GW - 40

REPORTS

YEAR(S):

1991

GIANT REFINING COMPANY
BLOOMFIELD REFINERY

REMEDIATION PROJECT
OPERATING AND
INSTRUCTION MANUAL

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SECTION I

LOCATION, HISTORY AND PURPOSE OF THE PROJECT

LOCATION, HISTORY AND PURPOSE OF THE PROJECT

LOCATION

The Giant Bloomfield Refinery is located approximately 5 miles west of Bloomfield, New Mexico. The precise location of the refinery is NW 1/4, Section 27 and SW 1/4, Section 22, T29 N, R12W in San Juan County, New Mexico.

HISTORY

The refinery was constructed in 1974 and operated until 1982, producing leaded and unleaded gasoline, diesel, kerosene and other refined petroleum products. The property also served as the headquarters for the Crude Oil Transportation Department until 1988. Subsequent to the closure of the refinery, ground water contamination, apparently emanating from the refinery, was discovered and investigated within the refinery property. The area within the refinery is referred to as the "On-Site" area. Details of the investigation and initial remediation efforts are contained in the "SOIL AND GROUND WATER INVESTIGATIONS AND REMEDIAL ACTION PLAN, GIANT INDUSTRIES, INC. BLOOMFIELD REFINERY BLOOMFIELD, NEW MEXICO" report, and the "DISCHARGE PLAN APPLICATION FOR GIANT BLOOMFIELD REFINERY BLOOMFIELD, NEW MEXICO" report prepared by Geoscience Consultants, LTD., of Albuquerque, New Mexico. Additionally, evidence of contamination south of the refinery has been investigated. This area is referred to as the "Off-Site" area. The results of the investigation and remedial plans are contained in the "OFF-SITE HYDROGEOLOGIC INVESTIGATION, FIRST REPORT OF OFF-SITE INVESTIGATION", "SECOND REPORT OF OFF-SITE INVESTIGATION", "TECHNICAL APPROACH FOR FURTHER OFF-SITE INVESTIGATION", and the "THIRD REPORT OF OFF-SITE INVESTIGATION", all prepared by Geoscience Consultants, LTD. These reports, as well as others are available for a more detailed review.

PURPOSE OF THE PROJECT

The purpose of the remediation system is to contain the migration of contamination in the soil and aquifer, and to clean the contaminated areas, with the eventual result being that the area will be remediated to within applicable government guidelines. In the Geoscience reports, three apparent sources of ground water contamination within the refinery are identified along with the contamination plume south of the refinery. The remediation system described within this document is designed to address these areas, both from a containment, and a remediation standpoint, allowing for future system enhancements to improve the effectiveness and efficiency of the project.

