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CALDWELL COUNTY N.C.

SANITARY LAND FILL

Engineering Report & Operation Plan

SEAL DATE 4-29-75

P. Marion Rothrock, P.E.

BY

Rothrock Engineering
LENOIR, N. C.

APRIL 1975

CONTENTS

ENGINEERING REPORT

The purpose of this Operation Plan and Engineering Report is to set forth the conditions now existing; the plans and steps to be taken; and the method by which Caldwell County will proceed to develop a given tract of land as described in a copy of the deed for said property to be found in the appendix of this report, as well as a topographic map developed by ROTHROCK ENGINEERING. This report will set forth the details of an Operational Plan which, if carried out in accordance with the plans and specifications submitted, will provide a satisfactory sanitary landfill without appreciable detrimental effects to the environmental considerations of the area in question. Efforts must be made to insure that siltation is kept to a minimum in order to minimize the detrimentail environmental effects of the area. This will be discussed at length in other areas of the report.

The property being developed for the landfill is located in Little River Township, Caldwell County, North Carolina and is recorded in Book 660 at page 1731. The site is located east of US 321 approximately 2 miles. The site can be reached by going east on the Mt. Herman road until you reach it's end and proceeding approximately ½ mile east on a road presently under construction, which will serve the new landfill site. At the present time there are no zoning ordinances for the area in question and it is not anticipated that any regulations will be adopted in the forseeable future. Dwg. No. 140-00-00 shows the property boundary on a topagraphic overlay with the exception of a small area on the north side. In addition it will be noted a building is indicated in the southwest corner of the property. This is a proposed building which is expected to serve as a maintenance facility for the Sanitation and Water Departments as well as offices for those two departments. The property located along the south side in general belongs to Hutton and Bourbonnais Company,other landowners adjoining the property may be noted in the deed to be found in the appendix.

At the present time land use of surrounding property will not be effected because all propertys joining the proposed site presently are used for the growth of timber only. There are no houses or other structures within ¼ mile of the proposed site. The county does plan to locate in addition to the buil-

ding previously mentioned, an incenerator on the site, located north of the building, for purposes of disposing of the various highly flamable substances which need to be disposed of in the area because of the manufacturing operations but which are not safe to dispose of in the sanitary landfill. With these two exceptions there are no buildings, no industrial construction, and at the present time none is anticipated, within ¼ mile of the proposed site.

Water for the site will come from a well to be located in the area of the new Sanitation and Water Departments building and will serve that building as well as other needs for potable water on the site.

Ther are no major streams located in the immediate area of the site, however there are several springs located on the site which must be taken care of. The area located on the north side which is shown as having swamp and marshes as well as a flowing stream will not be used for purposes of sanitary waste disposal. This particular area will aslo not have any subsurface drainage. The area will be used to install a barrier for siltation by using the materials coming from the site as it is cleared. By following this procedure several advantages arise. One is no potential problem exist for leaching from the sanitary waste, another is a very adequate siltation barrier can be built in the area shown and the third is the fact that this area can be used to dispose of the brush without having any adverse effects and without utilizing useable landfill space. In reviewing the topographic map it will be noted that there are several ravines but it will also be noted that there is an appreciable amount of pipe shown on the drawing. The purpose is to take care of that water now originating on the site. With the exception of a very small spring, which surfaces an the south side of the property in the deep ravine, all other water originates on the property itself. The pipe will be installed as shown in order to adequately remove the subsurface water from the site without detrimental effects. All wet areas and those showing water in the borings will be drained by means of preforated subsurface piping as shown on the drawing.

A detailed subsurface evaluation of the property was conducted by boring 36 augar holes and taking samples from these borings. The boring log as well as the soil report and analysis may be found in the appendix of this report. Also a very detailed surface analysis and evaluation of the property has been conducted. In inspecting the property and making the surface evaluation, the area

between north 11,500 and the property line on the north side of the ravine and north of borings 28, 29, and 30 does have significant rock outcropings. It is not expected that an appreciable amount of cover material can be obtained from this particular slope, however these outcropings should not present any significant problems except for the reduction of cover materials. In general there are indications of boulders located throughout the property, however,based on the soil borings and the surface evaluation average cuts of 20 to 40 feet can be accomplished on the site with the proper equipment. No rock was encountered at a high level in any of the borings except those in the low area where it must be floored.

As will be noted from the topagraphic map the terrain is very mountainous,the ravines are deep, and the slopes on the property are in many cases very steep. Some of the present slopes approach 2 to 1 and in certain instances are even steeper. This does present some problems in getting roads and clearing the site and preparing to start the landfill operation. However, it is not felt that the deep ravines are any drawback to the overall operation, in fact they present significant advantages due to the fact that adequate cover material can be found until the latter phases when borrow must be utilized. In discussing the matter of borrow with the county manager, Mr. Norman Schronce, I have been assured that the material needed for borrow will be no problem and that more than adequate cover material can be obtained from areas near or adjacent to the site.

The complete evaluation of the conditions existing at subsurface was made by Law Engineering Testing Company. A copy of their report is included in the appendix of this report. The soil borings which were taken ran from a minimum dept of some 5 feet where augar refusal was encountered at boring 18 to 63 feet to augar refusal in boring No. 4. The deep borings in general were made to try to determine the amount of cover material which could be reasonable excavated without the use of explosives. As can be noted on the topographic overlay which shows the location of each boring, as well as the drawing included in Law Engineerings report,Dwg. No. CH 3344,the borings were very well distributed over the property. In general the boring locations were selected to accomplish one of two purposes. The first was to determine whether adequate cover material could be obtained to make the site feasible for a sanitary landfill. These borings in general are located on or near the

ridgelines and are the borings selected for considerably deeper testing. Other borings were taken only to a depth of ten feet. Many of these were for the purpose of trying to determine the location of groundwater. Except for groundwater apparent on the site through visual inspection, water was not encountered in any any areas not expected and in fact was not encountered in some areas where it was expected. All borings were checked for water. Those indicated in the soil report as being checked were checked 24 hours after the boring was terminated. All borings were checked 72 hours following the boring. Ground water levels were not found to exist in any of the holes checked 24 hours after boring. However, it must be remembered that all holes were not checked for ground water 24 hours following termininations of boring. Water was found 72 hours after boring at borings 8, 13, 18, 26, and 27. The following chart will show the measured dept of the hole at the time which indicates in all cases that some caving of the hole did occur. The depts indicated are those measured 72 hours after boring from the top of the existing ground and the water dept shown is the depth from the bottom of the hole. It was expected that water would be encountered at borings 22, 23, possible 24. It was expected that water would be encountered in boring 26, the purpose of that boring was to determine the point at which it would be necessary to install perforated underdrain. However, due to the fact that water was not found to be present in borings 17, 22 & 23, 72 hours after drilling it is indicated that the water on the surface does not extend to any appreciable degree into other areas. No borings were made in the areas where surface water was obvious. (See appendix for chart.)

