CONSTRUCTION REPORT
HIDDEN VALLEY LANDFILL
NORTH AREA CLOSURE

HIDDEN VALLEY LANDFILL
PIERCE COUNTY, WASHINGTON

March 1990

Sweet-Edwards / EMCON, Inc.

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Prepared for

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P.O. Box 73057
Puyallup, Washington 98373

Prepared by

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Project No. T02-01.28

CONSTRUCTION REPORT

Closure Construction
North Area Refuse Hill
Hidden Valley Landfill

The engineering material and data contained in this report were prepared under the supervision and the direction of the undersigned, whose seal as a registered professional engineer is affixed below.

Bill Hensley (FOR)

Michael Stewart
Manager Construction Services

Mark J Amrhein

Mark J. Amrhein, P.E.
Project Engineer

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Executive Summary

The closure of the North Area Refuse Hill at the Hidden Valley Landfill in Pierce County, Washington was completed between June 1989 and October 1989.

The closure construction described in this report is a portion of work performed to close the North Area Refuse Hill in compliance with WAC 173-304-460 (3) (e), Minimal Functional Standards (MFS).

A construction quality assurance (CQA) program was established to document that the work was performed in accordance with the contract documents and Predesign Report. The CQA program included full-time construction monitoring and field engineering services along with laboratory materials testing. The monitoring and engineering was performed to observe construction, coordinate materials testing, and provide design clarifications or modifications during the work.

This report includes descriptions of the CQA program, construction techniques, observations, materials testing results, and design modifications as described in this report.

This project was constructed over a 5-month period. Some of the critical elements of the project design were modified.

This report documents that the closure of the North Area Refuse Hill at the Hidden Valley Landfill was constructed in accordance with the contract documents, Predesign Report, modifications, and with the design intent.

Section 1
INTRODUCTION

This report summarizes closure construction for the North Area Refuse Hill at the Hidden Valley Landfill. This is the first phase of closure construction at the site. The landfill is located in Puyallup, Washington and is owned and operated by Land Recovery, Inc.

The purpose of the report is to document that closure construction was completed in accordance with the closure plan, construction contract documents, and the Washington Administration Code [WAC 173-304-460 (3) (e)], Minimum Functional Standards for Solid Waste Handling (MFS).

The report includes the following:

- Project Background
- Construction Personnel Organization
- General Construction Details
- Summary of Construction Quality Control and Quality Assurance Programs
- As-Built Documentation
- Quality Assurance Test Summaries.

Section 2
PROJECT BACKGROUND

2.1 SITE DESCRIPTION

Hidden Valley Landfill is an existing, 72-acre solid waste facility owned and operated by Land Recovery, Inc. (LRI), a private solid waste disposal company. The landfill is located at 17925 South Meridian Street, which is approximately five miles south of Puyallup in Pierce County, Washington. The site lies in the N 1/2, NW 1/4, Section 34, T 19N, R 4E, W.M. It is bordered on the west by South Meridian Street (SR 161), on the north by two undeveloped parcels and the Thun Field-Pierce County Airport, and on the east by undeveloped, wooded property. To the south, Puyallup Sand and Gravel Company owns and operates a gravel processing operation. The site has been in operation since the mid-1960s. The site location is shown on Figure 2-1.

2.2 REFERENCE DOCUMENTS

The following list of reference documents are given as background information for closure construction at the site. The reports are available upon request from Sweet-Edwards/EMCON in Bothell, Washington. The documents provide information relevant to the design and construction of the North Area Closure.

- Development of Gas System Plan, dated September 1, 1989
  prepared by Sweet-Edwards/EMCON, Bothell, Washington
- Predesign Report, North Area Closure, Hidden Valley Landfill, dated June 1989
  prepared by Sweet-Edwards/EMCON, Bothell, Washington
- Project Manual for Hidden Valley Landfill North Area Geosynthetics Installation, dated July 1, 1989
  prepared by Sweet-Edwards/EMCON, Bothell, Washington

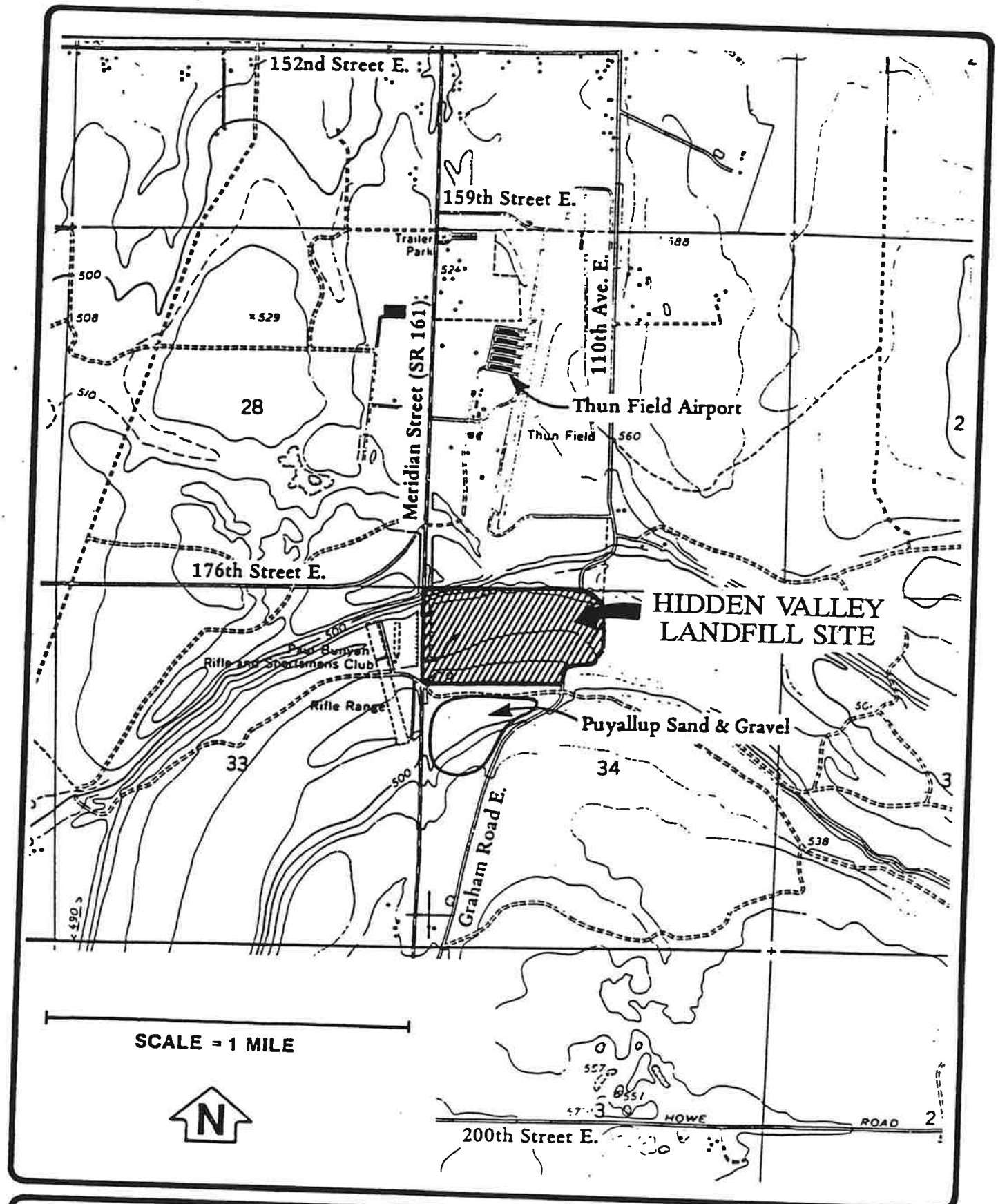

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Figure 2-1
HIDDEN VALLEY
NORTH AREA CLOSURE

SITE LOCATION MAP

DATE 5-89
DWN. MP
APPR.
REVIS.
PROJECT NO.
T0201.18

Section 3
CONSTRUCTION PERSONNEL ORGANIZATION

This section describes the parties responsible for the Hidden Valley Landfill closure construction. There were three primary parties, the Owner, Land Recovery, Inc.; the Engineer, Sweet-Edwards/EMCON; and the Contractor, Serrot Corporation.

The Owner is the party responsible for closure construction including the funding of the project. The Owner also provided a work force, equipment, and materials for the majority of the construction work.

The Engineer was the project designer. During the construction, the Engineer provided quality control services to the Owner's construction forces. The Engineer also provided a quality assurance program as the Owner's representative during work performed by the Contractor.

The Contractor was hired under contract by the Owner to perform installation of geosynthetic products. Those products included geomembrane and geotextile.

Section 4
GENERAL CONSTRUCTION DETAILS

4.1 GENERAL CLOSURE DESCRIPTION

Final closure construction was performed to mitigate impact to ground water by elimination of surface water infiltration to the landfill. To do this, the landfill was covered with an impermeable cover and surface water drainage facilities were constructed to divert surface water off and away from the landfill.

Closure construction also included the installation of a landfill gas recovery system. This system collects and burns landfill gases created by refuse in the landfill. It also prevents the off-site migration of the landfill gases.

Work on closure construction began in June of 1989 and was completed by October 1989. The major elements of construction included site grading, subgrade preparation for geomembrane, geomembrane placement, drainage layer placement, geotextile placement, vegetation and topsoil placement, surface drainage facilities construction, and landfill gas extraction system construction.

4.2 SITE GRADING

Final grades for the landfill cover area were constructed to meet the following criteria:

- Divert storm water runoff to surface water control structures while minimizing the potential for adverse drainage conditions resulting from long-term differential settlement
- Provide long-term stable slope conditions

- Provide access to the landfill surface for maintenance and repair of the final cover and the gas control facilities.

Three areas required regrading and/or filling in order to achieve the desired grades and drainage patterns for the closure area as shown on Drawing 1, Appendix A. Area I consisted of the central area os the southern margin of the closure. This area was where an old access road transversed the hill up the southern slope and crested the hill through a low point on the ridge. This low point was filled with refuse fill such that the ridge line was more uniform and the surface water drainage was directed to the north. If any surface water was allowed to drain to the south, it would be discharging into future active fill areas.

Area 2 consisted of a soil buttress fill on the Northeast portion of the closure. Originally, this slope was oversteepened to a maximum of approximately 2H:IV (horizontal:vertical). The soil buttress flattened the slope in this area to approximately 4H:IV, thereby increasing the stability of the cover section and allow easier closure construction.

Area 3 consisted of filling a large hole with refuse where the former maintenance building was located at the west end of the closure area. Filling of this area was optional as described in the predesign report. Fortunately, the schedule for closure project allowed filling of this area to final grade and its inclusion into the project.

Originally, the design of the slope on the northeast side included two sideslope ditches with foot paths transversing the slope to intercept surface water runoff. However, during construction of the soil buttress in Area 2, these foot paths were widened to full width access roads to allow for equipment access across the face of the slope as shown on Drawing I. These access road still incorporated drainage ditches on their uphill sides to control surface water as originally designed.

4.3 FINAL COVER

4.3.1 General

As outlined in the Predesign Report, the final cover section should provide three basic functions:

- Prevent excessive erosion of the final cover soil
- Significantly reduce or eliminate rainfall infiltration into waste
- Provide a barrier to prevent landfill gas venting and leachate seep discharges.

An "As-Built" cross-section of the final cover is shown on Drawing No. 4, Detail I of the Record Drawings, Appendix A. The geomembrane layer prohibits infiltration of rainfall into the refuse while also blocking gas venting and leachate seep discharges. Erosion of the final cover is controlled by drainage of the water infiltrating through the soils, drainage ditches to divert surface water and vegetation rooted in the topsoil.

4.3.2 Foundation Layer

The foundation layer consists of primarily gravel and cobbles with a maximum grain size of approximately six inches and included varying percentages of sand and silt. This material was mostly placed prior to this project, immediately after the refuse reached final grade. It was placed over the entire landfill closure area with a minimum thickness of 12 inches. This material was contoured and graded to form the subgrades for the drainage courses, sub-basins, benches, and general site grading.

4.3.3 Bedding Layer

The bedding layer consists of a 4-inch layer of sand placed directly over the foundation layer. The maximum particle size of this material is less than 1 inch and consisted mostly of sand. The purpose of this soil layer is to provide a protective layer to minimize the potential for puncture of the underlying geomembrane.

4.3.4 Geomembrane

The geomembrane cover consists of 60-mil high-density polyethylene (HDPE) sheeting. Both textured and non-textured geomembrane were used for this project. Textured geomembrane was used on slopes steeper than 20 percent (5H:1V) to increase the stability of the soil cover. A detailed analysis of the slope stability can be found in Section 3.3.7 of the Predesign Report. Non-textured material was placed on all other slopes.

An "As-Built" Panel Layout drawing of the geomembrane can be found on Drawing 5, Appendix A. This drawing shows the limits of textured and non-textured materials and the orientation of the geomembrane panels.

Seaming of the geomembrane panels was performed using hot-wedge welding machines. Seaming was performed in conformance with the project specifications.

Seaming of repair areas and patches, such as for destructive test panels, was performed using extrusion type welding machines.

4.3.5 Drainage Layer

The drainage layer consists of free-draining sandy soil with minor amounts of small gravel. The drainage layer material was placed directly over the geomembrane in a minimum thickness of 12 inches.

The completed thickness of the drainage layer was governed by the grade of the slope it was placed on. For slopes less than 20 percent (5H:1V) a thickness of 12 inches was placed. For slopes greater than 20 percent a thickness of 18 inches was placed. The in-place thickness of drainage layer material can be determined from the geomembrane panel layout drawing. In areas where textured geomembrane was used, 18 inches of drainage layer was placed. The one exception to this is on panels P1 through P3. It was decided that the relatively short length of slopes in this area allowed for a 12-inch layer of drainage material.

In addition to the drainage characteristics of the drainage material, an underdrain system of 3-inch perforated pipe was installed in the drainage layer. The underdrains facilitate the drainage of the cover section at peak flows. Locations of the underdrain piping system can be found in on Drawing 3, Appendix A.

4.3.6 Geotextile

The geotextile placed consists of a non-woven fabric. It is placed directly over the drainage layer material. The purpose of this material is to provide a filtering medium between the drainage layer and the overlying vegetative soil layer. The geotextile retains fines while maintaining the free-flowing characteristics of the drainage layer. The material was placed with the seams running vertically down the slopes (i.e., not across slopes). The seams were thermally bonded with a Leister gun. The geotextile panels were overlapped 6 inches at each seam.

4.3.7 Vegetative Soil

The vegetative layer is a pit-run material with the largest rocks measuring no greater than 6 inches. The material is a gravel with varying percentages of silt, sand, and peat. The vegetative layer was placed directly over the geotextile in a uniform thickness of 1 foot. The purpose of this material is to provide a rooting medium and moisture retention for vegetation on the topsoil layer.

