TERRA
▲ ENGINEERING & CONSTRUCTION CORPORATION ▲

ENVIRONMENTAL REMEDIATION
MUNICIPAL & UTILITY CONSTRUCTION
SPECIALTY EARTHWORK

CONSTRUCTION OBSERVATION REPORT

Shallow Gas Recovery and
Leachate Head Reduction System Installation

Refuse Hideaway Landfill
Town of Middleton
Dane County, Wisconsin

Prepared for:

Wisconsin Department of Natural Resources
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Town of Middleton
Dane County, Wisconsin

INTRODUCTION

This report describes construction activities performed during the installation of two (2) shallow lateral gas recovery wells as well as the placement of five (5) permanent leachate pumps. Restoration of the clay cap and cover is also addressed in this report.

SITE DESCRIPTION

The Refuse Hideaway Landfill is located in the NW 1/4 of Sec 8 T7N-R8E in Dane County and is currently closed.

There are thirteen (13) existing landfill gas extraction wells located on the site. The wells were installed in 1991 in order to control off-site migration of landfill gas. Vacuum to the wells is provided by a blower located in the Blower House. The landfill gas is piped via a 6" HDPE header pipe, to an enclosed flare where it is burned.

There are permanent leachate head reduction pumps located in three gas wells (GW-8, GW-9 and GW-11). The submersible pumps are outfitted with hour meters, Coyote pump controls and Franklin starters. The leachate is discharged from the wells, into a leachate conveyance system which consists of approximately 800 lineal feet of piping. The leachate is collected in a buried 25,000 gallon collection tank. The conveyance piping also transports condensate which accumulates within the active header piping. The condensate is transferred to the conveyance pipe through 4 drip legs located along the header piping.

BACKGROUND

Observations made during monthly activities dating back to July of 1993 showed the following:

- Elevated landfill gas concentrations at the facility property line in gas probe GP-11
- Stressed vegetation in the area of gas well GW-5
- Landfill gas emanating from the landfill surface in the vicinity of gas well GW-5
- Elevated leachate levels in five gas wells, GW-4, 5, 7, 12 and 13

PURPOSE AND SCOPE

In an effort to remediate the above mentioned conditions and to comply with the regulatory requirement of maintaining less than 1.25% methane by volume in air at the property line, it was decided that two shallow gas lateral wells should be installed, as well as installing permanent leachate head reduction pumps in those wells which showed elevated leachate levels.

The lateral wells would be placed in the areas adjacent to Gas Well GW-5. The enhanced gas recovery in this area would lead to decreased migration and healthier vegetation as gas would not be emanating through the cap and harming the existing vegetation. The elevated leachate heads would be decreased by installing five (5) permanent pumps into the gas wells showing the greatest head. Decreasing the leachate head would improve the gas extraction system by opening more screen in each well.

In order to facilitate the upgrade of the existing gas and leachate extraction systems, five (5) gas wells heads (GW-4, 5, 7, 12, 13) were retrofitted.

The purpose of the retrofit to the five (5) gas wells is to allow the leachate pumped from each gas well to be discharged into the existing vacuum header pipe, which transports the leachate to the collection tank via gravity flow.

A retro-fit of the header pipe at gas well GW-5 was also performed in order to use the existing vacuum from the header pipe for use in the two (2) lateral gas wells installed in the area of gas well GW-5. Drawings of the header pipe retro-fit and the typical well head retro-fit are attached.

Construction Activities Observed

GAS EXTRACTION

Excavation for the installation of the shallow gas lateral wells in the area of gas well GW-5 began the week of September 6, 1993. The lateral wells extend from gas well GW-5, one in a Northwesterly direction for 155 feet, the other trends in a East Northeast direction for 95 feet. A plan of the area of the lateral gas wells is attached.

GAS EXTRACTION (CON'T)

The lateral wells are constructed of 4-inch perforated High Density Polyethylene (HDPE) which are fused onto 2-inch solid HDPE pipe. The 2-inch solid HDPE pipe are connected to the existing vacuum header riser at gas well GW-5. A drawing of the lateral gas well detailed is attached.

Trenching for the lateral gas wells extended down into the refuse. The depth of the trenches varied from 5 to 15 feet below ground surface. Prior to the placement of the perforated HDPE extraction pipe into the trench, a 6 inch layer of gravel bedding was spread across the base of the trench. After placement, the perforated pipe was then covered with approximately 6 inches of the same bedding material. The gravel bedding is used to prevent the perforations from becoming blocked by refuse or soil. The trenches were backfilled with the previously excavated refuse to with-in approximately 2.5 feet of the surface. The remaining 2.5 feet was backfilled with the previously excavated cap material, compacted with a sheepfoot compactor and covered with topsoil. Prior to placement of cover soil, eight (8) field density test were conducted on the compacted clay, results of the density tests are tabulated in this report. The test results show that the clay was recompacted to at least 90% of the maximum density of the clay cap material. A maximum density of 118 pounds per cubic foot (pcf) was used based on previous moisture-density tests performed on the clay cap material. Refer to Construction Observation Reports for Clay Cap Restoration (Dames and Moore 1992) and Partial Gas and Leachate Extraction System Interim Remedial Measures (Warzyn, November 1990). Copies of the three (3) moisture density curves are attached.

In order to increase the efficiency of the lateral gas wells, each trench contained a length of 4-inch perforated HDPE pipe adjacent to a 4-inch HDPE solid pipe extending from gas well GW-5 for half the length of the trench. The perforated HDPE extracts landfill gas from the first half of the trench. The solid HDPE extends the vacuum header pipe to the second half of the trench where a length of perforated HDPE extracts landfill gas from the remaining length of the trench. In doing this, a consistent vacuum is maintained through out the length of the trench.

At the end of each lateral trench, a one-inch polyvinyl chloride (PVC) riser was installed for future pressure and gas monitoring. The vacuum header retro-fit at GW-5 also included a ball valve on each lateral header pipe, which may be adjusted to increase or decrease the vacuum to the lateral system. A photo of the well head retrofit is attached.