In reviewing the engineering report of the subsurface evaluation and the information obtained from the recompacted field samples it is apparent that the material which was collected for testing is very suitable and of good quality for the purposes of the sanitary landfill cover. Four field samples were taken. In reviewing these the optimum moisture when compared to the field moisture is within relatively close proximety. The only curve showing a potential problem is the material taken from the lower part of boring No. 4. In this particular case it may very well be necessary to add water in order to get adequate compaction. In all other cases the moisture in the field will give suitable compaction as related to the optimum. The permeability of all of the samples taken was very good. The highest permeability came from boring 4 at the upper level, however it is still satisfactory. In the the same boring at

OPERATIONAL PLAN

The Operational Plan as outlined in this report will detail the steps required, the basis upon which the projections are made and the procedures to be followed in order to carry out the intent of this report and to meet the overall needs as they are outlined. Drawing No. 140-00-00 titled " Landfill Site and Sanitation and Water Departments Site" prepared by ROTHROCK ENGINEERING as well as sheets 1 through 21 of 140-00-01 through -21 titled " Sanitary Landfill Caldwell County Cell Sections", also prepared by ROTHROCK ENGINEERING, form an intergral part of this operational plan and shall be utilized as if they were contained within this bound copy. The purpose of the cell sections is to indicate to the state officials as well as the responsible authorities of Caldwell County the recommended procedures by which maximum utilization of the site selected can be accomplished. The cell sections begin with cell No. 1 and run through cell No. 49. The landfill operational plan in general will follow the cell numbering sequence in numerical order. Cell No.'s 1 through 21 are included in what will be called phase I with cells 22 through 49 being in phase II.

As will be noted on Drawing No. 140-00-00 sheet 1 of 1, the requirement is for a substancial amount of preforated underdrain. This will vary in size as noted on the drawing, from 6 inch through 12 inch. All of the laterals will be 6 inch with the main trunkline being of the size noted on the drawing. The pipe shall be installed as shown on the plan and as indicated in the typical section Perforated Underdrain. The total length of pipe to be installed will be as shown on the drawing. It will be necessary to use good judgement in the laying of the 6 inch laterals and in some cases it may be necessary, depending upon field conditions, to make the laterals longer than indicated on the drawing. By the same token it may be possible, again depending on actual field conditions, to shorten a few of the laterals. This must be determined at the time the excavation is taking place for the installation for the underground piping. As the ditchlines are excavated for the 6 inch laterals, consideration shall be given to any ground water encountered and proper and prudent engineering judgments utilized in determining the exact length of the pipe. Should subsurface water be encountered beyond the areas shown on the drawing as the actual excuvation is taking place, the lateral MUST be extended.

The pipe shall be perforated, corrugated metal pipe meeting AASHO M136. In addition all coupling bands shall comply with AASHO M136 Section 10. All sections of the perforated, corrugated metal pipe shall be laid true to line and grade with tight joints with elevations as noted on the cross sections and topographic plans. The visual inspection of the surface conditions existing indicate that rock definately will be encountered in a large part of the main trunkline. It will be necessary that the pipe be laid at least 8 inches above any rock and if necessary to accomplish this, the rock shall be excuvated to the required dept. In no case shall any perforated drain be laid where rock is encountered and excavation of 8 inches is not provided below the invert of the pipe. This area underneath the pipe shall be backfilled in the manner indicated on the section. The filter media as shown in the typical section shall comply with AASHO spec M6-51 which gives the following limits passing standard ASTM Sieve (Same as Section 944-1 of N. C. State Highway Commission, Standard Specifications for Roads and Structure):

Passing a 3/8 inch Sieve	100%
Passing a #4 Sieve	95-100%
Passing a #16 Sieve	45-80%
Passing a #50 Sieve	10-30%
Passing a #100 Seive	2-10%

This particular filter media also complies with AASHO specifications for concrete sand, and as a result the PROPER use of concrete sand as a filter media would be acceptable provided that it met the AASHO specs. In addition to meeting the AASHO M136, the pipe shall also meet AREA specifications 1-4-11 which requires a minimum of 16 perforations, 3/8 inch in diameter, per lineal foot of pipe.

The backfill filter media shall be placed in 6 inch layers and thoroughly compacted. In no case shall any filter media be placed in an uncompacted manner. This will result in placement of approximately 4 uncompacted 6 inch layers of media in order to obtain the necessary 18 inches required after compaction. In addition, the first 12 inches of backfill material to be placed on top of the filter media shall have no vegetation or other unsuitable material mixed as it is placed. The material shall be of good quality fill material and shall be compacted to not less than 90% of the theretical maximum based on Standard Proctor (ASTM D-698).

Prior to the placement the perforated underdrain , the entire area in the ravine to receive the underdrain piping, should be cleared in stages to permit the movement of equipment and the proper placement of the pipe. It is understood that the intentions are to place the perforated underdrain in sections to be completed prior to the completion of phase I. This will require that all pipe be laid and the proper flooring be install before phase I is complete in order to carry through with uninterupted operation. It will not be possible to start into phase II without All of the perforated underdrain installed.

Phase I which includes cells 1 through 21 should be cleared and the material which is removed placed into the area at the northeast property corner of this particular phase. In this manner the vegetative material which is removed will form a brush barrier and will be a significant part of the overall plan to control siltation from phase I. In addition a brush barrier should be placed at the proper points in the various ravines in the other sections in order to minimize the amount of siltation which reaches the stream and consiquently leaves the property. By installing these brush barriers at the beginning of the system, siltation can be maintained at a minimum. Also it is recommended that only the vegetative cover needed to provide adequate operating room be removed at any one time and that the trees and other brush and material be left as long as practical. This will reduce the total water consetration and runoff and will reduce the amount of exposed disturbed area.

In order to adequately screen the site in the future it is recommended that an evergreen barrier be placed around the entire property. This should be done at the earliest point in time practical in order to permit the barrier to reach maximum size prior to the actual operations taking place. By providing the evergreen barrier now, it would not be anticipated that the site would ever be conspicious because of the present land use and that anticipated in the forseable future for all areas surrounding the site.

Proper drainage and diversion ditches shall be cut as the clearing and grading progresses to devert all of the water from the area being worked and to minimize the erosion and siltation which may take place. This is a very significant factor in the overall planning to minimize the determ-

ental effects which could be encountered, and in fact would be, if proper precautionary measures are not taken to prevent soil erosion. The slopes should be stabalized with vegetative cover as they are completed. In no case should any slope be left bare after the 10 foot lift is completed. In some cases where the cell sections are extremely long and long periods of time may elapse between the beginning and completion of a given cell section, the section should be stabilized with vegetative cover in phases.