4.3.8 Topsoil

The topsoil consists of a sandy silt with organics. It was loosely placed over the vegetative soil to provide a soil layer capable of supporting grassy vegetation.

4.3.9 Vegetation

The vegetation placed on the topsoil consisted of 40 percent Perennial Rye, 40 percent Red Fescue, 10 percent Colonial Bentgrass, and 10 percent White Dutch Clover. Placement on the sideslopes was completed in the first week of October. The balance of the seeding was completed by the third week in October. By mid-November sufficient rooting had taken place to prevent erosion of the topsoil. The seeding was performed by the hydroseeding method.

4.4 DRAINAGE

Drainage from the site is diverted from five main sub-basins to rock-lined ditches. The ditches for sub-basins A through E, as shown on Drawing 2, Appendix A, direct the runoff to the northeast corner of the closure limits. This runoff drains to the northeast section of the landfill property. Runoff from sub-basin G is diverted to

a rock-lined ditch alongside the entrance road where it is directed through a culvert to the western infiltration area.

4.5 GAS COLLECTION SYSTEM

As part of the final cover construction, the existing gas collection system within the closure area was completed. This included installing condensate sumps, drilling of additional vertical gas collection wells and final hookup. The condensate sumps installed could be modified to provide condensate collection capabilities in anticipation of future regulations prohibiting the discharge of condensate from the gas collection piping back into the landfill. Three additional vertical gas wells were required in the area of sub-basin E. These wells were installed after the placement of refuse was complete and before final cover construction was begun.

Section 5
CONSTRUCTION QUALITY CONTROL/QUALITY ASSURANCE

5.1 GENERAL

As discussed in Section 3 there were three primary parties responsible for the work: the Owner, the Engineer, and the Contractor. During the work, the Contractor performed a quality control program for the geosynthetic installations. The Engineer performed two functions during the work. The first was a quality control function working with the Owner's work force. The second was a quality assurance program working as the Owner's representative during the contracted installation of geosynthetic products.

5.2 CONTRACTOR'S QUALITY CONTROL

The Contractor's quality control program consisted of destructive and non-destructive testing of geomembrane field seams.

Two types of non-destructive tests were performed. The first was air testing of the seams. This process is performed by air pressure testing an air pocket that is formed into the double-welded seam. The hot wedge welding system used by the Contractor leaves a small air pocket between two parallel welded portions of the seam. The air pocket is pressurized after seaming is completed. If the seam holds a pressure of 25 to 30 psi for 5 minutes, the seam is considered passing or properly constructed.

The second non-destructive test is vacuum box testing. This is used principally on extrusion-type welds. This test is performed by applying vacuum to a seam that has a soapy solution spread on it. If a leak is present in the seam, the soapy solution bubbles, which detects a perforation or pinhole.

Destructive testing is performed on seam samples to determine the seam strength in peel and shear adhesion. The Contractor cuts a seam sample from the actual field seams and sends them to their laboratory for strength testing. A passing test is a shear value of 90 percent of the specified sheet strength and a peel value of 70 percent of the specified sheet strength. The above percentages are of the sheet tensile strength at yield.

In addition to laboratory seam testing, the Contractor performs daily field trial seam tests. The trial seam welds are field tested for peel and shear. The purpose of these tests is to test the function of the welding tools and the installers' welding techniques.

5.3 ENGINEER'S QUALITY CONTROL

The Engineer's Quality Control function was related only to work performed by the Owner as general contractor. The Quality Control function consisted of observation of the Owner's work for conformance to the drawings and materials testing for conformance with specifications. Variations from the drawings and specifications were reviewed by the Engineer for approval prior to implementation. If changes were made, they were documented by the Engineer for inclusion in this report. Appendix A includes as-built record drawings of the work and Appendix B summarizes material testing.

5.4 ENGINEER'S QUALITY ASSURANCE

The Engineer's Quality Assurance program was related only to geosynthetic work performed by the Contractor. The Quality Assurance program included observations of the Contractor's work for conformance to drawings and specifications,

conformance testing of materials delivered to the site, and destructive testing of the geomembrane seams on-site and by an independent laboratory.

Observations of the work were performed daily and records of our observations were documented in daily report forms. We observed trial seam construction and testing, welding techniques, panel placement, non-destructive testing, and destructive test sampling. The orientation of geomembrane panels was also documented and is shown on the panel layout drawing in Appendix A. This drawing also shows seam numbers, panel numbers, and locations of destructive test samples.

Conformance testing was performed on the geotextile and geomembrane materials delivered to the site. The purpose of these tests was to verify that the products met project specifications. Results of the conformance testing are summarized in Appendix B.

Our Quality Assurance program also included independent testing of the geomembrane seams. The location of the seam samples was determined by the SE/E Quality Assurance personnel. Samples were taken at a minimum of one per 500 lineal feet of seam. Each sample was approximately 44-inches long along the seam and 12-inches wide. The sample was divided into three separate samples. The Contractor received one sample which they tested and the Engineer received two samples. One was saved as an archive sample, one sample was tested.

At the beginning of placement for both smooth and textured geomembrane, the Engineer tested seams using both a field tensiometer and an independent outside laboratory tensiometer. This was done to compare results assuring that accurate results were being measured in the field. Following the initial testing and confirmation of the field tensiometer's accuracy, only the field tensiometer was used to test seams. During the course of the project, all seams were tested by both the Engi-

neer and Contractor, and 20 percent of the samples were sent to an independent laboratory.

Each destructive test consisted of five peel and five shear tests per sample location. The five tests were performed on 1-inch-wide sample coupons. A test was considered passing in peel if the average value of the five tests was 70 percent of the specified sheet strength. A test was considered passing in shear if the average value of the five tests was 90 percent of the specified sheet strength. The sheet strength is the specified tensile strength at yield (ASTM D-638).

Two types of geomembrane were installed on this project. Both were 60-mil thickness; however, some of the material had textured surface, the other had smooth surface. The tensile strength at yield for the two types of material were different. All destructive test results performed by the Engineer are summarized in Appendix B.

Section 6
MODIFICATIONS MADE DURING CONSTRUCTION

6.1 AMEND GEOMEMBRANE SPECIFICATION

In the Project Manual for Hidden Valley Landfill North Area Closure Geosynthetics Installation, a change was made to the Field Seaming Specifications. The change resulted from incorrect wording of the original specifications. Section 3.04D part 9 stated a trial weld specimen passes when the strength of break is 90 percent of the sheet break strength for shear test. It was corrected to say the specimen passes when the strength of break is 90 percent of the sheet yield strength for shear test.

6.2 AMEND GEOTEXTILE SPECIFICATIONS

The bid proposal received from the Contractor contained a proposal for a non-woven geotextile that did not meet all of the specifications. Upon review by the design engineer, this proposed material was excepted. It was found to have sufficient physical properties in the crucial areas of permitivity and tensile strength. The physical properties of this material are as follows:

Test	Test Designation	Requirement
Fabric Weight	ASTM D-3776	8 oz
Grab Tensile Strength	ASTM D-4632	203 lbs
Grab Tensile Elongation	ASTM D-4632	50 %
Burst Strength	ASTM D-3786	300 psi
Trapezoid Tear	ASTM D-4533	95 lbs
Puncture Resistance	ASTM D-3787	100
EOS		120-80 sieve

6.3 ACCEPT GEOTEXTILE QA RESULTS

The conformance testing indicated that the geotextile material met the requirements of all of the specifications with the exception of burst strength. A summary of the results may be found in Appendix B. Since the critical areas of concern are the permitivity and tensile strength of the geotextile and the average burst strength was not significantly below the specification value, it was accepted for use on the project.

6.4 EXTEND LIMITS OF FINAL COVER

As shown in the Predesign Report, the limits of final cover for the North Area Closure included approximately two acres in the area around the old maintenance building which were optional. At the time of that report, this area was a pit between the main perimeter access road ramp and the western edge of the North Area Refuse heap. Filling of this pit began in the beginning of July 1989 and was completed in mid September 1989. This allowed for expansion of the limits of final cover to include the pit area. A plan view of the site showing the as-built limits of final cover may be found in Drawing 1, Appendix A.

6.5 MODIFY GEOMEMBRANE FLAP

The northwestern edge of the North Area Refuse mound meets native ground in a near-vertical plane. The limits of final cover were extended onto the native ground in this area to prevent any runoff from seeping into the refuse mound. To alleviate the potential for stress on the liner due to differential settlement at this abrupt transition area, an overlap flap was designed to allow the geomembrane flap to "give" as differential settlement occurs.

The flap detailed in the predesign report was found to be inadvertently located in a drainage channel of sub basin A. To correct the potential for water to seep through the flap into the refuse, the flap was moved westward out of the drainage channel and onto a slope. The configuration of the flap is shown in the Geomembrane Panel Layout drawing in Drawing 5, Appendix A.

6.6 REVISE SLOPE ON NORTHEAST AREA BUTTRESS

The buttress fill on the northeast section of the North Area Closure was shown in the Predesign Report as a 3H:IV slope. This was changed during construction to a 4H:IV slope. It was decided that the extra cost involved in the additional fill volume was outweighed by the easier workability of a 4H:IV slope during closure construction. The as-built topographic plan view of the site shows the final configuration in this area (see Appendix A).

6.7 ADDITIONAL ACCESS ROADS

The typical sideslope ditch, shown in the Predesign Report, included a footpath alongside the drainage ditch. During construction, the footpaths were widened to allow for vehicular traffic. It was decided that this would help in the closure construction and in the future as access for maintenance of the gas collection system and the drainage ditches. A typical as-built section of the sideslope ditches and access roads is shown on Drawing No. 4 of the as-built drawings.

6.8 RECORD DRAWINGS

Many references have been made to the record drawings in this report. These record drawings were produced by modifying the original drawings used to define the construction. The modifications were made to show a representation of the as-built conditions. Enclosed in this report are complete sets of both the design

drawings issued in the Predesign Report presented in Appendix C and the Record Drawings.

Section 7
SUMMARY

The construction activities described in this report were observed by Sweet-Edwards/EMCON. Based on our observations and the test results presented in this report, we believe the closure construction of the North Area Refuse Fill at the Hidden Valley Landfill was performed in a satisfactory, workmanlike manner and in substantial compliance with the construction contract documents.

Appendix A
RECORD DRAWINGS

NEW GATE HOUSE AND SCALES

NEW MAINTENANCE/ EQUIPMENT BUILDING

LANDFILL GAS BLOWER AND FLARE FACILITY SEE DETAIL 7, DWG. 4 FOR GEOMEMBRANE CONNECTION TO CONCRETE SLAB

PERIMETER MAINTENANCE ROAD

CLOSURE AREA LIMIT

Dense Trees

Scales

Stack

HV112

Paved

Pipes

Pipe

N26000

ENTRANCE ROAD

MAIN ACCESS ROAD

GAS WELL LOCATIONS (TYP.)

AREA 3

AREA 2

AREA 1

APPROXIMATE AREA OF OLD PIT AND MAINTENANCE/ EQUIPMENT BUILDING FILLED IN SUMMER OF 1989

GAS SYSTEM TRANSMISSION LINES

ACCESS ROADS

CONTOURS FOLLOWING CLOSURE CONSTRUCTION

CLOSURE AREA LIMIT

ORIGINAL GATE HOUSE AND SCALES REMOVED DURING CLOSURE

Trailer

Brush

N25500

E53000

E54000

E53500

SCALE 0 50 100 150 FEET

Topography prepared by photogrammetric methods by: Walker and Associates. Date of aerial: Oct. 29, 1989.

HENRY LEE FORTES STATE OF WASHINGTON REGISTERED PROFESSIONAL ENGINEER

REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY
0	1/90	AS BUILT RECORDS	MP	BH	MGS	HLF

DATE OF ISSUE JAN. 1990 — DWN BY MLP — DES BY BH — CHK BY MGS — APP BY HLF

Sweet-Edwards EMCON

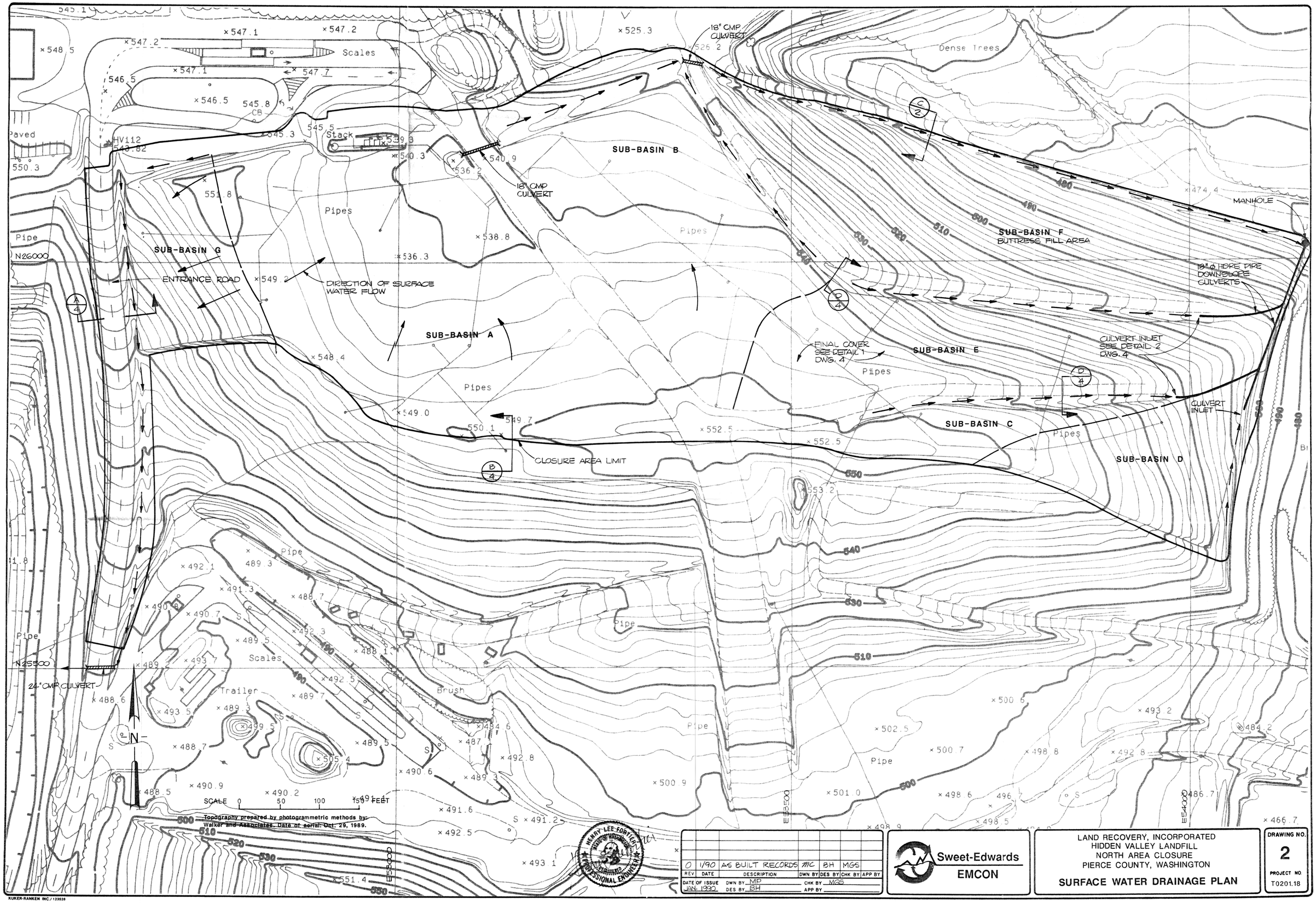
LAND RECOVERY, INCORPORATED
HIDDEN VALLEY LANDFILL
NORTH AREA CLOSURE
PIERCE COUNTY, WASHINGTON

FINAL GRADING PLAN

DRAWING NO. 1

PROJECT NO. T0201.18

KUKER-RANKEN INC./ 123528



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DATE OF ISSUE JAN. 1990 — DWN BY MP — DES BY BH — CHK BY MGS — APP BY

Sweet-Edwards EMCON

LAND RECOVERY, INCORPORATED
HIDDEN VALLEY LANDFILL
NORTH AREA CLOSURE
PIERCE COUNTY, WASHINGTON

SURFACE WATER DRAINAGE PLAN

DRAWING NO. 2

PROJECT NO. T0201.18

Dense Trees

Scales

Paved

Stack

Pipes

Pipe

Trailer

Brush

MANHOLE

HDPE DOWNSLOPE CULVERTS

OUTLET (TYP.)

