Solid and Hazardous Waste Management Branch

Rain
WEATHER CONDITIONS

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES
INSPECTION FOR SANITARY LANDFILLS

11

32-01
PERMIT NUMBER

NAME OF SITE	COUNTY
City of Durham	Durham
LOCATION	**SIGNATURE OF PERSON(S) RECEIVING REPORT**
SR 1636	*

SIR: AN INSPECTION OF YOUR LAND DISPOSAL SITE HAS BEEN MADE THIS DATE AND YOU ARE NOTIFIED OF THE VIOLATIONS, IF ANY, MARKED BELOW WITH A CROSS (X).

(1) PLAN AND PERMIT REQUIREMENTS
- ___ (a) Construction plans shall be approved and followed.
- ___ (b) Specified monitoring and reporting requirements shall be met.

(2) SPREADING AND COMPACTING REQUIREMENTS
- ___ (a) Solid waste shall be restricted into the smallest area feasible.
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REMARKS: Cover material is not available to meet operational requirement and continue landfilling for more than approximately six weeks based on site conditions

DATE: 6-7-89 NAME: Dexter Matthews
Solid and Hazardous Waste Management Branch

Arrangements must be made immediately to provide cover requirements beyond soils currently available at the landfill site.

DHS 1709 (Revised 4/85)
Solid & Hazardous Waste Management Branch (Review 4/86) (white — Raleigh Office yellow — Facility green — Preparer)

Wet
WEATHER CONDITIONS

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES
INSPECTION FOR SANITARY LANDFILLS

32-01
PERMIT NUMBER

RECEIVED MAR 1990 SOLID WASTE BRANCH

NAME OF SITE	COUNTY
City of Durham Landfill	Durham
LOCATION: SR 1636	SIGNATURE OF PERSON(S) RECEIVING REPORT: [signature]

SIR: AN INSPECTION OF YOUR LAND DISPOSAL SITE HAS BEEN MADE THIS DATE AND YOU ARE NOTIFIED OF THE VIOLATIONS, IF ANY, MARKED BELOW WITH A CROSS (X).

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REMARKS: Note: Reinspection will be made within the next 30 days!

DATE: 3-6-90 NAME: Mark S. Frey & Terry F. Dover
Solid and Hazardous Waste Management Branch

DHS 1709 (Revised 4/85)
Solid & Hazardous Waste Management Branch (Review 4/86) (white — Raleigh Office yellow — Facility green — Preparer)

1 2 1990

Cloudy
WEATHER CONDITIONS

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES
INSPECTION FOR SANITARY LANDFILLS

TAV 32-01
PERMIT NUMBER

SOLID WASTE SECTION
NOV 15 1990

NAME OF SITE	COUNTY
City of Durham Landfill	Durham
LOCATION: SR 1636	SIGNATURE OF PERSON(S) RECEIVING REPORT

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REMARKS: _____

DATE: 11-13-90 NAME: _____
Solid and Hazardous Waste Management Branch

DHS 1709 (Revised 4/85)
Solid & Hazardous Waste Management Branch (Review 4/86) (white — Raleigh Office yellow — Facility green — Preparer)

NOV 27 1990

Clear
WEATHER CONDITIONS

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES
INSPECTION FOR SANITARY LANDFILLS

32-01
PERMIT NUMBER

NAME OF SITE	COUNTY
City of Durham Landfill	Durham
LOCATION	SIGNATURE OF PERSON(S) RECEIVING REPORT
SR 1636	

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REMARKS: If sludge application on finished slopes is still planned, Waste Determination and Agronomist work needs to be done so seeding can be finished on slopes. Ident time for seeding is now.

DATE: 8-22-90 NAME: Mark D. Fry
Solid and Hazardous Waste Management Branch

SEP 7 1990

DHS 1709 (Revised 4/85)
Solid & Hazardous Waste Management Branch (Review 4/86) (white — Raleigh Office yellow — Facility green — Preparer)

Cloudy
WEATHER CONDITIONS

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES
INSPECTION FOR SANITARY LANDFILLS

32-01
PERMIT NUMBER

NAME OF SITE: City of Durham Landfill
COUNTY: Durham
LOCATION: SR 1636
SIGNATURE OF PERSON(S) RECEIVING REPORT:

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- ___ (c) After final termination of disposal operations at the site or a major part thereof or upon revocation of a permit, the area shall be covered with at least two feet of suitable compacted earth.

(4) EROSION CONTROL REQUIREMENTS
- X (a) Adequate erosion control measures shall be practiced to prevent silt from leaving the site.
- ___ (b) Adequate erosion control measures shall be practiced to prevent excessive on-site erosion.

(5) DRAINAGE CONTROL REQUIREMENTS
- ___ (a) Surface water shall be diverted from the operational area.
- X (b) Surface water shall not be impounded over or in waste.
- ___ (c) Completed areas shall be adequately sloped to allow surface water runoff in a controlled manner.

(6) VEGETATION REQUIREMENTS
- ___ (a) Within six months after final termination of disposal operations at the site on a major part thereof or upon revocation of a permit, the area shall be stabilized with native grasses.
- ___ (b) Temporary seeding will be utilized as necessary to stabilize the site.

(7) WATER PROTECTION REQUIREMENTS
- ___ (a) The separation distance of four (4) feet between waste and water table shall be maintained unless otherwise specified by the division in the permit.
- ___ (b) Solid waste shall not be disposed of in water.
- ___ (c) Leachate shall be contained on site or properly treated prior to discharge. An NPDES permit may be required prior to the discharge of leachate to surface waters.

(8) ACCESS AND SECURITY REQUIREMENTS
- ___ (a) The site shall be adequately secured by means of gates, chains, berms, fences, and other security measures approved by the division, to prevent unauthorized entry.
- ___ (b) An attendant shall be on duty at the site at all times while it is open for public use to ensure compliance with operational requirements.
- ___ (c) The access road to the site shall be of all-weather construction and maintained in good condition.
- ___ (d) Dust control measures shall be implemented where necessary.

(9) SIGN REQUIREMENTS
- ___ (a) Signs providing information on dumping procedures, the hours during which the site is open for public use, the permit number and other pertinent information shall be posted at the site entrance.
- ___ (b) Signs shall be posted stating that no hazardous or liquid waste can be received without written permission from the division.
- ___ (c) Traffic signs or markers shall be provided as necessary to promote an orderly traffic pattern to and from the discharge area and to maintain efficient operating conditions.

(10) SAFETY REQUIREMENTS
- ___ (a) Open burning of solid waste is prohibited.
- ___ (b) Equipment shall be provided to control accidental fires or arrangements shall be made with the local fire protection agency to immediately provide fire-fighting services when needed.
- ___ (c) Fires that occur at a sanitary landfill shall be reported to the division within 24 hours and a written notification shall be submitted within 15 days.
- ___ (d) The removal of solid waste from a sanitary landfill is prohibited unless the owner/operator approves and the removal is not performed on the working face.
- ___ (e) Barrels and drums shall not be disposed of unless they are empty and perforated sufficiently to ensure that no liquid or hazardous waste is contained therein.

(11) WASTE ACCEPTANCE AND DISPOSAL REQUIREMENTS
- ___ (a) A site shall only accept those solid wastes which it is permitted to receive.
- ___ (b) No hazardous, liquid, or infectious waste shall be accepted or disposed of in a sanitary landfill except as may be approved by the division.
- ___ (c) Spoiled foods, animal carcasses, abattoir waste, hatchery waste, and other animal waste delivered to the disposal site shall be covered immediately.
- ___ (d) Asbestos waste that is packaged in accordance with 40 CFR 61, as amended through January 1, 1985, may be disposed of separate and apart from other solid wastes at the bottom of the working face or in an area not contiguous with other disposal areas, in either case, in virgin soil. Separate areas shall be clearly marked so that asbestos is not exposed by future land-disturbing activities. The waste shall be covered immediately with soil in a manner that will not cause airborne conditions. Copies of 40 CFR 61 may be obtained and inspected at the Solid and Hazardous Waste Management Branch, Division of Health Services, P. O. Box 2091, Raleigh, NC. 27602.

(12) MISCELLANEOUS REQUIREMENTS
- ___ (a) Effective vector control measures shall be applied to control flies, rodents, and other insects or vermin when necessary.
- ___ (b) Appropriate methods such as fencing and diking shall be provided within the area to confine solid waste subject to be blown by the wind. At the conclusion of each day of operation, all windblown material resulting from the operation shall be collected and returned to the area by the owner or operator.

REMARKS: Clean out basin on left side.

DATE: 3-6-91 NAME: Mark Fry
Solid and Hazardous Waste Management Branch

MAR 11 1991

DHS 1709 (Revised 4/85)
Solid & Hazardous Waste Management Branch (Review 4/86) (white — Raleigh Office yellow — Facility green — Preparer)

Clear
WEATHER CONDITIONS

N.C. DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES
INSPECTION FOR SANITARY LANDFILLS

32-01
PERMIT NUMBER

NAME OF SITE	COUNTY
City of Durham Landfill	Durham
LOCATION: SR 1636	SIGNATURE OF PERSON(S) RECEIVING REPORT

SIR: AN INSPECTION OF YOUR LAND DISPOSAL SITE HAS BEEN MADE THIS DATE AND YOU ARE NOTIFIED OF THE VIOLATIONS, IF ANY, MARKED BELOW WITH A CROSS (X).

(1) PLAN AND PERMIT REQUIREMENTS
- ___ (a) Construction plans shall be approved and followed.
- ___ (b) Specified monitoring and reporting requirements shall be met.

(2) SPREADING AND COMPACTING REQUIREMENTS
- ___ (a) Solid waste shall be restricted into the smallest area feasible.
- ___ (b) Solid waste shall be compacted as densely as practical into cells.

(3) COVER REQUIREMENTS
- ___ (a) Solid waste shall be covered after each day of operation, with a compacted layer of at least six inches of suitable cover or as specified by the division.
- ___ (b) Areas which will not have additional wastes placed on them for 12 months or more shall be covered with a minimum of one foot of intermediate cover.
- ___ (c) After final termination of disposal operations at the site or a major part thereof or upon revocation of a permit, the area shall be covered with at least two feet of suitable compacted earth.

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- ___ (c) The access road to the site shall be of all-weather construction and maintained in good condition.
- ___ (d) Dust control measures shall be implemented where necessary.

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- ___ (d) Asbestos waste that is packaged in accordance with 40 CFR 61, as amended through January 1, 1985, may be disposed of separate and apart from other solid wastes at the bottom of the working face or in an area not contiguous with other disposal areas, in either case, in virgin soil. Separate areas shall be clearly marked so that asbestos is not exposed by future land-disturbing activities. The waste shall be covered immediately with soil in a manner that will not cause airborne conditions. Copies of 40 CFR 61 may be obtained and inspected at the Solid and Hazardous Waste Management Branch, Division of Health Services, P. O. Box 2091, Raleigh, NC, 27602.

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- ___ (a) Effective vector control measures shall be applied to control flies, rodents, and other insects or vermin when necessary.
- ___ (b) Appropriate methods such as fencing and diking shall be provided within the area to confine solid waste subject to be blown by the wind. At the conclusion of each day of operation, all windblown material resulting from the operation shall be collected and returned to the area by the owner or operator.

REMARKS: Clean all basins. Seed areas where needed.

DATE: 6-11-91 NAME: Mark J. Fay
Solid and Hazardous Waste Management Branch

JUN 18 1991

DHS 1709 (Revised 4/85)
Solid & Hazardous Waste Management Branch (Review 4/86) (white — Raleigh Office yellow — Facility green — Preparer)

NC DEPARTMENT OF ENVIRONMENT, HEALTH AND NATURAL RESOURCES

Division of Solid Waste Management

Solid Waste Section

SOLID WASTE MANAGEMENT FACILITY EVALUATION REPORT

Type of Facility MSW Landfill Permit # 32-01 County Durham

Name of Facility Durham City Landfill Location S. R. 1656

Date of Last Evaluation 10-24-91

I. Permit Conditions Followed ✓ Yes ____ No ____ N/A

A. Specific Condition(s) Violated

SOLID WASTE SECTION MAR 2 ... SECTION

II. Operational Requirements Followed ✓ Yes ____ No

15A N.C. Admin. Code 13B Section 0505

A. Specific Violation(s) by number and letter.

III. Other Violations of Rule or Law

IV. Evaluator's Comments Rip-Rap ditch at [illegible]

V. Continuation Page Required? ____ Yes ✓ No Receiving Signature [signature]

Evaluation Date 2-26-92 Solid Waste Section [signature]

DEHNR 3793 (Part I White: Facility Part II Canary: Central Office Part III Pink: Regional Office)

Solid Waste Section (Review 7/94)

NC DEPARTMENT OF ENVIRONMENT, HEALTH AND NATURAL RESOURCES

Division of Solid Waste Management

Solid Waste Section

SOLID WASTE MANAGEMENT FACILITY EVALUATION REPORT

Type of Facility [illegible] Permit # [illegible] County [illegible]

Name of Facility [illegible] Location [illegible]

Date of Last Evaluation 4-11-91

I. Permit Conditions Followed ✓ Yes ____ No ____ N/A

A. Specific Condition(s) Violated ____

II. Operational Requirements Followed ____ Yes ✓ No

15A N.C. Admin. Code 13B Section .0507

A. Specific Violation(s) by number and letter.

(2)(b) Intermediate cover is needed on [illegible]

III. Other Violations of Rule or Law ____

IV. Evaluator's Comments [illegible]

V. Continuation Page Required? ____ Yes ____ No Receiving Signature [illegible]

Evaluation Date 10-24-91 Solid Waste Section [illegible]

DEHNR 3793 (Part I White: Facility Part II Canary: Central Office Part III Pink: Regional Office)

Solid Waste Section (Review 7/96)

NC DEPARTMENT OF ENVIRONMENT, HEALTH AND NATURAL RESOURCES

Division of Solid Waste Management

Solid Waste Section

SOLID WASTE MANAGEMENT FACILITY EVALUATION REPORT

SOLID WASTE SECTION OCT 26 1992

Type of Facility MSW Landfill Permit # 32-01 County Durham

Name of Facility Durham City Landfill Location SR 1636

Date of Last Evaluation 7-8-92

I. Permit Conditions Followed ✓ Yes ____ No ____ N/A

A. Specific Condition(s) Violated ____

II. Operational Requirements Followed ✓ Yes ____ No

15A N.C. Admin. Code 13B Section .0505

A. Specific Violation(s) by number and letter.

III. Other Violations of Rule or Law ____

IV. Evaluator's Comments Overall site is in excellent shape. Pick up wind blown paper below working face at toe of slope. Continue seeding ie. North slope.

V. Continuation Page Required? ____ Yes ✓ No Receiving Signature DISCUSSED WITH FRED RAVIN MAILED SHEET

Evaluation Date 10-20-92 Solid Waste Section Mark S. Fry

DEHNR 3793 (Part I White: Facility Part II Canary: Central Office Part III Pink: Regional Office)

Solid Waste Section (Review 7/94)

NC DEPARTMENT OF ENVIRONMENT, HEALTH AND NATURAL RESOURCES

Division of Solid Waste Management

Solid Waste Section

SOLID WASTE MANAGEMENT FACILITY EVALUATION REPORT

SOLID WASTE SECTION
MAR 05 1993

Type of Facility MSW Landfill Permit # 32-01 County Durham

Name of Facility Durham City Landfill Location S.R. 1636

Date of Last Evaluation 10-20-92

I. Permit Conditions Followed ✓ Yes ____ No ____ N/A

A. Specific Condition(s) Violated ____

II. Operational Requirements Followed ____ Yes ✓ No

15A N.C. Admin. Code 13B Section .0505

A. Specific Violation(s) by number and letter.

(12)(b) Fencing should be used to control wind blown paper. Pick up wind blown paper below slope.

III. Other Violations of Rule or Law ____

IV. Evaluator's Comments Complete intermediate cover (1') on slopes as soon as weather permits. Clean out basin located between landfill & borrow area and repair erosion on slopes as soon as weather permits.

V. Continuation Page Required? ____ Yes ✓ No Receiving Signature DISCUSSED WITH FRED RAVIN, MAILED SHEET

Evaluation Date 3-2-93 Solid Waste Section Mark S. Frey

DEHNR 3793 (Part I White: Facility Part II Canary: Central Office Part III Pink: Regional Office)

Solid Waste Section (Review 7/96)

Division of Health Services
225 Green Street, Suite 606
Fayetteville, North Carolina 28301
(919) 486-1191

C + I

North Carolina Department of Human Resources

South Central Regional Office • Wachovia Building • 225 Green Street • Fayetteville, North Carolina 28301

James G. Martin, Governor

June 12, 1989

David T. Flaherty, Secretary

Tom Bastable
City of Durham
101 City Hall Plaza
Durham, North Carolina 27701

Re: Notice of Violation

Dear Mr. Bastable:

Pursuant to N.C.G.S. 130A-22(a) and to 10 NCAC 10G, an inspection was conducted on June 7, 1989, of the City of Raleigh Durham Sanitary Landfill, Permit No. 32-01, located in Durham County, N.C., on SR 1636. The inspection found the Durham City Sanitary Landfill to be in violation of a requirement contained in the North Carolina Solid Waste Management Rules, codified at 10 NCAC 10 G specifically:

1. 10 NCAC 10G .0505(3)(a) requires solid waste to be covered, after each day of operation, with a compacted layer of at least six inches of suitable cover or as specified by the Division.

Based upon the foregoing, the City of Durham is hereby ordered to take the action immediately to correct the violation as stated in this Notice of Violation, and otherwise be in compliance with the North Carolina Solid Waste Management Rules, codified at 10 NCAC 10G.

Comply with 10 NCAC 10G .0505(3)(a) by covering all exposed solid waste with a minimum of six inches of soil and cover the working fare daily thereafter with six inches of suitable cover.

Pursuant to N.C.G.S. 130A-22(a) and 10 NCAC 10G Section .0701-.0707, an administrative penalty of up to $500.00 per day may be assessed for violations of the Solid Waste Law or Regulations.

If you have questions concerning this matter, please call (919) 486-1191.

Sincerely,

Dexter Matthews ps

Dexter Matthews
Waste Management Specialist
Solid Waste Branch
Solid Waste Management Section

DM/lsd

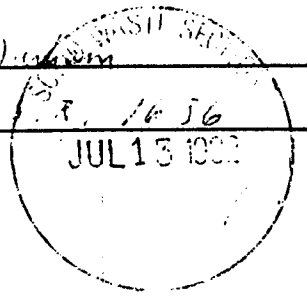
cc: Terry Dover
Central Files

NC DEPARTMENT OF ENVIRONMENT, HEALTH AND NATURAL RESOURCES

Division of Solid Waste Management

Solid Waste Section

SOLID WASTE MANAGEMENT FACILITY EVALUATION REPORT



Type of Facility MSW Landfill Permit # 32-01 County Durham

Name of Facility Durham City Landfill Location R. 1656

Date of Last Evaluation 2-26-92

SOLID WASTE SECTION JUL 13 1992

I. Permit Conditions Followed ✓ Yes ____ No ____ N/A

A. Specific Condition(s) Violated

II. Operational Requirements Followed ✓ Yes ____ No

15A N.C. Admin. Code 13B Section .0505

A. Specific Violation(s) by number and letter.

III. Other Violations of Rule or Law

IV. Evaluator's Comments Site looks good. Small amount of wind blown paper on slope - (west side or left of haul rd.)

V. Continuation Page Required? ____ Yes ✓ No Receiving Signature CALLED [illegible] MAILED SHEET

Evaluation Date 7-8-92 Solid Waste Section [illegible]

DEHNR 3793 (Part I White: Facility Part II Canary: Central Office Part III Pink: Regional Office)

Solid Waste Section (Review 7/94)

NC DEPARTMENT OF ENVIRONMENT, HEALTH AND NATURAL RESOURCES

Division of Solid Waste Management

Solid Waste Section

SOLID WASTE MANAGEMENT FACILITY EVALUATION REPORT

SOLID WASTE SECTION
AUG 17 1993

Type of Facility MSW Landfill Permit # 32-01 County Durham

Name of Facility Durham City Landfill Location S.R. 1636

Date of Last Evaluation 3-2-93

I. Permit Conditions Followed ✓ Yes ____ No ____ N/A

A. Specific Condition(s) Violated

II. Operational Requirements Followed ____ Yes ✓ No

15A N.C. Admin. Code 13B Section .0505

A. Specific Violation(s) by number and letter.

(4)(a) Clean out basin on north side of landfill w 30 days. Silt is leaving site. Install basin in new borrow area and use silt fence until basin in place. Seed back side of berms and roads.

III. Other Violations of Rule or Law

IV. Evaluator's Comments

V. Continuation Page Required? ____ Yes ✓ No Receiving Signature

Evaluation Date 8-11-93 Solid Waste Section Mark R. Fry

DEHNR 3793 (Part I White: Facility Part II Canary: Central Office Part III Pink: Regional Office)

Solid Waste Section (Review 7/94)

APPENDIX E

CLOSURE COST ESTIMATE

CITY OF DURHAM
SANITARY LANDFILL CLOSURE
COST ESTIMATE
OCTOBER 24, 1994

CONSTRUCTION ITEM	QUANTITY	UNIT	UNIT COST	EXTENSION
MOBILIZATION/DEMOBILIZATION		LS		$50,000
BOND		LS		$30,000
GENERAL REQUIREMENTS		LS		$100,000
SITE WORK/GRADING				
Establish Closure Grades (41.5 AC)	133,900	cy	$5.00	$670,000
FINAL COVER SYSTEM				
Erosion Layer (6")	33,000	cy	$11.00	$363,000
Infiltration Layer (18")	100,000	cy	$15.00	$1,500,000
				$1,863,000
Landscaping	41.5	ac	$2,000.00	$83,000
GAS COLLECTION SYSTEM				
Sitework		LS		$50,000
Gas Collection Header	8,000	lf	$20.00	$160,000
Lateral Collectors	13,700	lf	$15.00	$206,000
Gas Extraction Wells	56	ea	$5,000	$280,000
Misc. Valves/Appurtenances	1	LS	$50,000	$50,000
Blower/Flare	1	LS	$150,000	$150,000
				$896,000
STORMWATER/EROSION & SEDIMENT CONTROL				
Rip Rap	4,000	cy	$35.00	$140,000
Bedding	1,500	cy	$20.00	$30,000
Filter Fabric	70,000	sf	$0.25	$17,500
Chutes (Gabion Mattress)	3,500	sy	$35.00	$122,500
Excavation	3,500	cy	$10.00	$35,000
Benches	8,500	lf	$10.00	$85,000
Ditch	2,000	lf	$10.00	$20,000
Silt Fence	5,000	lf	$5.00	$25,000
Diversion Dike	1,500	lf	$5.00	$7,500
Culverts	10	ea	$1,000.00	$10,000
Endwalls	20	ea	$1,500.00	$30,000
Basin Modification	1	LS	$50,000	$50,000
				$572,500
SUBTOTAL				**$4,264,500**
CONTINGENCY (20%)				**$853,000**
ENGINEERING DESIGN/CONST. ADMIN./CQA (10%)				**$426,000**
ADMINISTRATION (Announcements, Deeds, Fees)(3%)				**$128,000**
TOTAL COST				**$5,671,500**

Note:
1. All Costs Are In FY–95 Dollars.
2. Unit Costs include material, labor and profit.

[05–Jan–95 ,F\U\PULLEN\DURHAM\CLOS3]

APPENDIX F

POST-CLOSURE COST ESTIMATE

CITY OF DURHAM
SANITARY LANDFILL POST–CLOSURE CARE
COST ESTIMATE

SEPTEMBER 28, 1994

POST CLOSURE ACTIVITY	COST
OPERATIONS, PREVENTIVE & CORRECTIVE MAINTENANCE	
Groundwater Monitoring	
– Monitoring Well, Casing and Lock	$4,200
Gas Collection and Flare	
– Blower, Flare, Header, Valves, Well Heads & Appurtenances	$36,800
Gas Monitoring System	
– Piping, Bentonite Seal and Valve	$1,600
Cap System	
– Mowing & Landscaping Vegetative Cover	$17,900
– Grading & Settlement Repair of Vegetative Cover Soils	$36,800
Storm Water Drainage System	
– Basins, Chutes, Ditches, Benches, Diversion Berms and Culverts	$52,500
INSPECTION	
Groundwater Monitoring	
– Monitoring Well and Riser	$2,100
– Protective Casing and Lock	$1,100
Gas Collection and Flare	
– Blower, Flare, Header, Valves, Well Heads & Appurtenances	$2,600
Gas Monitoring System	
– Piping, Bentonite Seal and Valve	$1,100
Cap System	
– Vegetative Cover	$2,600
Storm Water Drainage System	
– Basins, Chutes, Ditches, Benches, Diversion Berms and Culverts	$3,700
MONITORING	
Groundwater Wells	$26,300
Surface Water Locations	$15,800
Gas Probes	$15,800
ADMINISTRATION	$5,300
SUBTOTAL	$226,200
CONTINGENCY (10%)	$22,620
TOTAL ANNUAL COSTS	**$248,800**

Note:
1. All Costs Are in FY–95 Dollars.
2. Unit costs include material, labor and profit.