With the brush barriers completed and certain parts of the area cleared, the site would be ready to start operation of phase I. During the course of phase I and the laying of the perforated underdrain for phase II, care shall be taken to insure that the area where underdrain is laid is properly floored with no less than 4 feet of compacted backfill as shown on the sections which are an intergal part of this operational plan and must be followed if the results proposed are to be realized. This compacted material is to be compacted to a density of 95% of the theoretical maximum as determined by Standard Proctor Test (ASTM D-698).

As has been mentioned earlier, in order to maintain an overall earth balance through most of the life of the site, it will be necessary for the landfill operators to slopestake the cuts as they are shown on the cross-sections and strickly adhear to the plan as indicated. As can be noted in looking at the sections, there is considerabl excess material located in phase I. It will be necessary to stockpile this material for later use as cover during phase II.

A typical cell section is shown on Drawing 140-00-01 and will consist of a dept of 10 feet. This total dept contains 8 feet of compacted refuse along with a 2 feet compacted cover. It is mandatory that this 2 foot compacted cover seal be placed at the top of each cell in order to eliminate the problem which could arise from the seepage of water through one cell into another. The compaction required for the surface of each cell shall be 95% of the theoretical maximum as determined by Standard Proctor. There are exceptions to the typical section as can be noted in viewing the other sections. In some instances the cells may be less than 10 feet in total dept, however, they still require a 2 foot compacted cover at the completion of that particular cell. The other significant area where the typical section

does not apply is the cover material on the completion of the landfill. In this instance there shall be a 3 foot compacted cover as shown on the section, with a minimum of 2 feet of cover required on all slopes.

Upon completion of the clearing and removal of the vegetative cover in phase I, it will possible to start the routine use of the landfill by depositing the solid waste which will be compacted. This material shall be placed in layers no greater than 12 inches thick before compaction. Each cell shall be completed and capped with the 2 feet of cover before proceeding to the next cell. As excess material is obtained it shall be stockpiled in a suitable area to the south of phase I. As the refuse is placed into the cells for compaction it must be thoroughly compacted to the maximum capability of the equipment being utilized. If the refuse is of normal makeup, and a very thorough job is obtained, the densities should be to the order of 700 PCY. However, if a new compactor were bought with a gross weight in excess of 70,000 lbs.,preferably in the area of 80,000 lbs. this density could be increased from 700 PCY to possibly 12 - 1300 PCY. However, for purposes of determining the landfill life, the density of 700 PCY will be used with the existing equipment and 1000 PCY would be used for the heavier piece of equipment recommended. These averages would be used for projection of the life expectancy of the landfill over the entire area and life. In addition to the cover shown on the sections, sufficient cover material will be available to follow the operational requirement of 6 inches of compacted cover at the end of each days operation. It is estimated that this will require approximately 60,000 Cubic yards per year.

One other item which will be required prior to the depositing of the initial material into the landfill will be a need for a fence to catch the material which is blown around during the course of operation. It will be necessary to periodically collect this material and return it to the landfill area and compact it with the other refuse. This fencing should be of a temporary nature due to the fact that the need for moving the fence frequently will be encountered. A suitable material for the fencing is standard chicken wire 6 feet high. This moveable fencing or waste barrier should be located as close as practical to the actual operation as it takes place.

As will be noted on the sections an earthen dike will be required at the

toe of the slope for the beginning of phase I and also at the beginning of phase II. It is mandatory that this dike be installed in accordance with the cross sections. The thickness through the base shall be not less than 50 feet, with a 3 to 1 slope on the face side and a 2 to 1 slope on the side next to the refuse.

The basis upon which all projections are made in this report are taken from information supplied by the County Manager of Caldwell County. A summary of this particular data is included in the appendix.

Based on the study mentioned and the projections, an average population for 1970 through 1995 would be 66,650 for Caldwell County. In 1970 the average consumption was approximately 2.15 tons per captia per year. It is projected that the per captia waste will drop to 2.00 tons per year by 1995 giving an average for the 25 year period of 2.08 tons per year. On this basis the average annual tonage will be 138,632 tons per year over the entire life.

At a density of 700 lbs. per cubic yard, the volume would be 396,000 cubic yards per year. At a density of 1000 lbs. per cubic yard, the volume would be 277,000 yards per year. As can be seen this is a very significant difference in the density of the compacted refuse. In the event a new unit were purchased and extreme care were taken,the density could very well reach 1200 lbs. per cubic yard, which would give an additional 20% over and above the projection of 1000 lbs. per cubic yard. The total life expectancy for the entire site, based on 700 lbs. per cubic yard is approximately 20 years. If a new machine were purchased at the beginning, the projected useful life would be approximately 29 years. It is the recommendation of this report that a new compactor be bought at the earliest possible date in order to effect this increase of approximately 43%.

Another significant aspect of the solid waste being disposed of is the make-up of the industrial waste. For the most part this is various forms of cellulose and could be disposed of in other manners. Because of the difficulty in compacting the cellulose material, it is recommended that alternatives to landfill disposal be seriously considered and if a suitable alterative can be reached, that it be pursued. The net result of such an action would be the extension of the useful life of the landfill.

The types of material which will be disposed of in the landfill have considerable variations. The normal garbage and refuse from domestic sources will be disposed of in the landfill to take care of the population as indicated in the projections previously mentioned. In addition to the materials obtained from domestic sources, a very significant amount of the total volume will come from the industrial community. These materials will be varied in nature with, as mentioned earlier, a large percentage being of cellulose material which is a by product from the furniture manufacturing. It is expected at the present time that this particular type of industrial waste will form the major part of the industrial waste which must be handled at the site unless an alternate proposal method can be arrived at.

Several pieces of equipment are available for use at the landfill, they are; One 292C Hancock self-loading scraper with 11 cubic yard capacity, 1971 model; Two Le Tourneau push-type scrapers with 8 cubic yards capacity, 1960 model; One Galion roadscraper series 118, 1961 model; One D21 B Allis Chambers bulldozer, 1971 model; One D 4 catipillar bulldozer, 1972 model; One PO 9 International bulldozer, 1955 model; One Rex 3-50 Trash Master compactor, 1973 model, 50,000 lbs.; One B-75 Michigan compactor, 1971 model, 30,000 lbs.

As has been indicated previously, it is recommended that additional equipment be obtained for the proper operation of the landfill. These specifically would be one large push-type pan and at least one large compactor with a gross weight of not less than 70,000 lbs. If these two pieces of equipment are obtained, and the material in the fill is placed in no more than 6 inch uncompacted layers, densities as high as 1400 lbs. per cubic yard possibly would be obtained.

The individual in responsible charge of the landfill will be Mr. Dewey Hughes, Landfill Supervisor.

After completion of the entire landfill area as shown on the plan the site would be suitable for several different uses. Present thinking is that the site would be best utilized as a Recreational area to be developed and managed by Caldwell County.