CLAY CAP REPAIR

The area of cap repair included areas larger than the lateral gas well trenches. These were areas of stressed vegetation and erosion where landfill gas had been emanating through the cap.

The irregular shaped areas adjacent to the trenches are shown on an attached plan. The cap repair in these areas entailed removal of approximately 18 inches of root zone material, scarifying and recompacting the existing clay cap material, re-establishing the root zone and placing approximately 6 inches of topsoil over the areas. Density test performed in these areas indicated compaction of the clay cap material met or exceeded 90% compaction. Refer to the tabulated density test results. Density tests were performed using Troxler nuclear density testing equipment (ASTM D2922).

CLAY CAP REPAIR (CON'T)

Following backfill and compaction of the clay cap, the repaired areas received approximately 4-inches of topsoil, seed and mulch. The seed is a "Quick-2-GRO Lawn Seed Mixture" composed of 24.5% creeping red fescue, 24.5% perennial rye grass, 24.23% annual rye grass and 21.25% Kentucky Bluegrass with the remainder containing inert matter, other crop seed and weed seed.

LEACHATE EXTRACTION

In an effort to reduce elevated leachate heads in gas wells GW-4, 5, 7, 12 and 13, a permanent submersible pump was installed in each of these gas wells.

Electrical power for the new pumps is provided from the existing electrical panel located adjacent to the Blower/Flare Control Panel. Town and Country Electric of Madison was subcontracted to install all wiring for the permanent pumps. A layout of the trenching for the electrical conduit to the five (5) gas wells is attached.

At each gas well out-fitted with a permanent pump, a pump panel was installed. The weatherproof panel contains pump controls which include a fuse box, Franklin pump starter, Coyote Control, GFI electrical outlet and a pump hour meter.

The Coyote Control is used as an automatic on-off switch for the pump. Once started, the Coyote Control senses the amperage required to pump leachate from the gas well. A change in amperage occurs when the pump "spins free" i.e. reduces the leachate head past the pump intake, or if there is blockage in the discharge hose. In the former case, an underload condition is indicated on the controls, an overload condition occurs in the latter case. If either condition occurs, the power to the pump is shut off. The power to the pump remains off for a set period of time. During this "down" time the well recharges and once power is restored, leachate can once again be pumped from the well. The pump hour meters run only when the pump runs. The meters are used to not only estimate a pumping volume, but also as a diagnostic as to weather or not the pump is pumping too often, or not enough. A photo of a typical control panel is included in this report.

Trenching for electrical conduit installation from the existing electrical panel to the individual gas wells began on October 7, 1993. The trenches were typically 18-inches deep and were backfilled with the same excavated material. Compaction of the shallow trenches was performed with rubber tired equipment.

Once the wires were pulled through the 1/2-inch conduit, the pump panels located at each well were wired. The electrical wires are run through a 1/2 inch conduit from the panel to the gas well riser. A junction box is strapped to the gas well head. The submersible pump wire leads are routed through the gas well riser into the junction box where the power connection is made. The conduit from the pump panel to the junction box includes a "seal off" to prevent methane from entering the pump panel through the conduit.

LEACHATE EXTRACTION (CON'T)

The pumps were installed by Terra personnel on October 25 and 27, 1993. The pumps were set at a depth to remain approximately 1 to 2 feet above the bottom of the well. The pumps are supported by 1/4-inch stainless steel cable that is attached to the well head flange through an eye bolt. Leachate is discharged through a 1-inch reinforced flexible hose. The flexible hose is connected to a stainless steel stab fitting and a nipple which is threaded through the gas well flange. A ball valve was installed to control discharge flow. A 1-inch true union connects the ball valve to the 1-inch coated steel to HDPE transition fitting. The transition fitting was then fused to the vacuum header riser. The exposed HDPE was then insulated, taped and painted with a ultra violet protection paint.Leachate pumped from the gas wells and discharged into the vacuum header pipe is eventually discharged into to 25,000 gallon buried collection tank through the leachate/condensate conveyance line via existing driplegs located along the vacuum header pipe. A drawing of the typical Gas/Leachate Extraction Well retrofit is attached.

SYSTEM START-UP

Monthly monitoring of the permanent pumps in gas wells GW-4, 5, 7, 12 and 13 began in October, 1993. Based on early pump hour meter readings, problems were discovered in gas wells GW-5 and GW-13. The problem in GW-5 was a blown fuse which was corrected. The problem in GW-13 appeared to be a malfunctioning pump. The pump was removed, bench tested and returned to the supplier. A replacement pump was installed on November 9, 1993.

GENERAL NOTES

The installation of the five (5) permanent pumps had an immediate effect on the volume of leachate hauled off-site. The increase in leachate volume removed is not expected to continue as the recharge time for the gas wells has increased compared to the recharge time experienced when pumping began. The leachate heads have been reduced in some wells. Further pumping will be necessary before a more noticeable decrease in leachate head is observed.

The effects of the lateral gas wells on the stressed vegetation around gas well GW-5 may take some time to notice as the seed had not sprouted prior to snow covering the area. There was a noticeable decrease in the percent of methane observed in gas probes 11 - shallow and deep. Historical data of this site suggests that there is a drop in migration due to the seasonal change. Continued monthly monitoring and comparisons with past data will be needed before determining the effects of the lateral gas extraction wells.

If you have any questions regarding this report, please do not hesitate to contact us.

Sincerely,
TERRA ENGINEERING & CONSTRUCTION CORP.