[05–Jan–95 ,F\U\PULLEN\DURHAM\POSTCLOS]

5

CITY OF DURHAM SANITARY LANDFILL OPERATIONS PLAN

CITY OF DURHAM, NORTH CAROLINA

APRIL 1994

MALCOLM PIRNIE, INC.

11832 Rock Landing Drive, Suite 400
Newport News, Virginia 23606

0759-022-330

Transition Plan Amendment
January 1995

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2	Phasing Plan - Phase 1, December 31, 1995
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5	Final Grades
6	Gas Management System
7	Details

1.0 INTRODUCTION

This Operations Plan for the City of Durham Sanitary Landfill is being prepared in conjunction with the Landfill Transition Plan and Closure/Post Closure Plan required by the State of North Carolina Department of Environment, Health and Natural Resources, Solid Waste Management Rules, T15A: 13B Rule .1625 and .1626, issued on October 9, 1993.

This Operations Plan includes five drawings:

- Site Plan/Existing Conditions
- Phasing Plan
- Final Grades
- Gas Control System
- Details

The Site Plan/Existing Conditions drawings present the site's current features including permitted buffers. The Phasing Plan gives area and direction of filling within the proposed interim fill area. Final Grades sheet depicts final contours, erosion and sedimentation control, and stormwater management features. The Gas Control System sheet shows location of gas monitoring probes, gas extraction wells, header, and blower/flare station. The Detail sheet presents typical and specific details for erosion and sedimentation control, stormwater management, and gas monitoring and control. These drawings will work in conjunction with this Operations Plan.

The City of Durham Sanitary Landfill is located on East Club Boulevard, State Route 1669 in the City of Durham, North Carolina. The facility began receiving municipal solid waste in 1973. The City of Durham is the Owner, Permit Holder, and Operator of this facility. The facility includes truck scale, scalehouse/administration building, soil borrow area, and sanitary landfill with buffers. The facility also includes a recycling center and a yard waste process/composting area, which are beyond the scope of this Operations Plan.

The purpose of the Operations Plan is to furnish the City of Durham, in their capacity as landfill operator, written guidance on standard and contingency operations. This plan contains the following:

- Description of facilities programs as set forth in North Carolina Solid Waste Management Rules, T15:13B Rule .1626, paragraphs 1f, 2b, and 4b. The plan is based on the requirements of Rule .1625.
- Erosion and Sediment Control Plan, which incorporates adequate measures to control surface water runon/runoff from a 25-year storm event.
- Operational Drawings, which illustrate the phased development of the landfill to closure.

The City of Durham intends to discontinue landfilling municipal solid waste at this facility by January 1, 1998. Therefore, operations at this facility can be considered interim at this stage.

2.0 WASTE ACCEPTANCE AND DISPOSAL

2.1 ACCEPTABLE WASTE

2.1.1 Landfill Waste

This landfill facility currently receives municipal solid waste from the City of Durham and County of Durham. Major refuse collection and transportation users include: Browning Ferris Industries, Waste Management, Waste Industries, and the City of Durham Sanitation Department.

2.1.2 Other Waste

The landfill facility has provisions for receiving and processing:

- Tires
- White goods
- Yard waste

These items are <u>not</u> disposed of within the landfill unit. Tires and white goods are collected and transported off-site. Yard waste is processed into a mulch and/or compost product which are distributed to users.

The City of Durham is participating in a regional household hazardous waste (HHW) collection and disposal program implemented through the Triangle Region Solid Waste Planners Committee. The City in conjunction with the regional effort, is proposing development of a HHW collection facility at the proposed transfer station to help divert these materials from the landfill. A permanent facility will be developed to serve the City of Durham in order to maximize the capture of HHW. Included in Appendix A is Draft Resolution Regarding Regional Coordination of Household Hazardous Waste Collection.

2.1.3 Notification

The landfill manager shall notify the Division of Solid Waste Management within 24 hours of an attempt to dispose of any waste that landfill is not permitted to receive.

2.2 PROHIBITED WASTE

The following types of waste are prohibited from disposal at the site:

- Hazardous wastes as defined by 15A NCAC 13A.
- Polychlorinated biphenyls (PCB) wastes as defined in 40 CFR 761.
- Liquid wastes as defined in Section 10.0, Liquid Restrictions, in this Operations Plan.

2.3 PUTRID WASTE

Putrid waste such as animal carcasses, hatchery waste, and other animal waste will be disposed of on the working face and shall be covered immediately with minimum 6 inches of daily cover soils to reduce impact of vectors. Vectors are defined in Section 4.0, Disease Vector Control, of this Operations Plan.

2.4 ASBESTOS WASTE

Although not prohibited, this facility does not accept any asbestos waste materials.

2.5 WASTEWATER TREATMENT SLUDGE

Stabilized wastewater treatment sludge will be used at agronomic rates in the final vegetative layer. The City will apply for a waste determination from the Solid Waste Section prior to using the wastewater treatment sludge.

2.6 DETECTION AND PREVENTION OF PROHIBITED WASTE

2.6.1 Random Inspection

On a daily basis, at the discretion of the landfill manager and as weather permits, the landfill manager or his designee shall direct 1 percent of waste collection vehicles, selected at random, to discharge a portion of their contents within a lined bermed area located adjacent to the existing scalehouse facility. Details of the inspection area are shown on

Figure 2-1. The composition of the waste will be identified by landfill staff trained to identify prohibited waste materials. Any questionable waste should be brought to the immediate attention of the landfill manager. The landfill manager will make the final determination of waste acceptability.

In addition to visual inspections, random inspection utilizing a photo ionization detector or a flame ionization detector may be conducted. These detectors are able to register the presence of volatile organic compounds. Volatile Organic Compounds are present in the majority of the hazardous waste compounds in 15A NCAC 13A. These inspections may be conducted by hazardous materials trained personnel who have the capability to investigate readings.

2.6.2 Contingency Plan

On the working face, the facility will maintain a spotter to back up vehicles during peak periods of incoming waste. Spotters will be trained to identify prohibited waste materials. The spotter will watch for suspicious waste or waste containers and free liquids discharging from the waste hauling vehicles. Any potential prohibited waste will be isolated and removed from the facility by the original vehicle transporting the suspected material or by an appropriately trained and licensed waste hauler.

In the event prohibited materials have been discovered after disposal, the landfill staff should notify the landfill manager and implement the following procedures:

- Note time when discovery of prohibited waste was made.
- Notify Division of Solid Waste Management within 24 hours.
- Redirect traffic to other parts of the working face.
- Notify City of Durham Fire Department Hazardous Material Unit if unidentified or hazardous waste materials are suspected to be present.
- Follow hazardous material procedures for containing prohibited waste.
- Dispose of waste through permitted contractor/hauler.
- Forward proper disposal receipts to Division.

2.6.3 Records of Inspection

Figure 2-2 provides a sample of an inspection record to be maintained for each inspection. The landfill manager shall maintain all Records of Inspection.

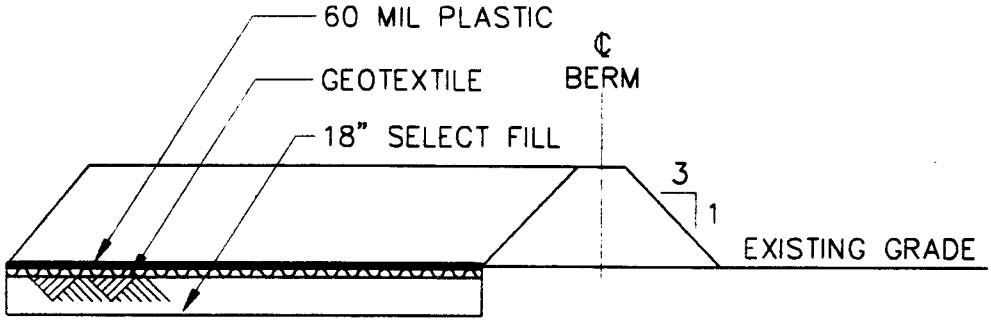
2.6.4 Training

Each landfill operator receives several levels of training in order to identify prohibited waste including:

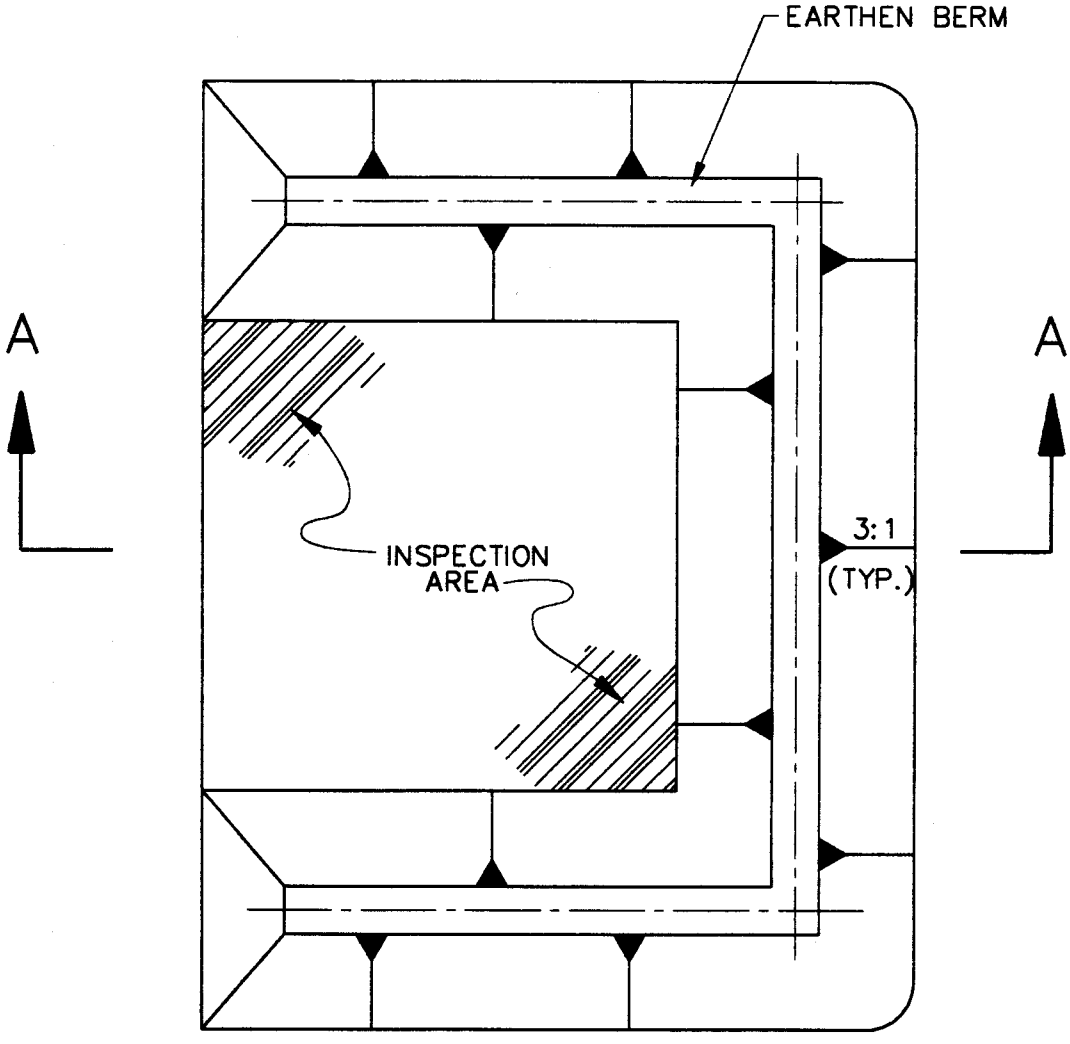
- Orientation by the landfill manager.
- Hazardous materials training in accordance with OSHA (8-hour First Responder training course).

2.6.5 Waste Placement

The landfill manager or his designee will identify the direction and sequence of filling and location and orientation of the working face. Waste placement will be within the permitted limits of the landfill and contained within limits of waste filling established prior to October 9, 1993. Refer to operational Phasing Plan and Final Grade sheets for limits and directions of waste filling.



SECTION A–A



JUNE 1995
CITY OF DURHAM, NORTH CAROLINA
SANITARY LANDFILL
OPERATIONS PLAN

WASTE INSPECTION AREA

NOT TO SCALE

MALCOLM PIRNIE

TRANSITION PLAN AMENDMENT
JANUARY 1995

FIGURE 2-2

RECORD OF INSPECTION

Inspection No.: _____
Day: _____ Time Crossed Scales: _____
Weather Condition: _____
Truck Owner: _____ Driver Name: _____
Truck Type: _____
Vehicle ID# or Tag#: _____
Weight: _____
Tare: _____
General Description of Waste: _____
_____
_____
Waste Generating Company/Source: _____

Reason Load Inspected: ____ random inspection ____ staff initials
____ detained by scalehouse ____ staff initials
____ detained by LF operating staff ____ staff initials
Approved County "Special Waste Determination" letter present ____Yes____ No____N/A
Description of waste load: _____
_____
_____

Disposition: Load Accepted (signature)_____Date:_____
Load Not Accepted (signature)_____Date:_____

Reason Load Not Accepted: (complete this section only if waste NOT ACCEPTED)
Description of Suspicious Contents:
color _____ Haz. Waste markings _____
texture _____ smell _____
drums present _____ approx Cu.Yds. present in load _____
approx tons present in load _____
County Emergency Management Contact: _____Yes_____No
Prohibited Waste:

	Yes	No
Hazardous Waste	☐	☐
Hazardous Material Labels	☐	☐
Medical Waste	☐	☐
Polychlorinated biphenyls (PCBs)	☐	☐
Electrical Transformer or Similar Equipment	☐	☐
Liquid Waste	☐	☐
Drums	☐	☐
Containers	☐	☐
Sludge	☐	☐
Asbestos	☐	☐
Other _____	☐	☐

Hauler notified (if waste not accepted)
Phone: _____ Time person contacted: _____
Other observations: _____
_____
_____
Final Disposition: _____
Signed by: _____ Date: _____
(Waste Screening Inspector or Landfill Manager)
Inspection Report Reviewed By: _____

3.0 COVER MATERIAL

3.1 DAILY COVER

At the end of each day, soil shall be placed in a minimum 6-inch lift across the working face. Frequency and amount of cover soil placement may increase as necessary to control litter, vectors, odors, and scavenging. Landfill personnel should be cognizant that excessive daily cover can detrimentally impact landfill airspace and overall facility life.

3.2 INTERMEDIATE COVER SOIL

Intermediate cover soil consisting of 12 inches minimum clean earth will be placed in the following areas:

- Top of each lift
- Areas which are not expected to receive waste for 12 months or more

4.0 DISEASE VECTOR CONTROL

Vectors of concern include rodents, mosquitoes, flies, and other animals and insects. Control of vectors can be accomplished by elimination of access to food and harborage through the placement and compaction of daily, intermediate and final cover, elimination of nearby shelter (weeds and debris) and elimination of ponded surface water. The application of cover material prevents habitation of the landfill by rodents and also interrupts the life cycle of flies because the organic matter required to host fly larvae is covered with compacted soil daily and fly reproduction is eliminated.

Mosquito control will be provided as required. The mosquito control program consists of adding slow-release chemicals to any water remaining in the perimeter drainage channels. This practice, termed "larvaciding," is generally conducted on a 12-day cycle during breeding season. The slow-release chemicals eliminate mosquito larvae, thus providing mosquito control.

5.0 EXPLOSIVE GASES CONTROL

5.1 MONITORING

Gas monitoring shall be conducted quarterly and scheduled by the landfill manager. The gas management system shall be operated in such a manner as to maintain combustible gas readings at the permitted boundary and within facility structures in accordance with the following:

Location	Frequency	Limits (% LEL)
Permitted Boundary	Quarterly	100
Facility Structures	Quarterly	25

All perimeter boundary and on-site structure locations shown on Operational Drawings will be monitored on a quarterly basis for percent lower explosive limit (percent LEL) and percent total volume (percent TV) of methane. All data will be recorded on a monitoring sheet and maintained on file in the operating record at the landfill site.
LEL is the lowest percent (by volume) of a mixture of explosive gases in air that will propagate a flame at 25°C and atmospheric pressure.

A sample gas monitoring report is shown in Figure 5-1.

5.1.1 Permitted Boundary

Explosive gases control monitoring at the permitted boundary will be conducted utilizing a series of gas probes installed around the perimeter. The gas probes will be installed at 500-foot spacing around the permitted property boundary. The wells will be installed 1 foot below seasonal low groundwater table.

Operational Drawings, Gas Monitoring Plan (Sheet 4) show the gas monitoring system to be installed prior to October 9, 1994. Details on the Operational Drawings present a typical gas monitoring probe for each location. Typically, gas monitoring wells will be installed at 500-feet spacing around the landfill's permitted boundary.

Operational Manuals for gas monitoring equipment and methods of sampling are contained in Appendix B.

Landfill gas monitoring will be performed with a dual range, natural gas indicator that measures concentrations as percent by volume of methane equivalents. Two ranges of detection should be available: 0 to 5 percent and 0 to 100 percent methane by volume. A device such as the GAS-TECH Model NP-204, or equivalent will be used. The combustible gas indicator will be equipped with a flexible extension hose and rigid metal or fiberglass 30-inch long probe. At a minimum, the combustible gas indicator will be calibrated prior to each monitoring event. The amount of monitoring and the handling of the meter will dictate if the calibration frequency should be increased.

The instrument is not to be used at locations where compounds such as tetraethyl lead or hydraulic fluids or lubricants, which contain silanes, silicates, or silicones may be present in the atmosphere. These chemicals contaminate the sensor and thus reduce measurement accuracy. If it is suspected that such compounds may be present in the test area, check the calibration of the instrument after making a maximum of five measurements.

Combustible gas monitoring procedures will be done initially in the high range. If the reading is less than 5 percent, the procedure will be repeated at the low range.

Pressure readings in probes provide useful data for assessing the migration of combustible gas and are typically expressed in inches of water column (in-w.c.) and measured with devices such as a Dywer Magnehelic, or equivalent pressure gauge. These gauges are available for measuring positive or negative (vacuum) pressures ranging from zero to 100 in w.c.

Liquid level measurements will be considered in evaluating the performance of probes. If the liquid level is above the screened or perforated portion of the probe, then the probe is to be considered "watered out" and the monitoring data considered invalid. Liquid levels obtained during probe installations will be considered when determining the screened or perforated length of the probe. A liquid level measuring device will be used to measure liquid levels in the probes.

Permanent Gas Probes

Gas monitoring at the permitted boundary will be performed via perimeter soil-gas probes. Permanent gas probes will be monitored for: 1) gas pressure, 2) combustible gas concentration, and 3) liquid levels. In order to minimize air infiltration during monitoring and also to obtain accurate pressure readings, the top end of the probe will be fitted with either a rubber stopper and flexible hose, or a PVC end cap with a threaded plastic sample port. The flexible hose and sample port will be clamped off to provide positive closure when

not being sampled. The fitting will facilitate a simple connection to the combustible gas indicator's sampling hose.

To effectively monitor the permanent probes, the following procedures will be implemented, in the following order:

1. Obtain pressure reading.
2. Purge a predetermined volume of gas from the permanent probe.
3. Observe the gas concentration after purging and record the steady-state (continuous) gas reading.
4. Obtain liquid level readings.

When the percentage of gas, liquid level, and pressure have been obtained, one of four general categories will be applied to analyze the data:

1. <u>High percent gas and high pressure</u>

   In this situation, there is an indication of combustible gas accumulation and migration, attributed to elevated pressure. Special attention should be taken in reporting these findings. Additional barhole probing may be required to determine the extent of migration.

2. <u>High percent gas and no/low pressure</u>

   In this situation, there is an indication that combustible gas accumulation and migration, attributed to diffusion (movement from higher concentration to lower concentration), rather than pressure. Although this does not present an immediate concern, the analyst should pay special attention to the probe during upcoming monitoring.

3. <u>No/low percent-gas and high pressure</u>

   In this situation, the pressure observed may be attributed to the water level rising above the screened section of the probe, or to the barometric pressure of that particular day. The analyst should observe the liquid level measurements and make special note if the screened portion is below the liquid level.

4. <u>No percent gas and no pressure</u>

   In this situation, there is no evidence of combustible gas accumulation within the probe.

Interim Bar Probes

Prior to October 9, 1994, drive bar probe holes will be used to measure soil gases. Drive bar probes are steel or wood stake driven in the soil 2 to 3 feet deep and removed. Soil gas reading are taken upon removal of the probe.

Barhole probing is most useful when conducted along the perimeter of a landfill to determine whether combustible gas is migrating off-site. Areas with gas-stressed vegetation (burned-out areas) are usually indicators of near surface landfill gas migration.

With the aid of a plunger bar, a hole is made to a depth of 2.5 to 3 feet below ground surface. Upon removal of the plunger bar, the sampling probe is immediately inserted into the hole and sealed to minimize air infiltration of the barhole sample. With the instrument in the HIGH range, the aspirator bulb is slowly squeezed and released several times, recording the reading obtained following continuous sampling (stabilized value). If the concentration of gas is less than 5 percent on the HIGH scale, another barhole is punched and the sampling procedure is repeated in the LOW range. When barhole monitoring yields a high concentration of combustible gas, additional barhole probing is required. Barholes are punched and sampled at "as directed" intervals, radiating out in various directions from the original barhole of concern, until readings of zero are obtained. By employing a radial or grid-type pattern, a graph depicting the apparent movement of gas based on concentration can be plotted.

Barhole probing will be done at varying depths from the ground surface to a depth of about 3 feet. Shallower barhole probing on the order of 6 to 12 inches will be done when investigating for cover soil gas concentrations in vegetation stressed areas.

The monitoring technician should note that there are a number of seasonal variables which may affect the overall effectiveness of the barhole probe method. The moisture content of the ground greatly affects the concentration of gas detected because combustible gas migrates readily through dry soil and water saturated conditions may prohibit the use of the barhole probe method. Under these conditions, water infiltrates the barhole and can be sucked into the instrument during sampling. This would damage the filament and render the instrument useless. The use of a moisture trap and an aluminum probe with small diameter cross-drilled holes about 6 inches from the tip, helps reduce the possibility of liquid drawing into the gas detector, but does not prevent it.

During testing, the technician should note the retraction of the aspirator bulb. If the bulb is very slow in returning to its normal inflated form, this is an indication that liquids are being drawn through the probe.

Frozen ground conditions will inhibit plunger bar penetration. The preferred months for employing the barhole probe technique are the summer months, when conditions are dry. Though seasonal weather conditions may inhibit the use of the barhole technique, they do not prohibit its use as a year-round monitoring technique.

5.1.2 Facility Structures

The monitoring of structures can present a sensitive situation due to the possibility/proximity of human inhabitants. Combustible gas accumulation should be monitored within confined areas of the structure such as corners, along baseboards, crawl spaces, attics, underground facilities, drainage structures (drains, toilets, sumps, etc.) or any area where air movement is restricted.

Monitoring for combustible gases in facility structures will be via two mechanisms:

- Quarterly monitoring of air using portable gas detector instruments.
- Continuous monitoring with credible alarm using fixed combustible gas monitors at selected locations.

When monitoring for combustible gas in buildings or structures, a rigid fiberglass probe will be used. The narrow tip allows for easy access to cracks and other narrow spaces. An aluminum probe can also be used for sampling; however, the two cross-drilled holes should first be covered to prevent the dilution of the sample.

The instrument will not be used at locations where compounds such as tetraethyl lead or hydraulic fluids or lubricants, which contain silanes, silicates, or silicones, may be present in the atmosphere. These chemicals contaminate the sensor and thus reduce measurement accuracy.

Permanent Gas Detector Installations

In addition to routine sampling, buildings may be monitored by permanently installed gas detectors. As continuous monitoring devices, these detectors have a built-in alarm system which sounds if gas concentrations exceed a predetermined value.