As indicated previously, the total useful life with the present equipment is projected at approximately 20 years. If the new equipment is bought, a life of as much as 29 years could be expected, and with very careful operation, and the placement of material in 6 inch uncompacted layers, in order to maintain maximum densities, this life could be extended to approximately 40 years by reaching a density of 1400 lbs. per cubic yard, which is not unrealistic with a 70 to 80,000 lb. unit and careful operation.

APPENDIX

NOW, THEREFORE, said parties of the first part, acting as Commissioners as aforesaid, under authority of said Order of Court and in consideration of the said purchase price of Thirty-Five Thousand and no/100 ($35,000.00) Dollars, have bargained and sold and by these presents do bargain, sell, and convey unto said party of the second part and its successors and assigns a certain tract or parcel of land lying and being in Little River Township, Caldwell County, North Carolina, and more particularly described as follows:

BEGINNING on an iron stake, the same being the northwest corner of the Hutton and Bourbonnais Company tract, and runs thence North 89° West 297 feet to an iron stake in the John D. Clark line; thence North 2°11' East 2,033.02 feet with the John D. Clark line to an iron stake; thence North 89° 28' East 1,158.16 feet with the C. J. Whisnant line to an iron stake; thence South 6°20' East 480.65 feet to an iron stake; thence North 87°56' East 753.84 feet to an iron stake; thence North 3°58' East 662.62 feet to an iron stake; thence South 85°35' East 318.15 feet to an iron stake in the E. H. Tolbert line; thence South 2°50' West 672.88 feet with the E. H. Tolbert line to an iron stake; thence South 87°00' East 407.49 feet to an iron stake; thence South 0°50' West 1,126.75 feet with Mrs. Christine Martin's line to an iron stake; thence South 83°6' West 636.70 feet to an iron stake; thence North 25°2' West 252.82 feet to an iron stake; thence North 83°5' West 192 feet to an iron stake; thence South 16°21' West 415.72 feet to an iron stake in the Hutton and Bourbonnais Company line; thence South 81°53' West 1,424.64 feet with the Hutton and Bourbonnais Company line to the point of BEGINNING, and containing 103.4 acres, more or less, as surveyed by Clarence N. Bolick, registered surveyor, on September 2, 1970.

BACK REFERENCE: Book 124 Page 399 Book 124, Page 435, Caldwell County Registry.

TO HAVE AND TO HOLD said lands and premises, together with all privileges and appurtenances thereunto belonging, to it the party of the second part and its successors and assigns in as full and ample a manner as said parties of the first part as Commissioners as aforesaid are authorized and empowered to convey the same.

IN TESTIMONY WHEREOF, said parties of the first part, acting as Commissioners as aforesaid, have hereunto set their hands and seals the day and year first above written.

H. HOUSTON GROOME, JR., COMMISSIONER (SEAL)

TED S. DOUGLAS, COMMISSIONER (SEAL)

WEST & GROOME
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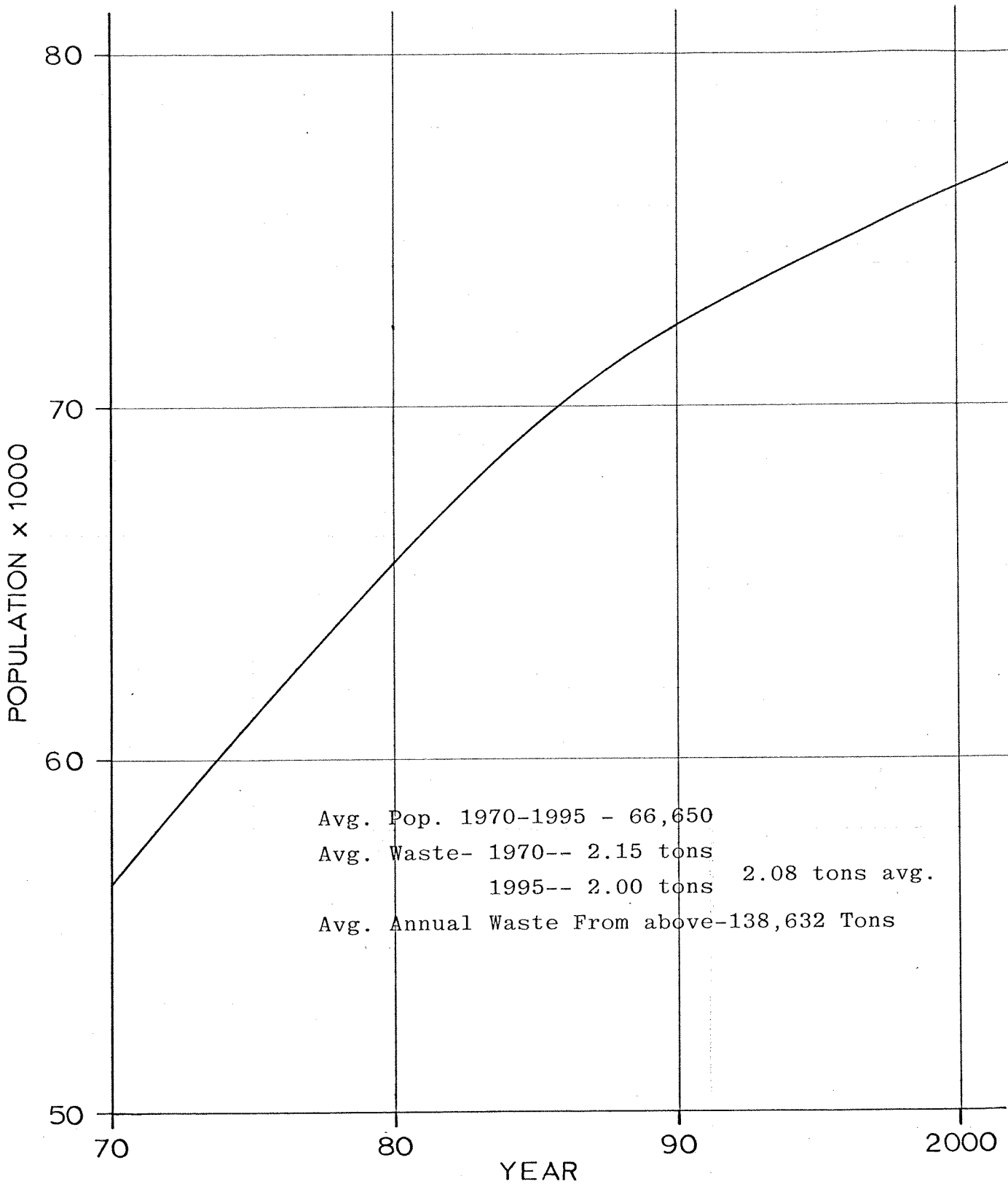
80
70
60
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POPULATION x 1000
70
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2000
YEAR
Avg. Pop. 1970-1995 - 66,650
Avg. Waste- 1970-- 2.15 tons
1995-- 2.00 tons
2.08 tons avg.
Avg. Annual Waste From above-138,632 Tons

LAW ENGINEERING TESTING COMPANY

501 Minuet Lane • P. O. Box 11297

Charlotte, North Carolina 28209

January 21, 1975

P. Marion Rothrock, P. E.
Rothrock Engineering
Route No. 8, Box 215
Lenoir, North Carolina 28645

Subject: Soil Investigation
Caldwell County Landfill
Caldwell County, North Carolina
LETCo. Job CH 3344

Dear Mr. Rothrock:

As authorized by your letter dated December 17, 1974, Law Engineering Testing Company has completed the requested auger borings and laboratory tests for the above site. The purpose of this investigation has been to determine the soil types, groundwater conditions, and the presence of any rock or very hard soils at the boring locations. In addition, laboratory compaction testing of bulk samples and permeability testing of remolded bulk samples were performed on the proposed borrow material to be used as cover for the sanitary landfill.