Kirk Solberg

Kirk J. Solberg
Environmental Geologist

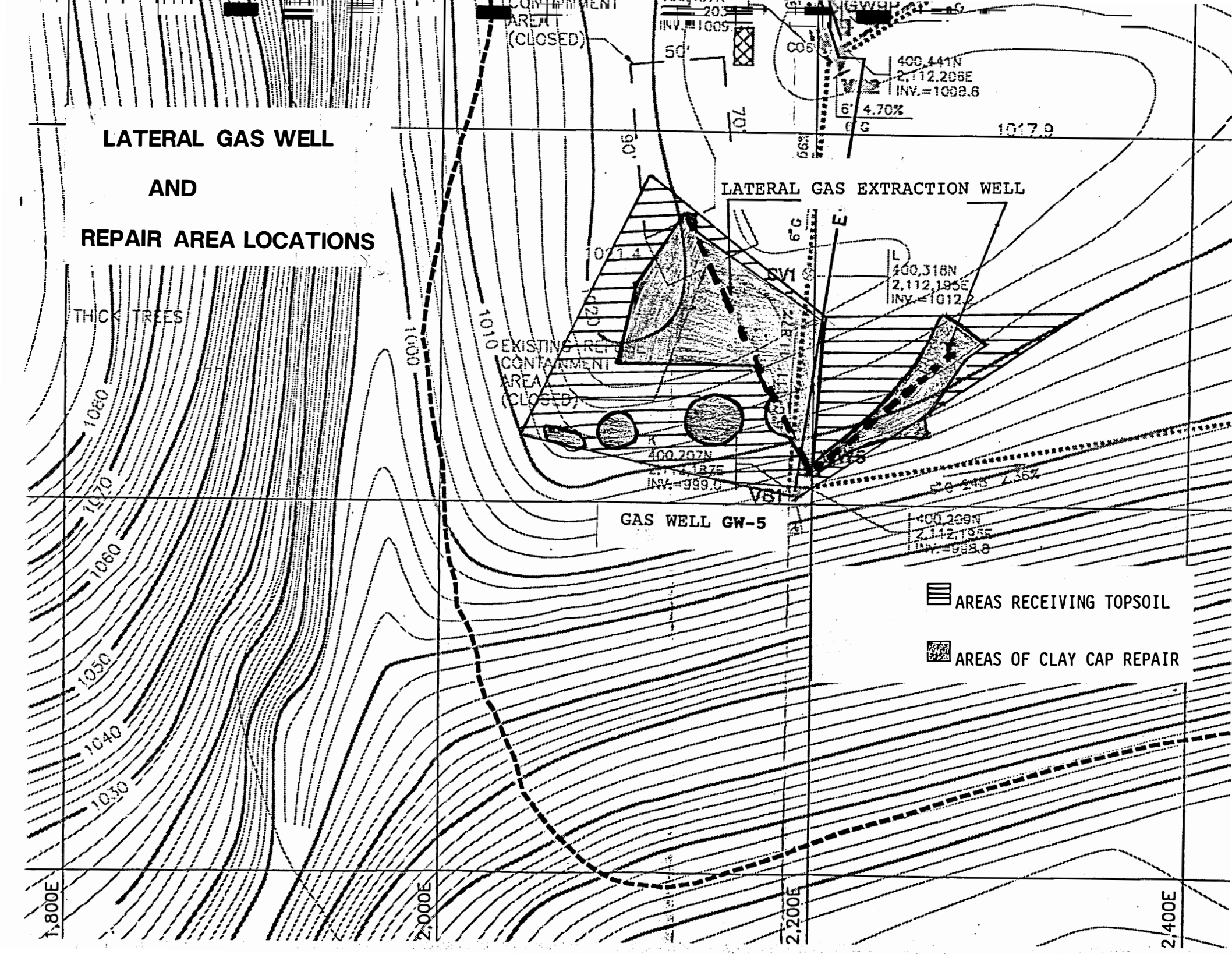

LATERAL GAS WELL
AND
REPAIR AREA LOCATIONS
LATERAL GAS EXTRACTION WELL
GAS WELL GW-5
EXISTING LFG CONTAINMENT AREA (CLOSED)
THICK TREES
AREAS RECEIVING TOPSOIL
AREAS OF CLAY CAP REPAIR
400,441N
2,112,206E
INV.=1008.6
400,316N
2,112,195E
400,207N
2,112,187E
INV.=999.0
400,209N
2,112,195E
1017.9
1,800E
2,000E
2,200E
2,400E

TABLE 1

DENSITY TEST RESULTS

TEST #	SOIL TEST	LOCATION	ELEVATION	MAX DENSITY (PCF)	WET DENSITY (PCF)	% MOISTURE	DRY DENSITY (PCF)	% PROCTOR
1	BROWN CLAY	45 FT NE OF GW-5	1.5 BELOW GROUND SURFACE	118	131.6	20.6	109.1	92.5
2	BROWN CLAY	90 FT NE OF GW-5	1.5 BELOW GROUND SURFACE	118	130.4	20.8	108.0	91.5
3	BROWN CLAY	40 FT NE OF GW-5	0.5 FT BELOW GROUND SURFACE	118	132.0	20.8	109.2	92.5
4	BROWN CLAY	85 FT NE OF GW-5	0.5 FT BELOW GROUND SURFACE	118	129.6	21.5	106.6	90.4
5	BROWN CLAY	70 FT WEST OF GW-5	1.5 FT BELOW GROUND SURFACE	118	130.3	21.9	106.8	90.5
6	BROWN CLAY	120 FT WEST OF GW-5	1.5 FT BELOW GROUND SURFACE	118	132.5	21.4	109.2	92.5
7	BROWN CLAY	75 FT WEST OF GW-5	0.5 FT BELOW GROUND SURFACE	118	130.4	22.0	106.9	90.6
8	BROWN CLAY	115 FT WEST OF GW-5	0.5 FT BELOW GROUND SURFACE	118	132.9	21.0	109.8	93.1