The Sierra Model 2001 Combustible Gas Monitor, or equivalent (see Appendix B), which is factory and dealer calibrated to sound an internal alarm when combustible gas concentrations reach or exceed by volume 1 percent methane (10,000 ppm), will be used for structure monitoring. The monitors will be installed where combustible gas is most likely to accumulate and in areas of potential leaks, as discussed above.

The monitors will be recalled periodically for calibration. A simple check of the alarm should be performed each month to verify sensor activity. This can be achieved using an ordinary butane lighter. More frequent checks are necessary during periods of extreme humidity and temperature changes.

Care should be taken in the placement of the monitors, because they will be affected by the following:

- High concentrations of carbon monoxide
- Paint thinner, gasoline fumes, and other similar vapor emitting components
- Aerosol spray or cleaners

Situations such as these should be avoided because several occurrences may affect the calibration of the monitor.

5.2 CONTINGENCY PLAN

In the event that methane is detected in concentrations exceeding regulatory limits, the following contingency measures will be taken to further evaluate the source of landfill gas and mitigate any hazardous effects.

- Take all necessary steps to ensure protection of human health.
- Notify NCDEHNR, Division of Solid Waste Management of the concentration if methane gas exceeds 25 percent LEL in facility structures or if the concentration of methane gas exceeds the LEL for methane of the facility property boundary.
- Place methane/gas monitoring data in Operating Record within 7 days from detection.

- Additional readings will be taken on a weekly basis from any gas probe which indicates repeatable measurements of methane in concentrations exceeding 25 percent LEL.

- If additional readings indicate the concentration of methane subsides for 2 consecutive weeks, then no additional contingency actions are required and monitoring shall revert to the original quarterly frequency.

- Consecutive methane concentrations in excess of the trigger level at perimeter gas probe locations will require installation of additional gas probes at approximately 100-foot spacing along the site perimeter in the vicinity of the elevated gas concentrations.

- Additional gas probes will be monitored at weekly intervals to evaluate the extent of gas migration.

- Confirmed off-site migration of methane gas in concentrations exceeding 100 percent LEL will initiate immediate development of remedial measures to mitigate any potential impacts.

- In the event of persistent elevated methane concentrations, investigations will be made as to the extent of gas accumulation beneath the landfill cap system and contingency actions proposed to vent and relieve build-up of any accumulation of methane.

- If any occupied dwelling exist in close proximity to the landfill in the direction of migration, gas measurements shall be taken at least weekly in basements and/or crawlspaces.

- A remediation plan shall be developed and implemented within 60 days of a high reading. Notification to the Division of Solid Waste Management will be made once the remediation plan has been implemented.

FIGURE 5-1

GAS MONITORING REPORT

TECHNICIAN: DATE:

GAS INSTRUMENT TYPE: SERIAL NO.:

DATE LAST CALIBRATED:

METHOD:

PRESSURE INSTRUMENT TYPE: SERIAL NO.:

WATER LEVEL INSTRUMENT TYPE: SERIAL NO.:

BAROMETRIC PRESSURE: STATUS (R,F,S):

GAS MONITORING PROBE	TIME	PRESSURE	PERCENT METHANE	WATER LEVEL	COMMENT (CONDITION OF PROBE)

NOTES: All readings are 0-100% methane by volume in air
All pressure readings are expressed as inches of H2O

WEATHER:

6.0 AIR CRITERIA

6.1 REGULATORY COMPLIANCE

The operations of this landfill will be in accordance with all applicable requirements developed under the State Implementation Plan approved and promulgated by the U.S. Environmental Protection Agency pursuant to Section 110 of the Clean Air Act.

6.2 OPEN BURNING

Open burning of solid waste and other waste is strictly prohibited at this landfill (see .1626(5)(b). Burning brush and land clearing debris generated on-site will be permittable only with prior approval from the landfill manager and Division of Solid Waste Management.

6.3 ACCIDENTAL FIRES

6.3.1 Minor Fires

Minor accidental fires which may occur on the working face or other locations in the facility should be smothered using clean soils. Once the fire has been suppressed, the waste should be spread out to ensure the fire source has been eliminated. A minor fire is defined as a small fire with limited flame, smoke, and area which does not pose an immediate or potential risk to personnel, equipment, or property.

6.3.2 Other Fires

Other accidental fires which may occur at this facility shall be reported immediately to the City of Durham Fire Department. Landfill staff and equipment should be deployed to contain the fire. Facility users should be denied access until all risks from heat, flame, and smoke have been eliminated. The City of Durham Fire Department maintains a station within 1 mile of the facility. The City of Durham Fire Department is a fully trained, equipped, and staffed 24-hour professional department with capacity to handle any potential fire scenario.

6.4 NOTIFICATION

Notify the Division of Solid Waste Management within 24 hours of a fire at this facility. Furnish a written report to the Division of Solid Waste Management within 15 days. Include in report the following information:

- Date and time of incident
- Specific location of incident
- Fire Department notification
- Time fire was suppressed
- Cause of incident
- Corrective measures

The landfill manager shall be responsible for compliance and submitting this report to the Division of Solid Waste Management.

7.0 ACCESS AND SAFETY

7.1 SITE SECURITY

The site is secured by an entrance gate which denies access to vehicles during off hours. The perimeter of the landfill site is heavily wooded which limits unauthorized vehicle entrance into the facility. The landfill manager shall make a quarterly review of the perimeter to ensure no unauthorized entrance is being gained.

7.2 ATTENDANT

During hours of operation, a scalehouse attendant shall be on duty as well as a landfill operator. The landfill operator shall be trained and have the ability to enforce the operational requirements of this facility. The landfill operator shall understand all contingency plans and recordkeeping requirements.

7.3 ACCESS ROAD

The access road from the public highway to the scalehouse and to the disposal area is capable of maintaining operations in all weather conditions. Landfill operations equipment is adequate to perform emergency repairs and maintenance of the facility's internal roadways.

7.4 DUST CONTROL

Dust control shall be undertaken on an as needed basis. Dust control shall be performed using a water truck. During extreme dust conditions, other chemicals may be used. These chemicals shall be consistent with all current federal, state, and local regulations.

7.5 SIGNAGE

Entrance sign currently in place shall be maintained with the current facility operating hours and site identification including the Solid Waste Permit Number.

Signs stating prohibited liquid and hazardous waste shall not be received at this facility will be maintained.

Traffic signs between the scalehouse and disposal area shall be maintained to control vehicle speed and direct users to and from the disposal area of the facility.

7.6 SCAVAGING

Scavaging at this facility by users and employees is strictly prohibited. Signage at the facility entrance state this strictly enforced rule.

7.7 BARRELS AND DRUMS

Barrels and drums pose a unique risk to facility staff and operations. No drums or barrels shall be disposed of on-site unless the containers are thoroughly perforated and do not have residue from its previous contents.

8.0 EROSION AND SEDIMENTATION CONTROL

The disposal facility utilizes a series of benches, chutes, ditches and stormwater ponds to control stormwater and minimize erosion and sedimentation control. These measures attempt to trap the sediment as close to the source as possible. Additionally, erosion and sediment control features may be used to divert stormwater runon away from active cell areas within the landfill.

The landfill's erosion and sediment and stormwater control features will be developed to the following criteria:

- Maximum slope steepness 4 horizontal to 1 vertical
- Reverse sloped benches every 40 vertical feet
- Lined down chutes
- Stabilized outfalls
- Stormwater basin upgrades

These features are depicted on the Operations Drawings.

The benches divert stormwater runoff from the slopes into stabilized structures thereby minimizing unprotected slopes to 40 feet. These stormwater structures will be maintained on the schedule indicated below. Benches will not be constructed in previously filled areas.

All stormwater and erosion control structures have been designed and sized to accommodate 25-year, 24-hour storm events. Both the TR55 computer model and the Rationale Methods were utilized in design of these structures.

Provisions for vegetative ground cover sufficient to retain erosion will be accomplished within 30 working days or 120 calendar days upon completion of any phase of landfill development.

Facilities will be maintained on the following schedule:

Component	*Maintenance Procedure*	*Frequency*
Ditches	• Excavate sediment • Re-establish vegetation	Biannually
Benches and Chutes	• Repair damaged areas • Reinstall erosion control fabrics	Biannually
Stormwater Basins	• Excavate sediment • Repair slopes • Inspect discharge structure	Annually
Reseeding	• Reseed and mulch • Inspect for vegetative stress	Annually

9.0 DRAINAGE CONTROL AND WATER PROTECTION

9.1 DRAINAGE CONTROL

This facility will comply with the Clean Water Act including but not limited to National Pollutant Discharge Elimination System (NPDES) requirements.

The working face is oriented, to the extent possible, to minimize runon of stormwater into the waste. Diversion dikes may be used to divert stormwater flow away from the working face. Many of the stormwater features and criteria are discussed in Section 8.0, Erosion and Sedimentation Control. In general, stormwater will be channelized in established drainage ways to minimize severe erosion. Runoff down slopes will be intercepted into reverse slope benches. The channelized flow from the benches enter down slope chutes. The chutes discharge into a perimeter ditch system. The perimeter ditches discharge all storm water into one of three stormwater basins prior to discharge off-site.

The top of the area will be graded to promote runoff. No impounded water will be permitted within the limits of waste indicated.

Under no circumstances will waste be deposited in water. Prior to establishing the working face at the beginning of the day, any collected water will be pumped or otherwise removed from the working area.

9.2 LEACHATE SEEPS

A leachate seep occurs when leachate from within the landfill unit surfaces at the toe of the landfill or on the slope. Leachate seeps or breakouts which may occur on the slopes shall be reported to the landfill manager. The following procedures will be observed when dealing with a leachate seep:

- Identify the extent of the seep
- Excavate down to waste, discard waste in the current working face
- Place additional soil over the waste
- Re-establish cap system

10.0 LIQUID RESTRICTIONS

10.1 LIQUID WASTE

Liquids are defined as free liquids by Method 9095, Paint Filter Liquids Test, SW 846 (see Appendix C).

Bulk or containerized liquid waste is prohibited from disposal at this landfill unless the waste is household waste other than septic waste or waste oil.

Containers holding liquid wastes may not be placed at this landfill unless the containers are from household waste or small containers similar in size to household waste containers or containers designed to hold liquids for use other than storage.

Any questions or discrepancies should be brought to the immediate attention of the landfill manager. Any violation of this requirement or covert attempt to violate this requirement shall be brought to the attention of the Division of Solid Waste Management.

10.2 GAS CONDENSATE

Gas condensate will be collected from locations at gas collection lateral pipes and at the flare/blower station. Condensate traps will be minimized by locating traps at the ends of sloped laterals. Gas condensate leaving the landfill will be minimized by locating condensate traps within the limits of waste. Condensate collecting within the traps will return to the waste via gravity. Gas condensate collected outboard at the blower station will be pumped and hauled to the City of Durham wastewater treatment plant located adjacent to the landfill facility.

11.0 RECORDKEEPING

Operating records shall be maintained by the landfill manager at the City of Durham landfill. Alternatively, subject to NCDEHNR approval, records may be maintained at the following adjacent location:

- City of Durham Sanitation Department
  1833 Camden Avenue
  Durham, North Carolina 27704

  Attention: Solid Waste Process Engineer

Records to be maintained include:

- Permits
- Waste Determination Records
- Random Screening Inspection Forms
- Training Procedures
- Amounts by Weight of Solid Waste Received
- Gas Monitoring Results
- Certifications, Monitoring and Testing Data
- Closure Cost Estimates
- Groundwater Monitoring Results
- Scrap Tire Certification Forms

12.0 SPREADING AND COMPACTION

12.1 FILLING

The filling of the landfill unit shall be in general conformance with approved final grades and phasing plans.

During actual fill operations, confine the working face to minimum dimensions to handle anticipated peak traffic flows. This may make the working face approximately 50 feet wide. Figure 12-1 shows a typical working face configuration.

Filling at this facility will be conducted utilizing both the bottom and top dump area method as depicted in Figure 12-1. Lifts will be approximately 10 feet thick.

12.2 COMPACTION

Waste placed on the working face shall be compacted to the maximum practical density using the following procedures:

- Spread waste to approximately 2 to 3 feet thick.
- Make a minimum of two passes over the spread waste using either of the following heavy waste compactors:
  - Cat 826C
  - Rex 370A

12.3 SPECIAL PROCEDURES

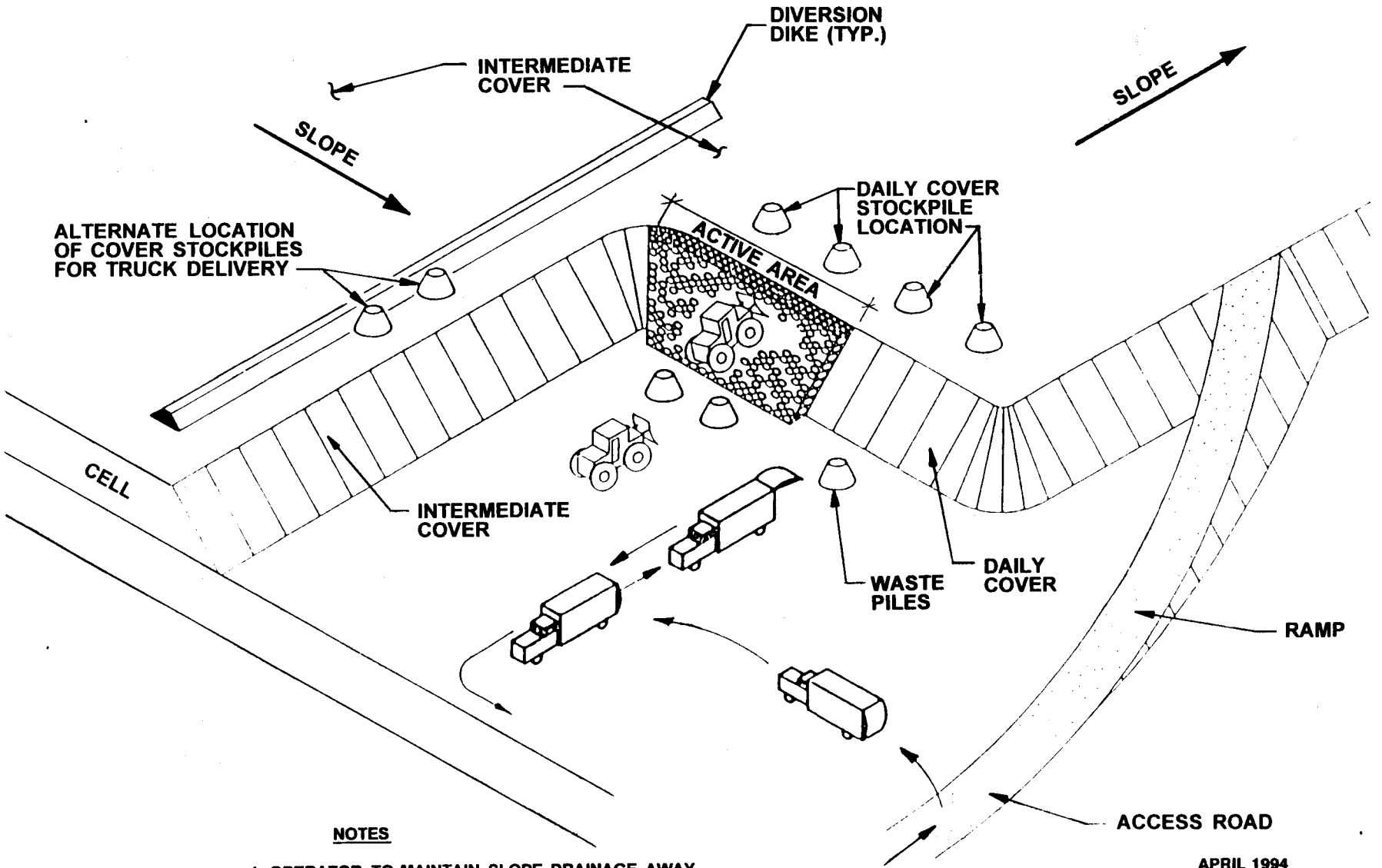
Under certain adverse weather conditions, special procedures shall be implemented to ensure continued compliance with landfill regulation and requirements. The following is a list of procedures to follow pertinent to landfill operations.

Rain

- Reduce speed of vehicles on landfill access roads.
- Stockpile dry soil from borrow area to improve access to the working face and for daily cover.

Dry/Windy

- Install fencing or diking around daily work area to prevent litter and contain debris.
- Collect wind blown litter at end of each working day and return to working area.
- Orient working face to minimize wind blown litter.
- Police litter around perimeter.



NOTES

1. OPERATOR TO MAINTAIN SLOPE DRAINAGE AWAY FROM ACTIVE FILL AREA.
2. ALTERNATELY, TEMPORARY DIVERSION DIKES TO BE UTILIZED TO DIVERT STORMWATER RUN-OFF FROM ACTIVE FILL AREA.

MALCOLM PIRNIE

APRIL 1994
CITY OF DURHAM, NORTH CAROLINA
SANITARY LANDFILL OPERATIONS PLAN

TYPICAL WORKING FACE

NOT TO SCALE

(TRANSITION PLAN AMENDMENT)
JANUARY 1995

FIGURE 12-1

APPENDIX A

DRAFT RESOLUTION REGARDING REGIONAL COORDINATION OF HOUSEHOLD HAZARDOUS WASTE COLLECTION

Appendix A
Draft
Resolution Regarding Regional Coordination Of Household Hazardous Waste Collection

WHEREAS, many common household products such as oven cleaners, metal and furniture polishes, pesticides, drain cleaners, disinfectants, rug and upholstery cleaners, motor oil, transmission and brake fluids, and paints can be a threat to public safety and the environment if not properly handled and disposed of; and

WHEREAS, solid waste planners from local governments in Chatham, Durham, Orange, and Wake Counties, comprising the Triangle Region Solid Waste Planners Committee, have met frequently and researched and examined possible benefits to a regional effort for the construction of permanent household hazardous waste facilities in each of the four counties, as well as servicing of those facilities by a single private corporate entity engaged in the business of collection and disposal of household hazardous waste and regional coordination of administration and public education through a representative regional agency; and

WHEREAS, the Committee has determined that permanent household hazardous waste collection facilities have been successful in other jurisdictions in capturing from residents more household hazardous waste than collected in single-day household hazardous waste collection events; and

WHEREAS, the Committee has determined that the use of a permanent household hazardous waste collection facility will result in less costly disposal per unit of material than the use of single-day household hazardous waste collection events; and

WHEREAS, the Committee has determined that regional coordination of household hazardous waste collection and disposal through one private disposal contractor will result in less costly disposal of household hazardous waste for the City/Town/County of _____ ; and

WHEREAS, the Committee has recommended Laidlaw Environmental Services, Inc. as the best and most cost effective private disposal contractor for providing household hazardous waste disposal services within the region; and

WHEREAS, the Committee has determined that public education is a critical component of any household hazardous waste collection program; and

WHEREAS, the Committee has determined that regional coordination of the administration and public education associated with household hazardous waste collection through a representative regional agency will result in cost savings to the City/Town/County of _____ ;

NOW, THEREFORE, BE IT RESOLVED that the City/Town/County of _____ commits to the provision of one permanent household hazardous waste collection facility within its County during fiscal year 1994-95; and

BE IT FURTHER RESOLVED that the City/Town/County of _____ agrees to enter into an interlocal agreement with local governments in _____ , _____ , and _____ Counties regarding coordinated household hazardous waste collection, disposal, administration, and public education, including coordination of administration and public education by a representative regional agency; and

BE IT FURTHER RESOLVED that the City/Town/County of _____ agrees to negotiate and enter into a single contract between the local governments in Chatham, Durham, Orange, and Wake Counties and Laidlaw Environmental Services, Inc. for the provision of household hazardous waste disposal services.

This the _____ day of _____ , 1994

APPENDIX B

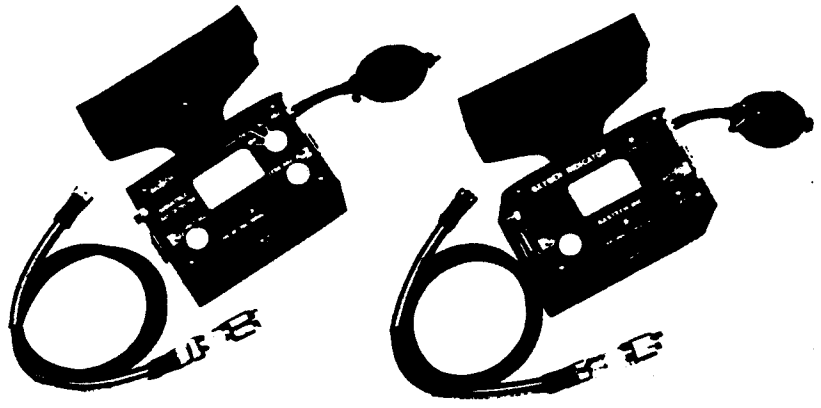
LANDFILL GAS MONITORING PROCEDURES

GAS-TECH MODEL MP-204 NATURAL GAS INDICATOR

HAND HELD PORTABLE COMBUSTIBLE GAS AND OXYGEN INDICATORS

P-200 SERIES

GASTECH



FEATURES

- Fast Response
- Light Weight
- Rugged Construction
- Simplicity of Operation
- Low Cost
- Gas Tech's Proven Dependability

DESCRIPTION

Series P200, five lightweight, handheld portables for detecting combustible gases/vapors and monitoring atmospheric oxygen content, represent the broadest line of common design instruments available. Engineered to serve the demanding field requirements of industry, public works and public utilities, these instruments share many common features and offer the user distinct advantages in terms of economy, dependability, maintainability and ease of operation. Built to withstand rough field environments, all Series P200 instruments are constructed with rugged cast aluminum housings, and incorporate highly reliable advanced electrical design characteristics. All active and passive components are mounted on easy-to-get-at, high quality, printed circuit boards. In operation, all P200 instruments are not only easy to use, sharing common functional characteristics, but they are extraordinarily fast in providing accurate readings. For gas indicators, the response time is no more than 4 seconds, and for oxygen indicators an accurate reading is attained within 6 seconds.

By maximizing the use of common components and operating characteristics, GasTech offers not only high quality field instruments, but has greatly simplified and expedited other very important considerations, such as field service, personnel training and accessory interchangeability. And finally, and perhaps most importantly, the commonality of components can save valuable time when field service becomes necessary. Fundamental operating features are easy to understand and all components are very accessible for checkout, replacement or repair.

GP-204 GENERAL COMBUSTIBLE GAS INDICATOR

A general-purpose instrument for measuring or testing any area where combustible gases or vapors may accumulate. Having a range of 0 to 100% LEL, and providing a reading within 4 seconds of sample draw with standard hose length, this instrument utilizes a closely-matched two-filament bridge detection circuit that features inherent electrical compensation characteristics. In addition to having a very fast response time this circuit exhibits outstanding zero stability, even as the level of the battery voltage decreases. Another important feature of GP-204 is the span adjust capability, allowing for increased accuracy, especially in situations where different gases are being tested. Compact, easy to hold in one hand, and weighing but 5 pounds, the GP-204 is powered by either two D size rechargeable nickel-cadmium batteries, or two D size flashlight batteries. The instrument has an illuminated meter which together with the basic rugged construction makes it suitable for almost any work situation. Calibration is performed on methane, but other calibrations may be requested when ordering. As with all Series P200 instruments, necessary accessories are provided in the standard package to include 3-foot Teflon-lined hose, end-of-line probe with integral removable dust filter, leather carrying case with strap, and batteries (charger included if required).

NP-204 NATURAL GAS LEAK DETECTOR

A dual-range instrument designed primarily for locating natural gas leaks. Normally calibrated on natural gas, the instrument has two ranges, 0 to 5% natural gas by volume, and 0 to 100% gas, which are displayed on the graduated illuminated scale. In addition to all of the design characteristics of the GP-204, this gas leak detector has a second complete Wheatstone bridge utilizing thermal conductivity filaments. When testing for gas leaks, this second range is selected by an additional position on the selector switch marked "100% GAS". NP-204 operates from two D size dry cell or rechargeable-type batteries and comes complete with carrying case and all necessary accessories. Rechargeable batteries substantially improve the accuracy of this version of the NP-204 in comparison to any dry-cell type instrument on the 100% gas range where the reading at a given gas concentration is directly proportional to the detector circuit voltage. Especially useful to the gas distribution industry for bar-hole readings when searching for leaks in underground mains, NP-204 is a versatile instrument also suitable for testing hazardous work spaces such as manholes, sewers and other confined areas. Calibration on other gases with a thermal conductivity substantially different from air, may be requested when ordered.