FIELD AND LABORATORY INVESTIGATION

Auger Borings

Thirty-six auger borings were made at the site at locations (shown on the attached Boring Location Plan) selected and staked by Rothrock Engineering. Borings were advanced by mechanically twisting a sharpened auger into the ground. The soils encountered were identified in the field from cuttings brought to the surface by the drilling process. Soil consistencies were estimated by the driller from the difficulty of advancing the auger during the drilling process. Soil descriptions are tabulated on the attached Record of Auger Borings. Ground surface elevations at the boring locations were furnished by Rothrock Engineering.

Compaction Tests

Representative loose soil samples from auger borings AB-4, AB-19, and AB-20, in proposed cut areas, were collected in cloth sacks and returned to the laboratory for compaction testing. Standard Proctor compaction tests (ASTM D-698) were performed on these soils to determine their compaction characteristics, including their maximum dry densities and optimum moisture contents. The test results are presented on the attached Compaction Test Sheets.

Permeability Tests

In the laboratory, representative soil samples from auger borings AB-4, AB-19, and AB-20 were remolded to 95% of the standard Proctor maximum dry density as defined by ASTM D-698. The remolded samples were compacted in 3" diameter steel tubes which were then sealed at the top and bottom. A constant head of deaired water was applied to each sample between the seals until saturation and uniform flow through the sample occurred. The measured flow rate, applied head and known sample geometry were then used to calculate the soil permeabilities. The test results are presented on the attached Permeability Data Sheet.

FINDINGS AND COMMENTS

We understand that the site is to be used for a sanitary landfill. The ridges and areas of higher ground (generally toward the west and south edges of the site) will furnish the borrow soils to be used to blanket the lower areas prior to constructing the sanitary landfill and to cover the landfill. The surficial blanket in the low areas will provide a seal to prevent contaminants from leaching into the underlying soil and groundwater from the landfill.

The soils encountered by the borings are all virgin soils (with the exception of the surficial 3 foot layer in boring AB-17, which was fill probably deposited during the initial clearing and grading) formed by in-place chemical decomposition of the underlying parent bedrock. These soils consist predominantly of layered sandy clayey silts, sandy silts, and silty sands. Generally, the silt soils containing variable amounts of clay are confined to the upper 4 to 5 foot stratum with the sand and mica content increasing with depth and the soils grading into sandy silts and silty sands. In addition, numerous gravel layers were encountered throughout the borings. Boring depths and soil descriptions are shown on the attached Record of Auger Borings.

For engineering purposes, residual material having standard penetration resistances (N) greater than 100 blows per foot is called partially weathered rock. In some areas, our driller estimated penetration resistances (based on the difficulty of advancing the auger) that indicated the presence of partially weathered rock (see Record of Auger Borings). Generally efficient excavation of these materials requires heavy ripping or light blasting. However, the depths shown in this report to partially weathered rock materials are only estimates and should be treated as such.

In this area of North Carolina, the upper surface of sound bedrock is quite erratic and may vary considerably over short horizontal distances. In addition, hard weathered rock, boulders and thin rock seams may be found well above the top of continuous rock within the soil mantle. These materials may cause auger refusal. Shallow refusal was encountered in boring AB-18 (5 feet below grade, elevation 1383)

and boring AB-28 (6 feet below grade, elevation 1465). Listed below are other borings encountering refusal with the depths and approximate elevations of refusal.

Boring Number	Depth to Refusal	Approximate Refusal Elevation
AB-1	30.0'	1553
AB-2	41.5'	1540
AB-4	63.0'	1552
AB-13	39.0'	1391
AB-19	51.0'	1454
AB-35	27.5'	1555
AB-36	20.5'	1578

The refusal material was not core-drilled with a diamond bit to verify its nature and continuity. Material hard enough to cause auger refusal will probably require blasting for removal.

Groundwater was not encountered within the depths drilled in any of the borings at time of drilling or in those borings checked after a 24 hour stabilization period.

Field compaction criteria is based on 95 percent of the standard Proctor maximum dry density with a moisture content within 2 to 4 percent of optimum. The compaction tests indicate that the designated borrow soils will provide an excellent source for a sanitary landfill cover and moisture barrier provided close moisture control is maintained in the field during filling operations. The field moisture content of the compacted samples tested from auger borings AB-4 (two samples) and AB-20 for this investigation were within the field compaction criteria. The sample tested from auger boring AB-19 had a field moisture content 4.6% wet of optimum or 0.6% wet of the desired field compaction criteria. Therefore, the field moisture content of the majority of the borrow soils tested was well within the established compaction criteria. Mixing the soils when excavating and moving them to the area of compaction will likely disperse the isolated deposits of soils slightly wet of the desired field compaction criteria. Scattering these wet soils will permit compaction without the need of spreading the soils for drying. Of course, the weather at the time of landfill blanketing can be detrimental to efficient compaction.

The laboratory permeability of the remolded samples ranges from 4.7×10^{-8} cm/sec to 5.3×10^{-7} cm/sec. This relatively low permeability is fairly typical of the fine grained silt soils of this area and indicates that when these soils are properly compacted, an effective moisture barrier is formed.

In summary, it is our opinion that the fine grained residual soils found at the site will provide an acceptable landfill cover and a relatively impermeable moisture barrier when properly compacted.

Rothrock Engineering
Lenior, North Carolina
January 21, 1975

Closure

If you have any questions about this report or if we may be of further service to you at any time, please do not hesitate to call us.

Very truly yours,

LAW ENGINEERING TESTING COMPANY

Richard T. Hunt

Richard T. Hunt
Staff Soils Engineer
E. L. T.