WARZYN

MOISTURE - DENSITY CURVE

PROJECT: REFUSE HIDEAWAY

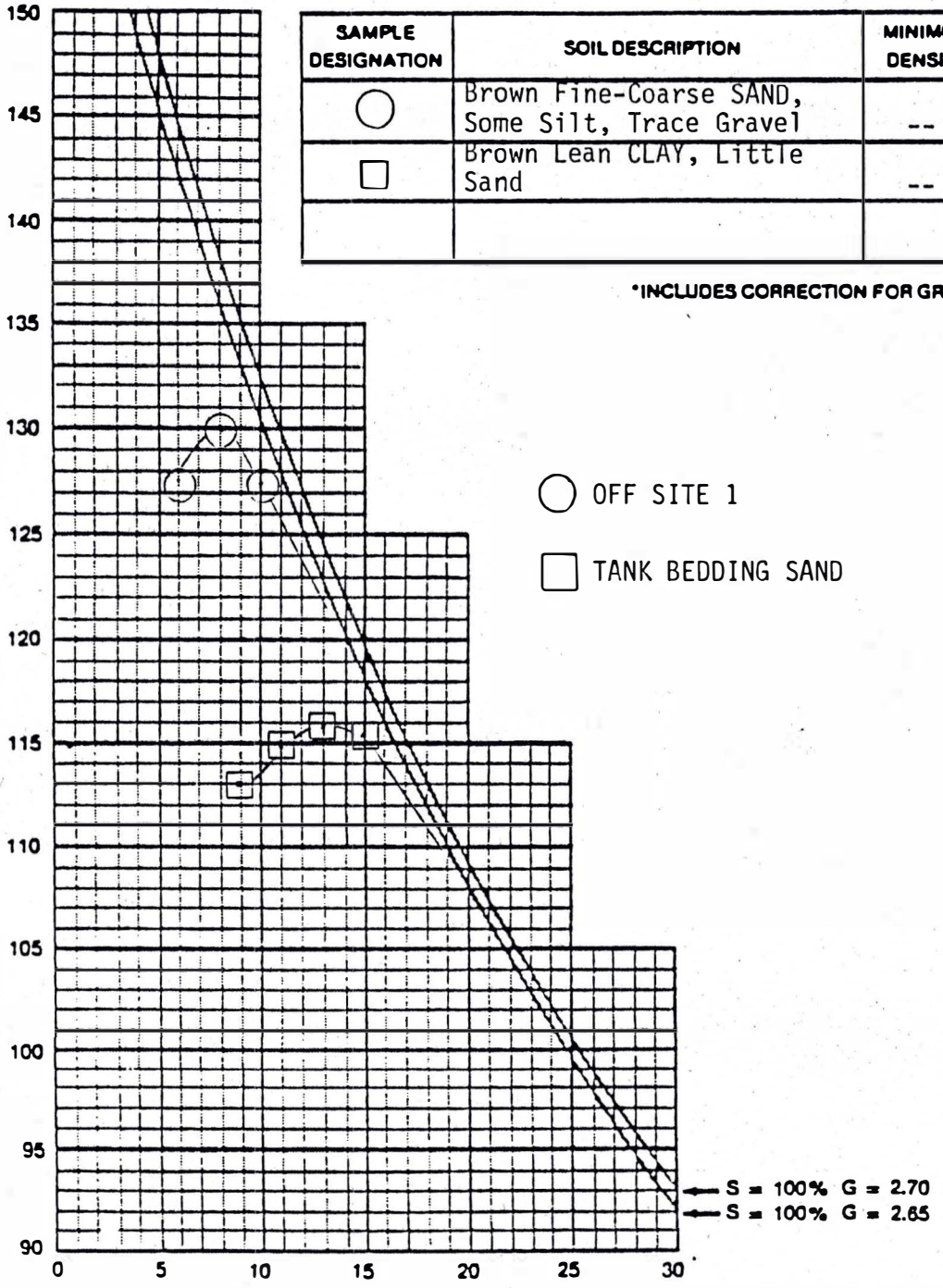
LOCATION: TOWN OF MIDDLETON

FDT Report No. _____
Job No. 13928.45
Date 5/9/90
Sheet 1 of 1

WARZYN ENGINEERING INC. • ONE SCIENCE COURT • UNIVERSITY RESEARCH PARK • P.O. BOX 5385 • MADISON, WISCONSIN 53705

SAMPLE DESIGNATION	SOIL DESCRIPTION	MINIMUM DENSITY	MAXIMUM DENSITY	OPTIMUM MOISTURE
○	Brown Fine-Coarse SAND, Some Silt, Trace Gravel	--	130 pcf	8 %
□	Brown Lean CLAY, Little Sand	--	116 pcf	13 %