3" ADS CORRUGATED, PERFORATED PIPE (TYP.) SEE SECTIONS C/4 D/4

END CAP (TYP.)

CLOSURE AREA LIMIT

N26000

N25500

E53500

E54000

SCALE 0 50 100 150 FEET

Topography prepared by photogrammetric methods by: Walker and Associates. Date of aerial: Oct. 29, 1989.

KUKER-RANKEN INC./123528

REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP'P BY
0	1/90	AS BUILT RECORDS	MP	BH	MGS	HLF

DATE OF ISSUE JAN. 1990 — DWN BY MP — DES BY BH — CHK BY MGS — APP BY HLF

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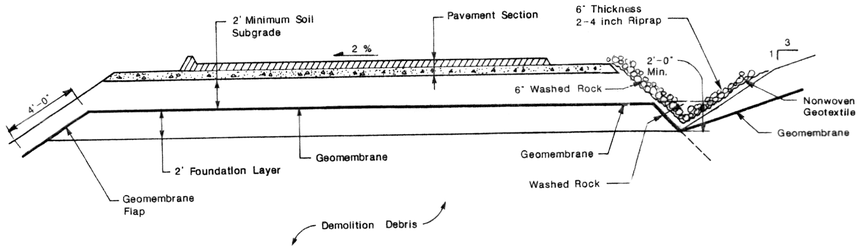
LAND RECOVERY, INCORPORATED
HIDDEN VALLEY LANDFILL
NORTH AREA CLOSURE
PIERCE COUNTY, WASHINGTON

UNDERDRAIN LAYOUT

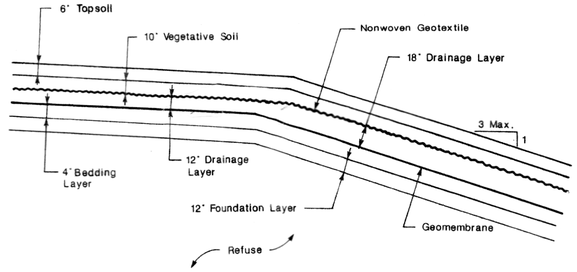
DRAWING NO. 3

PROJECT NO T0201.18

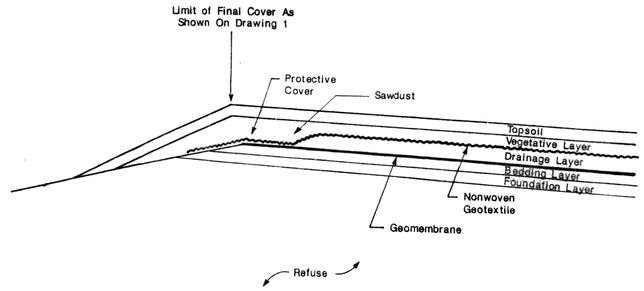


NOTE: Geomembrane seams should be oriented perpendicular to the road alignment.

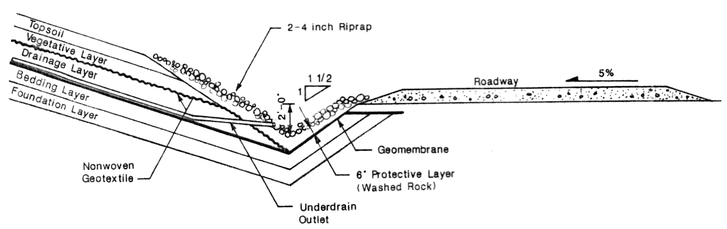
ENTRANCE ROAD
SECTION A/2
NTS



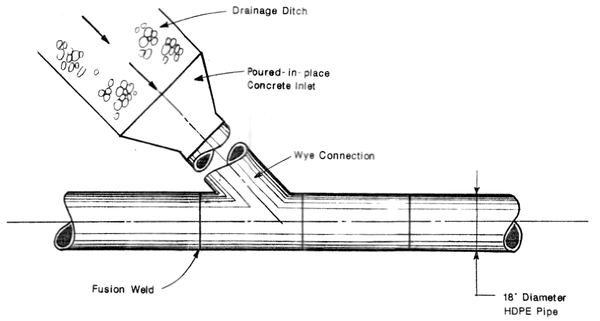
FINAL COVER
DETAIL 1
NTS



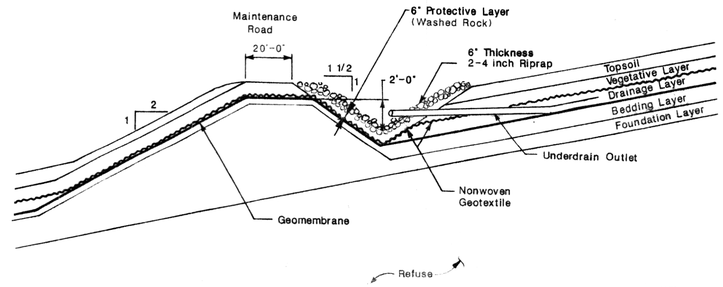
TYPICAL END SECTION
SECTION B/2
NTS



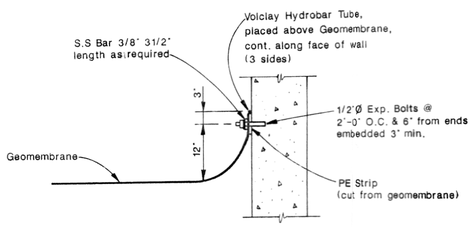
PERIMETER ROADSIDE DITCH
SECTION C/2
NTS



DOWNSLOPE CULVERT INLETS
DETAIL 2
NTS



TYPICAL SIDESLOPE DITCH
SECTION D/2
NTS



GEOMEMBRANE CONNECTION
DETAIL 3
NTS

HENRY LEE FORTIN — STATE OF WASHINGTON — REGISTERED PROFESSIONAL ENGINEER

MARK J. AMRHEIN — STATE OF WASHINGTON — REGISTERED PROFESSIONAL ENGINEER

REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY
2	1/90	AS BUILT RECORDS	TMC	MA	MGS	
1	7/28/89	ISSUED FOR CONST.				
0	6/20/89	ISSUED FOR BIDS				

DATE OF ISSUE 6-20-89 | DWN BY TMC/MP | DES BY MA | CHK BY PRM/MGS | APP BY HLF

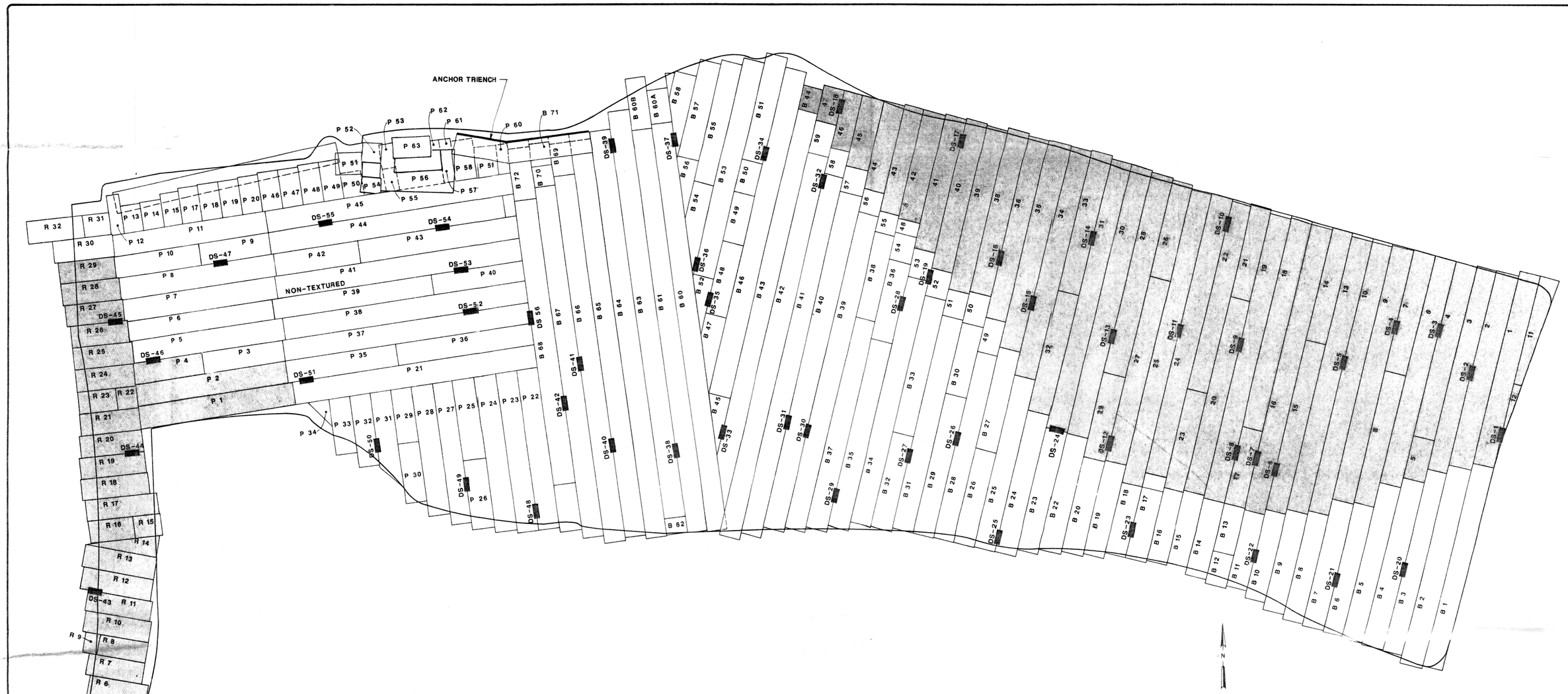
Sweet-Edwards
EMCON

LAND RECOVERY, INCORPORATED
HIDDEN VALLEY LANDFILL
NORTH AREA CLOSURE
PIERCE COUNTY, WASHINGTON

DETAILS

DRAWING NO. 4
PROJECT NO T0201.18

KUKER-RANKEN INC. / 123528



HENRY LEE FORTIER STATE OF WASHINGTON REGISTERED PROFESSIONAL ENGINEER

REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY
0	1/90	AS BUILT RECORDS	MC	BH	MGS	HLF

DATE OF ISSUE JAN 1990 DWN BY JA DES BY BH CHK BY MGS APP BY HLF

Sweet-Edwards EMCON

LAND RECOVERY, INCORPORATED
HIDDEN VALLEY LANDFILL
NORTH AREA CLOSURE
PIERCE COUNTY, WASHINGTON

GEOMEMBRANE PANEL LAYOUT

DRAWING NO. 5

PROJECT NO T0201.18

KUKER-RANKEN INC. / 12352#

Appendix B
SUMMARY OF QUALITY CONTROL/QUALITY ASSURANCE DATA

Geomembrane Conformance Test Results

Geotextile Conformance Test Results

Summary of Destructive Seam Test Results

Laboratory Soils Test Results

HIDDEN VALLEY LANDFILL
NORTH AREA CLOSURE

Geomembrane Conformance Test Results
Performed by: Precision Laboratories
Performed for: Sweet-Edwards/EMCON

Roll No.	Stress (yield lb/in)	Stress (break lb/in)	Tear (lb)	Puncture (lb)	Thickness (mil)
Textured Geomembrane					
Specified values	126	72	30	70	60
30677	162	152	55	100	66.5
30724	199	165	63	130	81
Smooth Geomembrane					
Specified values	130	225	30	75	60
50527	159	278	54	102	62.4
50745	152	277	54	103	62.3
50763	154	226	47	99	62.9

HIDDEN VALLEY LANDFILL
NORTH AREA CLOSURE

Geotextile Conformance Test Results
Performed by: Precision Laboratories
Performed for: Sweet-Edwards/EMCON

Roll No.	Puncture (lb.)	Burst (PSI)	Thickness (mil.)	Mass (oz./sy)	Permitivity
Specified values	100	300	105	8.3	1.9
ASG834522	108	278	90	8.8	1.7
AGG834708	125	345	109	8.7	1.6
AEA834988	106	306	106	8.1	1.6
ASG834776	99	297	113	8.0	1.7
AGB834896	93	299	104	7.9	1.8
AGA834561	104	280	104	8.0	1.7

SUMMARY OF DESTRUCTIVE SEAM TEST RESULTS

Project Name:HIDDEN VALLEY - NORTH AREA CLOSURE
Project Number:T02-01.18
Prepared by:BILL HURLEY

Geosynthetic Manufacturer:GUNDLE
Type of Geosynthetic:60 mil HDPE

	TEXT.	SMOOTH	
Passing Criteria Peel:	88	91	PPIW
Passing Criteria Shear:	113	117	PPIW
Nominal Thickness:	60	60	Mils