EP-204 DUAL-RANGE INDICATOR

A dual-range version of the GP-204, with a second more sensitive detection circuit for determining the toxic concentrations of certain hydrocarbon gases or vapors. This additional circuit has a range of from 0 to 10% LEL and is selected by an additional switch position. The advantage of this instrument is the fundamental practicality provided by the two ranges. With the EP-204, an industrial hygienist/safety officer can accomplish essential tests for leakage or accumulation of combustibles, as well as perform tests for low level concentration of toxic hydrocarbon vapors resulting from industrial processes. Circuit is powered by two D size rechargeable nickel-cadmium batteries. The optional pump described below is a very attractive addition to the Model EP-204, enhancing accuracy when testing for toxic concentrations. All necessary accessories are provided.

XP-204 OXYGEN DEFICIENCY INDICATOR

This very lightweight instrument, weighing only 3 pounds, is for use by workers who periodically need to enter work spaces where the atmosphere may be deficient in oxygen content. Model XP-204 enables the user to determine if the tested atmosphere is above the OSHA limit of 19.5% oxygen. Built-in, easy-to-read meter displays an accurate reading of atmospheric oxygen content within 6 seconds after sample draw on a graduated scale of from 0 to 25%. Detection method is with an electrochemical cell that is not only very fast in relative response time, but will operate at temperatures down to +15°F and is not affected by angle or position of the instrument. This cell is guaranteed for six months from date of shipment, and may be reactivated indefinitely at a nominal cost. Amplification is through a highly stable integrated circuit amplifier that matches cell output to meter Amplification circuit also enables the user to zero Model XP-20 on oxygen-free gas providing a true zero reading. This feature, combined with routine calibration on atmospheric air (21% oxygen), results in dependable accuracy at all points on the scale. Power is through two 8.4V transistor-type batteries. All other necessary accessories are included.

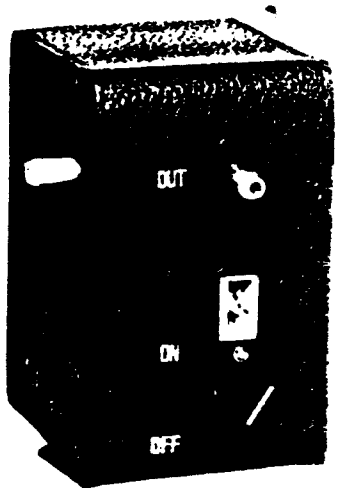
IP-204 INERTING INDICATOR

Dual-range indicator especially suited for utility and industrial inerting operations where purged atmospheres need to be tested for residual contents of oxygen. Typical applications of the IP-204 include periodic testing of transformer housings, testing of gas handling equipment for initiation of service, testing for leakage into purged petrochemical process equipment, and testing purged electrical and telephone conduit for leakage. In addition to having all the features of the XP-204 described above, this instrument has a second, more sensitive range that provides readings in the 0–5% range. This second range, also responsive within 6 seconds of sample draw, is selected by a two-position range switch.

SPECIFICATIONS

MODEL NO.		GP-204 COMBUSTIBLE INDICATOR		NP-204 NATURAL GAS DETECTOR		EP-204 EXPANDED SCALE INDICATOR	XP-204 OXYGEN DEFICIENCY	IP-204 INERTING INDICATOR
STOCK NO.		72-0110	72-0100	72-0121	72-0120	72-0116	72-0051	72-0052
PARAMETERS								
BATTERIES	1-5 V Alkaline D-Size	2	–	2	–	–	–	–
	1-2 V Ni-Cad D-size	–	2	–	2	2	–	–
	8.4 V NEDA 1604M	–	–	–	–	–	2	2
Operating Hours		3	4	3	4	4	30	30
Calibration		Methane		Methane		Toluene	Oxygen	Oxygen
Range(s)		0–100% LEL		0–5% Gas 0–100% Gas		0–100% LEL 0–10% LEL	0–25%	0–25% 0–5%
Detection Method		Catalytic Combustion		Catalytic; Thermal Cond.		Catalytic Combustion	Electrochemical Cell	Electrochemical Cell
Operating Temp.		0–120° F (–15 + 50° C)		0–120° F (–15 + 50° C)		0–120° F (–15 + 50° C)	10–110° F (–12 + 45° C)	10–110° F (–12 + 45° C)
Meter Light		Std		Std (2)		Std	NA	NA
Speed of Response		4 Sec.		4 Sec.		4 Sec.	6 Sec.	6 Sec.
Weight		5#		5#		5#	3#	3#
Size		6-1/2" x 5-1/4" x 4"						
Sampling Method		Hand Aspirated with Detachable Pump Optional						
Sample Time		One Second Lag Per Five Feet of Sample Line						
Accessories Included		Batteries, End of Line Probe, 3 Foot Sample Hose W/Fittings Both Ends, Instruction Book, Leather Case and Strap, Recharger When Applicable						

Ordering–Specify Quantity, Model Number, Stock Number, Non-Standard Calibration, (Single Combustible No Charge, For Multiple Calibrations Check Factory), and any desired accessories



80-0101–Minipump

A self-powered (rechargeable battery) pump useful as an accessory to all instruments in the P200 line. Use of the pump eases the effort involved in sampling from deep tanks with the GP-204, allows field determination of leakage rate in bar-hole testing with the NP-204, and allows sampling of exhaust streams during purging operations for testing with the XP or IP-204. Unit is lightweight (20 oz.) and comes complete with leather case, charger cord and adapter hose. May be supported by instrument carrying straps.

GAS-TECH NP-204 OPERATING PRINCIPLE

The Model NP-204 is essentially two instruments combined into one. In the LOW (0-5%) range, it is a combustible gas indicator - utilizing the catalytic detection principle. In the HIGH (0-100%) range, it is a thermal conductance indicator - utilizing the cooling effect of natural gas. Both detection methods employ the Wheatstone bridge measurement principle.

Low Range (0-5%)

The LOW range employs a catalytic platinum filament. The filament is initially heated by the battery current (based upon voltage setting), to a point where it will cause catalytic oxidation of combustible gas that comes in contact with the active surface. This oxidation produces a definite heat of combustion - correlating to the concentration of gas. The heat generated increases the temperature (i.e., higher electrical resistance) of the filament. This increase in resistance produces an upward deflection on the meter corresponding to gas concentration.

The catalytic method is only applicable in areas where gas concentrations are less than 5%, as oxygen is necessary to support catalytic oxidation. As gas concentrations exceed 5%, the heat of combustion no longer increases with increase in gas content (Refer to Sampling of Rich Mixtures).

High Range (0-100%)

The HIGH range employs a thermal conductance filament. The filament is initially heated by the battery current (based upon voltage setting), to a point where it assumes a definite temperature and resistance. As natural gas is introduced, the filament becomes cooler (i.e., lower electrical resistance) due to the cooling ability of natural gas. This decrease in resistance

on the HIGH range scale, internal calibration of the meter is required. Variations from zero, up to 3.0% may be subtracted from the observed result. However, variations from zero of greater than 3.0% cannot be subtracted out (non-linear) and require internal calibration of the meter.

NOTE: During sampling, the voltage and LOW range zero must be rechecked every two to three samples.

The instrument is now adjusted and ready for use. When not in use, the instrument should always be in the "off" position. This will help prolong the operating life of the batteries. The instrument should always be purged of residual gas with fresh air immediately following each sample.

Internal Adjustments

"ZERO - H": an adjustment potentiometer used to "zero" the meter needle while in the HIGH range.

"SPAN - L": an adjustment potentiometer used to set the meter to the correct value while sampling a known concentration of methane gas during calibration. A 2.5% methane gas is recommended for calibration on the LOW scale.

"SPAN - H": an adjustment potentiometer used to set the meter to the correct value while sampling a known concentration of methane gas during calibration. A 50%-40%-10% (Methane-Carbon Dioxide-Nitrogen) mixture is recommended for calibration on the HIGH scale.

INSTRUMENT SET-UP

To ensure the functionality of the instrument prior to sampling, the following procedure for instrument set-up must be followed:

1. Confirm that the needle is set at zero when the meter is off. If necessary, "zero" the needle by adjusting the small plastic set screw located directly beneath the scale on the face of the instrument.

2. Confirm that the voltage setting is satisfactory. To do this, switch the instrument to the "VOLT ADJ" position. Lift and turn the "VOLT ADJ" control knob to position the needle at the red "V" line on the meter scale. If the needle cannot be set as high as the red "V" line with the "VOLT ADJ" control knob all the way clockwise, the nickel-cadmium batteries require re-charging. A 16-hour charge is necessary to restore batteries to full capacity. If necessary, standard size D alkaline-type (Duracell or Energizers) dry cell batteries may be used. However, these batteries will give only three to four hours of operating life. Do not attempt to use the instrument if the voltage check proves unsatisfactory. If the voltage check prove satisfactory, proceed as follows with the remaining steps of instrument set-up.

3. Switch the meter to the LOW range, and with the sample inlet in fresh air, squeeze the aspirator bulb four to five times to purge residual gas from the instrument.

4. With the instrument in the LOW range, confirm that the needle is set at zero. If necessary, adjust the needle using the "ZERO ADJ L" control knob until the needle is "zeroed".

5. Switch the meter to the HIGH range and confirm that the needle settles on, or close to, zero. A slight variation from zero is acceptable, however, if the needle "zeroes" above 3.0% as read

produces an upward deflection on the meter corresponding to gas concentration.

The thermal conductance method is not dependent on combustion, hence it is applicable regardless of the oxygen content of the sample. It is a relatively insensitive method, hence it is utilized at higher gas concentrations - greater than 5%.

INSTRUMENT CALIBRATION

Prior to each sampling event, the instrument should be calibrated for accuracy on both the LOW and HIGH scales, using known gas concentrations of methane. 2.5% and 50% methane are recommended for meter calibration.

To calibrate the instrument, the following procedure should be employed:

A. Perform preliminary adjustments as described in Section 4.0 - Instrument Set-up, Steps 1-4.

B. Switch the needle to the HIGH range and confirm that the needle settles on zero. If the needle does not "zero", internal calibration is required. This is accomplished by adjusting the internal "ZERO-H" potentiometer until the needle is centered on zero.

C. Purge a dedicated gas sampling bag of all residual gas. Fill the gas sampling bag 3/4 full with 2.5% methane and clamp the bag closed. With the instrument in the LOW range, remove the clamp from the gas sampling bag and aspirate the 2.5% methane through the meter and confirm a reading of 2.5% on the LOW scale. If necessary, adjust the internal "SPAN-L" potentiometer until a reading of 2.5% is achieved.

D. Purge a second dedicated gas sampling bag of all residual gas. Fill the gas sampling bag 3/4 full with a 50% mixture of methane and clamp the bag closed. With the instrument in the HIGH range, remove the clamp from the gas sampling bag and aspirate the 50% methane through the meter and confirm a reading of 50% on the HIGH scale. If necessary, adjust the internal "SPAN-H" potentiometer until a reading of 50% is achieved.

E. Purge the instrument of residual gas with fresh air.

F. The instrument is now calibrated and ready for use.

NOTE: The use of the mini-pump, in place of the aspirator bulb, is preferred for calibration, as it provides a constant draw of gas through the instrument during calibration.

FILAMENT REPLACEMENT

As previously mentioned, prolonged sampling of high gas concentrations while in the LOW range, or introduction of moisture into the internal workings of the instrument, may damage or destroy the internal filament assembly. Faulty instrument performance in calibration and/or sampling signal the need to replace the internal filament assembly.

Two pairs of filaments are used in the Model NP-204: catalytic filaments for the LOW range, and thermal conductance filaments for the high range. Each pair consists of an active or measuring filament and a reference or compensating filament. The active and reference catalytic elements and the active thermal element are all housed within a sintered bronze, porous metal cup, which acts as a flame arrester to retain explosions when sampling explosive gas/air mixtures. The flame arrester is installed within a cavity in the instrument housing, so that a sample drawing into the instrument will pass through the flame arrester and reach the elements. The reference thermal element is mounted outside the flame arrester so that when installed in the instrument, it is enclosed in an isolated cavity and does not encounter the sample.

All four elements and the flame arrester are permanently assembled onto an anodized aluminum plate with holes in each corner, allowing them to be retained within the instrument by means of four screws. Short wires with lugs are provided to connect the elements and flame arrester to the terminals on the circuit board. The wires and terminals are color-coded for proper connection.

The entire filament/flame arrester assembly must be replaced as a unit if any portion becomes defective or damaged. To replace:

1. Loosen the two panel hold-down screws; remove and invert top panel.

2. Loosen (do not remove) the six screws holding the terminals (T1-16) to the colored lead wires. Pull wires from terminals.

3. Remove four screws, one in each corner of plate.

4. Remove complete plate and filament/flame arrester assembly. Inspect cavity and gasket and be sure that cavity and incoming passage is clear and dry.

5. Install new filament/flame arrester in same position with gasket in place.

6. Connect lead wires to corresponding color-coded terminals and fasten screws securely. Be sure to observe color coding. Note that there are two red wires, T_2 or T_6, that is most readily accessible.

CAUTION: While handling the new assembly, be very careful not to touch or otherwise damage the exposed thermal reference filament. Line it up carefully with cavity in panel before pushing the assembly into position.

SAMPLING OF RICH MIXTURES

When using the LOW range, gas concentrations greater than 5% will liberate considerable heat on the filament. This heat can damage and thus shorten the life of the filament. Therefore, sustained testing of samples containing gas concentrations greater than 5% should be avoided when the meter is in the LOW range. Rather, this testing should be conducted with the meter in the HIGH range. When sampling rich mixtures using the LOW range, the following instrument reaction can be expected:

1. Mixtures up to 5% (lower explosive limit) methane will read directly on the LOW scale.

2. Mixtures between 5% and 15% (upper explosive limit) methane will read beyond full scale.

3. Mixtures greater than 15% methane will initially read beyond full scale, then subsequently come back down on, or below scale - depending upon gas concentration. Extremely rich mixtures will yield a zero or negative reading.

D. Oxygen Deficient Mixtures

Samples which do not have the normal proportion of oxygen may tend to read low on the % LEL range, if there is not enough oxygen to react with all combustible gas present in the sample As a general rule, samples containing 10% oxygen or more have enough oxygen to give a full reading on any combustible gas sample up to the L.E.L.

Oxygen deficiency does not affect the % GAS range, since it does not depend on oxidation or combustion, but only on the cooling effect of the gas.

Instruments for measurement of oxygen concentration are available from Gas Tech Inc.

E. Oxygen - Enriched Mixtures

Samples having more than the normal proportion of oxygen will give a normal reading. However, they should be avoided because the flame arrestor used is not dense enough to arrest flames from combustible gas in oxygen, which can be much more intense than those in air. DO NOT ATTEMPT TO USE THE MODEL NP-204 ON SAMPLES OF COMBUSTIBLE GAS IN OXYGEN.

VII. ACCESSORIES

A. Probe

The standard probe supplied with the NP-204 is a 30" aluminum probe with holes cross-drilled 4" from the end, to prevent water from being drawn in if the end of probe is inadvertently immersed.

Other probes are available including a 30" fiberglass probe for electrical insulation, and a short (10") probe which is convenient in leak checking around meters and in confined spaces,

B. Extension Hoses

Additional lengths of hose may be used, up to approximately 5 for sampling from deep tanks and manholes. The polyethylene-lined hoses (80-0015 and 80-0025, see parts list) are satisfactory for most samples including natural gas, hydrogen, propane, and gasoline vapors. Some of the more complex hydrocarbons such as xylene and styrene, tend to be adsorbed on the walls of the polyethylene hose. For these samples, consult factory for the most appropriate hose selection.

C. Moisture Trap

Where there is danger of water being drawn into instrument, a moisture trap should be used. This glass-bodied trap with sintered metal filter couples to indicator inlet and will collect water that is drawn into or condensed in sample hose. Inspect trap periodically while in use, and empty or clean bowl and filter whenever visible water or dust accumulate. Regular sample hoses connect to inlet of trap when it is installed on instrument. Order stock No. 80-0200.

D. Calibration Test Kit

Dependable results from any gas indicator are best assured by frequent tests for response. The Calibration Test Kit provides a convenient means for making such tests. It consists of two cylinders of compressed gas-air mixture, a control valve and a hose for coupling valve to indicator, all stored in a convenien carrying case. Gas cylinders are filled with a mixture of 2.5% natural gas in air, which should produce a reading of 60 on the indicator scale. Natural gas (primarily methane) is used because this is the most critical material for catalytic activity on a platinum filament. If the instrument gives a normal response on natural gas, it will also give a normal response to all other combustible gases and vapors. To make a respons test, first turn on and adjust the indicator to zero in the normal way. Couple control valve and hose to cylinder, and connect hose to indicator. Open control valve slowly and watch meter reading carefully, noting maximum reading. Normal reading should be between 55 and 70; if it is not, recalibrate indicator to a reading corresponding to that marked on cylinder (about 60).

Order Stock No. 81-0202.

E. Storage Case

A durable plastic storage case with carrying handle is availabl for the NP-204. Case is padded with foam for protection, and includes space for probe, hose, charger, moisture trap, spare filaments, spare batteries and other parts and accessories.

Order Stock No. 20-0201.

VIII. PARTS LIST

The following parts are considered as normal repair or replacement items or accessories, and may be ordered separately, by description and stock number. Always specify model and serial number of instrument for which parts and accessories are required. For problems with parts not listed, write or telephone GasTech for information or request shipping instructions for return of the instrument for repair.

Stock No.	Description
51-0101	Lamp, meter illuminating
49-2011	Charger for NP-204, 120/240 volts AC
49-1201	Battery, alkaline, size D
49-1501	Battery, nickel-cadmium, size D
30-0410	Aspirator bulb with tube
80-0150	Probe with filter, 10" plastic
80-0155	Probe with filter, 30" aluminum
80-0156	Probe with filter, 30" fiberglass
80-0003	Hose, 3', Polyethylene, complete with couplings
80-0002	Hose, 6', Teflon-lined, complete with couplings
80-0015	Hose, 15', polyethylene-lined, complete with couplings
80-0025	Hose, 25' polyethylene-lined, complete with couplings
33-1031	Filter element, cotton, pkg. of 24
80-0200	Moisture trap, attachment
81-0202	Calibration Test Kit, 2.5% natural gas
81-0012	Cylinder, replacement, 2.5% natural gas
20-0201	Storage case, Model NP-204
62-0106	Filament/flame arrestor assembly, including cata and thermal conductivity filaments, wired and ready for installation

CALIBRATION - MODEL GP-204/5

TYPICAL GASES & VAPORS

GAS	LEL (VOLUME PERCENT)	CURVE NO.
METHANE	5.0	2
HYDROGEN	4.1	2
PROPANE	2.2	3
TOLUENE	1.2	4
NATURAL GAS	4.7	1

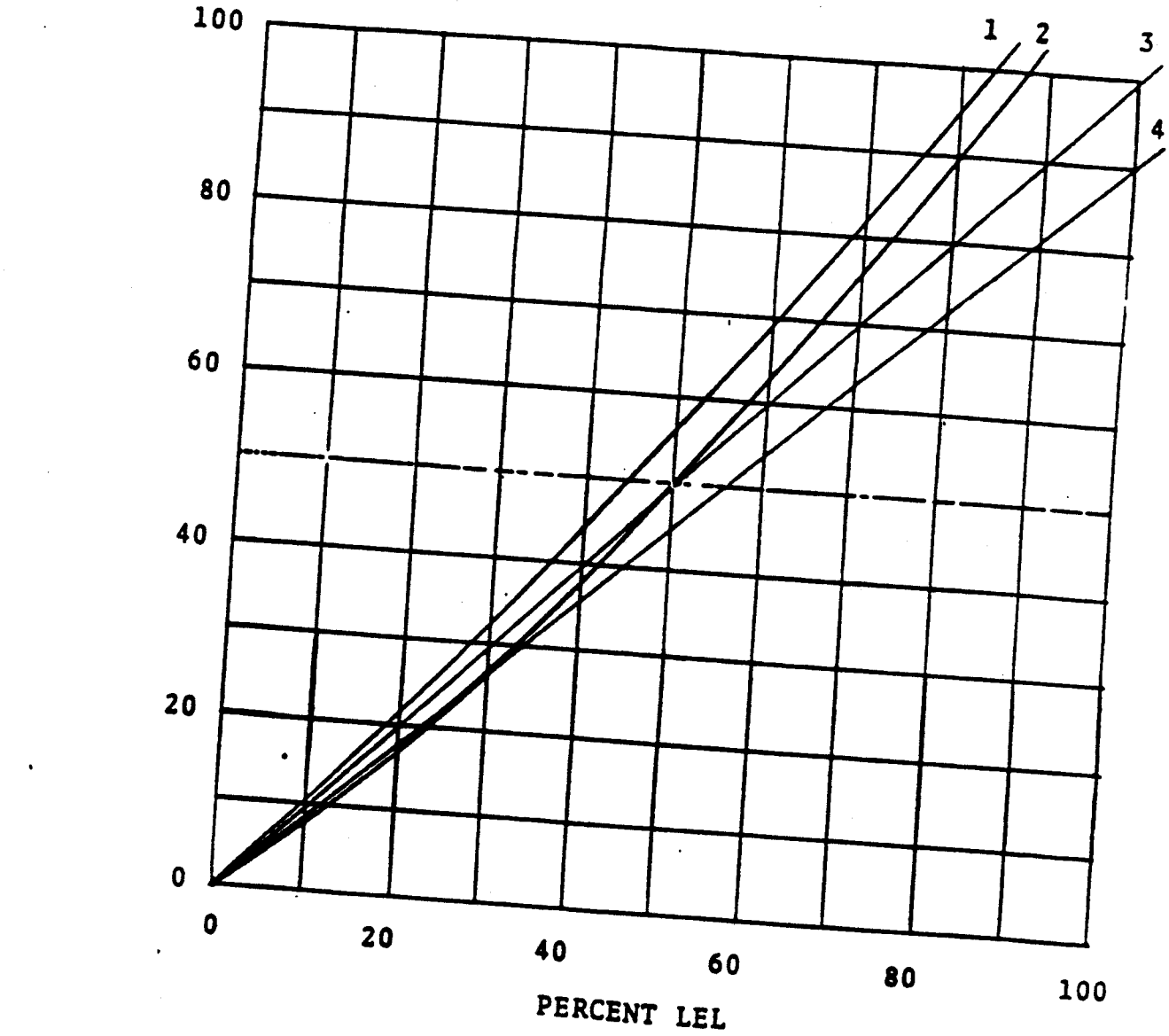
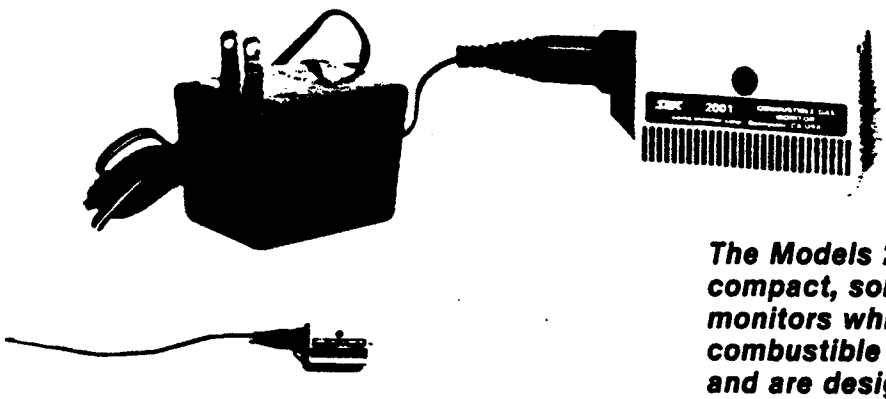


FIGURE 1
8.10.72

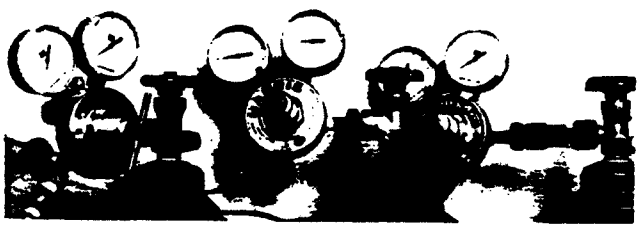
SIERRA MODEL 2001
COMBUSTIBLE GAS MONITOR

sierra monitor corporation

Combustible Gas Monitors



The Models 2001 and 2002 are compact, solid-state stationary monitors which detect all combustible gases and vapors, and are designed for continuous, full-time operation anywhere area monitoring is required.