*INCLUDES CORRECTION FOR GRAVEL RETAINED ON 3/4 IN. SIEVE



TEST METHOD: ☒ MODIFIED PROCTOR
☐ STANDARD PROCTOR

FORM NO 30-03

WARZYN

MOISTURE-DENSITY CURVE

PROJECT: REFUSE HIDEAWAY

LOCATION: TOWN OF MIDDLETON

FDT Report No. _____

Job No. 13928.45

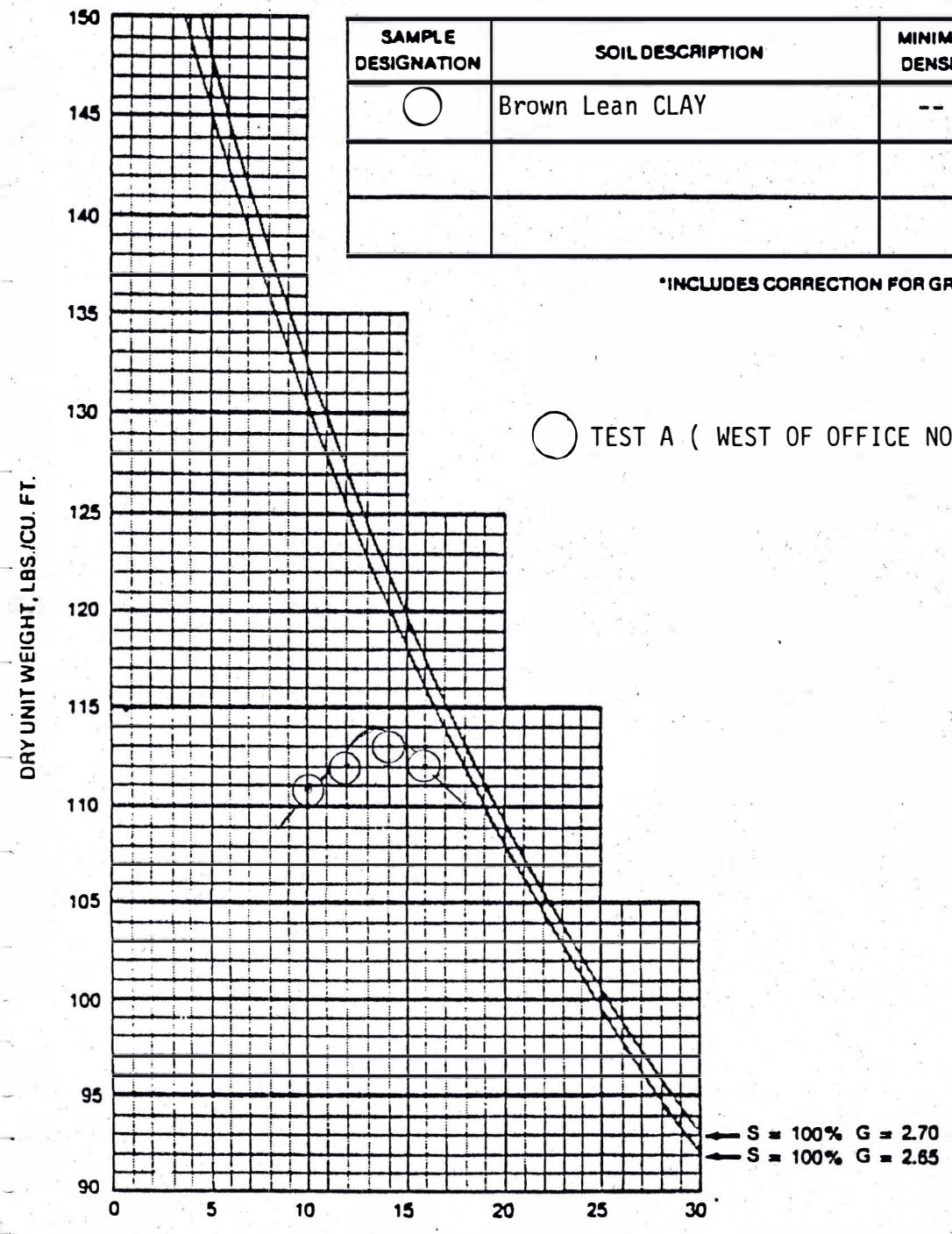
Date 5/9/90

Sheet _____ of _____

WARZYN ENGINEERING INC. • ONE SCIENCE COURT • UNIVERSITY RESEARCH PARK • P.O. BOX 5385 • MADISON, WISCONSIN 53705

SAMPLE DESIGNATION	SOIL DESCRIPTION	MINIMUM DENSITY	MAXIMUM DENSITY	OPTIMUM MOISTURE