Sample Number	Sample Location (Seam #)	Type of Material (text/smooth)	Type of Weld (Fus/Ext)	Avg. Peel VALUE (PPIW)	Pass/Fail (P/F)	Avg.Shear Value (PPIW)	Pass/Fail (P/F)	Remarks
1	1-12	Textured	Fusion	126	Pass	207	Pass	
2	2-3	Textured	Fusion	145	Pass	198	Pass	
3	4-6	Textured	Fusion	151	Pass	184	Pass	
4	7-9	Textured	Fusion	139	Pass	182	Pass	
5	10-13	Textured	Fusion	148	Pass	191	Pass	
6	15-16	Textured	Fusion	125	Pass	174	Pass	
7	16-17	Textured	Fusion	129	Pass	165	Pass	
8	17-19	Textured	Fusion	143	Pass	188	Pass	
9	19-20	Textured	Fusion	132	Pass	179	Pass	
10	21-22	Textured	Fusion	137	Pass	175	Pass	
11	24-25	Textured	Fusion	121	Pass	174	Pass	
12	27-29	Textured	Fusion	101	Pass	167	Pass	
13	28-30	Textured	Fusion	135	Pass	181	Pass	
14	31-32	Textured	Fusion	163	Pass	188	Pass	
15	34-35	Textured	Fusion	149	Pass	197	Pass	
16	36-38	Textured	Fusion	151	Pass	208	Pass	
17	41-48	Textured	Fusion	152	Pass	194	Pass	
18	46-47	Textured	Fusion	146	Pass	172	Pass	
19	52-53	Textured	Extrusion	154	Pass	192	Pass	
20	B3-B4	Smooth	Fusion	120	Pass	177	Pass	
21	B6-B7	Smooth	Fusion	111	Pass	195	Pass	
22	B10-B11	Smooth	Fusion	105	Pass	180	Pass	
23	B18-B19	Smooth	Fusion	121	Pass	206	Pass	
24	B1-B23	Smooth/Text.	Fusion	150	Pass	179	Pass	
25	B24-B25	Smooth	Fusion	139	Pass	187	Pass	
26	B28-B29	Smooth	Fusion	127	Pass	199	Pass	
27	B31-B32	Smooth	Fusion	120	Pass	187	Pass	
28	B34-B36	Smooth	Fusion	118	Pass	197	Pass	
29	B35-B37	Smooth	Fusion	116	Pass	188	Pass	
30	B39-B40	Smooth	Fusion	124	Pass	196	Pass	
31	B40-B41	Smooth	Fusion	111	Pass	184	Pass	
32	B41-B42	Smooth	Fusion	112	Pass	198	Pass	
33	B45-B43	Smooth	Fusion	128	Pass	182	Pass	
34	B51-B46	Smooth	Fusion	130	Pass	175	Pass	
35	B52-B48	Smooth	Fusion	142	Pass	190	Pass	
36	B53-B54	Smooth	Fusion	138	Pass	199	Pass	
37	B58-B59	Smooth	Fusion	132	Pass	189	Pass	
38	B61-B63	Smooth	Fusion	138	Pass	197	Pass	
39	B63-B64	Smooth	Fusion	132	Pass	204	Pass	
40	B65-B66	Smooth	Fusion	134	Pass	193	Pass	
41	B66-B67	Smooth	Fusion	136	Pass	200	Pass	
42	B67-B68	Smooth	Fusion	126	Pass	207	Pass	
43	R11-R12	Textured	Fusion	153	Pass	216	Pass	
44	R19-R20	Textured	Fusion	156	Pass	203	Pass	
45	R26-R27	Textured	Fusion	154	Pass	218	Pass	
46	P4-P5	Smooth	Fusion	155	Pass	188	Pass	
47	P8-P9	Smooth	Fusion	150	Pass	196	Pass	
48	P22-P23	Smooth	Extrusion	113	Pass	145	Pass	
49	P26-P27	Smooth	Extrusion	121	Pass	142	Pass	
50	P31-P32	Smooth	Extrusion	114	Pass	153	Pass	
51	P21-P35	Smooth	Extrusion	151	Pass	180	Pass	

Notes:
1. Sample Location: See as - built drawing for exact location
2. PPIW: Pounds per inch width.
3. Mils: thousandths of an inch.

SUMMARY OF DESTUCTIVE SEAM TEST RESULTS

Project Name:HIDDEN VALLEY - NORTH AREA CLOSURE
Project Number:T02-01.18
Prepared by:BILL HURLEY

Geosynthetic Manufacturer:GUNDLE
Type of Geosynthetic:60 mil HDPE

	TEXT.	SMOOTH	
Passing Criteria Peel:	88	91	PPIW
Passing Criteria Shear:	113	117	PPIW
Nominal Thickness:	60	60	Mils

Sample Number	Sample Location (Seam #)	Type of Material (text/smooth)	Type of Weld (Fus/Ext)	Avg. Peel VALUE (PPIW)	Pass/Fail (P/F)	Avg.Shear Value (PPIW)	Pass/Fail (P/F)	Remarks
52	P37-P38	Smooth	Fusion	139	Pass	233	Pass	
53	P39-P41	Smooth	Fusion	151	Pass	203	Pass	
54	P42-P44	Smooth	Fusion	182	Pass	186	Pass	
55	P44-P45	Smooth	Fusion	160	Pass	222	Pass	
56	P37-B68	Smooth	Extrusion	122	Pass	204	Pass	

Summary of Destructive Samples sent to Presion Labratories for independent testing

1	1-12	Textured	Fusion	150	Pass	248	Pass
2	2-3	Textured	Fusion	164	Pass	229	Pass
3	4-6	Textured	Fusion	154	Pass	219	Pass
4	7-9	Textured	Fusion	140	Pass	208	Pass
5	10-13	Textured	Fusion	158	Pass	217	Pass
6	15-16	Textured	Fusion	148	Pass	216	Pass
7	16-17	Textured	Fusion	156	Pass	205	Pass
25	B24-B25	Smooth	Fusion	134	Pass	218	Pass
26	B28-B29	Smooth	Fusion	125	Pass	224	Pass
27	B31-B32	Smooth	Fusion	120	Pass	220	Pass
28	B34-B36	Smooth	Fusion	117	Pass	218	Pass
29	B35-B37	Smooth	Fusion	124	Pass	215	Pass

Notes:
1. Sample Location: See as - built drawing for exact location
2. PPIW: Pounds per inch width.
3. Mils: thousandths of an inch.

HONG CONSULTING ENGINEERS, INC.

• Geotechnical Engineering • Material Testing • Construction Quality Control Inspection •

GRAIN SIZE DISTRIBUTION

Project: Hidden Valley

Project Number: T-0024

Date Tested: 8-16-89

Remarks: Brown, silty, sandy, fine to coarse GRAVEL (Drainage layer)

Test Hole Number: #7

Depth:

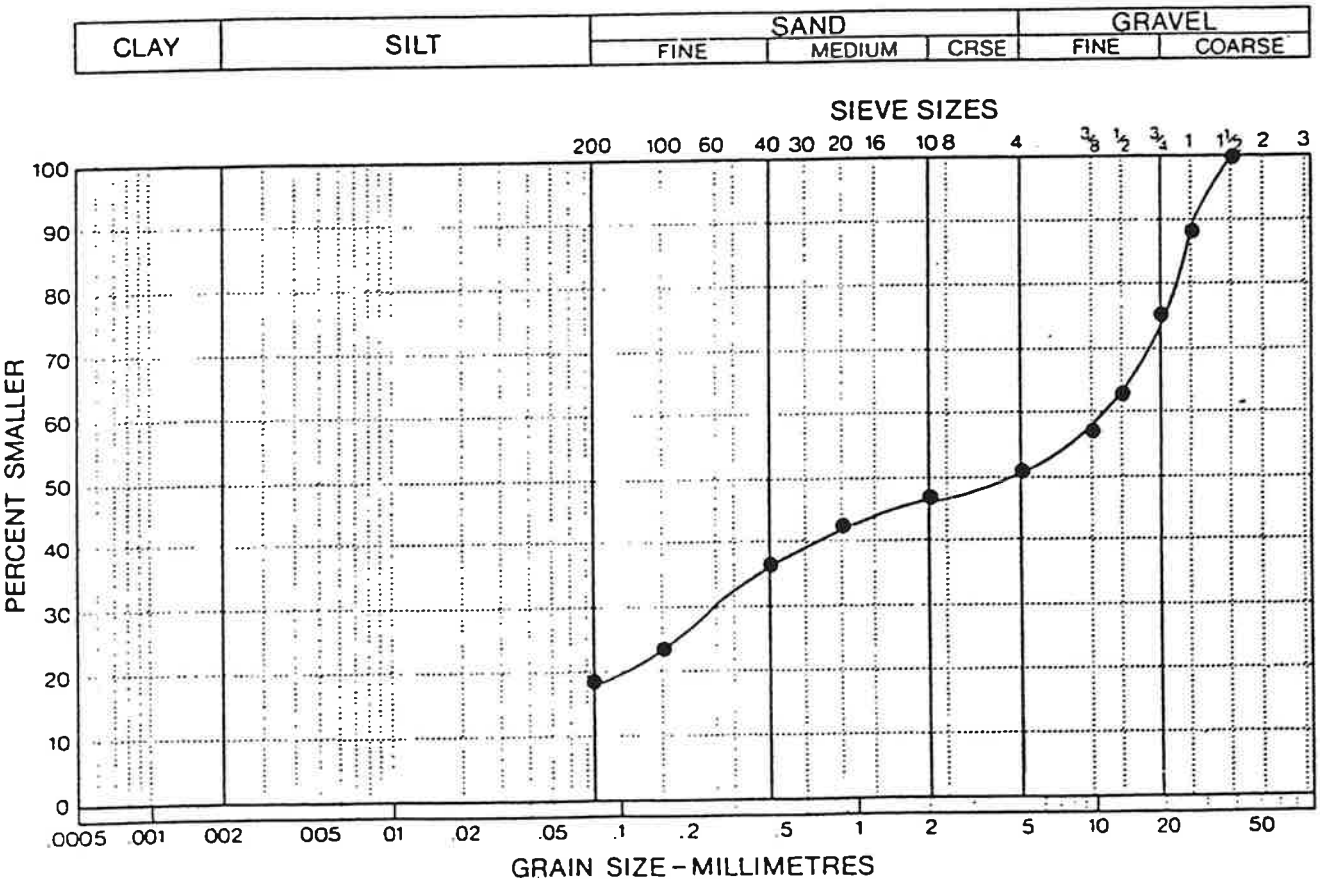
Sample Description

Gravel: 49.0

Sand: 32.0

Silt: 19.0

Clay:



Reviewed By:

All tests performed in accordance with ASTM

HONG CONSULTING ENGINEERS, INC.

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GRAIN SIZE DISTRIBUTION

Project: Hidden Valley

Test Hole Number: #8

Depth:

Project Number: T-0024

Sample Description

Date Tested: 8-16-89

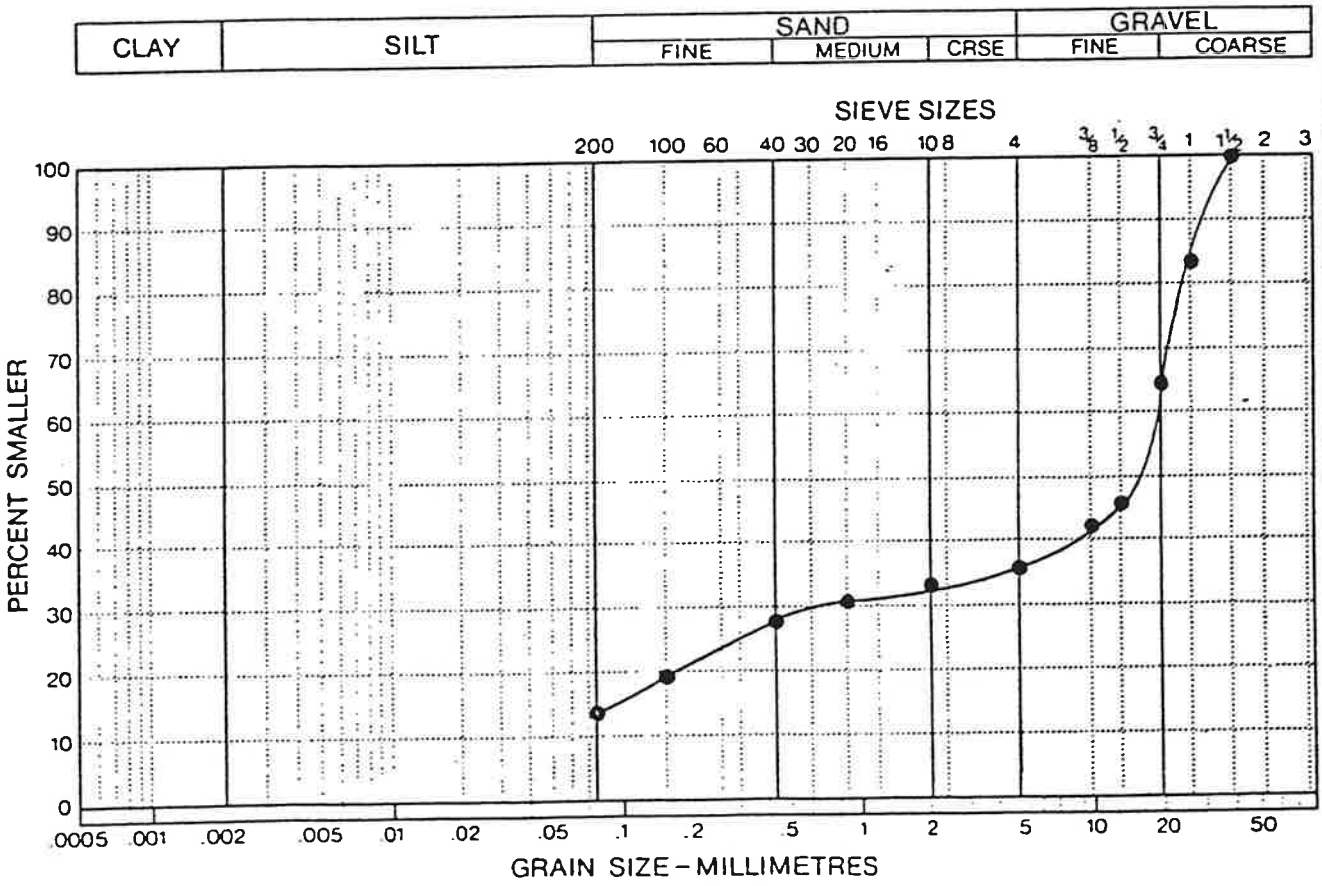
Gravel: 64.2

Remarks: Brown, silty, sandy fine to coarse GRAVEL (Drainage layer)

Sand: 21.2

Silt: 14.6

Clay:



Reviewed By:

All tests performed in accordance with ASTM

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GRAIN SIZE DISTRIBUTION

Project: Hidden Valley Landfill

Test Hole Number: 1A

Depth:

Project Number: T-0024

Date Tested: 6-20-89

Remarks: Brown, silty, sandy GRAVEL (Drainage layer)