SECTION II

DESCRIPTION OF THE TECHNICAL APPROACH, THE EQUIPMENT AND ITS OPERATION

DESCRIPTION OF THE TECHNICAL APPROACH, THE EQUIPMENT AND ITS OPERATION

Technical Approach

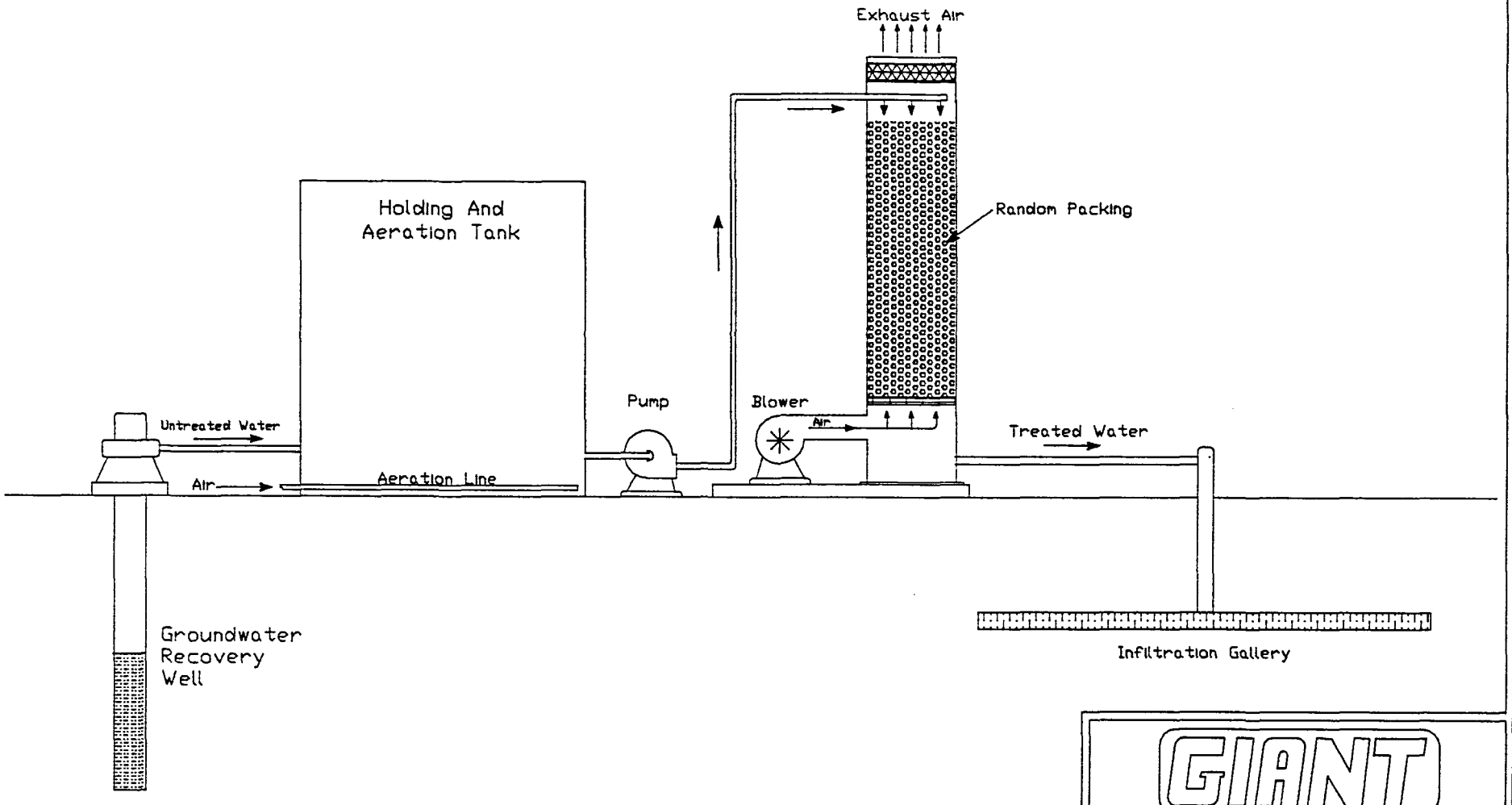
Figure #1 is a simplified pictorial representation of a ground water recovery, treatment, and disposal system. At the Giant Bloomfield Refinery, contaminated water is pumped from the aquifer through a series of recovery wells located strategically within the migrating contaminated plume, collected in storage tanks, and subsequently treated by air stripping prior to discharge into the aquifer through an infiltration trench.

The recovery wells recover free floating product and contaminated ground water from the aquifer and create a hydraulic barrier to prevent migration of the contamination plume beyond the well. A hydraulic barrier is formed when a pumping recovery well depresses the water table. This creates a cone of depression to which contamination from surrounding areas preferentially migrates. The area from which the contamination migrates is known as the well's radius of influence. Figure #2 illustrates the concept. If sufficient wells are placed so that the radii of influence from adjacent wells overlap, a barrier can be formed across the plume which prevents migration beyond the barrier. This is the principle employed at the refinery to contain and remediate the contamination plume.

Recovered water exhibiting dissolved phase and/or free phase hydrocarbons above regulatory levels needs to be treated to within applicable guidelines prior to discharge. The method of treatment used at the Giant Bloomfield Refinery for the removal of dissolved phase hydrocarbons is air stripping. Air stripping is an operation in which undesirable dissolved hydrocarbon molecules are transferred from a liquid into a flowing air stream. The driving force for the transfer is provided by the concentration gradient between the liquid and gas phases. Henry's law serves to govern the relationship and the efficiency of the transfer which takes place. Figure #3 illustrates a typical air stripper. Contaminated water is pumped to the top of the tower and distributed uniformly across the randomly packed column. It flows downward in a film layer along the packing surfaces. Air is injected into the base of the tower and flows upward, contacting the water. Volatile hydrocarbons are transferred from the water to the air and carried out the top of the column. Packed column operation provides a high level of turbulence and a very large surface area for mass transfer. The stripped effluent water exits the bottom of the column.

At times, recovered water exhibits free phase hydrocarbons. Gravity separation of these components takes place in a tank. The difference in specific gravity causes the less dense hydrocarbon components to float to the surface separating them from the more dense water phase. The free floating hydrocarbon that is skimmed off the water is stored in a separate tank.