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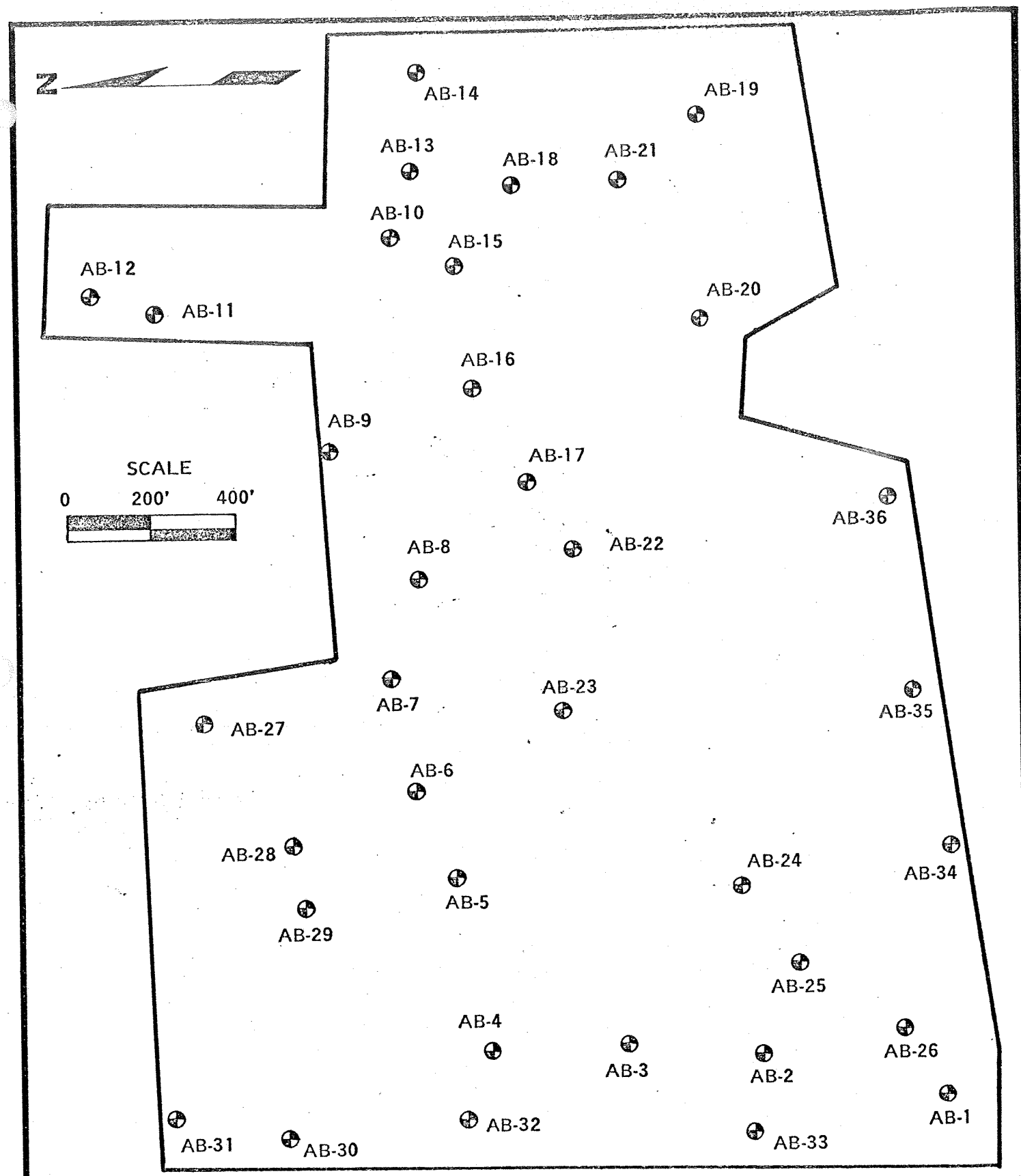
RTH/AGF/jif



LAW ENGINEERING TESTING CO.
CHARLOTTE, NORTH CAROLINA

CALDWELL COUNTY LANDFILL
CALDWELL COUNTY, NORTH CAROLINA

ROTHROCK ENGINEERING
LENIOR, NORTH CAROLINA

DWN. BY	DHM		SCALE: Shown
CKD. BY	RTH		DRAWING NO.
APPR'D.	RTH		CH 3344

RECORD OF AUGER BORINGS

Auger Boring	Surface Elevation	Depth From	Depth To	Soil Description (Soil consistencies defining partially weathered rock were estimated by the driller in the field based on difficulty of advancing the auger)
AB-1	1583.076	0	1.0'	Topsoil (Removed by Bulldozer)
		1.0'	10.0'	Red Fine Sandy Clayey Silt
		10.0'	13.0'	Brown Red Micaceous Fine Sandy Silt
		13.0'	13.5'	Layer Of Gravel
		13.5'	19.0'	Brown Micaceous Fine Sandy Silt
		19.0'	19.5'	Layer Of Gravel
		19.5'	29.0'	Brown Micaceous Silty Fine Sand
		29.0'	30.0'	Partially Weathered Rock

Auger Refusal At 30.0 ft.
No Groundwater Encountered At Time Of Boring
Borehole Caved And Dry At 27.0 ft After 24 Hours

AB-2	1581.616	0	1.0'	Topsoil (Removed by Bulldozer)
		1.0'	3.0'	Brown Red Micaceous Silt
		3.0'	3.5'	Layer Of Gravel And Broken Rock
		3.5'	5.0'	Tan Silty Fine To Coarse Sand
		5.0'	18.0'	Brown Micaceous Fine Sandy Silt
		18.0'	18.5'	Layer Of Broken Rock
		18.5'	40.0'	Brown Micaceous Silt
		40.0'	41.5'	Partially Weathered Rock

Auger Refusal At 41.5 ft.
No Groundwater Encountered At Time Of Boring
Borehole Caved And Dry At 34.25 ft After 24 Hours

AB-3	1562.806	0	1.0'	Topsoil (Removed by Bulldozer)
		1.0'	6.0'	Brown Micaceous Fine Sandy Silt
		6.0'	12.0'	Gray Micaceous Fine To Coarse Sandy Silt
		12.0'	16.0'	Brown Micaceous Fine Sandy Silt
		16.0'	22.0'	Gray Silty Fine To Coarse Sand
		22.0'	33.0'	Gray Brown Micaceous Fine To Coarse Sandy Silt
		33.0'	35.0'	Partially Weathered Rock

Boring Terminated At 35.0 ft.
No Groundwater Encountered At Time Of Boring
Borehole Caved And Dry At 29.0 ft After 24 Hours

RECORD OF AUGER BORINGS
(Continued)

Auger Boring	Surface Elevation	Depth From	Depth To	Soil Description (Soil consistencies defining partially weathered rock were estimated by the driller in the field based on difficulty of advancing the auger)
AB-4	1614.846	0	1.0'	Topsoil (Removed by Bulldozer)
		1.0'	3.0'	Red Micaceous Clayey Silt
		3.0'	7.0'	Brown Red Micaceous Fine To Medium Sandy Silt
		7.0'	11.0'	Tan Fine To Coarse Sandy Silt
		11.0'	13.0'	Layer Of Broken Rock
		13.0'	18.0'	Tan Fine To Coarse Sandy Silt
		18.0'	18.5'	Layer Of Gravel
		18.5'	27.0'	Brown Micaceous Silt
		27.0'	27.5'	Layer Of Gravel
		27.5'	28.5'	Brown Micaceous Silt
		28.5'	30.0'	Layer Of Gravel
		30.0'	53.0'	Brown Micaceous Fine Sandy Silt
		53.0'	53.5'	Layer Of Gravel
		53.5'	57.0'	Brown Micaceous Fine Sandy Silt
		57.0'	59.0'	Layer Of Gravel
		59.0'	61.5'	Brown Micaceous Fine Sandy Silt With Gravel
		61.5'	63.0'	Partially Weathered Rock

Auger Refusal At 63.0 ft.
No Groundwater Encountered At Time Of Boring
Borehole Caved And Dry At 53.0 ft After 24 Hours
Bulk Samples Taken At Depths Of 7 ft to 13.5 ft. and 38.5 ft to 43.5 ft.