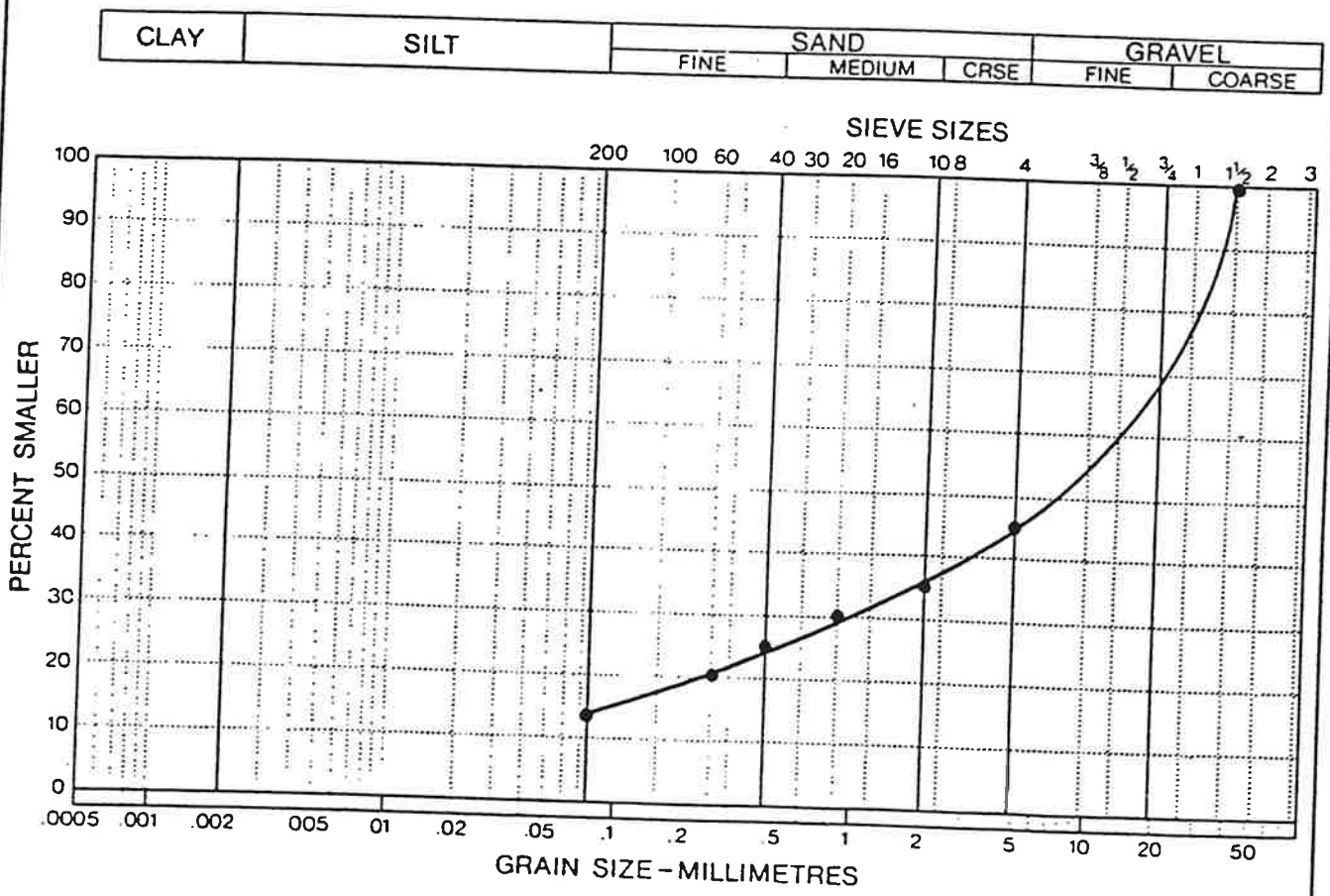
Sample Description

Gravel: 55.0

Sand: 31.9

Silt: 13.1

Clay:



Reviewed By:

All tests performed in accordance with ASTM

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• Geotechnical Engineering • Material Testing • Construction Quality Control Inspection •

GRAIN SIZE DISTRIBUTION

Project: Hidden Valley Landfill

Test Hole Number: 2A

Depth:

Project Number: T-0024

Sample Description

Date Tested: 6-20-89

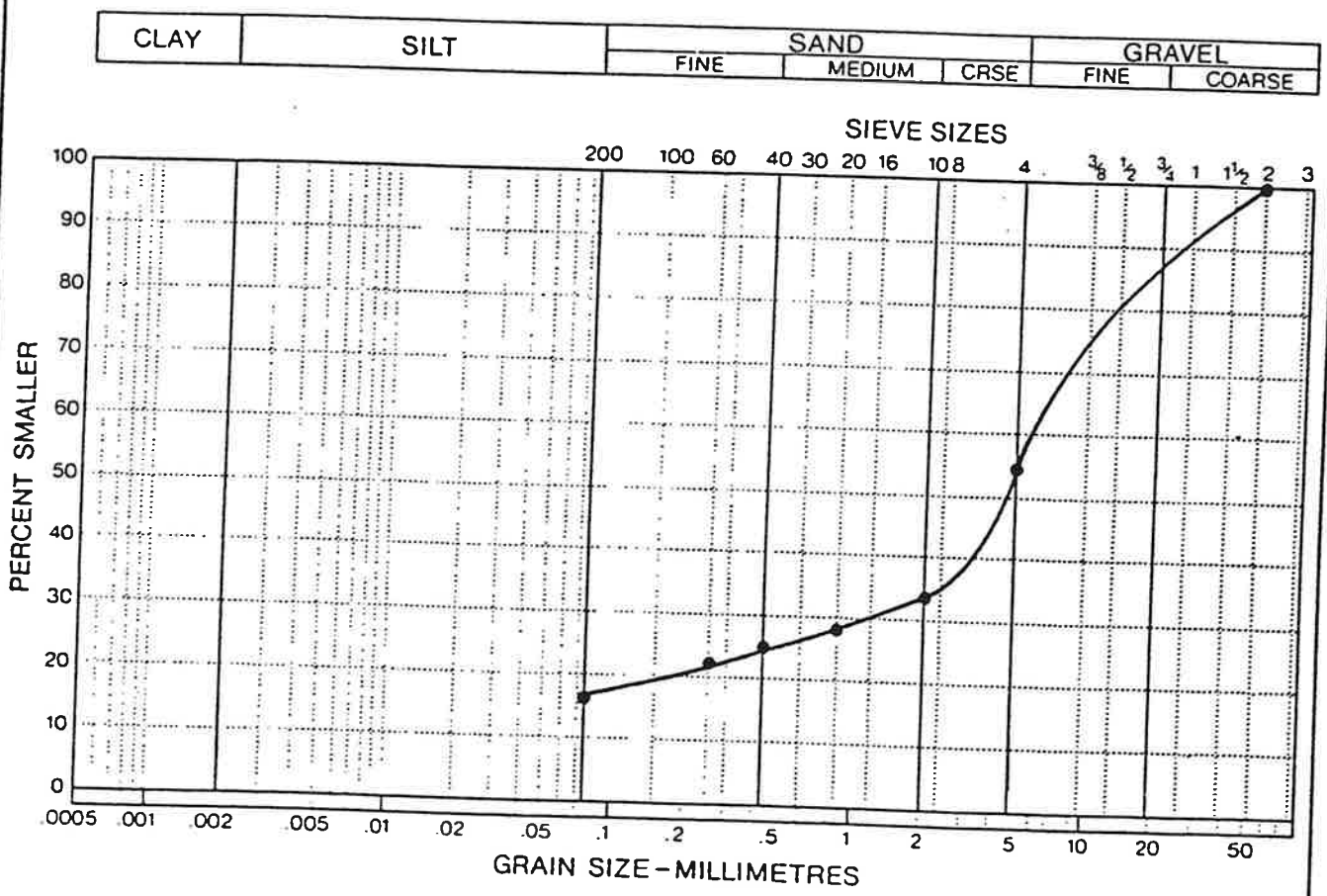
Gravel: 46.1

Remarks: Brown, silty, sandy GRAVEL (Drainage layer)

Sand: 38.0

Silt: 15.9

Clay:



Reviewed By:

All tests performed in accordance with ASTM

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GRAIN SIZE DISTRIBUTION

Project: Hidden Valley Landfill

Test Hole Number: 3B

Depth:

Project Number: T-0024

Date Tested: 6-20-89

Remarks: Brown, sandy GRAVEL with some silt (Drainage layer)

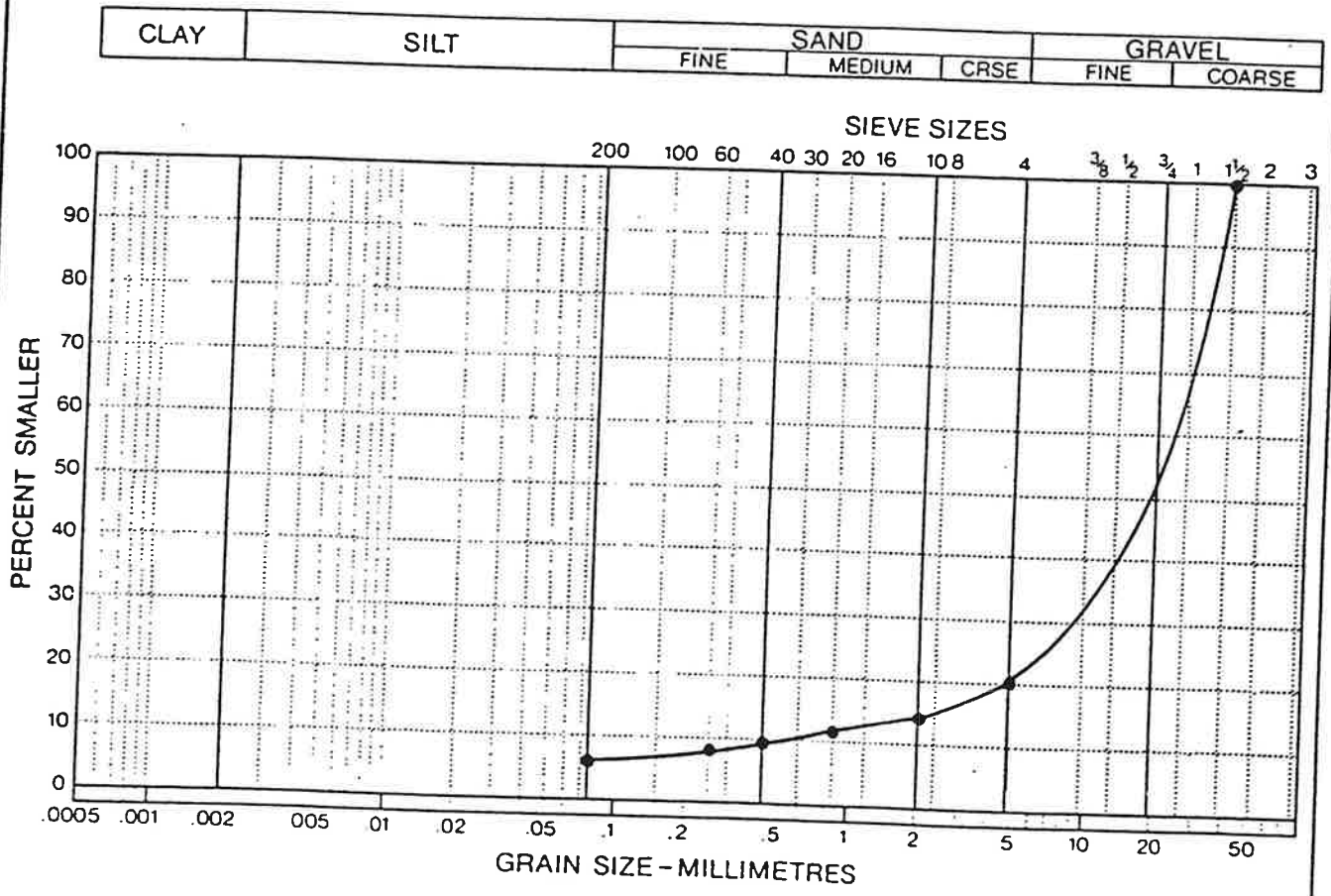
Sample Description

Gravel: 79.9

Sand: 13.8

Silt: 6.3

Clay:



Reviewed By:

All tests performed in accordance with ASTM

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• Geotechnical Engineering • Material Testing • Construction Quality Control Inspection •

GRAIN SIZE DISTRIBUTION

Project: Hidden Valley P02-0118 North Area Closure Drainage Layer

Test Hole Number:

Depth:

Project Number: T0024

Date Tested: 6-20-1989

Remarks: Brown, sandy, fine to coarse GRAVEL with trace to some silt (Drainage layer).