An alarm sounds when the concentration of gas exceeds the factory-set (and user-adjustable) level. Simultaneously, the monitor produces an alarm output signal that may be used to activate a remote alarm, fan or process controller.

A green LED (light-emitting diode) indicator on the monitor shows that power is connected.

The Models 2001 and 2002 are designed for instrinsically safe operation in the presence of flammable gases or vapors. The alarm circuit has no sparking contacts, and the maximum available input power from the AC/DC converter is 9 volts DC and 200 mA.

Acetone, Acetylene, Benzene, Butane, Carbon Monoxide, Dioxane, Ethane, Ethanol, Ethyl Ether, Ethylene Oxide, Gasoline, Hydrogen, Isopropanol, Jet Fuels, Kerosene, Methane, Methanol, Methyl Ethyl Ketone, Natural Gas, Propane, Toluene, Xylene,...to name a few.

A solid-state semiconductor-type sensor and associated electronic circuitry ensure trouble-free, long-term operation. There are no pumps, filters, or chemical cells to replace or maintain. Except for periodic calibration to verify the alarm setting, no attention is required after installation. The user may set the alarm level to any point within the specified range by turning an externally accessible potentiometer with a jeweler's screwdriver.

Should the sensor fail (open circuit), a sensor self-check feature ensures that the monitor will sound an interrupted tone as a warning and its LED will flash on and off.

A 5 volt, 25 mA TTL-compatible output signal is produced by the monitor for activating *or* de-activating remote devices such as horns, fans, solenoid valves, process controllers, etc. Depending upon the pins selected on the cable connector, it is possible to have either a continuous output signal *except* during the alarm, or a signal only *during* the alarm (Normally ON or Normally OFF). This output signal may be transmitted hundreds of meters via a properly shielded cable.

Mines, manholes, tanks, silos, sewers, fuel and solvent storage areas, natural gas fields, pipelines, pump rooms, garages and vehicle maintenance facilities, refineries, LPG-LNG plants, utilities, sewage treatment plants, laboratories, construction tunnels, chemical and metal refining plants, semiconductor wafer-fab and Epi processes.

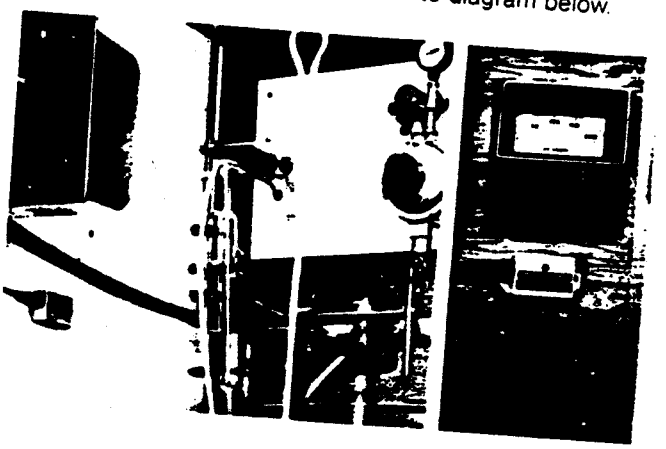
All of the electronic circuitry needed to operate the monitors, except for the DC input power, is contained in a lightweight unit (56 grams) no larger than 10 x 5 x 2.7 cm (4 x 2 x 1 inches). It may be mounted in any orientation on a wall or other surface using either the adhesive strip or screws provided.

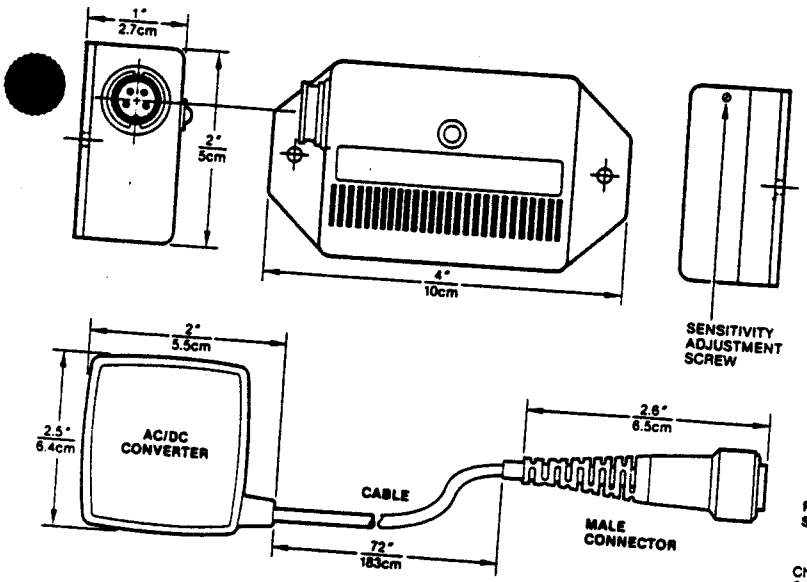
For a single-monitor installation and a local alarm, the accompanying AC-to-DC power supply may be plugged into a standard AC source, and its cable connected to the monitor. No tools are required. CAUTION: The AC/DC power supply is not considered intrinsically safe for use in areas where high concentrations of flammable gases may be present.

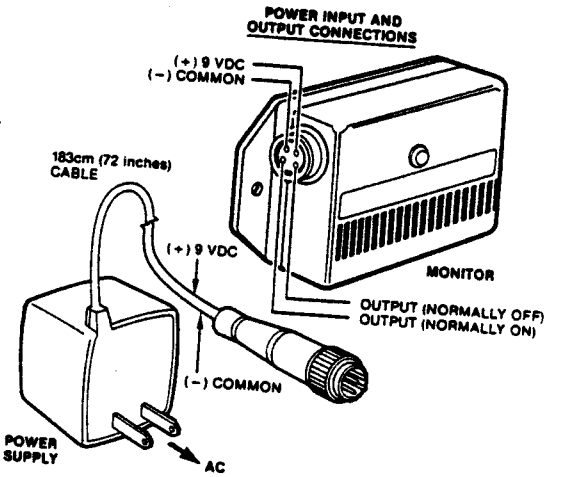
If a remote alarm is desired, SMC's Model 2101 Remote Alarm/Power Supply can be connected up to 100 meters (328 feet) away from the monitors. For multipoint monitoring, the SMC Model 2200 Central Alarm Panel will power one to ten monitors up to 100 meters away.

The Models 2001 and 2002 are warranted against defects in workmanship and materials for one year from the date of shipment, when installed in accordance with instructions.

INDICATORS	
Visual:	Green LED for Monitor "ON"
Audio:	Interrupted test tone at warm-up (30–60 seconds). Sustained alarm tone for as long as gas is present. Interrupted (ON/OFF) tone for sensor failure.
SENSOR TYPE	Solid-State Metal Oxide Semiconductor
RANGE	
Hydrogen, ppm	2001: 300–2,000
Methane, ppm	2002: 20–500 / 25–2000
RESPONSE TIME	Less than 30 seconds
PERIODIC MAINTENANCE, REPLACEMENTS	None, other than routine calibration
OPERATING TEMPERATURE RANGE	+5 °C to +35 °C (+41 °F to +95 °F)
INPUT	120 VAC/60 Hz, converted to 9 VDC, 200 mA
OUTPUT	Nominal 5 volts DC, TTL-compatible, will source 5 mA or sink 1.6 mA; Normally ON or Normally OFF signal.
CONNECTIONS	a) Power Supply to AC outlet b) 9 VDC Power Supply to Monitor (Supplied with Model 2003): DIN (Audio), 4-pin connector.
ENCLOSURE MATERIAL	Polystyrene
DIMENSIONS	Refer to diagram below.







Choice of 5 Volt DC output signal is obtained by connecting additional wire to COMMON, and one to desired 5 Volt signal:
Normally ON: 5 VDC, 60 mA available, *except* during Alarm, for fail-safe applications.
Normally OFF: 5 VDC, 60 mA available only during Alarm.

REPRESENTED BY:

CALL OR WRITE TODAY FOR MORE INFORMATION

sierra monitor corporation
1991 Tarob Court
Milpitas, CA 95035 USA ***(408) 262-6611***

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INSTRUCTION MANUAL

IM02/0983

COMBUSTIBLE GAS MONITOR

MODEL 2001

SMC

sierra monitor corporation

1050K East Duane Ave, Sunnyvale, CA 94086

S/N 11236

SMC INSTRUCTION MANUAL

INSTALLATION AND OPERATION INSTRUCTIONS

COMBUSTIBLE GAS MONITORS

Models 2001 and 2002

I. DESCRIPTION AND FUNCTION

The Models 2001 and 2002 are continuous-duty, stationary monitors which detect combustible gases and vapors. The sensors on these monitors will detect toxic gases such as carbon monoxide and hydrogen sulfide. However, hydrogen sulfide will trigger the alarm at a concentration of only 4% of that required for methane, while carbon monoxide and methane require nearly equal concentrations. (See Appendix B).

A. Major Components

1. Power Supply: Consists of plug-in transformer and 183 cm (72 inches) of two-conductor cable, which is connected to the terminal strip on the monitor electronics board.

Input: 105 -130 VAC, 60Hz Output: 9VDC, 250mA

2. Monitor: 10 X 5 X 2.5 cm enclosure includes solid-state sensor, internal alarm range-adjust screw, and associated circuitry. Refer to block diagrams for Models 2001 and 2002 in Appendix C.

Input:	9 Volts DC, 250 mA
Alarm Output:	TTL-compatible and can supply 60mA into a 50-ohm load, or sink 1.6mA from a 5-volt source.

B. THE SENSOR

The sensor used in the Models 2001 and 2002 is a sintered n-type metal-oxide semiconductor, the conductivity of which increases in the presence of combustible gases (methane, hydrogen, etc.) and organic solvent vapors. Classes of compounds which can be detected are:

Hydrocarbons and derivatives
Halogenated hydrocarbons
Alcohols
Ethers

See Appendix A for a partial list of gases and vapors detected. This sensor is designed to operate for years without failure, and it is not as prone to "poisoning" by silicones and halogen gases as a sensor which depends upon catalytic combustion (Platinum-wire sensors).

The sensor operating temperature is maintained at about 450°C for maximum sensitivity. This is well below the 585°C autoignition temperature of hydrogen. (Note: Most catalytic-type sensors operate at approximately 800°C.) The sensor dissipates less than 1 Watt of power.

C. Alarms

Three alarm conditions are possible on the monitor:

1. Interrupted (On/Off) test tone when power is first connected to the monitor, followed by 30-60 seconds of sustained (continuous) tone.

2. Sustained alarm tone indicating presence of gas at a concentration at or above the pre-set threshold. The source of the gas or vapor must be determined immediately and the situation corrected.

3. Interrupted (On/Off) tone after unit has been in operation, indicating a sensor failure. Take the monitor out of service and replace the sensor.

IF THE MONITOR MALFUNCTIONS . . . The suspect unit should be returned to Sierra Monitor Corporation directly, or via Sierra's authorized distributor, with an accompanying explanation. Sierra will repair or replace units under warranty. Sierra will recommend repair or replacement for units out of warranty.

D. Outputs

TTL-compatible outputs are provided to activate remote alarms or other electrical devices such as fans, relays, and valves.

1. The electrical configuration of the terminal strip on the monitor electronics board is shown in Figure 1. The ALARM signal can be connected by wiring to the COMMON (Pin 3) and the NORMALLY OFF (Pin 4) terminals. The SAFE signal can be connected by wiring to the COMMON (Pin 3) and the NORMALLY ON (Pin 1)terminals.

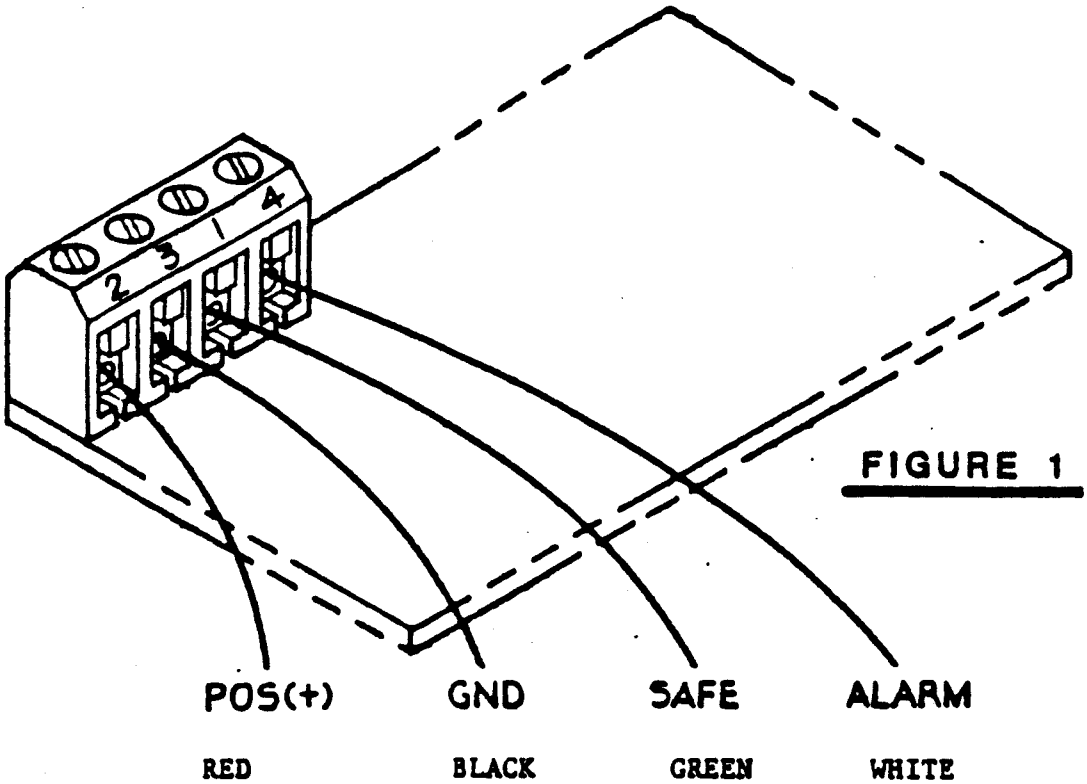


FIGURE 1

(NOTE: These signals should be used only to activate external relays and not for direct operation of other equipment. This type of work should be referred to a qualified electronic technician. (See Figure 2.)

2. The audible and electronic alarm outputs are non-latching. As soon as the gas concentration falls below the alarm set-point, the alarm will stop and the alarm output will fall immediately to zero. Accordingly, to operate an exhaust fan, for example, it will be advisable to include provision in the external circuit for time-delay or "latching", so that the fan will remain on for a required minimum time period.

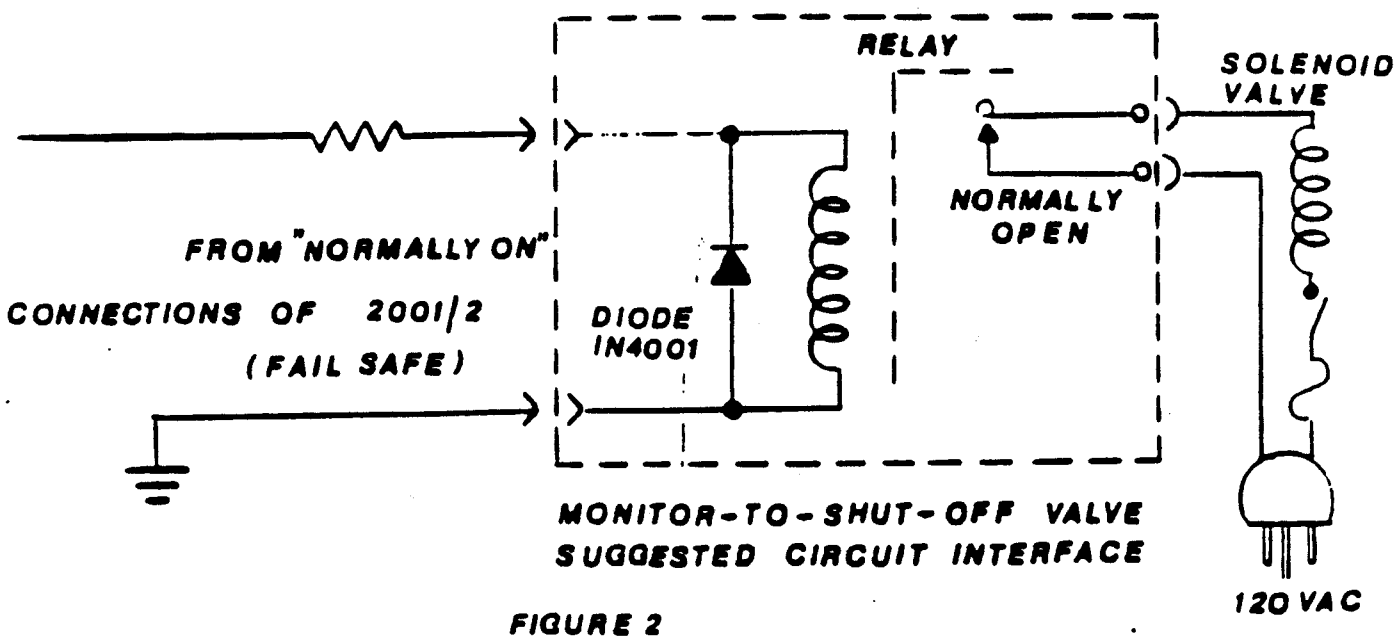


FIGURE 2

II. INSTALLATION

A. Monitors which are intended for use with the plug-in AC/DC power supply are shipped with the power supply connected to the monitor.

If, for installation puposes, the power supply must be disconnected remove the cover* and disconnect the power cord from the terminal strip. Reconnect in the same configuration.

B. Plug power supply into a standard 120-Volt AC outlet.

The monitor will sound an alarm during an initial warm-up period of less than two minutes. Both the [illegible] and red LEDs on the monitor will be on during this time. When [illegible] up is completed, the audible alarm will cease and the red LED will turn off.

If alarm continues beyond two minutes, there is likely a threshold of combustible gas in the area already. Move the monitor to another area and repeat steps A and B. If the alarm ceases after two minutes, check previous area for source of combustible gas. If it continues, and the area is known to be gas-free, the monitor is out of calibration.

C. Mount the monitor in the desired location using the adhesive backing, or with screws through the mounting flanges.

Many combustible gases are heavier than air. Install the monitor where combustible gas is most likely to collect, and in the areas of potential leaks.

* COVER REMOVAL: Remove the two cover retaining screws from each side of the cover and gently pull the cover forward 1/2" and turn to the right. The LEDs will remain in the cover attached by three wires.

III. CALIBRATION

A. Factory Calibration

The Model 2001 is factory calibrated to alarm at 1,000 ppm Methane 50% RH.

The Model 2002 is factory calibrated to alarm at 50 ppm Methane 50% RH.

B. User Calibration

1. Frequency: It is recommended that the calibration of each monitor be verified monthly. More frequent checks are necessary during periods of extreme humidity and temperature changes.

The Monitor should have operated continuously (uninterrupted) for at least 6 days prior to

a. verifying the factory set-point for methane, or

b. calibrating to another gas of known concentration.

2. As shown on the table of Appendix B, many gases or vapors will trigger the alarm at lower concentrations than the equivalent settings for methane. We recommend, however, that calibration be performed with actual gas you desire to detect.

For example: A factory-calibrated alarm set-point for 1000 ppm methane in air is equivalent to approximately 300 ppm hydrogen in air, e.g., the monitor is more sensitive to hydrogen than to methane.

NOTE: For optimum accuracy, use a calibration gas mixed with air, rather than with an inert gas like nitrogen; since the monitor was factory-calibrated in this manner and the actual ambient gases detected will be mixed with air.

3. Remove the cover and, with the monitor in operation, expose the sensor to a sample of calibration gas.

a. The sensor is located in the lower right hand corner on the lower edge of the electronics board.

b. Apply the calibration gas slowly at a pressure barely exceeding atmospheric. Do not flood the monitor with a stream of gas, as this will cool down the sensor and alter the sensor's characteristics.

The objective is to calibrate under conditions closely approximating an actual gas episode. It is unlikely that a leaking stream of gas will center itself directly upon the sensor.

c. If the monitor alarms, this means the monitor set point is either at the desired calibration threshold, or the monitor alarm setting is too sensitive.

Locate the calibration set-screw marked with the white dot. Use a jeweler's screwdriver to turn the screw slowly CLOCKWISE until the alarm just stops, all the while continuing to apply calibration gas to the sensor.

Then turn set-screw slightly COUNTERCLOCKWISE until the alarm sounds again. This will ensure that the desired alarm set-point has been achieved.

d. If the monitor fails to alarm, the monitor is likely set for a higher concentration than the calibration gas being used. While applying the calibration gas turn the set-screw slowly COUNTERCLOCKWISE until the alarm sounds. Remove the gas and check that the alarm stops within several seconds. Repeat the application of gas to confirm the calibration.

APPENDIX A

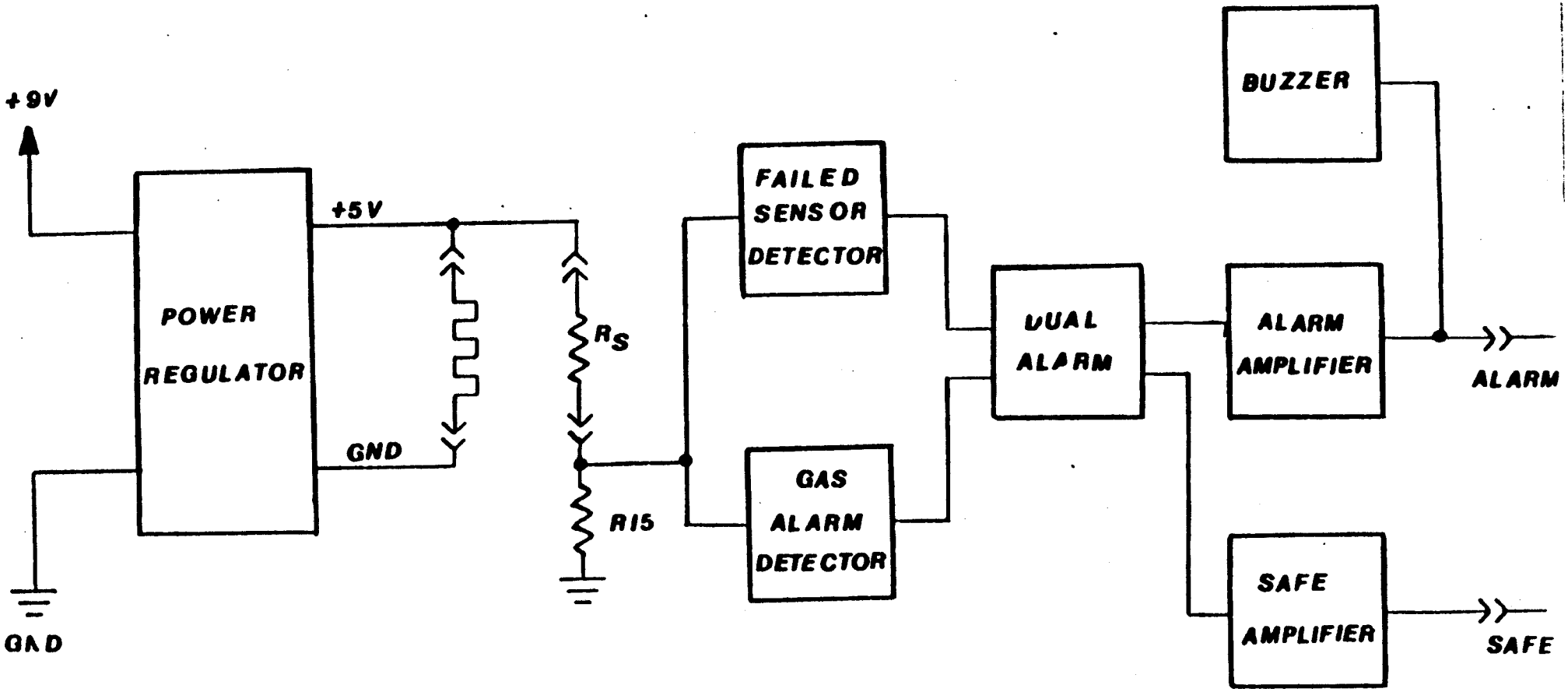
TYPICAL GASES AND VAPORS DETECTED BY THE MODELS 2001 AND 2002

GASES		VAPORS
ACETONE	C_3H_6O	DIESEL FUEL
ACETYLENE	C_2H_2	GASOLINE, JET FUELS
AMMONIA	NH_3	KEROSENE
BENZENE	C_6H_6	NATURAL GAS
BUTANE	C_4H_{10}	
CARBON MONOXIDE	CO	
CHLORINE	Cl_2	
DIOXANE	$C_4H_8O_2$	
ETHANE	C_2H_6	
ETHANOL	C_2H_5OH	
ETHYL ETHER	$C_4H_{10}O$	
ETHYLENE OXIDE	C_2H_4O	
HYDROGEN	H_2	
ISOPROPANOL	C_3H_7OH	
METHANE	CH_4	
METHANOL	CH_3OH	
METHYL ETHYL KETONE	$CH_3COC_2H_5$	
PROPANE	C_3H_8	
TOLUENE	C_7H_8	
XYLENE	C_8H_{10}	

APPENDIX B

APPROXIMATE CONCENTRATIONS (ppm) TO TRIGGER MODEL 2001 ALARM FOR SELECTED GASES, FOR FACTORY SETTINGS OF 500 AND 1000 ppm METHANE, 65% RH:

Methane	CH_4	500	1000
Isobutane	C_4H_{10}	<200	300
Propane	C_3H_8	250	550
Hydrogen	H_2	200	300
Carbon Monoxide	CO	400	1000
Hydrogen Sulfide	H_2S	20	40
Carbon Dioxide	CO_2	>10,000	>10,000
Sulfur Dioxide	SO_2	3	7
Benzene	C_6H_6	1,000	2,500
Chlorine	Cl_2	>50	>50
Freon 12	CCl_2F_2	1800	4000
Methanol	CH_3OH	200	450


+9V
POWER
REGULATOR
+5V
GND
GND
Rs
R15
FAILED
SENSOR
DETECTOR
GAS
ALARM
DETECTOR
DUAL
ALARM
BUZZER
ALARM
AMPLIFIER
ALARM
SAFE
AMPLIFIER
SAFE

SIERRA MONITOR CORPORATION

*** SPECIAL INSTRUCTIONS ***

ELECTRICAL ADJUSTMENTS AND CALIBRATION FOR GAS MONITOR SERIES 200X AND 20X

NOTICE: Gas monitors in the series 200X and 20X are typically used in applications where a single point alarm is required and where the specific concentration of the gas is a less critical factor than the fact that gas exists at all. These instructions are provided to assist users in a.) understanding the monitor function, b.) performing minor installation troubleshooting, and c.) adjusting the calibration of the monitor to approximately the required level without the use of calibration gas.