○	Brown Lean CLAY	--	114 pcf	15 %

*INCLUDES CORRECTION FOR GRAVEL RETAINED ON 3/4 IN. SIEVE

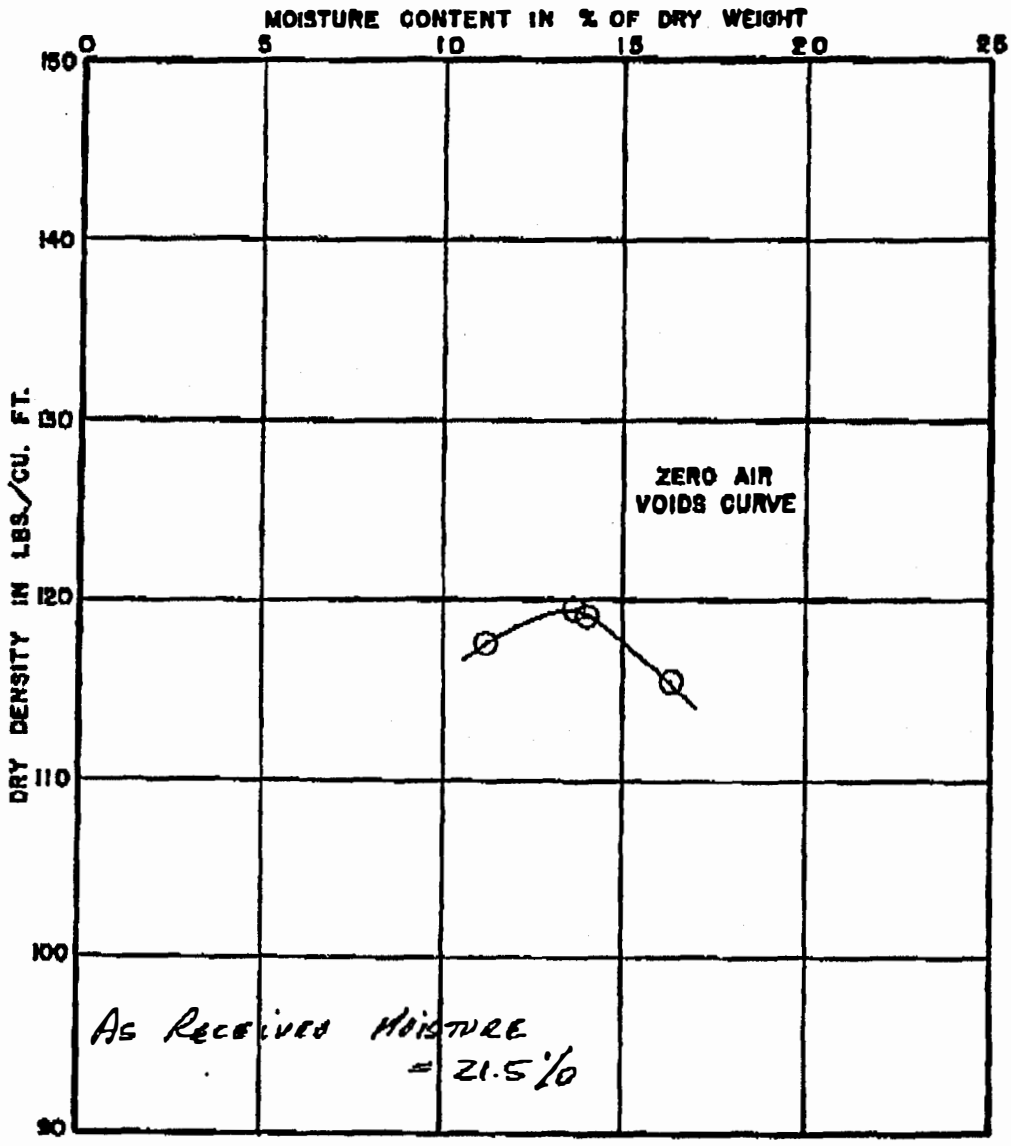


TEST METHOD: ☒ MODIFIED PROCTOR

☐ STANDARD PROCTOR

FORM NO 3003

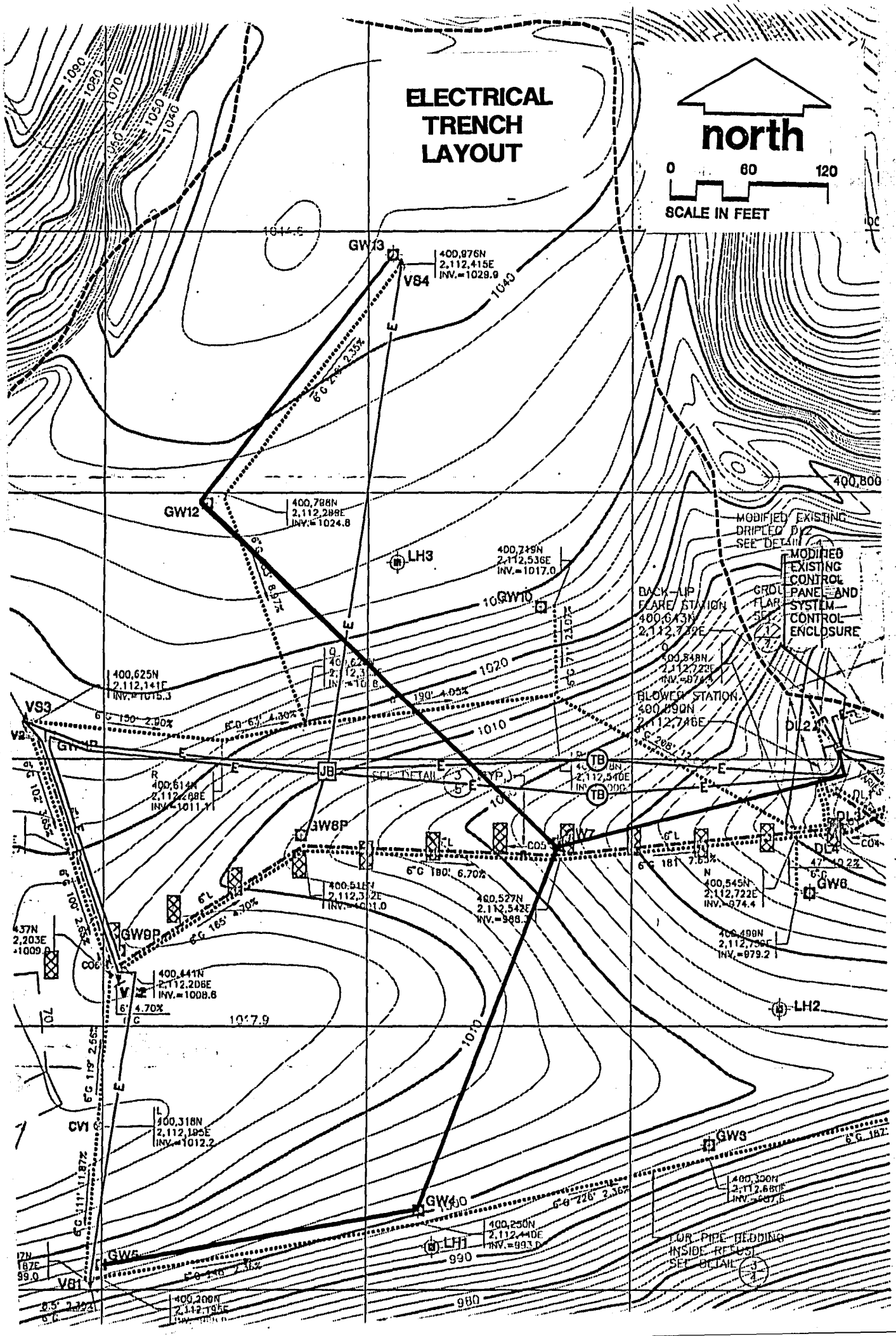
SAMPLE NO. BULK DEPTH _____ ELEVATION _____
SOIL CL CLAY CAP
LOCATION HIDEAWAY LANDFILL, MIDDLETON, WI.
OPTIMUM MOISTURE CONTENT 13.7 %
MAXIMUM DRY DENSITY 119.3 PCF
METHOD OF COMPACTION ASTM D1557 PROCEDURE A