Sample Description

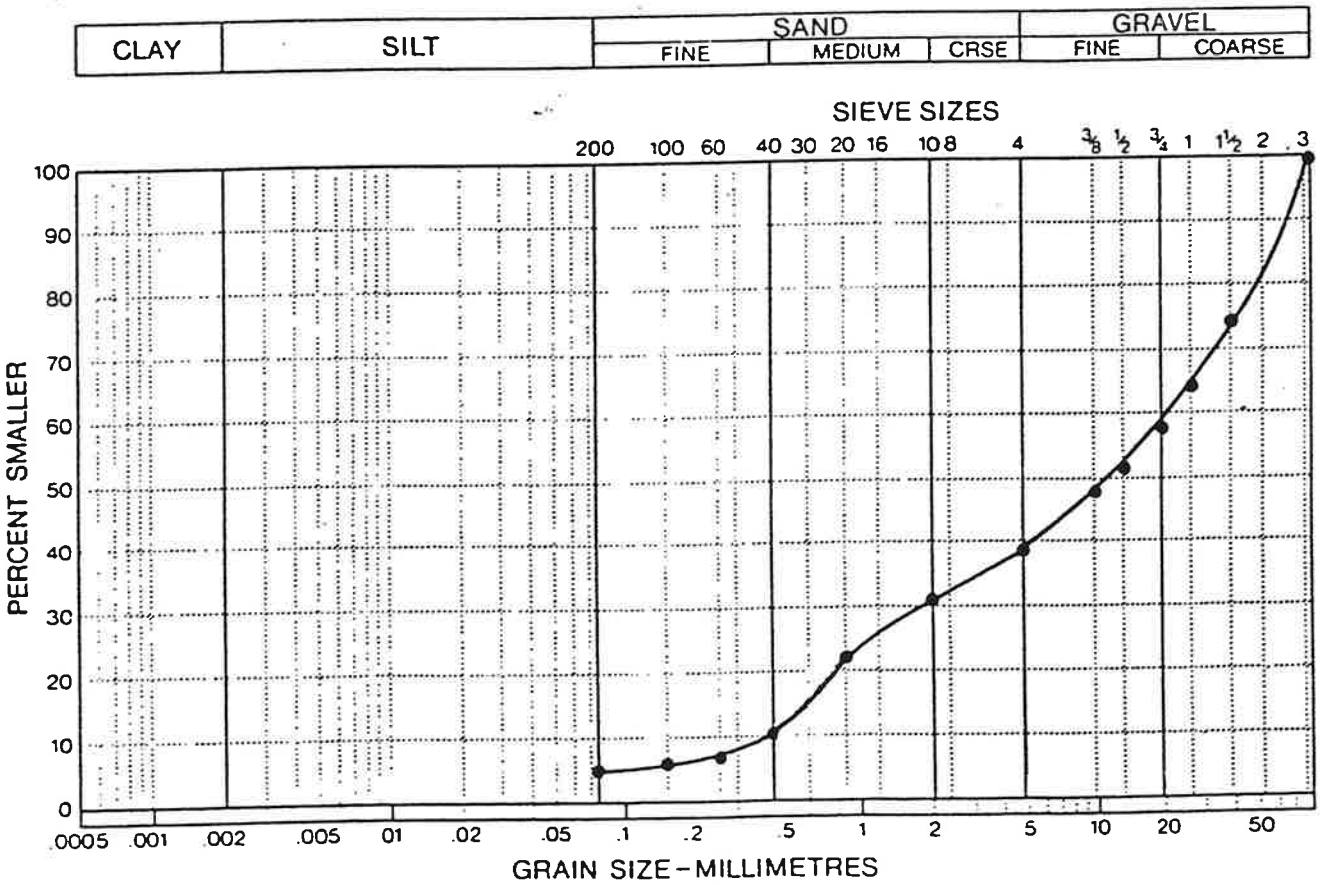
Gravel: 61.4%

Sand: 26.2%

Silt: 5.4%

Clay:

Sweet Edwards/EMCON Att: Bill Hurley



Reviewed By:

All tests performed in accordance with ASTM

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GRAIN SIZE DISTRIBUTION

Project: Hidden Valley Landfill

Project Number: T-0024

Date Tested: 6-20-89

Remarks: Brown, sandy GRAVEL with trace to some silt (Drainage layer).

Test Hole Number: 2B

Depth:

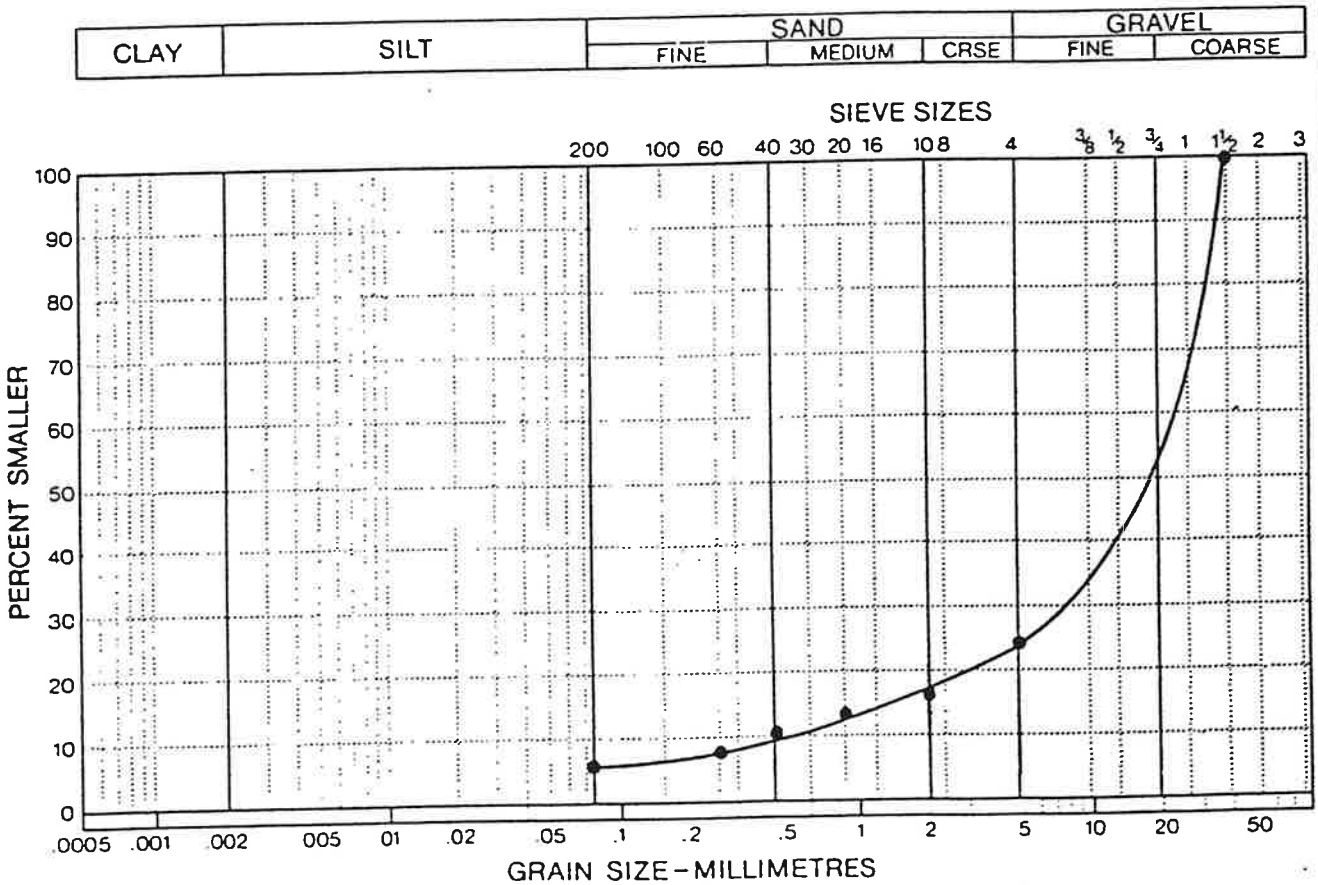
Sample Description

Gravel: 76.6

Sand: 17.6

Silt: 5.8

Clay:



Reviewed By: Steven E. Hong

All tests performed in accordance with ASTM

HONG CONSULTING ENGINEERS, INC.

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GRAIN SIZE DISTRIBUTION

Project: Hidden Valley Landfill

Test Hole Number: 1-B

Depth:

Project Number: T-0024

Date Tested: 6-20-89

Remarks: Brown, sandy GRAVEL with trace to some silt (Drainage layer).

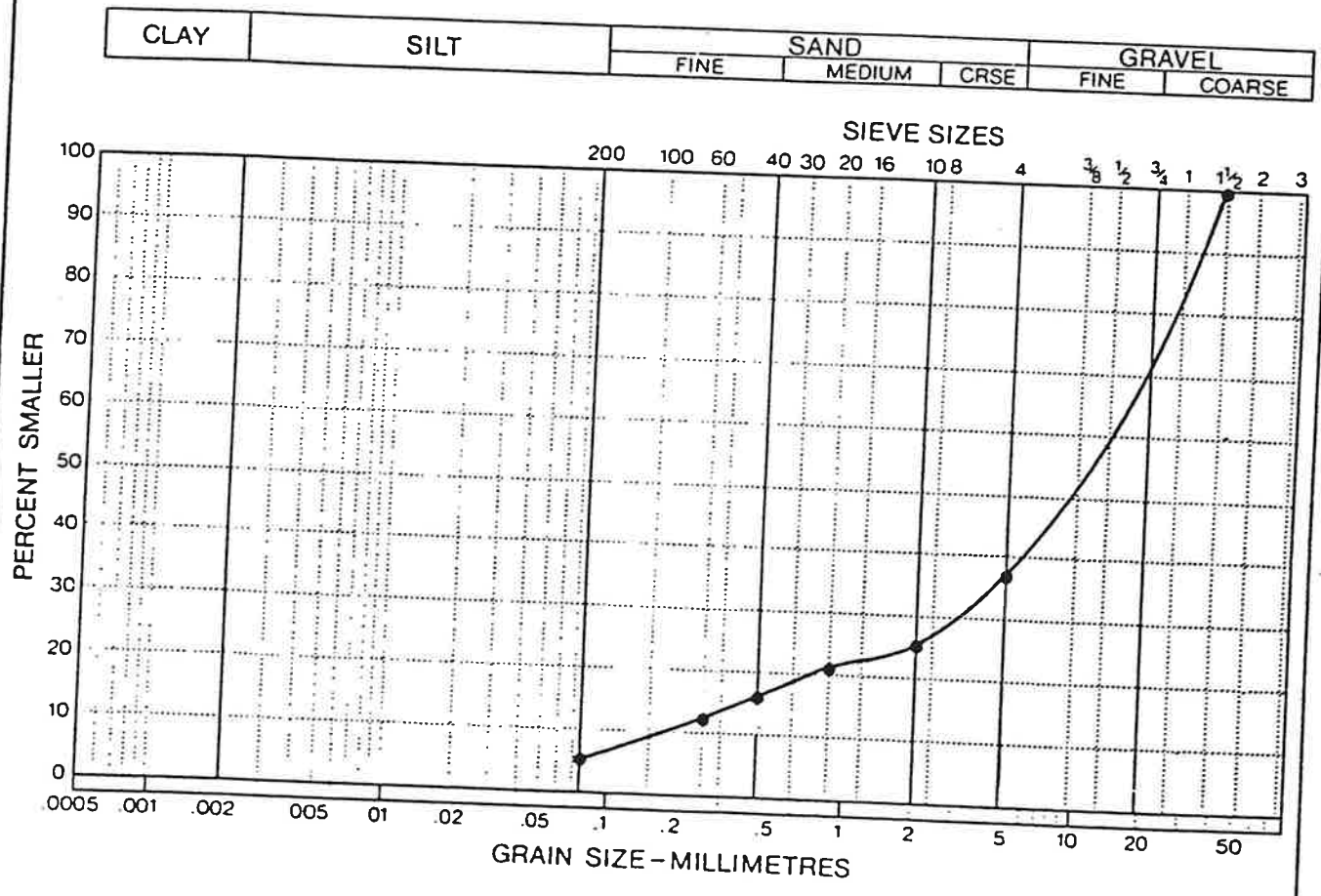
Sample Description

Gravel: 62.7

Sand: 31.9

Silt: 5.4

Clay:



Reviewed By:

All tests performed in accordance with ASTM

HONG CONSULTING ENGINEERS, INC.

• Geotechnical Engineering • Material Testing • Construction Quality Control Inspection •

GRAIN SIZE DISTRIBUTION

Project: Hidden Valley

Project Number: T-0024

Date Tested: 8-31-89

Remarks: Gray, gravelly, fine to medium SAND with trace silt (Drainage layer).

Test Hole Number: T02-01.18 #1

Depth:

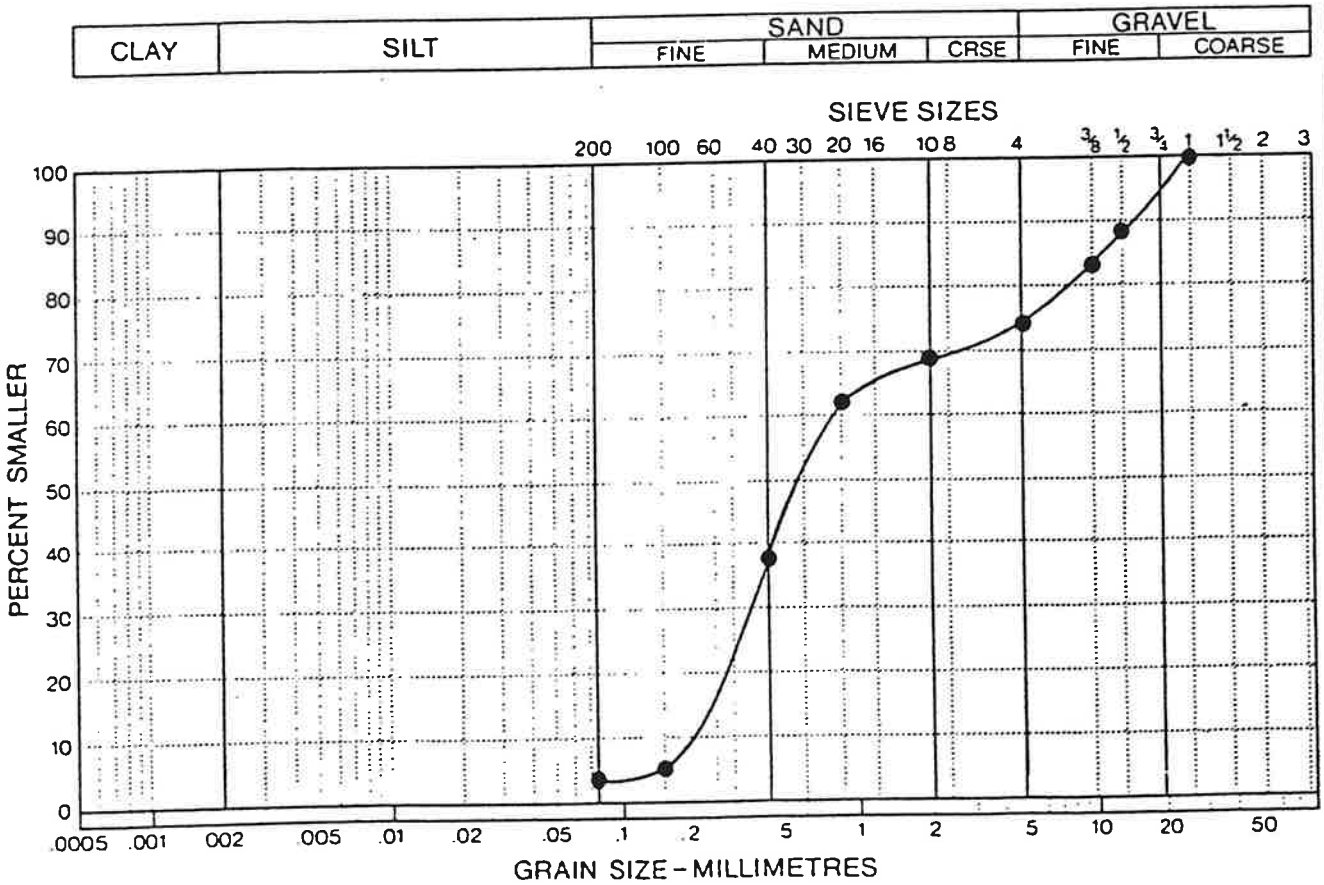
Sample Description

Gravel: 25.4

Sand: 71.5

Silt: 3.1

Clay:



Reviewed By:

All tests performed in accordance with ASTM

HONG CONSULTING ENGINEERS, INC.