AB-5	1543.446	0	1.0'	Topsoil (Removed by Bulldozer)
		1.0'	3.0'	Red Micaceous Fine Sandy Clayey Silt
		3.0'	7.0'	Brown Red Micaceous Fine Sandy Silt
		7.0'	10.0'	Gray Micaceous Fine To Coarse Sandy Silt

Boring Terminated At 10.0 ft.
No Groundwater Encountered At Time Of Boring
Borehole Caved And Dry At 7.0 ft After 24 Hours

AB-6	1512.186	0	4.0'	Red Micaceous Fine Sandy Silt
		4.0'	6.0'	Brown Red Micaceous Fine To Medium Sandy Silt
		6.0'	9.0'	Gray Silty Fine To Coarse Sand
		9.0'	10.0'	Brown Micaceous Fine To Coarse Sandy Silt

Boring Terminated At 10.0 ft.
No Groundwater Encountered At Time Of Boring
Borehole Caved And Dry At 7.5 ft After 24 Hours

RECORD OF AUGER BORINGS
(Continued)

Auger Boring	Surface Elevation	Depth From	Depth To	Soil Description (Soil consistencies defining partially weathered rock were estimated by the driller in the field based on difficulty of advancing the auger)
AB-7	1530.296	0	2.5'	Red Micaceous Fine Sandy Clayey Silt
		2.5'	7.0'	Brown Micaceous Fine Sandy Silt
		7.0'	7.5'	Layer Of Gravel
		7.5'	10.0'	Brown Micaceous Fine Sandy Silt

Boring Terminated At 10.0 ft.
No Groundwater Encountered At Time Of Boring
Borehole Caved And Dry At 7.5 ft After 24 Hours

AB-8	1510.956	0	4.0'	Tan Fine To Medium Sandy Clayey Silt
		4.0'	7.0'	Tan Micaceous Fine To Medium Sandy Silt
		7.0'	10.0'	Gray Micaceous Silty Fine To Coarse Sand

Boring Terminated At 10.0 ft.
No Groundwater Encountered At Time Of Boring
Borehole Caved And Dry At 6.5 ft After 24 Hours.

AB-9	1527.716	0	2.5'	Red Brown Micaceous Fine Sandy Clayey Silt
		2.5'	10.0'	Brown Very Micaceous Fine Sandy Silt

Boring Terminated At 10.0 ft.
No Groundwater Encountered At Time Of Boring
Borehole Caved And Dry At 6.25 ft After 24 Hours

AB-10	1412.936	0	6.5'	Red Tan Fine Sandy Slightly Clayey Silt
		6.5'	10.0'	Brown Tan Fine Sandy Silt

Boring Terminated At 10.0 ft.
No Groundwater Encountered At Time Of Boring.

AB-11	1513.616	0	7.0'	Brown Micaceous Fine To Coarse Sandy Silt
		7.0'	10.0'	Gray Very Micaceous Silty Fine To Coarse Sand

Boring Terminated At 10.0 ft.
No Groundwater Encountered At Time Of Boring
Borehole Caved And Dry At 6.0 ft After 24 Hours

AB-12	1496.686	0	6.5'	Brown Red Fine To Medium Sandy Clayey Silt
		6.5'	10.0'	Brown Slightly Micaceous Fine To Coarse Sandy Silt

Boring Terminated At 10.0 ft.
No Groundwater Encountered At Time Of Boring
Borehole Caved And Dry At 6.0 ft After 24 Hours

RECORD OF AUGER BORINGS
(Continued)

Auger Boring	Surface Elevation	Depth From	Depth To	Soil Description (Soil consistencies defining partially weathered rock were estimated by the driller in the field based on difficulty of advancing the auger)
AB-13	1431.116	0	8.0'	Red Tan Micaceous Fine Sandy Silt
		8.0'	8.5'	Boulder
		8.5'	39.0'	Brown Tan Fine Sandy Silt
Auger Refusal At 39.0 ft. No Groundwater Encountered At Time Of Boring				
AB-14	1391.896	0	7.0'	Red Fine Sandy Slightly Clayey Silt
		7.0'	10.0'	Brown Red Fine Sandy Slightly Clayey Silt
Boring Terminated At 10.0 ft. No Groundwater Encountered At Time Of Boring				
AB-15	1428.236	0	1.0'	Topsoil (Removed by Bulldozer)
		1.0'	10.0'	Brown Micaceous Fine Sandy Silt
Boring Terminated At 10.0 ft. No Groundwater Encountered At Time Of Boring				
AB-16	1478.926	0	5.0'	Red Tan Fine Sandy Slightly Clayey Silt
		5.0'	10.0'	Gray Brown Fine Sandy Silt
Boring Terminated At 10.0 ft. No Groundwater Encountered At Time Of Boring				
AB-17	1451.946	0	3.0'	Brown Fine To Coarse Sandy Clayey Silt With Root Matter (Possible Fill Or Disturbed Soil)
		3.0'	5.0'	Tan Fine Sandy Clayey Silt
		5.0'	6.0'	Layer Of Partially Weathered Rock
		6.0'	10.0'	Gray Silty Fine To Coarse Sand
Boring Terminated At 10.0 ft. No Groundwater Encountered At Time Of Boring				
AB-18	1388.116	0	5.0'	Green Brown Fine To Coarse Sandy Silt
Auger Refusal At 5.0 ft. No Groundwater Encountered At Time Of Boring				

RECORD OF AUGER BORINGS
(Continued)

Auger Boring	Surface Elevation	Depth From	Depth To	Soil Description (Soil consistencies defining partially weathered rock were estimated by the driller in the field based on difficulty of advancing the auger)
AB-19	1505.086	0	5.0'	Brown Micaceous Fine Sandy Silt
		5.0'	10.0'	Brown Tan Micaceous Fine To Medium Sandy Silt
		10.0'	30.0'	Brown Micaceous Fine Sandy Silt
		30.0'	30.5'	Layer Of Gravel
		30.5'	36.0'	Brown Micaceous Fine Sandy Silt
		36.0'	39.0'	Layer Of Gravel
		39.0'	44.0'	Brown Micaceous Fine Sandy Silt
		44.0'	45.5'	Layer Of Gravel
		45.5'	46.5'	Brown Micaceous Fine Sandy Silt
		46.5'	47.0'	Layer Of Gravel
		47.0'	48.5'	Brown Micaceous Fine Sandy Silt
		48.5'	50.0'	Layer Of Gravel
		50.0'	51.0'	Partially Weathered Rock

Auger Refusal At 51.0 ft.
No Groundwater Encountered At Time Of Boring
Bulk Sample Taken At A Depth Of 1 ft to 5 ft.