1. THEORY OF OPERATION: The gas sensor is a resistive surface which, when maintained at a specific temperature, will reduce its resistance when it comes in contact with any combustible gas. The manufacturer increases the sensitivity to certain gases and decreases the sensitivity to others by the electronic design.

The sensor is installed in a voltage divider circuit so that a voltage change can be detected when the sensor resistance changes. The resulting voltage is monitored by two comparators, one of which compares to a very low voltage to monitor for a sensor failure and the other compares to a higher voltage (U1-2) to determine if gas is present.

During calibration the amount of change which will occur due to a certain concentration of gas is determined and the voltage is set so that it remains lower than the reference voltage until gas is detected. When gas is detected the comparator output goes high causing an alarm circuit to turn on so that visual and audible alarms occur.

If the calibration adjustment is wrong or if the sensor resistance changes to very high (or open), the resulting voltage at the divider will approach zero and the failed sensor comparator will turn on to cause an oscillating alarm (green/red/green).

The terminal strip where the DC voltage (usually 9 to 14 VDC) is connected contains a "safe" and an "alarm" connection. During an alarm the "alarm" connection goes High (approx 4.5 VDC) and the "safe" connection goes Low (0 VDC). During safe conditions the reverse occurs.

2. CALIBRATION:

Connect a voltmeter across test points 3 and 4 as indicated in the board diagram (FIG 1). The following are the voltage ranges and the correct system status.

VOLTAGE READING	SYSTEM STATUS
0 VDC TO .20 VDC	FLASHING RED/GREEN/RED/GREEN
.200 VDC TO 2.5 VDC	SYSTEM SAFE - GREEN LIGHT ON
2.5 VDC TO 4.5 VDC	ALARM - AUDIO & RED LIGHT ON

(The 2.5 VDC reference is approximate and may be higher in hot conditions and lower in cold conditions.)

(If the system is not in the condition stated for the particular voltage there is wiring or equipment failure and the trouble shooting section of this instruction should be followed prior to adjustment of the calibration.)

If the calibration adjustment is being made with no gas present adjust the Potentiometer (see board diagram) so that the voltage is less than 2.5 VDC and check that the alarm is off. For standard factory calibration, the correct voltage will be as follows.

	2001/201	2003/203	2006/206
GAS	Methane	H2S	CO
CONCENTRATION	1000 ppm	50 ppm	100 ppm
VOLTAGE	1.25 VDC	1.00 VDC	1.75 VDC

When the customer has specified the gas and concentration at which an alarm is required (other than the above mentioned), we have completed the section below with our recommended voltage setting.

GAS CH4
CONCENTRATION 10000 PPM
VOLTAGE SETTING .300 VDC

After the setting has been made, apply some gas (from a cigarette lighter or other source) to the sensor to see that the voltage rises above 2.5 VDC and that the alarm turns on.

3. TROUBLESHOOTING

To check the set-up of the monitor leave the ground of the meter connected to Test Point 3 and inspect for the following:

a.) Voltage at connector (logical) position 1 (marked 2) = 8 to 14 VDC. If not, check that wiring is correct and that power supply is connected to 120 VAC.

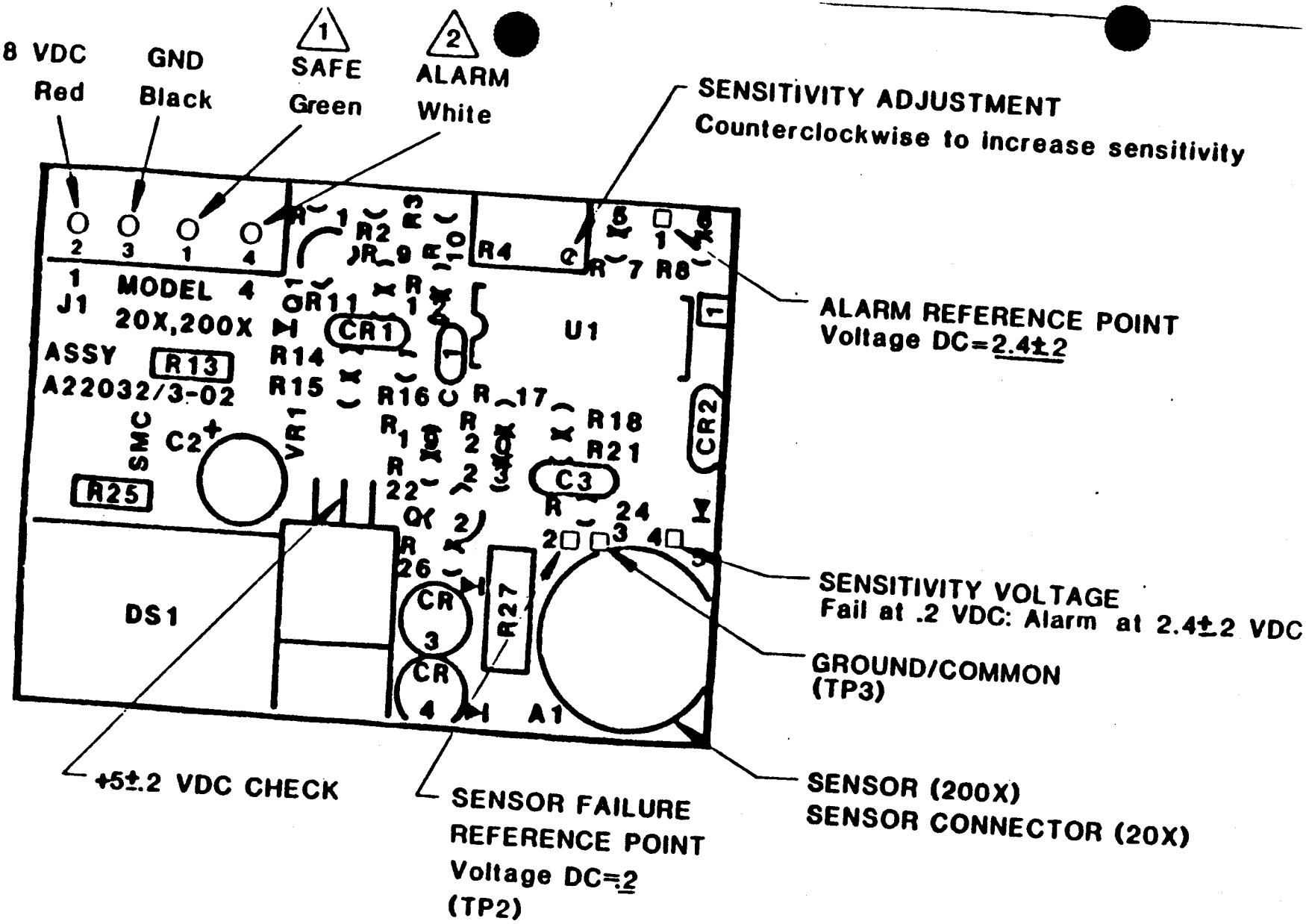
b.) Voltage at connector (logical) position 2 (marked 3) = 0. If not check, that wiring is correct and that meter is correctly grounded to Test Point.

c.) Voltage at Pin 4 of U1 = 5.0 VDC. (+/- .2 VDC).

d.) Voltage at Pin 9 of U1 = 2.5 VDC. (+/- .5). If not, monitor is faulty.

e.) With green light ON: Voltage at connector (logical) position 3 (marked 1) > 3.0 VDC and at position 4 = 0. If not disconnect any wiring which has been installed to these points and measure again.

f.) With red light ON: Voltage at connector position 4 > 3.0 VDC and at (logical) position 3 0. If not remove any wiring which has been installed to these points and measure again.



1 When in SAFE condition, voltage DC=+3.4±5

2 When in ALARM condition, voltage +5±2

SMC sierra monitor corporation

MODELS 20X / 200X
Sensor Bd. Layout
&Test Point Locations

A

SIERRA MONITOR CORPORATION

*** SPECIAL INSTRUCTIONS ***

ELECTRICAL ADJUSTMENTS AND CALIBRATION FOR GAS MONITOR SERIES 200X AND 20X

NOTICE: Gas monitors in the series 200X and 20X are typically used in applications where a single point alarm is required and where the specific concentration of the gas is a less critical factor than the fact that gas exists at all. These instructions are provided to assist users in a.) understanding the monitor function, b.) performing minor installation troubleshooting, and c.) adjusting the calibration of the monitor to approximately the required level without the use of calibration gas.

1. THEORY OF OPERATION: The gas sensor is a resistive surface which, when maintained at a specific temperature, will reduce its resistance when it comes in contact with any combustible gas. The manufacturer increases the sensitivity to certain gases and decreases the sensitivity to others by the electronic design.

The sensor is installed in a voltage divider circuit so that a voltage change can be detected when the sensor resistance changes. The resulting voltage is monitored by two comparators, one of which compares to a very low voltage to monitor for a sensor failure and the other compares to a higher voltage (U1-2) to determine if gas is present.

During calibration the amount of change which will occur due to a certain concentration of gas is determined and the voltage is set so that it remains lower than the reference voltage until gas is detected. When gas is detected the comparator output goes high causing an alarm circuit to turn on so that visual and audible alarms occur.

If the calibration adjustment is wrong or if the sensor resistance changes to very high (or open), the resulting voltage at the divider will approach zero and the failed sensor comparator will turn on to cause an oscillating alarm (green/red/green).

The terminal strip where the DC voltage (usually 9 to 14 VDC) is connected contains a "safe" and an "alarm" connection. During an alarm the "alarm" connection goes High (approx 4.5 VDC) and the "safe" connection goes Low (0 VDC). During safe conditions the reverse occurs.

2. CALIBRATION:

Connect a voltmeter across test points 3 and 4 as indicated in the board diagram (FIG 1). The following are the voltage ranges and the correct system status.

VOLTAGE READING	SYSTEM STATUS
0 VDC TO .20 VDC	FLASHING RED/GREEN/RED/GREEN
.200 VDC TO 2.5 VDC	SYSTEM SAFE - GREEN LIGHT ON
2.5 VDC TO 4.5 VDC	ALARM - AUDIO & RED LIGHT ON

(The 2.5 VDC reference is approximate and may be higher in hot conditions and lower in cold conditions.)

(If the system is not in the condition stated for the particular voltage there is a wiring or equipment failure and the trouble shooting section of this instruction should be followed prior to adjustment of the calibration.)

If the calibration adjustment is being made with no gas present adjust the Potentiometer (see board diagram) so that the voltage is less than 2.5 VDC and check that the alarm is off. For standard factory calibration, the correct voltage will be as follows.

	2001/201	2003/203	2006/206
GAS	Methane	H2S	CO
CONCENTRATION	1000 ppm	50 ppm	100 ppm
VOLTAGE	1.25 VDC	1.00 VDC	1.75 VDC

When the customer has specified the gas and concentration at which an alarm is required (other than the above mentioned), we have completed the section below with our recommended voltage setting.

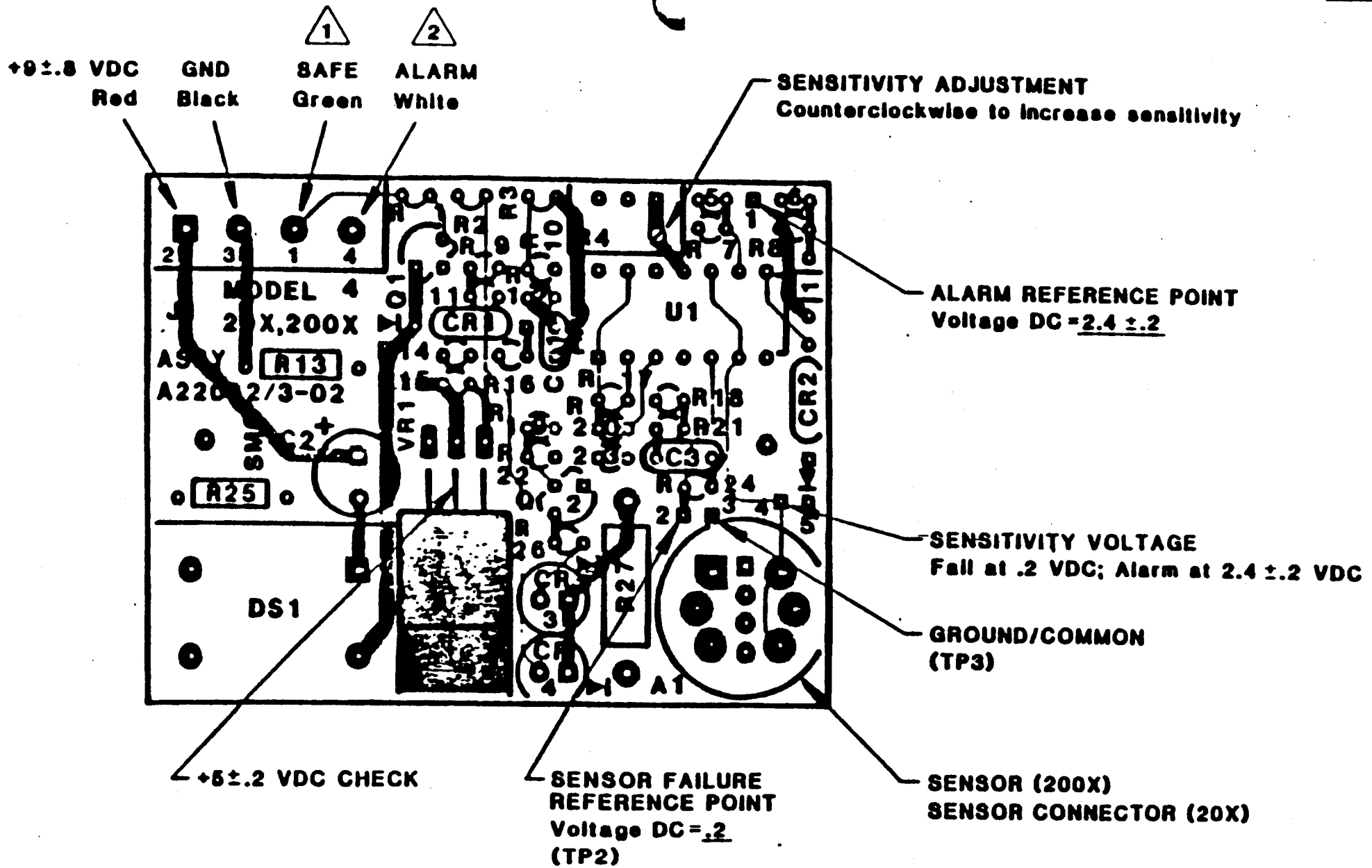
GAS CH4
CONCENTRATION 10000 PPM
VOLTAGE SETTING .80 VDC
S/N 11173

After the setting has been made, apply some gas (from a cigarette lighter or other source) to the sensor to see that the voltage rises above 2.5 VDC and that the alarm turns on.

3. TROUBLESHOOTING

To check the set-up of the monitor leave the ground of the meter connected to Test Point 3 and inspect for the following:

a.) Voltage at connector (logical) position 1 (marked 2) = 8 to 14 VDC
If not, check that wiring is correct and
to 120 VAC



1 When in SAFE condition, voltage DC = +3.4 ±.5

2 When in ALARM condition, voltage DC = +5 ±.2

SMC sierra monitor corporation

MODELS 20X/200X
Sensor Bd. Layout
& Test Point Locations

b.) Voltage at connector (logical) position 2 (marked 3) = 0. If not check, that wiring is correct and that meter is correctly grounded to Test Point.

c.) Voltage at Pin 4 of U1 = 5.0 VDC. (+/- .2 VDC).

d.) Voltage at Pin 9 of U1 = 2.5 VDC. (+/- .5). If not, monitor is faulty.

e.) With green light ON: Voltage at connector (logical) position 3 (marked 1) > 3.0 VDC and at position 4 = 0. If not disconnect any wiring which has been installed to these points and measure again.

f.) With red light ON: Voltage at connector position 4 > 3.0 VDC and at (logical) position 3 0. If not remove any wiring which has been installed to these points and measure again.

BARHOLE PLUNGER BAR

BAR HOLE PLUNGER BAR

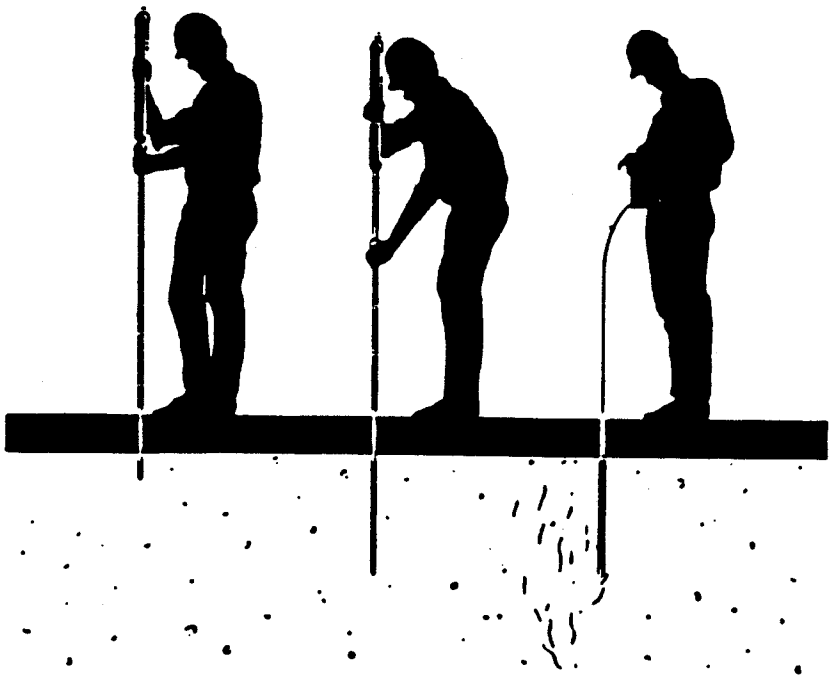
For barhole probing, a plunger bar is required and is available from the following vendors. It is suggested to check delivery time before placing order.

- Heath Consultants
  100 Tosca Drive
  Stoughton, MA 02072
  (617) 344-1400

  ORDER: Heavy Duty Steel Plunger Bar; Insulated 9 lb. Handle and 40" x ½" Rod w/Ball Tip, Model No. 474
  List Price: $67.00

- Engineer Tool Co.
  116 West Main Street
  Lake City, IA 51449
  (712) 464-3591

  ORDER: Deluxe Gas Leak Probe Model No. 50 with 36" Rod, Ball Tip, and Model No. 44 Insulated Handle
  List Price: $59.00



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APPENDIX C

PAINT FILTER LIQUIDS TEST USEPA SW 846 (TEST METHOD 9095)

METHOD 9095

PAINT FILTER LIQUIDS TEST

1.0 SCOPE AND APPLICATION

1.1 This method is used to determine the presence of free liquids in a representative sample of waste.

1.2 The method is used to determine compliance with 40 CFR 264.314 and 265.314.

2.0 SUMMARY OF METHOD

2.1 A predetermined amount of material is placed in a paint filter. If any portion of the material passes through and drops from the filter within the 5-min test period, the material is deemed to contain free liquids.

3.0 INTERFERENCES

3.1 Filter media were observed to separate from the filter cone on exposure to alkaline materials. This development causes no problem if the sample is not disturbed.

4.0 APPARATUS AND MATERIALS

4.1 Conical paint filter: Mesh number 60 (fine meshed size). Available at local paint stores such as Sherwin-Williams and Glidden for an approximate cost of $0.07 each.

4.2 Glass funnel: If the paint filter, with the waste, cannot sustain its weight on the ring stand, then a fluted glass funnel or glass funnel with a mouth large enough to allow at least 1 in. of the filter mesh to protrude should be used to support the filter. The funnel is to be fluted or have a large open mouth in order to support the paint filter yet not interfere with the movement, to the graduated cylinder, of the liquid that passes through the filter mesh.

4.3 Ring stand and ring, or tripod.

4.4 Graduated cylinder or beaker: 100-mL.

5.0 REAGENTS

5.1 None.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

6.1 All samples must be collected according to the directions in Chapter Nine of this manual.

6.2 A 100-mL or 100-g representative sample is required for the test. If it is not possible to obtain a sample of 100 mL or 100 g that is sufficiently representative of the waste, the analyst may use larger size samples in multiples of 100 mL or 100 g, i.e., 200, 300, 400 mL or g. However, when larger samples are used, analysts shall divide the sample into 100-mL or 100-g portions and test each portion separately. If any portion contains free liquids, the entire sample is considered to have free liquids.

7.0 PROCEDURE

7.1 Assemble test apparatus as shown in Figure 1.

7.2 Place sample in the filter. A funnel may be used to provide support for the paint filter.

7.3 Allow sample to drain for 5 min into the graduated cylinder.

7.4 If any portion of the test material collects in the graduated cylinder in the 5-min period, then the material is deemed to contain free liquids for purposes of 40 CFR 264.314 and 265.314.