• Geotechnical Engineering • Material Testing • Construction Quality Control Inspection •

GRAIN SIZE DISTRIBUTION

Project: Hidden Valley

Project Number: T-0024

Date Tested: 8-31-89

Remarks: Gray, sandy, fine GRAVEL with trace silt (Drainage layer).

Test Hole Number: T02-01.18 #2

Depth:

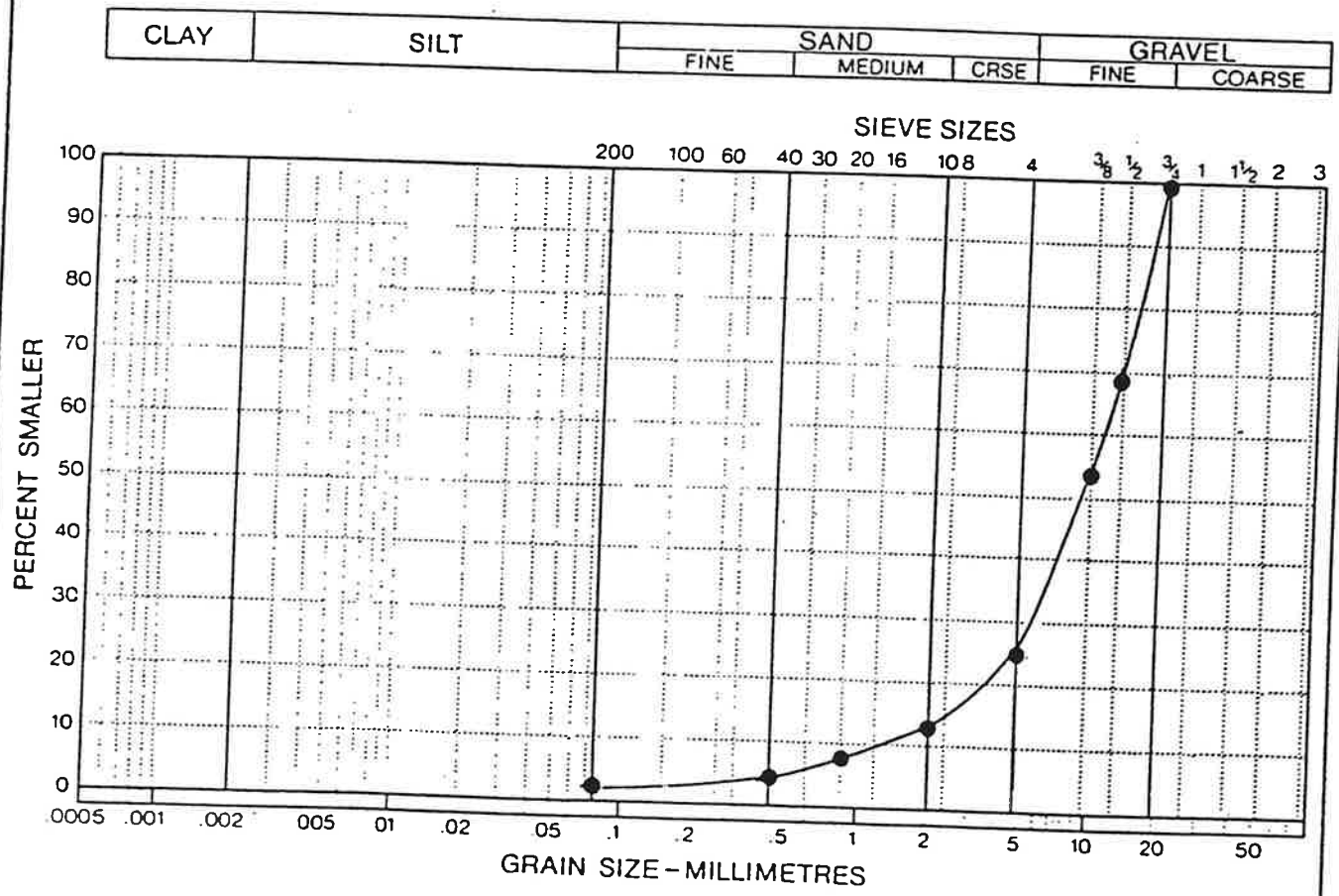
Sample Description

Gravel: 74.5

Sand: 23.4

Silt: 2.1

Clay:



Reviewed By:

All tests performed in accordance with ASTM

HONG CONSULTING ENGINEERS, INC.

• Geotechnical Engineering • Material Testing • Construction Quality Control Inspection •

GRAIN SIZE DISTRIBUTION

Project: Hidden Valley

Project Number: T-0024

Date Tested: 8-31-89

Remarks: Gray, sandy, fine GRAVEL with trace silt (Drainage layer).

Test Hole Number: T02-01.18 #3

Depth:

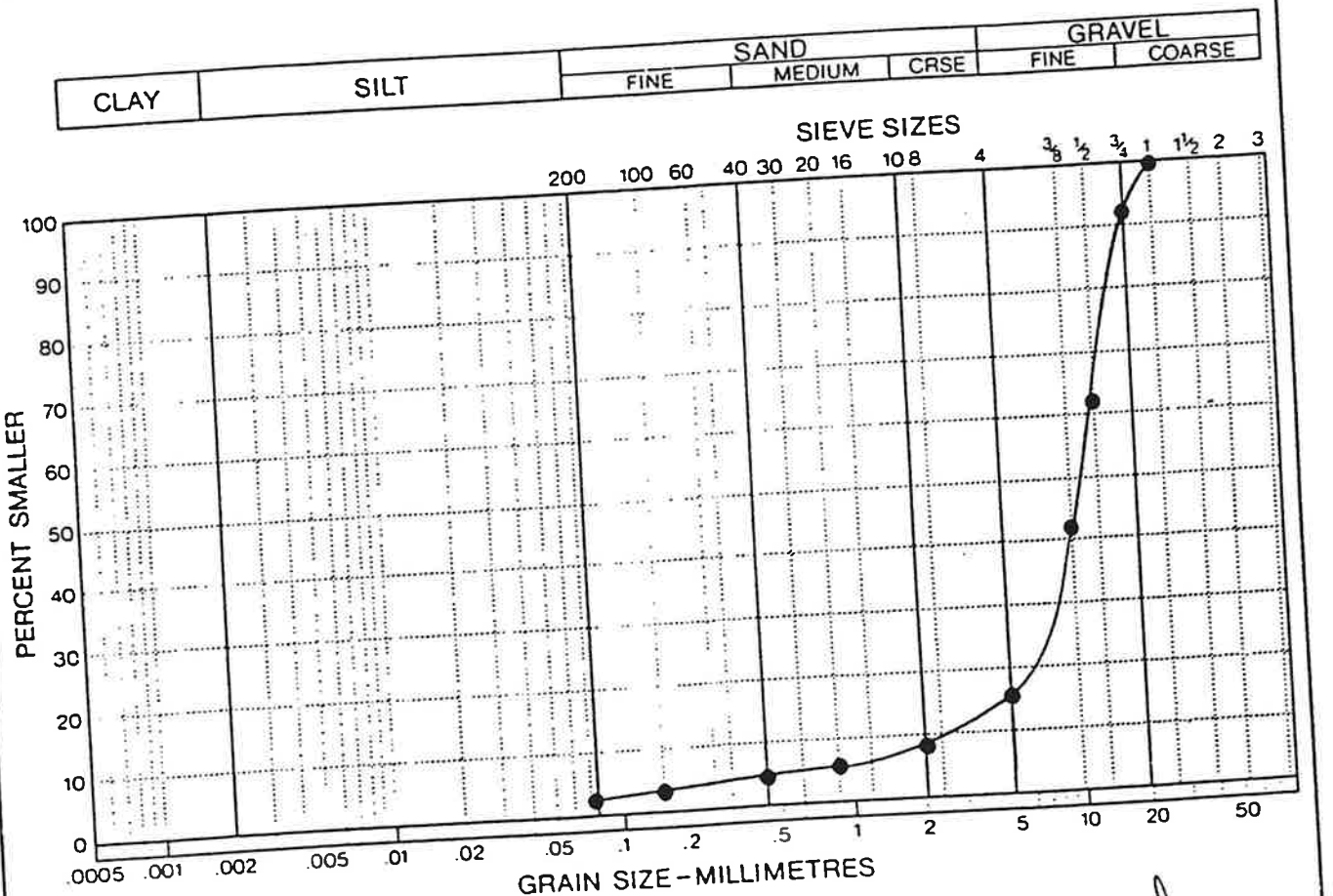
Sample Description

Gravel: 84.5

Sand: 13.3

Silt: 2.2

Clay:



Reviewed By:

All tests performed in accordance with ASTM

HONG CONSULTING ENGINEERS, INC.

• Geotechnical Engineering • Material Testing • Construction Quality Control Inspection •

GRAIN SIZE DISTRIBUTION

Project: Hidden Valley Landfill

Project Number: T-0024

Date Tested: 6-20-89

Remarks: Brown, silty, fine to coarse SAND with some gravel (Foundation layer)

Test Hole Number: 3A

Depth:

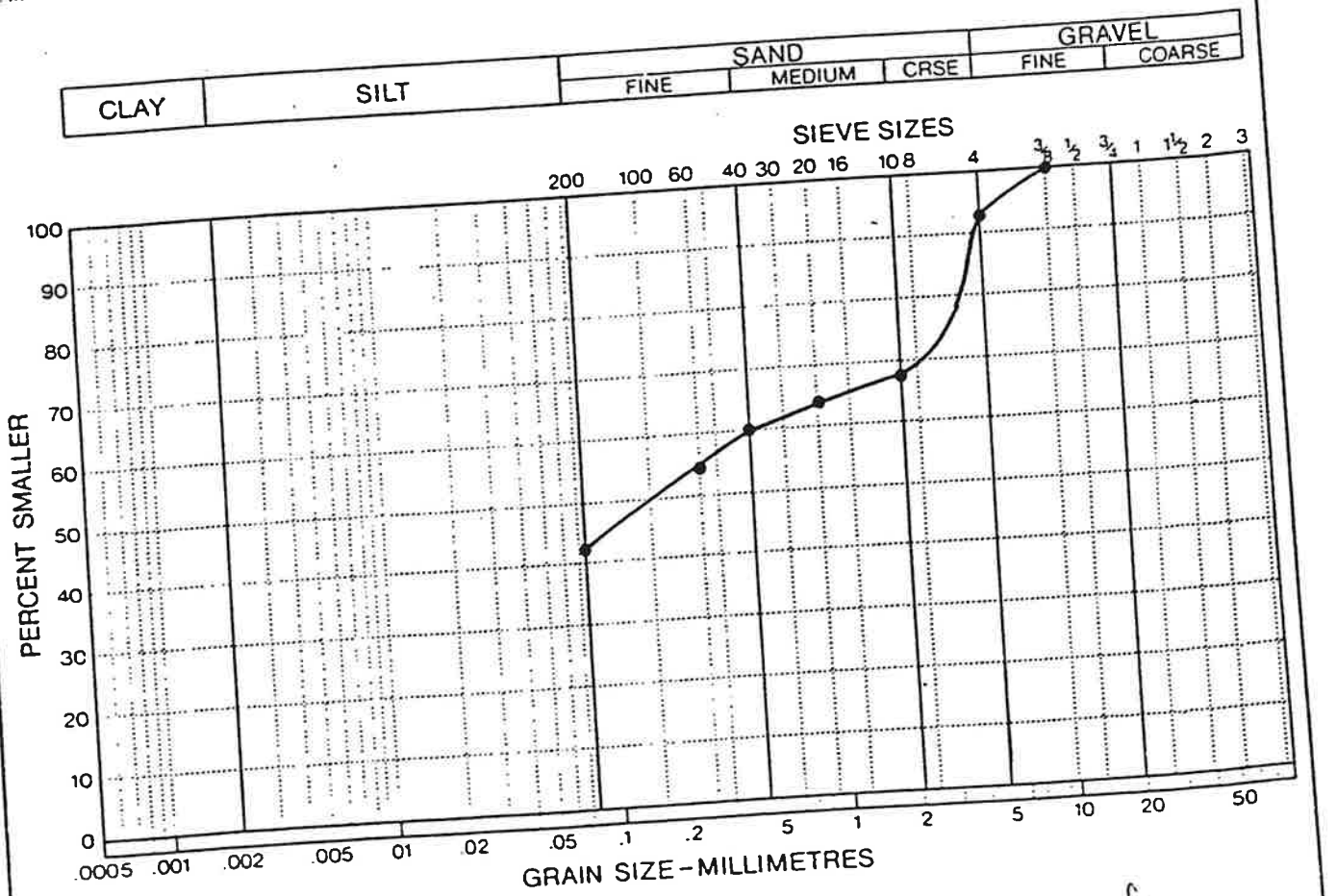
Sample Description

Gravel: 7.5

Sand: 50.5

Silt: 42.0

Clay:



Reviewed By:

All tests performed in accordance with ASTM

Appendix C
PRE-DESIGN REPORT DRAWINGS

N

E 52500 E 53000 E 53500 E 54000 E 54500 E 55000

N 26000 N 25500 N 25000 N 24500

Maintenance / Equipment building

Relocated Gate house and Scales

Proposed property line adjustment

PROPOSED COUNTY ROAD R.O.W.

Maintenance road

Landfill office

Landfill Gas Blowers Flare Facility

Area to be Buttressed

PROPOSED INFILTRATION GALLERY

CONTRACTORS STAGING AREA

Access Road See Detail 1, Dwg 4

Geomembrane Connection (See Detail 7 Drawing 4)

OVERLAP FLAP LOCATION

Proposed Contours

Remove existing Maintenance / Equipment building

CLOSURE AREA Limit of geomembrane as part of final cover

Approximate Area Requiring Textured HDPE Membrane

Drainage ditch (Typ.)

Anchor Trench Limit

Anchor Trench (See Detail 3, Dwg 4)

Limit of existing waste fill

Relocate existing Gate house and Scales

Limits of Access Road Geomembrane (See Detail 1 Dwg 4)

Culvert (Typ.)

Type I catch basin (Typ.)