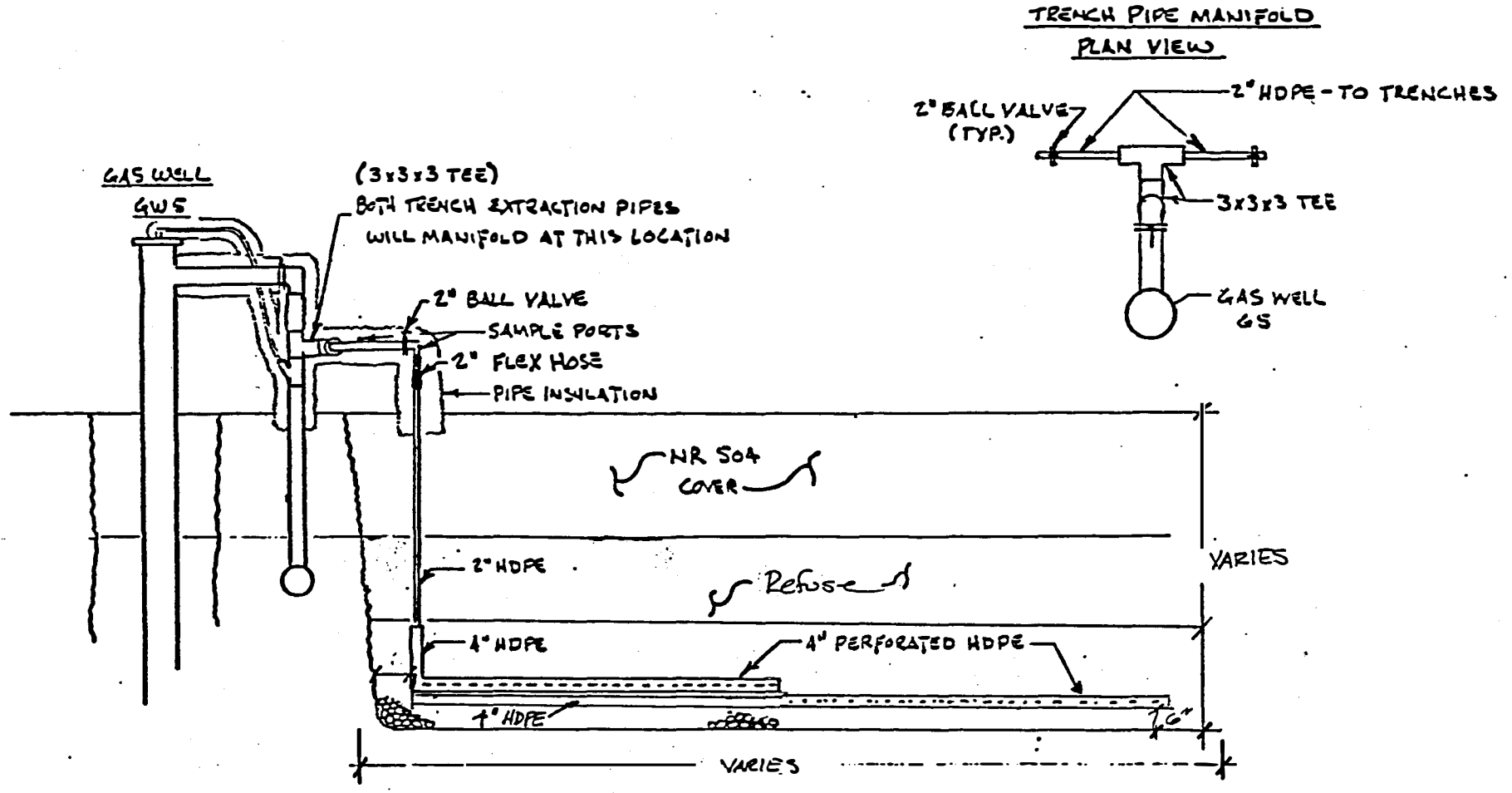


FILE 17557-006.5 BY EJL DATE 2/4 CHECKED BY _____ DATE _____

COMPACTION TEST DATA

Dames & Moore


ELECTRICAL
TRENCH
LAYOUT
north
0
60
120
SCALE IN FEET
GW13
400,976N
2,112,415E
INV.=1028.9
VS4
GW12
400,788N
2,112,289E
INV.=1024.8
LH3
400,749N
2,112,536E
INV.=1017.0
GW10
BACK-UP
FLARE STATION
400,643N
2,112,779E
BLOWER STATION
400,690N
2,112,746E
MODIFIED EXISTING
DRIPLEG DI'Z
SEE DETAIL
MODIFIED
EXISTING
CONTROL
PANEL AND
SYSTEM
CONTROL
ENCLOSURE
400,625N
2,112,141E
INV.=1015.3
VS3
JB
SEE DETAIL
TYP.
GW8P
GW7
GW6
DL1
DL2
DL3
DL4
400,545N
2,112,722E
INV.=974.4
400,498N
2,112,736E
INV.=979.2
LH2
GW8P
400,441N
2,112,208E
INV.=1008.6
CV1
400,318N
2,112,195E
INV.=1012.2
GW5
GW4
GW3
400,300N
2,112,668E
INV.=967.6
LH1
400,250N
2,112,440E
INV.=993.0
VB1
400,200N
2,112,195E
FOR PIPE BEDDING
INSIDE REFUSE
SEE DETAIL
1040
1030
1020
1010
990
980
400,800