AB-20	1451.366	0	4.0'	Red Brown Micaceous Fine Sandy Clayey Silt
		4.0'	10.0'	Brown Micaceous Silt

Boring Terminated At 10.0 ft.
No Groundwater Encountered At Time Of Boring
Bulk Sample Taken At A Depth Of 1 ft to 3 ft.

AB-21	—	0	1.0'	Topsoil (Removed by Bulldozer)
		1.0'	5.0'	Red Brown Micaceous Fine Sandy Silt
		5.0'	10.0'	Brown Micaceous Fine Sandy Silt

Boring Terminated At 10.0 ft.
No Groundwater Encountered At Time Of Boring

AB-22	1450.056	0	2.0'	Brown Tan Fine Sandy Slightly Clayey Silt
		2.0'	5.0'	Red Orange Fine Sandy Silt
		5.0'	10.0'	Red Brown Fine Sandy Silt With Small Cobbles

Boring Terminated At 10.0 ft.
No Groundwater Encountered At Time Of Boring

RECORD OF AUGER BORINGS
(Continued)

Auger Boring	Surface Elevation	Depth From	Depth To	Soil Description (Soil consistencies defining partially weathered rock were estimated by the driller in the field based on difficulty of advancing the auger)
AB-23	1456.496	0	3.0'	Red Orange Fine Sandy Clayey Silt
		3.0'	10.0'	Tan Gray Slightly Micaceous Fine Sandy Silt
Boring Terminated At 10.0 ft. No Groundwater Encountered At Time Of Boring				
AB-24	1485.166	0	4.0'	Red Tan Fine Sandy Slightly Clayey Silt
		4.0'	4.5'	Boulders
		4.5'	10.0'	Brown Tan Fine Sandy Silt
Boring Terminated At 10.0 ft. No Groundwater Encountered At Time Of Boring				
AB-25	1514.176	0	5.0'	Brown Red Micaceous Fine To Medium Sandy Silt
		5.0'	10.0'	Brown Very Micaceous Fine Sandy Silt
Boring Terminated At 10.0 ft. No Groundwater Encountered At Time Of Boring				
AB-26	1521.106	0	3.0'	Black Fine Sandy Clayey Silt With Organic Strains
		3.0'	10.0'	Red Micaceous Fine To Medium Sandy Clayey Silt
Boring Terminated At 10.0 ft. No Groundwater Encountered At Time Of Boring				
AB-27	1441.726	0	1.0'	Topsoil (Removed by Bulldozer)
		1.0'	5.0'	Red Micaceous Fine Sandy Clayey Silt
		5.0'	10.0'	Brown Micaceous Fine Sandy Silt
Boring Terminated At 10.0 ft. No Groundwater Encountered At Time Of Boring				
AB-28	1471.036	0	6.0'	Brown Fine To Coarse Sand (Partially Weathered Rock)
Auger Refusal At 6.0 ft. No Groundwater Encountered At Time Of Boring.				
AB-29	1515.006	0	6.0'	Brown Fine Sandy Clayey Silt
		6.0'	10.0'	Brown Fine Sandy Silt
Boring Terminated At 10.0 ft. No Groundwater Encountered At Time Of Boring				

RECORD OF AUGER BORINGS
(Continued)

Auger Boring	Surface Elevation	Depth From	Depth To	Soil Description (Soil consistencies defining partially weathered rock were estimated by the driller in the field based on difficulty of advancing the auger)
AB-30	1643.206	0	1.0'	Topsoil (Removed by Bulldozer)
		1.0'	5.0'	Brown Micaceous Fine Sandy Silt
		5.0'	10.0'	Brown Very Micaceous Fine Sandy Silt
Boring Terminated At 10.0 ft. No Groundwater Encountered At Time Of Boring				
AB-31	1652.656	0	1.0'	Topsoil (Removed by Bulldozer)
		1.0'	6.0'	Red Micaceous Fine Sandy Clayey Silt
		6.0'	10.0'	Brown Silty Fine To Coarse Sand
Boring Terminated At 10.0 ft. No Groundwater Encountered At Time Of Boring				
AB-32	1650.926	0	6.0'	Red Micaceous Fine Sandy Clayey Silt
		6.0'	10.0'	Brown Fine To Coarse Sand
Boring Terminated At 10.0 ft. No Groundwater Encountered At Time Of Boring				
AB-33	1620.286	0	2.0'	Red Tan Slightly Clayey Fine Sandy Silt
		2.0'	10.0'	Brown Black Micaceous Fine Sandy Silt
Boring Terminated At 10.0 ft. No Groundwater Encountered At Time Of Boring				
AB-34	1584.006	0	3.5'	Red Micaceous Fine Sandy Clayey Silt
		3.5'	10.0'	Brown Micaceous Fine Sandy Silt
Boring Terminated At 10.0 ft. No Groundwater Encountered At Time Of Boring				
AB-35	1582.986	0	5.0'	Red Micaceous Fine Sandy Clayey Silt
		5.0'	18.0'	Brown Micaceous Fine Sandy Silt
		18.0'	25.5'	Brown Very Micaceous Silt
		25.5'	26.5'	Layer Of Gravel
		26.5'	27.5'	Partially Weathered Rock
Auger Refusal At 27.5 ft. No Groundwater Encountered At Time Of Boring				

RECORD OF AUGER BORINGS
(Continued)

Auger Boring	Surface Elevation	Depth From	Depth To	Soil Description (Soil consistencies defining partially weathered rock were estimated by the driller in the field based on difficulty of advancing the auger)
AB-36	1598.686	0	4.0'	Brown Micaceous Fine To Coarse Sandy Silt
		4.0'	4.5'	Layer Of Gravel
		4.5'	5.5'	Brown Micaceous Fine Sandy Silt
		5.5'	6.0'	Layer Of Partially Weathered Rock
		6.0'	11.0'	Brown Micaceous Fine Sandy Silt
		11.0'	11.5'	Layer Of Gravel
		11.5'	14.0'	Brown Micaceous Fine Sandy Silt
		14.0'	15.0'	Layer Of Gravel
		15.0'	20.5'	Partially Weathered Rock

Auger Refusal At 20.5 ft.
No Groundwater Encountered At Time Of Boring