8.0 QUALITY CONTROL

8.1 Duplicate samples should be analyzed on a routine basis.

9.0 METHOD PERFORMANCE

9.1 No data provided.

10.0 REFERENCES

10.1 None required.

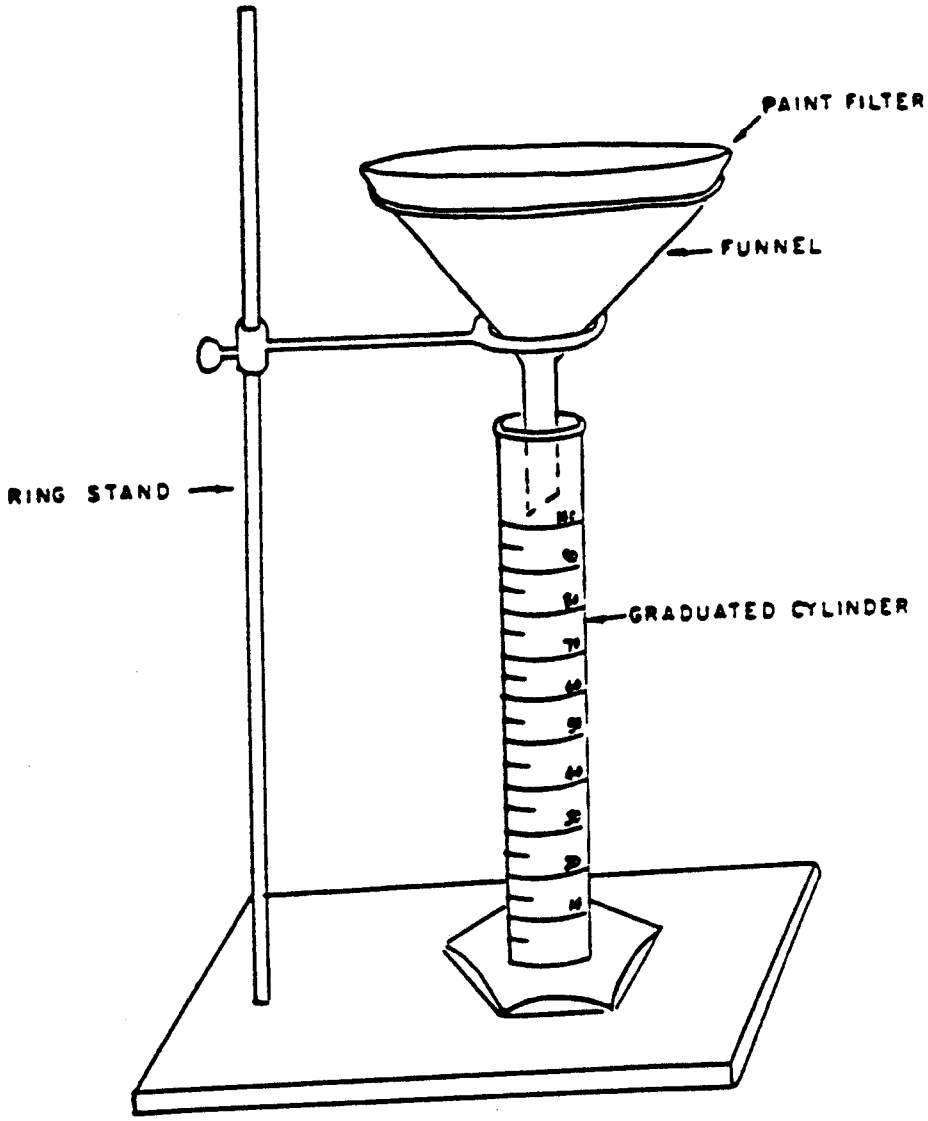
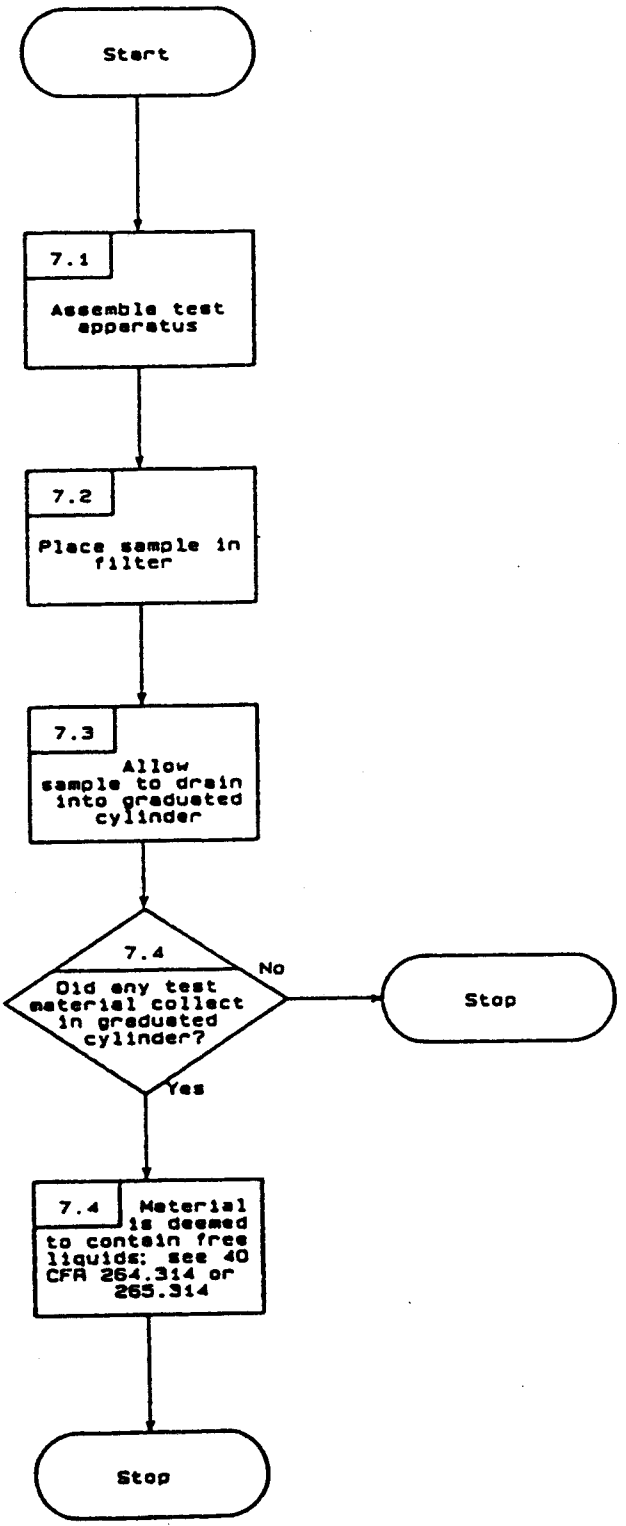


Figure 1. Paint filter test apparatus.


Start
7.1
Assemble test apperatus
7.2
Place sample in filter
7.3
Allow sample to drain into graduated cylinder
7.4
Did any test material collect in graduated cylinder?
No
Stop
Yes
7.4
Material is deemed to contain free liquids: see 40 CFR 264.314 or 265.314
Stop

32-01

CITY OF DURHAM, NORTH CAROLINA

Vicinity Plan

DURHAM

1869

CITY OF MEDICINE

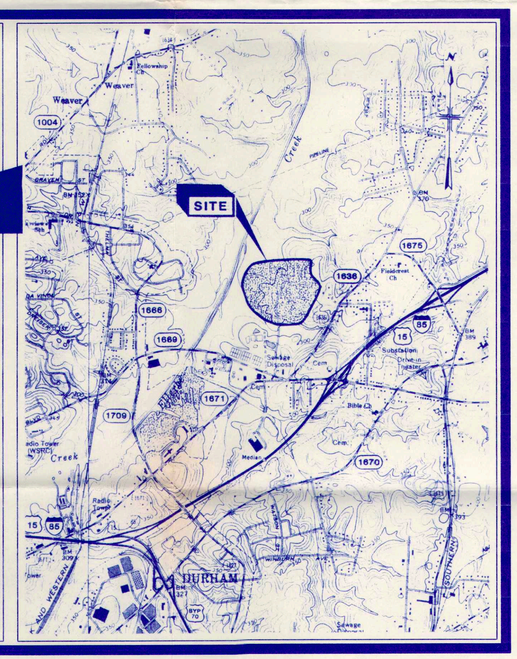
SANITARY LANDFILL TRANSITION PLAN
OPERATIONS DRAWINGS

INDEX OF DRAWINGS

SHEET NO.	TITLE
1	SITE PLAN/EXISTING CONDITIONS
2	PHASING PLAN
3	FINAL GRADES
4	GAS MANAGEMENT SYSTEM
5	DETAILS

LOCATION PLAN

4 0 4
SCALE IN MILES



VICINITY PLAN

2000 0 2000
SCALE IN FEET

LEGEND

- REVERSE SLOPE BENCH
- DRAINAGE CHUTE
- CULVERT
- RIP RAP APRON
- SILT FENCE
- TD — TEMPORARY DIVERSION DIKE
- RIP RAP SLOPE STABILIZATION
- SOLID HDPE GAS COLLECTION HEADER
- SOLID HDPE LATERAL GAS COLLECTOR
- LIMITS OF DISPOSAL AREA
- CT — GAS CONDENSATE TRAP
- GAS EXTRACTION WELL
- GAS MONITORING PROBE
- DL-1 — GROUNDWATER MONITORING WELL
- P4 — PIEZOMETER

SHEET ON WHICH SECTION IS FIRST REFERRED — 1 / 2 . 3 — SECTION NUMBER; SHEET ON WHICH SECTION IS SHOWN

SHEET ON WHICH DETAIL IS FIRST REFERRED — 1 / 2 . 3 — DETAIL NUMBER; SHEET ON WHICH DETAIL IS SHOWN

SECTION AND DETAIL KEY

APPROVED:

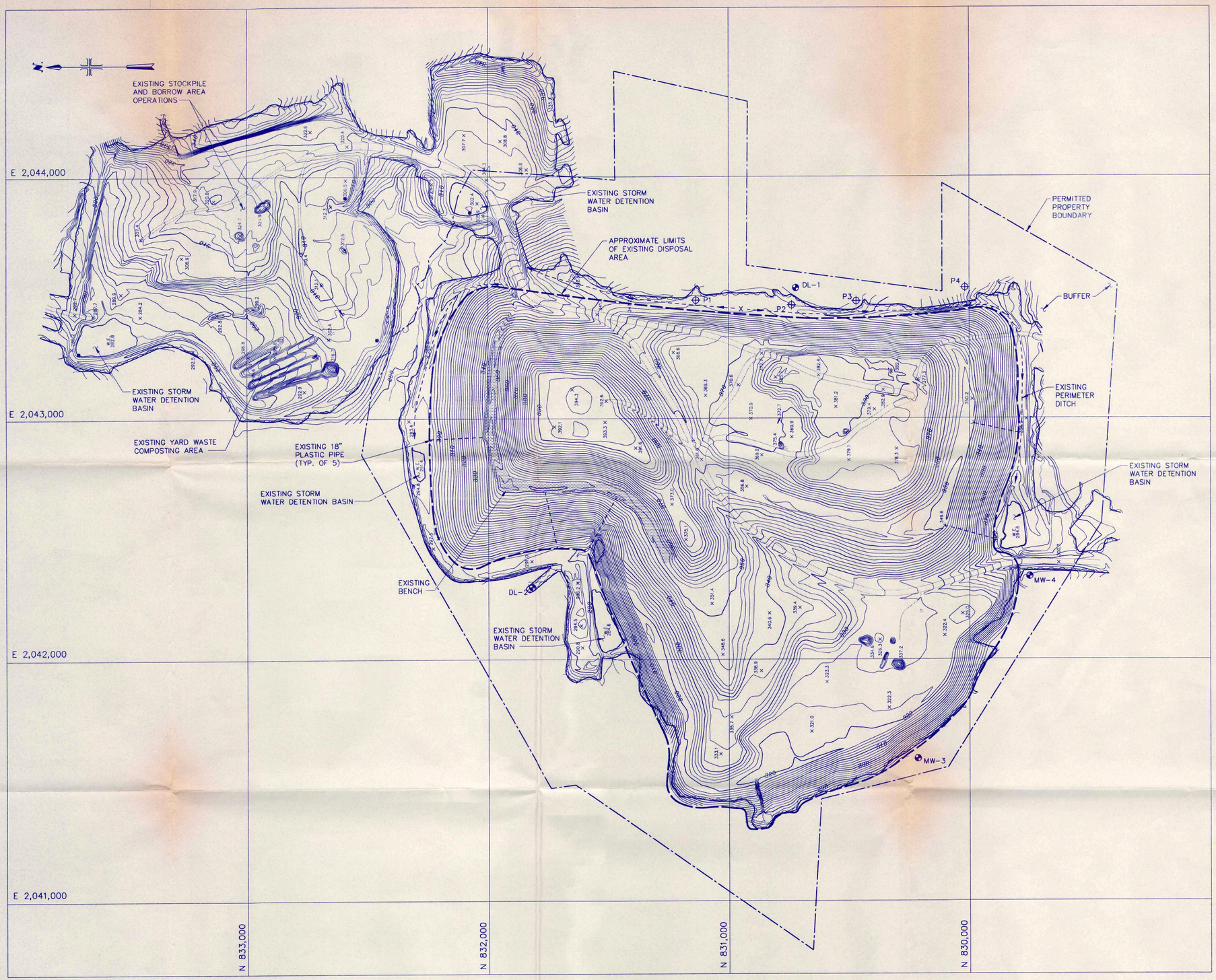
Don Robinson
DIRECTOR SANITATION DEPARTMENT

Millard Robb
MALCOLM PIRNIE INC.

NORTH CAROLINA PROFESSIONAL SEAL 7137 ENGINEER

MALCOLM PIRNIE INC., ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS
NEWPORT NEWS, VIRGINIA
gall freeman associates, STRUCTURAL, CIVIL AND ARCHITECTURAL ENGINEERING
DURHAM, NORTH CAROLINA

Site Plan



NOTES:

1. TOPOGRAPHY AND PLANIMETRIC FEATURES ARE BASED UPON WESTINGHOUSE LANDMARK GIS SURVEY OF MARCH 19, 1993.
2. COORDINATE SYSTEM SHOWN IS NORTH CAROLINA STATE PLANE COORDINATE SYSTEM.
3. PROPERTY BOUNDARY SHOWN IS APPROXIMATE, TAKEN FROM PERMIT DRAWING PREPARED BY DUANE K. STEWART & ASSOC., INC., DATED APRIL 25, 1983 AND CITY OF DURHAM BOUNDARY SURVEY BY TRIANGLE SURVEYORS, INC. DATED OCTOBER 25, 1988. THE PROPERTY BOUNDARY IS NOT TIED TO SPECIFIC STATE PLANE COORDINATES.
4. EXISTING GROUNDWATER MONITORING WELLS ARE SHOWN AT THEIR APPROXIMATE LOCATION.
5. NO SPECIAL WASTE AREAS EXIST WITHIN THE LANDFILL DISPOSAL AREA.
6. APPROXIMATE LIMITS OF EXISTING DISPOSAL AREA DETERMINED BY CITY OPERATIONS PERSONNEL.
7. EXISTING STOCKPILE AND BORROW AREA OPERATIONS EXTEND NORTH. AREA NOT SHOWN ON THIS SHEET.

NORTH CAROLINA PROFESSIONAL ENGINEER WILLIAM P. ROBINS

MALCOLM PIRNIE

REVISIONS			
NO.	BY	DATE	REMARKS

DES PDP
DWN RLB
CKD RWS

CITY OF DURHAM, NORTH CAROLINA

SANITARY LANDFILL TRANSITION PLAN OPERATIONS DRAWINGS

SITE PLAN/EXISTING CONDITIONS

SCALE: 1" = 200'

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DATE APRIL 1994

SHEET 1 OF 5

CAD REF. NO. 0759Y-94.001-0

4995 : 0707091000\C:\WORK\DURHAM\DURSHT1 SCALE: 1:2400 03/22, 1994 at 11:17

NOTES:

1. WASTE FILLING TO BEGIN IN NORTHEAST CORNER AND PROCEED NORTH TO SOUTH AND EAST TO WEST.
   - OPERATOR SHALL MINIMIZE ACTIVE WASTE FILLING AREA, NOT TO EXCEED 10,000 SQ. FT.
   - OPERTAOR SHALL PLACE WASTE WITHIN DAILY CELLS IN UNIFORM LIFTS NOT EXCEEDING 2 FEET AND THOROUGHTLY COMPACT ALL WASTE.
2. OPERATOR SHALL USE "AREA FILL METHOD". A SINGLE LIFT OF WASTE WILL BE PLACED OVER ENTIRE FILL AREA PRIOR TO BEGINNING NEXT LIFT. MAXIMUM WASTE LIFT THICKNESS SHALL BE 10'-0".
3. WASTE LIFT WILL BE PLACED TO ALLOW POSITIVE DRAINAGE IN THE DIRECTION OF FILLING (SEE TYPICAL WASTE LIFT, SHEET 5).
4. TEMPORARY DIVERSION DIKE WILL BE CONSTRUCTED AROUND PERIMETER OF ACTIVE WASTE FILL AREA TO DIVERT STORM WATER RUN-ON. TEMPORARY SLOPE DRAINS WILL BE PLACED ON SIDESLOPES AS NECESSARY TO CONVEY DIRVERTED STORM WATER DOWN SLOPES AND TO PERIMETER DITCHES AND BASINS. (SEE TEMPORARY DIVERSION DIKE AND TEMPORARY SLOPE DRAIN DETAILS, SHEET 5).
5. GRADES SHOWN IN INTERIM FILL AREA REPRESENTS FINAL GRADES INCLUDING CAP SYSTEM.
6. ➡ DENOTES DIRECTION OF FILLING.
7. EXISTING GRADES OUTSIDE LIMITS OF INTERIM FILL AREA ARE CLOSED AND REPRESENT FINAL GRADES (SEE SHEET 3).

Phasing Plan

NORTH CAROLINA PROFESSIONAL SEAL 7137 ENGINEER RALPH P. ROBINSON, JR.

MALCOLM PIRNIE

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CITY OF DURHAM, NORTH CAROLINA

SANITARY LANDFILL TRANSITION PLAN OPERATIONS DRAWINGS

PHASING PLAN

SCALE: 1" = 100'

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SHEET 2 OF 5

CAD REF. NO. 0759Y-94.002-0

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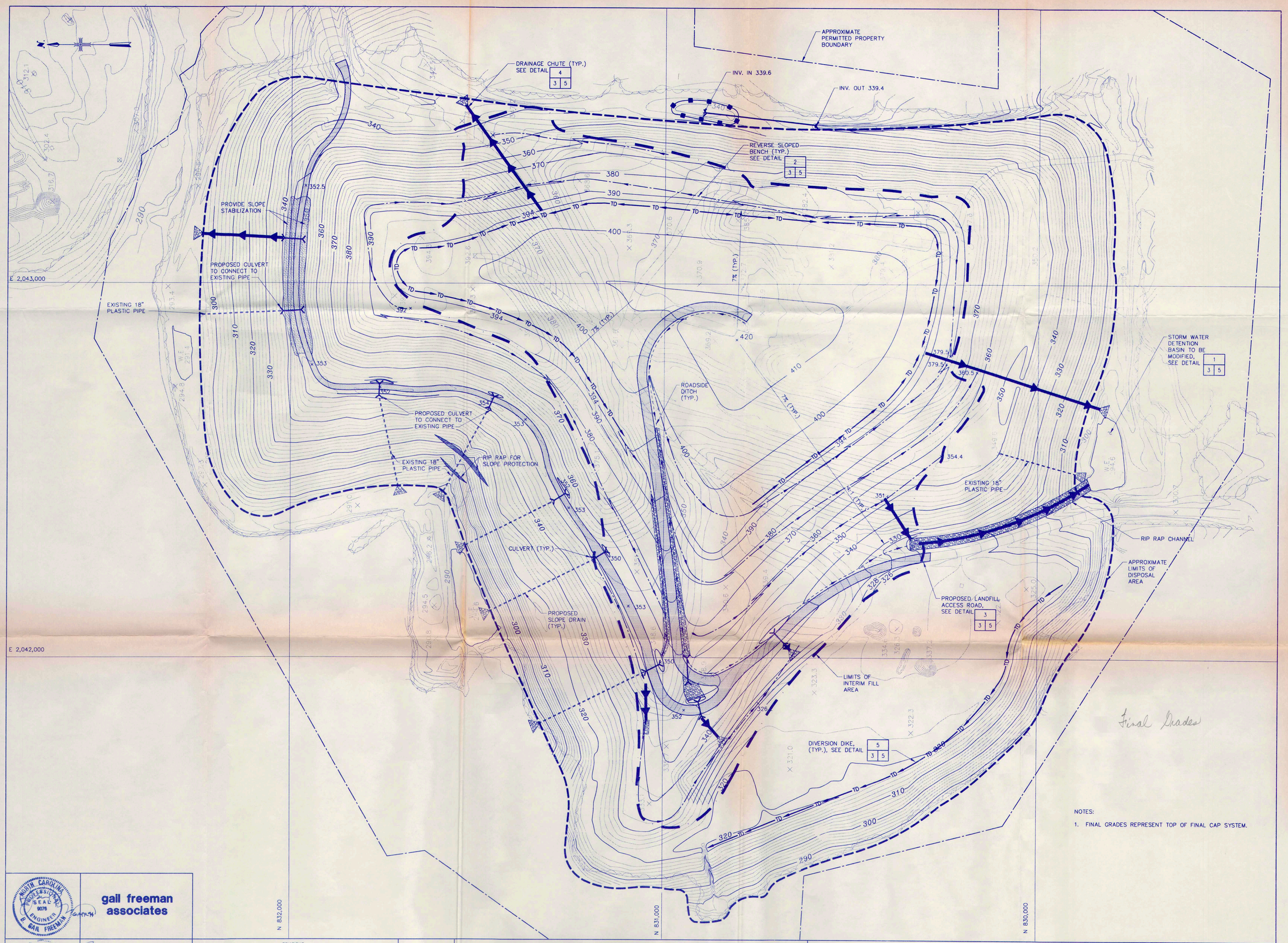

NOTES:

1. FINAL GRADES REPRESENT TOP OF FINAL CAP SYSTEM.

gail freeman associates

MALCOLM PIRNIE

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DWN RLB
CKD RWS

CITY OF DURHAM, NORTH CAROLINA

SANITARY LANDFILL TRANSITION PLAN
OPERATIONS DRAWINGS

FINAL GRADES

SCALE: 1" = 100'

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SHEET 3 OF 5

CAD REF. NO. 0759Y-94.003-0

APPROXIMATE PERMITTED PROPERTY BOUNDARY

TYPICAL SOLID HDPE LATERAL COLLECTOR

PROPOSED GAS BLOWER / FLARE STATION

EXISTING 18" PLASTIC PIPE

EXISTING 18" PLASTIC PIPE

EXISTING 18" PLASTIC PIPE

APPROXIMATE LIMITS OF DISPOSAL AREA

TYPICAL GAS MONITORING PROBE, SEE DETAIL 1 (4 | 5)

300' DIA. ZONE OF INFLUENCE (TYPICAL)

TYPICAL GAS EXTRACTION WELL SEE DETAIL 2 (4 | 5)

TYPICAL SOLID HDPE COLLECTION HEADER

TYPICAL GAS CONDENSATE TRAP

E 2,043,000

E 2,042,000

N 832,000

N 831,000

N 830,000

NOTES:
1. ACTUAL NUMBER AND LOCATION OF GAS EXTRACTION WELLS MAY VARY FROM PLAN SHOWN PENDING INITIAL INSTALLATION AND PUMPING TESTS.

Gas Mgmt. Plan

NO. 7137 PROFESSIONAL SEAL ENGINEER MILLARD P. ROBINSON, JR.