Recycling facility

Property line

Proposed property line adjustment

Dense Trees

Brush

SCALE: 0 100 200 300 FEET

Topography prepared by photogammetric methods by: Walker and Associates. Date of aerial: Sept. 13, 1988

HENRY LEE FORTNER STATE OF WASHINGTON REGISTERED PROFESSIONAL ENGINEER

MARK J. AMRHEIN STATE OF WASHINGTON REGISTERED PROFESSIONAL ENGINEER

REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY
1	7/28/89	ISSUED FOR CONST				
0	6/20/89	ISSUED FOR BIDS				

DATE OF ISSUE 6-20-89 | DWN BY MP | CHK BY PM/MES | DES BY MA | APP BY HLF

Sweet-Edwards EMCON

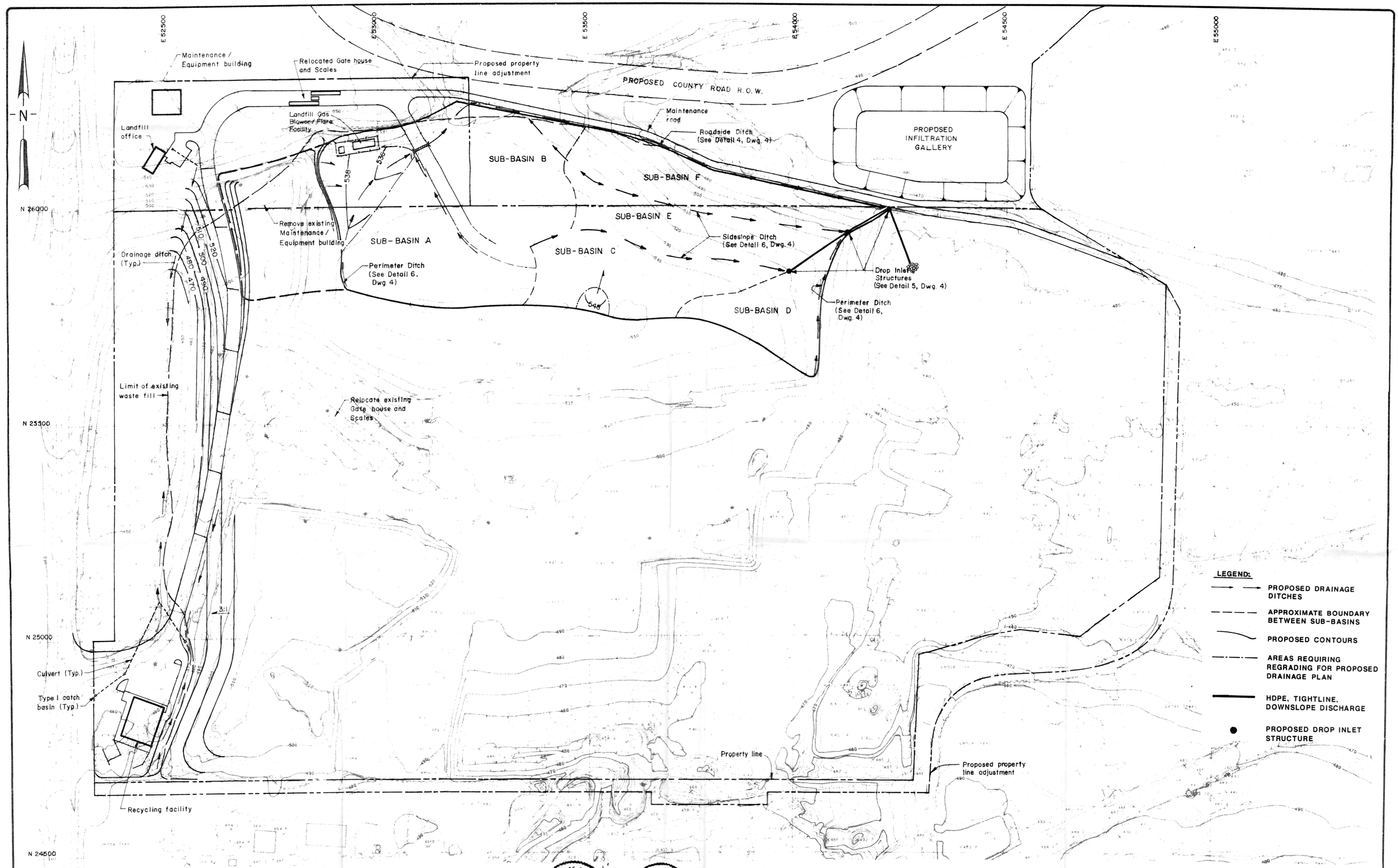
LAND RECOVERY, INCORPORATED
HIDDEN VALLEY LANDFILL
NORTH AREA CLOSURE
PIERCE COUNTY, WASHINGTON

GRADING PLAN

DRAWING NO. 1

PROJECT NO. T0201.18

KUKER-RANKEN INC./100007



SCALE 0 100 200 300 FEET

Topography prepared by photogammetric methods by: Walker and Associates. Date of aerial: Sept. 13, 1988

HENRY LEE FORTIER — STATE OF WASHINGTON — REGISTERED PROFESSIONAL ENGINEER

MARK J. AMRHEIN — STATE OF WASHINGTON — REGISTERED PROFESSIONAL ENGINEER

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1	7/28/89	ISSUED FOR CONST.				
0	6-20	ISSUED FOR BIDS				

DATE OF ISSUE — DWN BY MP — DES BY MA — CHK BY PM/MES — APP BY HLF

Sweet-Edwards EMCON

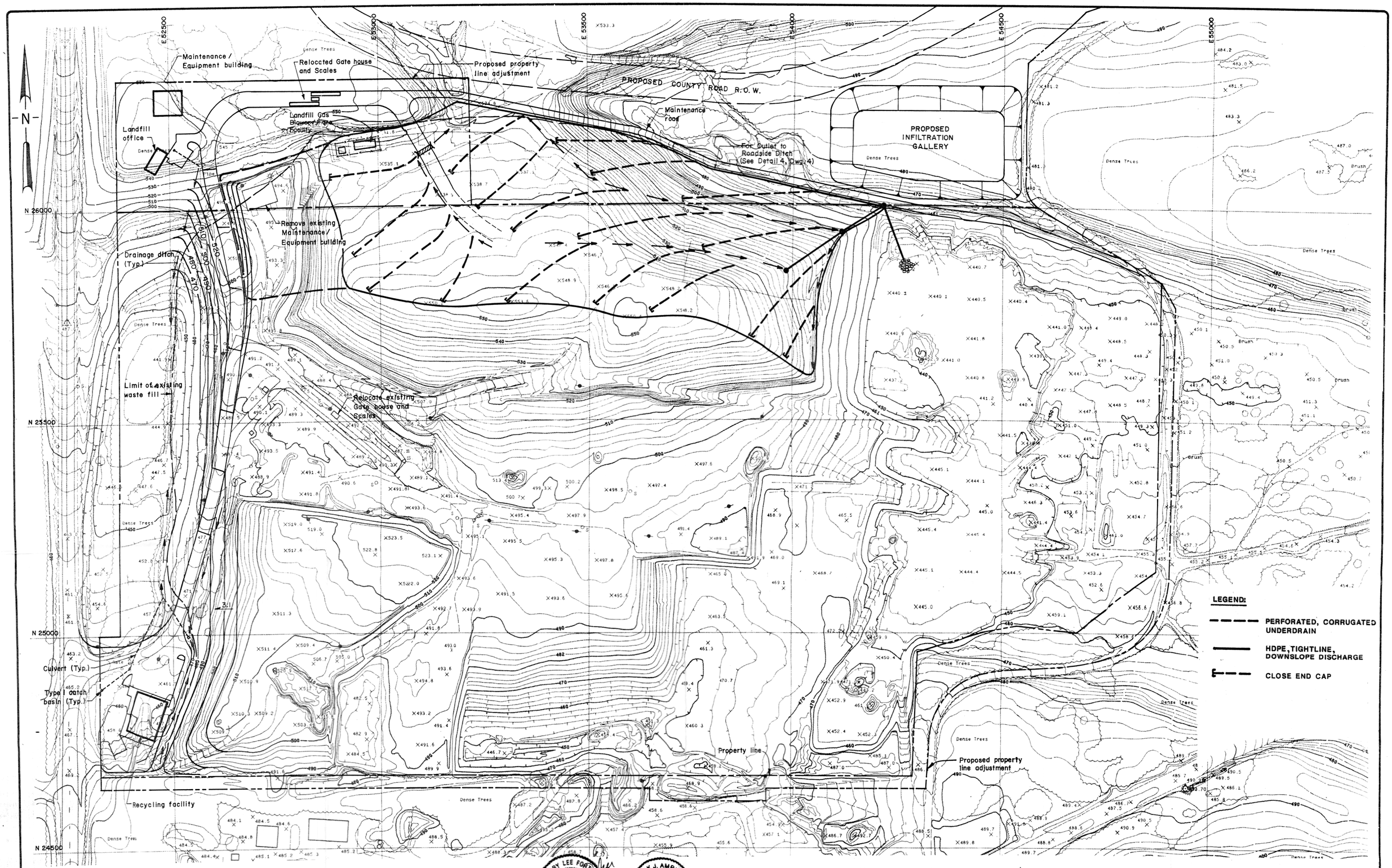
LAND RECOVERY, INCORPORATED
HIDDEN VALLEY LANDFILL
NORTH AREA CLOSURE
PIERCE COUNTY, WASHINGTON

SURFACE WATER DRAINAGE

DRAWING NO. 2

PROJECT NO. T0201.18

KUKER-RANKEN INC./106887



Topography prepared by photogammetric methods by:
Walker and Associates. Date of aerial: Sept. 13, 1988

HENRY LEE FORTNER — STATE OF WASHINGTON — REGISTERED PROFESSIONAL ENGINEER

MARK J. AMRHEIN — STATE OF WASHINGTON — REGISTERED PROFESSIONAL ENGINEER

REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY
1	7/28/89	ISSUED FOR CONST.				
0	6-20	ISSUED FOR BIDS				

DATE OF ISSUE — DWN BY MP — DES BY MA — CHK BY PM/MGS — APP BY HLF

Sweet-Edwards EMCON

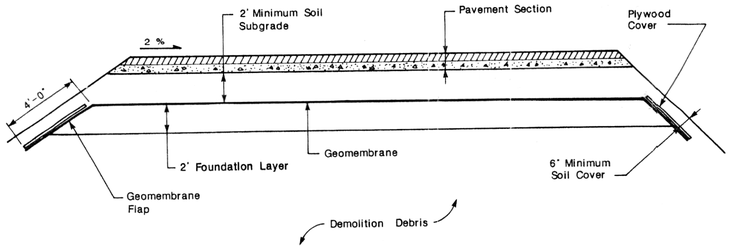
LAND RECOVERY, INCORPORATED
HIDDEN VALLEY LANDFILL
NORTH AREA CLOSURE
PIERCE COUNTY, WASHINGTON

UNDERDRAIN LAYOUT

DRAWING NO. 3

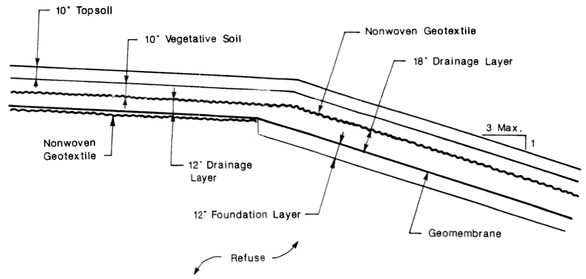
PROJECT NO. T0201.18

KUKER-RANKEN INC./106867

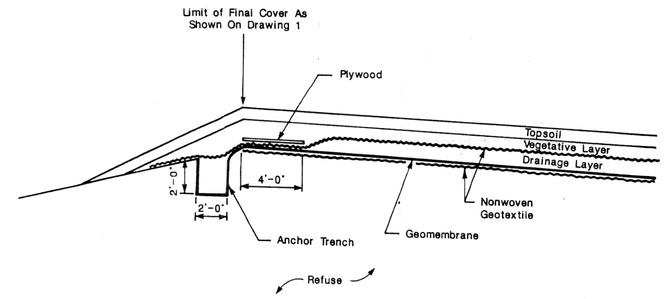


NOTE: Geomembrane seams should be oriented perpendicular to the road alignment.

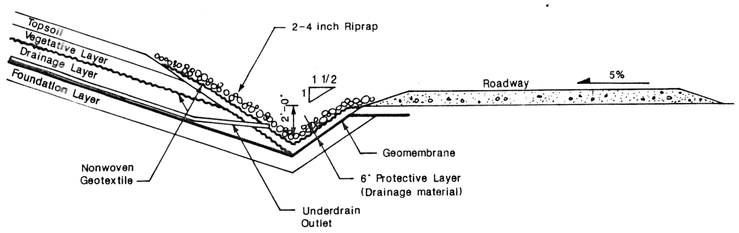
ENTRANCE ROAD
DETAIL 1



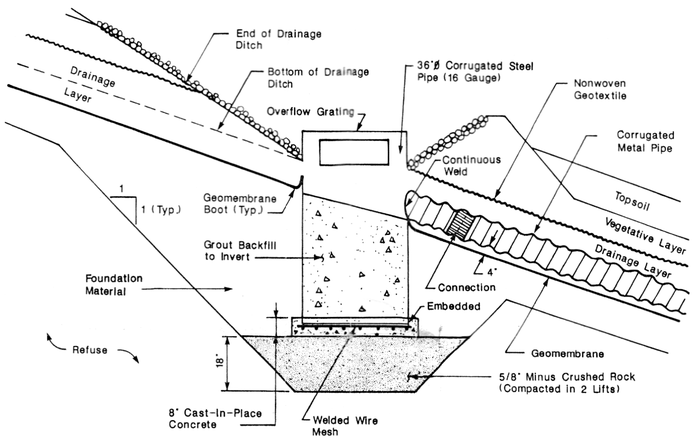
FINAL COVER
DETAIL 2



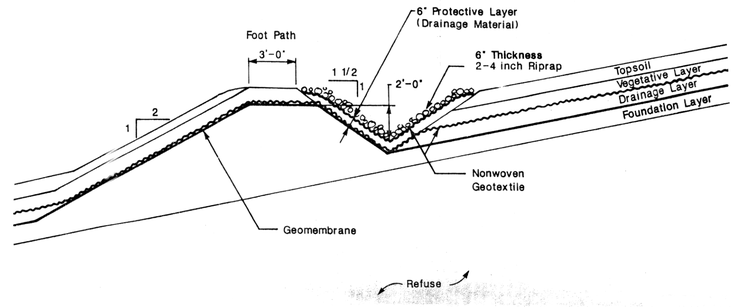
TYPICAL ANCHOR TRENCH
DETAIL 3



TYPICAL ROADSIDE DITCH
DETAIL 4



TYPICAL DROP INLET STRUCTURE
DETAIL 5



NOTE: For perimeter ditch, geomembrane and geotextile is discontinued on downhill side of foot path.

TYPICAL SIDESLOPE DITCH
DETAIL 6

REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY

DATE OF ISSUE
DWN BY TMC CHK BY PRM
DES BY MA APP BY

Sweet-Edwards
EMCON

LAND RECOVERY, INCORPORATED
HIDDEN VALLEY LANDFILL
NORTH AREA CLOSURE
PIERCE COUNTY, WASHINGTON

DETAILS

DRAWING NO. 4
PROJECT NO T0201.18

KUKER-RANKEN INC./123528