GAS WELL GW-5 RETRO-FIT

AND

LATERAL GAS WELL DETAIL

NOT TO SCALE

GAS WELL GW-5

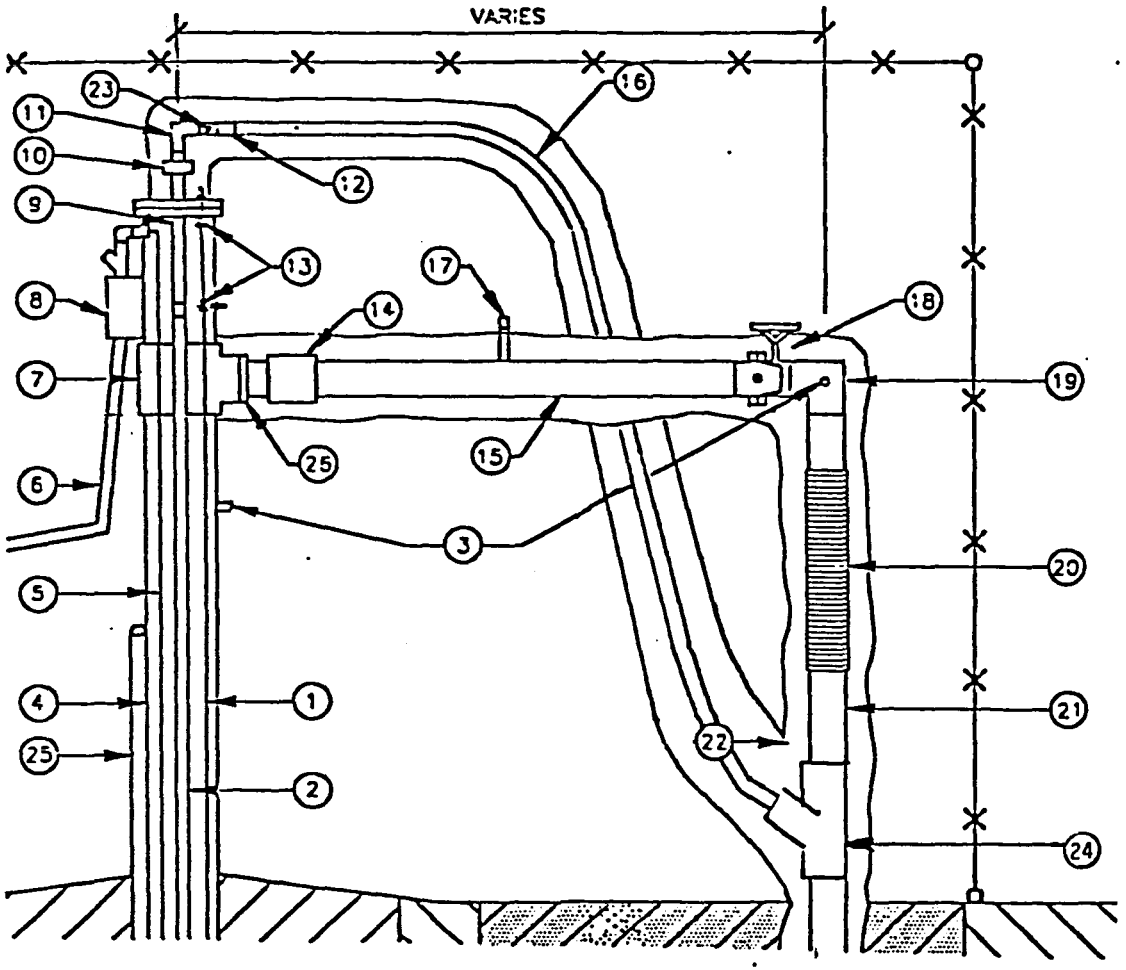
WELL HEAD RETROFIT

TYPICAL PUMP

CONTROL PANEL

TYPICAL GAS/LEACHATE EXTRACTION WELL RETRO-FIT DETAIL

Not to Scale



KEY

1. 1/4" DIA. 304 STAINLESS STEEL PULLOUT CABLE
2. 1" DIA. FLEXIBLE DISCHARGE HOSE
3. 1/4" PVC LABCOCK VALVE
4. 6" DIA. SCH. 80 PVC GAS WELL PIPE
5. ELECTRICAL WIRING FOR PUMP
6. ELECTRICAL CONDUIT AND WIRING FOR PUMP
7. 6" x 4" SCH. 80 PVC TEE
8. WELL CASING PENETRATION WITH SEALED CONDUIT TO ELECTRICAL JUNCTION BOX STRAPPED TO WELL CASING
9. 1" DIA. STAINLESS STEEL NIPPLE THREADED THROUGH BLIND FLANGE
10. 1" DIA. STEEL UNION FLANGE
11. 1" DIA. STEEL 90° ELL
12. 1" DIA. COATED STEEL TO HDPE TRANSITION FITTING
13. 1/4" STAINLESS STEEL EYEBOLT WITH WASHERS AND NUT
14. 3" DIA. PVC COUPLING
15. 3" DIA. SCH. 80 PVC PIPE
16. 1" DIA. HDPE LEACHATE DISCHARGE PIPE
17. 3/4" x 1/2" SCH. 80 PVC REDUCING BUSHING WITH 1/2" DIA. SCH. 80 PVC NIPPLE AND CAP (MONITORING PORT)
18. 3" DIA. GEAR OPERATED BUTTERFLY VALVE
19. 3" DIA. SCH. 80 PVC 90° ELL
20. 3" DIA. FLEXIBLE TUBING WITH CLAMPS
21. 3" DIA. HDPE PIPE
22. PIPE INSULATION WITH WATERPROOF COVER INSTALLED TO APPROXIMATELY 24" BELOW FINAL GRADE
23. 1" BALL VALVE
24. 3" HDPE WYE WITH BUSHING
25. TWO-1" DIA. RIGID SCH. 80 PVC PIPES STRAPPED TO WELL PIPE SLIP CAP AT TOP
26. 4" x 3" REDUCING COUPLING WITH 3" MALE ADAPTER

Notes:

This Detail Revised from Drawing 15292-D3, Extraction Well Details, Construction Observation Report, Gas and Leachate Extraction System. Refuse Hideaway Landfill, Dated November 04, 1991

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REFUSE HIDEWAY LANDFILL

WELL HEAD DETAIL

DR. DATE: 7/16/93	PROJECT NO. 7468	DWG. NO. 1 OF 3