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CITY OF DURHAM, NORTH CAROLINA

SANITARY LANDFILL TRANSITION PLAN OPERATIONS DRAWINGS

GAS MANAGEMENT SYSTEM

SCALE: 1" = 100'

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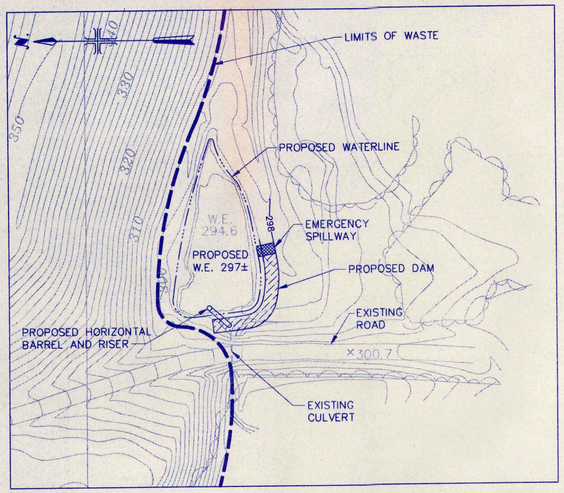
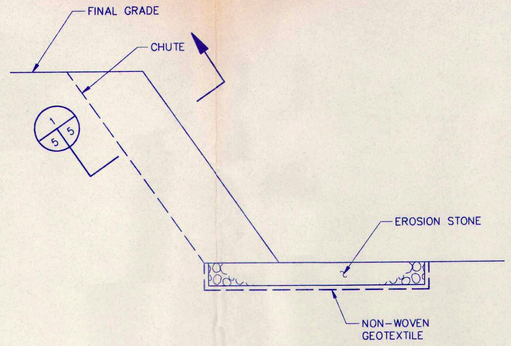
SHEET 4 OF 5

CAD REF. NO. 0759Y-94.004-0



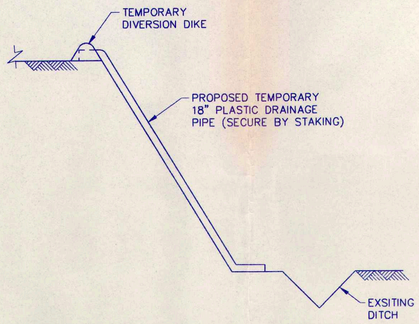
STORM WATER DETENTION BASIN (SOUTH SIDE) MODIFICATIONS

DETAIL 1 / 3 5

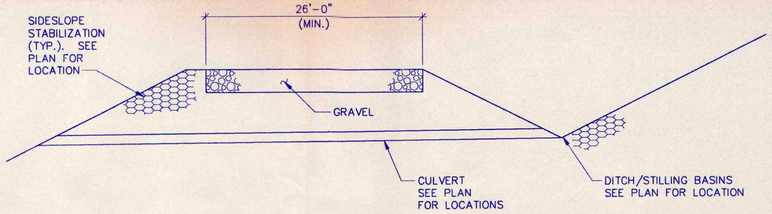


TYPICAL DRAINAGE CHUTE

DETAIL 4 / 3 5

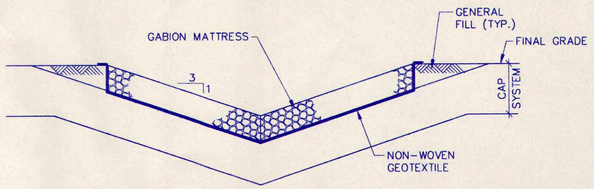


TEMPORARY SLOPE DRAIN



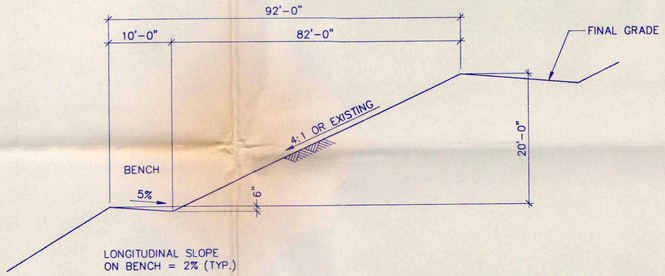
LANDFILL ACCESS ROAD

DETAIL 3 / 3 5



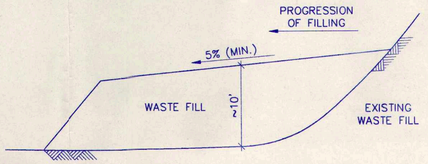
SECTION 1 / 5 5

NOTE:
CHUTES TO BE DESIGNED TO SAFELY CONVEY THE 24-HOUR, 25-YEAR STORM EVENT.

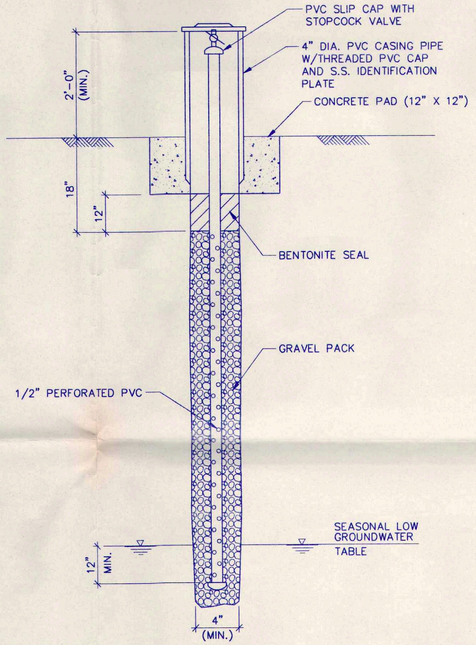


TYPICAL BENCH

DETAIL 2 / 3 5

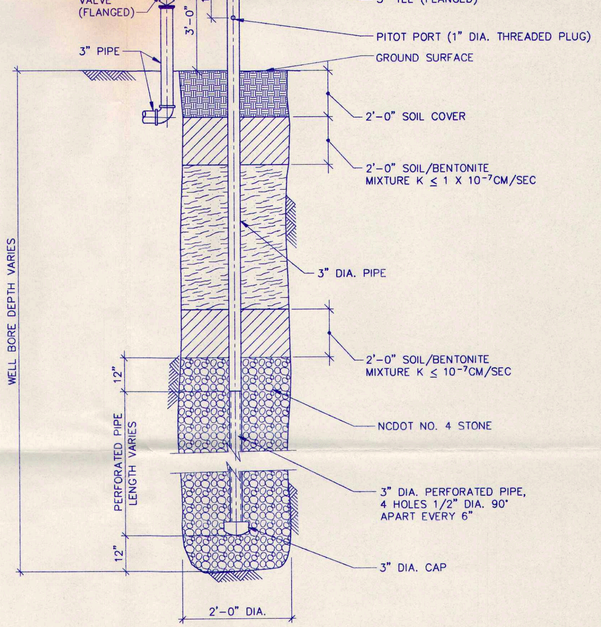


TYPICAL WASTE LIFT SCHEMATIC



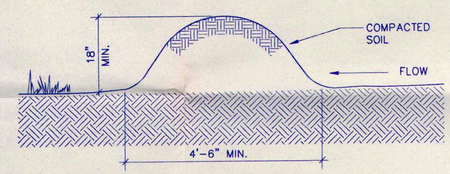
TYPICAL GAS MONITORING PROBE

DETAIL 1 / 4 5



TYPICAL GAS EXTRACTION WELL ASSEMBLY

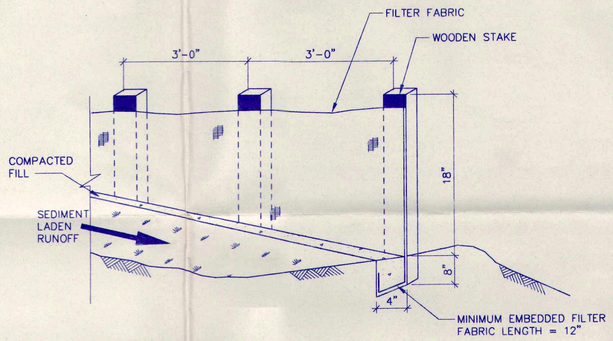
DETAIL 2 / 4 5



NOTE: DIVERSION DIKE SHALL BE CONSTRUCTED AND MAINTAINED PER NORTH CAROLINA EROSION & SEDIMENTATION CONTROL DESIGN MANUAL REQUIREMENTS. THE DIKE SHALL BE SEEDED AND MULCHED IMMEDIATELY AFTER CONSTRUCTION. VEGETATIVE STABILIZATION SHALL BE MAINTAINED IN ORDER TO PREVENT DIVERSION DIKE EROSION.

DIVERSION DIKE

DETAIL 5 / 3 5



NOTE: SILT FENCE BARRIER SHALL BE CONSTRUCTED AND MAINTAINED PER NORTH CAROLINA EROSION & SEDIMENT CONTROL PLANNING & DESIGN MANUAL, SEPT. 1988.

SILT FENCE

DETAIL 1 / 2 5

NORTH CAROLINA PROFESSIONAL SEAL 7137 ENGINEER RICHARD L. BUTLER JR.

MALCOLM PIRNIE

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CITY OF DURHAM, NORTH CAROLINA

SANITARY LANDFILL TRANSITION PLAN OPERATIONS DRAWINGS

DETAILS

NOT TO SCALE

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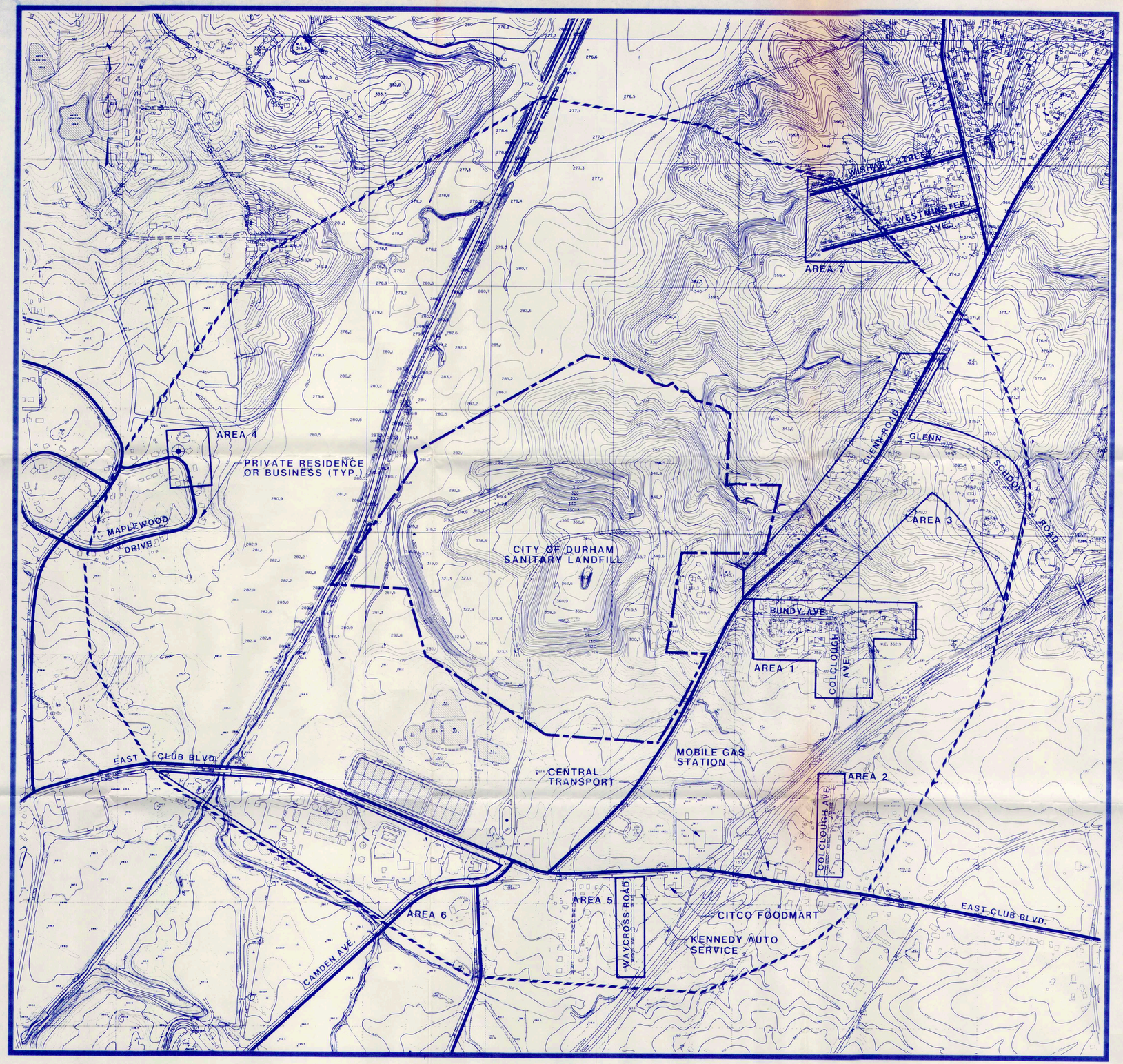
DATE APRIL 1994

SHEET 5 OF 5

CAD REF. NO. 0759Y-94.005-0

06 : 0759022000\C:\WORK\DURHAM\DURSHT5 SCALE: 1:1; 04/06, 1994 at 10:24



GENERAL NOTES:

1. TOPOGRAPHIC INFORMATION FROM CURRENT CITY OF DURHAM MAPPING DATED 1981 AND 1987.
2. 170 RESIDENCES AND BUSINESSES WERE IDENTIFIED IN THE STUDY AREA. 81 RESIDENCES AND BUSINESSES WITHIN THE STUDY AREA ARE NOT PROVIDED WITH SERVICE CONNECTIONS TO THE CITY OF DURHAM WATER DISTRIBUTION SYSTEM. THESE RESIDENTS AND BUSINESSES ARE INDICATED BELOW CORRESPONDING TO AREAS 1 THROUGH 7 AND REPRESENT POTENTIAL DRINKING WATER WELL LOCATIONS:

AREA 1

2006	BUNDY AVE.	3102	COLCLOUGH AVE.
2007	BUNDY AVE.	3106	COLCLOUGH AVE.
2010	BUNDY AVE.	3110	COLCLOUGH AVE.
2012	BUNDY AVE.	3117	COLCLOUGH AVE.
2015	BUNDY AVE.	3114	COLCLOUGH AVE.
2016	BUNDY AVE.	3115	COLCLOUGH AVE.
2017	BUNDY AVE.	3117	COLCLOUGH AVE.
2021	BUNDY AVE.	3119	COLCLOUGH AVE.
2100	BUNDY AVE.	3120	COLCLOUGH AVE.
2110	BUNDY AVE.		
2114	BUNDY AVE.		
2124	BUNDY AVE.		

AREA 2

2910	COLCLOUGH AVE.
2911	COLCLOUGH AVE.
2912	COLCLOUGH AVE.
2917	COLCLOUGH AVE.
2922	COLCLOUGH AVE.

AREA 3

2132	GLENN ROAD	3415	GLENN ROAD
3224	GLENN ROAD	3417	GLENN ROAD
3230	GLENN ROAD	3501	GLENN ROAD
3301	GLENN ROAD	3515	GLENN ROAD
3313	GLENN ROAD	1807	GLENN SCHOOL ROAD
3314	GLENN ROAD	1815	GLENN SCHOOL ROAD
3318	GLENN ROAD	1821	GLENN SCHOOL ROAD
3322	GLENN ROAD	1823	GLENN SCHOOL ROAD
3325	GLENN ROAD	1825	GLENN SCHOOL ROAD
3326	GLENN ROAD		
3406	GLENN ROAD		
3409	GLENN ROAD		
3411	GLENN ROAD		
3413	GLENN ROAD		

AREA 4

1470 MAPLEWOOD DRIVE

AREA 5

2803	WAYCROSS ROAD
2815	WAYCROSS ROAD
2819	WAYCROSS ROAD

AREA 6

2116	CAMDEN AVENUE
2117	CAMDEN AVENUE
2122	CAMDEN AVENUE
2012	EAST CLUB BOULEVARD
2202	EAST CLUB BOULEVARD
2206	EAST CLUB BOULEVARD
2302	EAST CLUB BOULEVARD
2304	EAST CLUB BOULEVARD
2305	EAST CLUB BOULEVARD
2306	EAST CLUB BOULEVARD
2320	EAST CLUB BOULEVARD
2321	EAST CLUB BOULEVARD

AREA 7

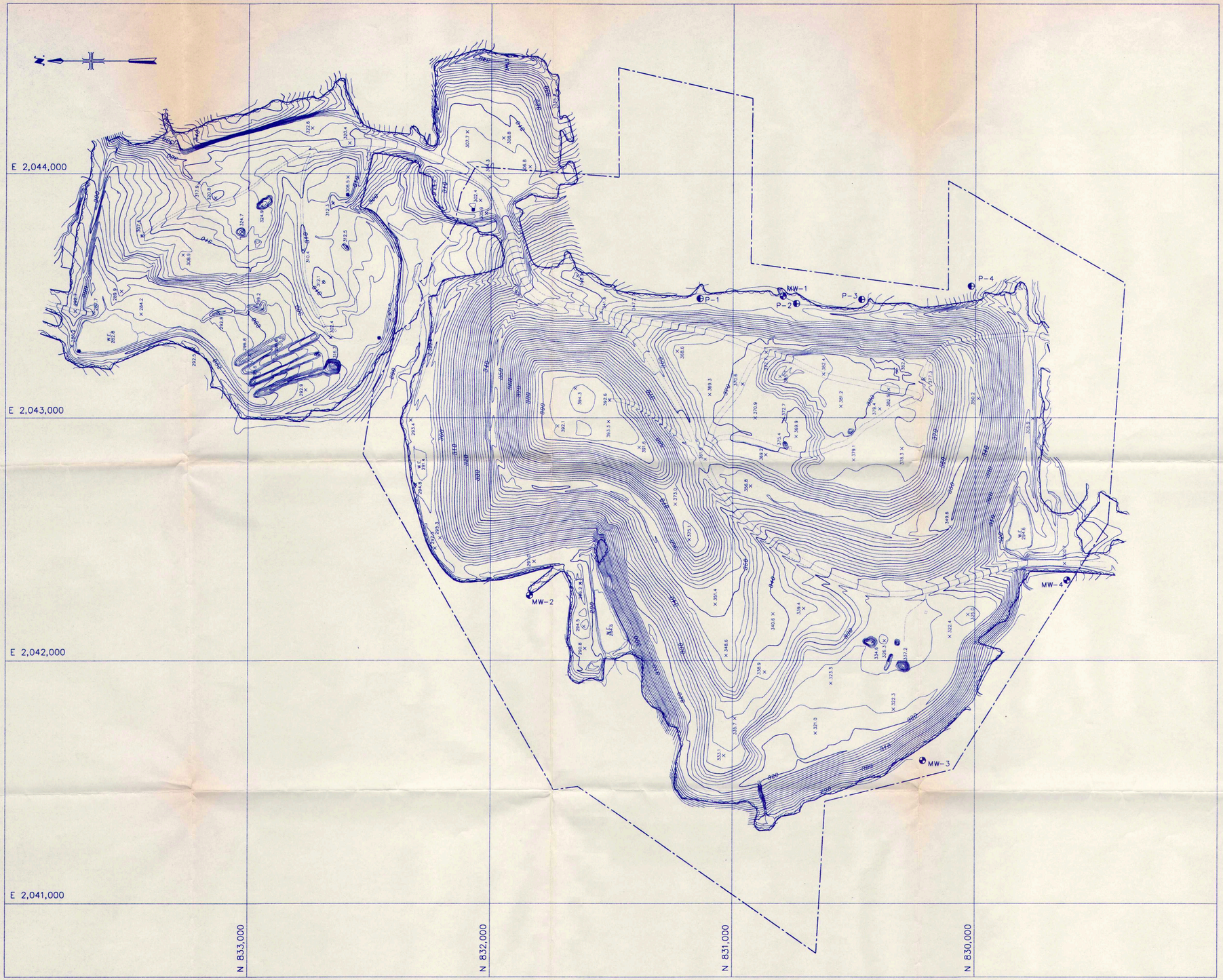
3605	WESTMINSTER AVENUE
3606	WESTMINSTER AVENUE
3609	WESTMINSTER AVENUE
3613	WESTMINSTER AVENUE
3610	WISHART STREET
3614	WISHART STREET

LEGEND

- PERMITTED FACILITY BOUNDARY
- 2000' PERIMETER
- UTILITIES
- STUDY AREAS

MALCOLM PIRNIE

APRIL 1994
CITY OF DURHAM, NORTH CAROLINA
LANDFILL CLOSURE AND POST-CLOSURE PLAN
LOCAL CHARACTERIZATION STUDY
SCALE: 1" = 400'



NOTES:

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2. PROPERTY LINE SHOWN IS APPROXIMATE, TAKEN FROM PERMIT DRAWING PREPARED BY DUANE K. STEWART & ASSOC., INC., DATED APRIL 25, 1983 AND CITY OF DURHAM BOUNDARY SURVEY BY TRIANGLE SURVEYORS, INC. DATED OCTOBER 25, 1988.
3. EXISTING GROUNDWATER MONITORING WELLS ARE SHOWN AT THEIR APPROXIMATE LOCATION.

LEGEND:

- EXISTING WATER QUALITY MONITORING WELLS
- TEST WELLS

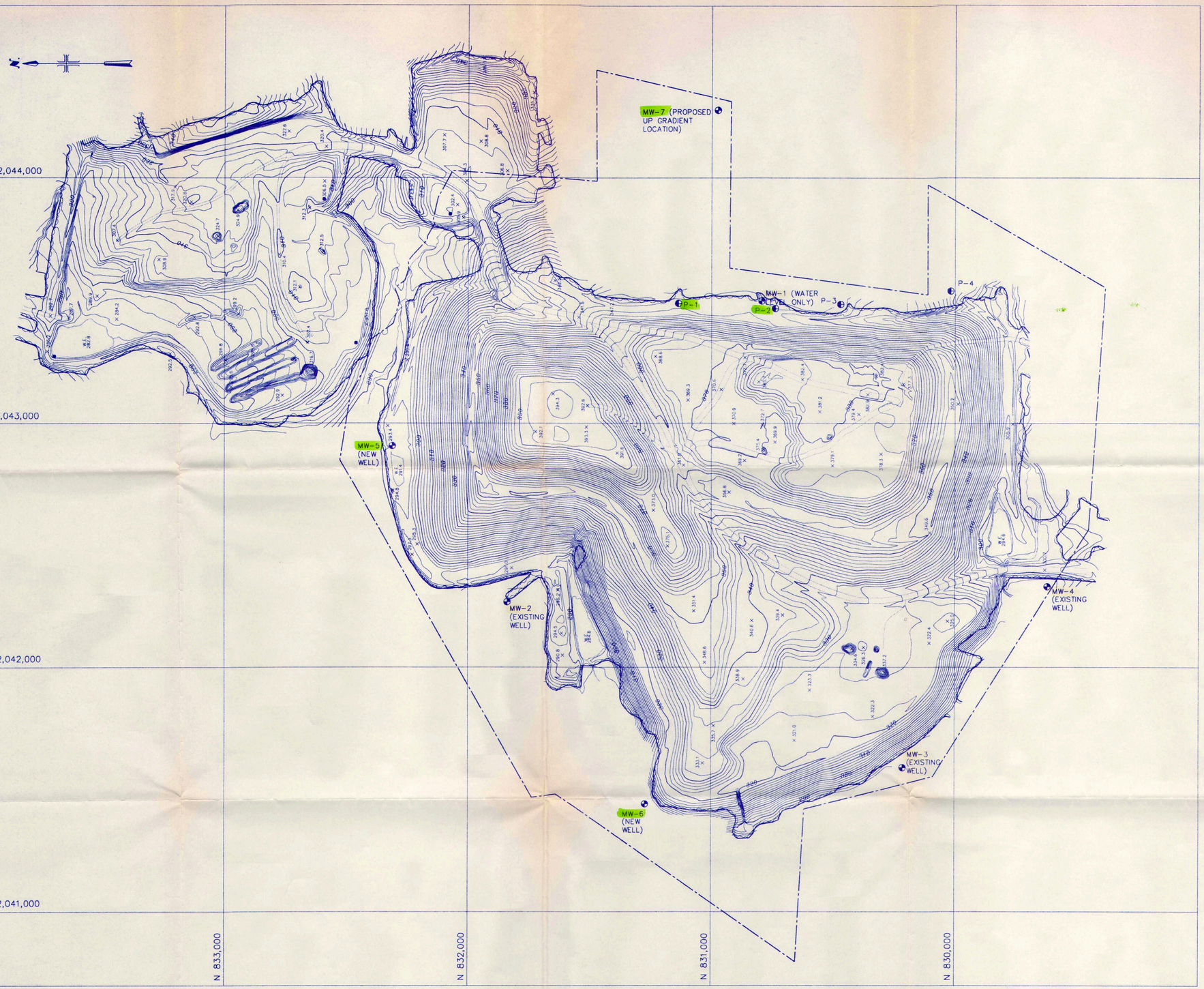
MALCOLM PIRNIE

APRIL 1994
CITY OF DURHAM, NORTH CAROLINA
SANITARY LANDFILL TRANSITION PLAN
WATER QUALITY MONITORING SYSTEM

SITE PLAN/EXISTING CONDITIONS GROUNDWATER MONITORING WELL LOCATIONS

SCALE: 1" = 200'

4846 : 0759022000\C:\WORK\DURHAM\PLATE1 SCALE: 1:2400| 04/06, 1994 at 13:27



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3. EXISTING GROUNDWATER MONITORING WELLS ARE SHOWN AT THEIR APPROXIMATE LOCATION.
4. ONLY ONE REPLACEMENT WELL FOR MW1 WILL BE USED FOR WATER QUALITY MONITORING, BASED ON RESULTS OF ON-GOING INVESTIGATIONS.
5. SURFACE WATER SAMPLING LOCATIONS ARE INDICATED ON FIGURE 2-3.

LEGEND:

- EXISTING WATER QUALITY MONITORING WELLS
- TEST WELLS

MALCOLM PIRNIE

APRIL 1994
CITY OF DURHAM, NORTH CAROLINA
SANITARY LANDFILL TRANSITION PLAN
WATER QUALITY MONITORING SYSTEM

UPGRADED WATER QUALITY PLAN SAMPLING LOCATIONS

SCALE: 1" = 200'

4846 : 0759022000\C:\WORK\DURHAM\PLATE2 SCALE: 1:2400: 04/06, 1994 at 13:36