Treated water is disposed of in two different ways. Water can be discharged to infiltration galleries or to surface application impoundments. Infiltration galleries consist of subsurface perforated piping systems placed within gravel packs where water can infiltrate the surrounding strata and eventually make its way to the aquifer. Figure #4 illustrates a typical infiltration gallery. Water can also be discharged to surface impoundments. Water applied to these areas infiltrates the ground from the surface and eventually reaches the aquifer. The return of recovered water to the aquifer, by either method, serves to recharge the aquifer and to flush contamination from soil zones above the recovery well system. The speed of remedial efforts is enhanced by the application of recovered water to specific source areas within the refinery. See Geoscience reports, "CONTROLLED APPLICATION OF WATER TO REMEDIATE HYDROCARBON IN SOIL AT THE GIANT BLOOMFIELD REFINERY", and "EVALUATION OF CONTROLLED WATER APPLICATIONS PILOT TEST GIANT BLOOMFIELD REFINERY" for details of the approach and its effectiveness.



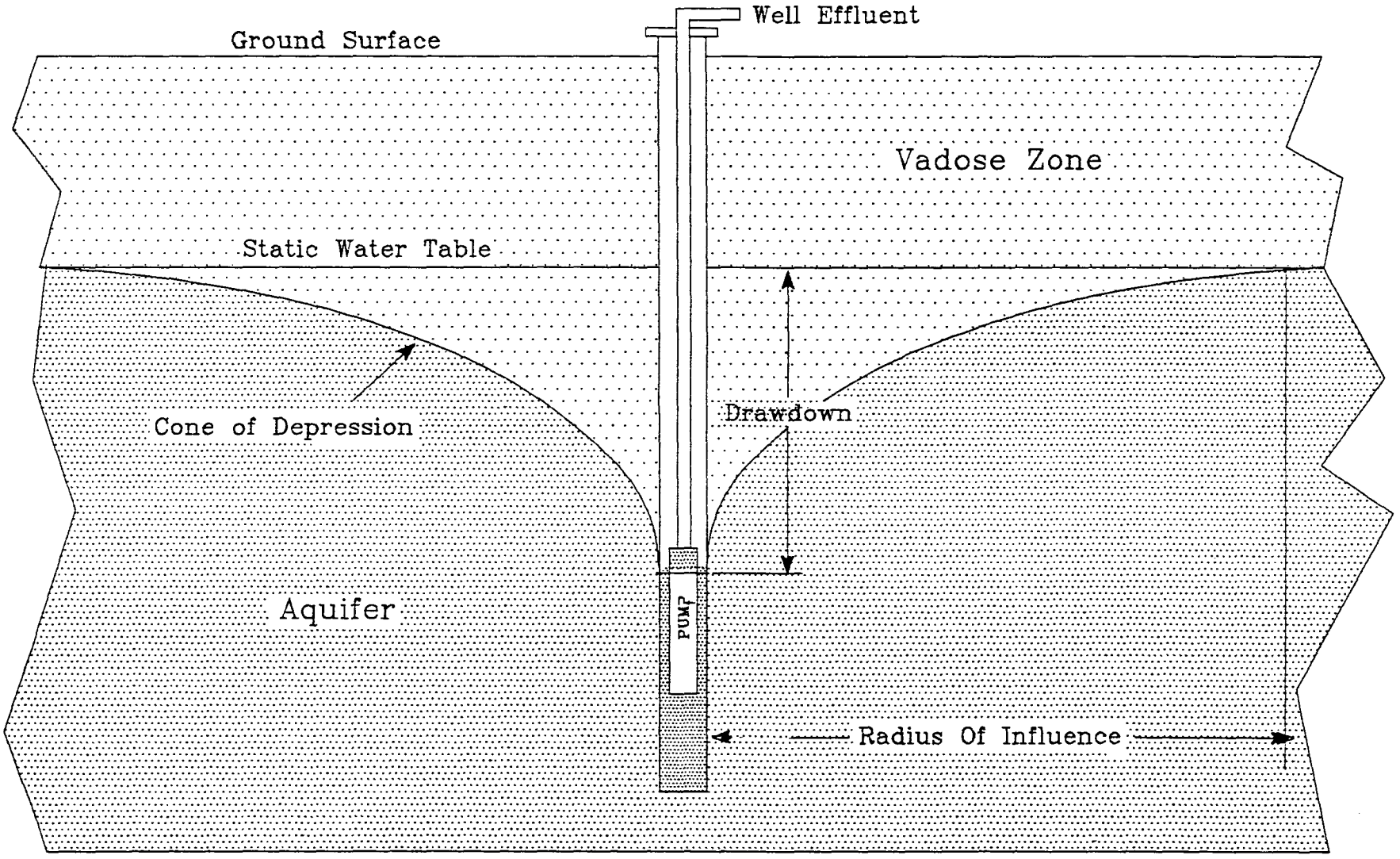
GIANT

Simplified Pictorial
Representation Of The
Water Recovery, Cleanup,
And Reintroduction Process

Dwg # 1006	By: Tim Kinney	Date: 11/14/89	Rev: 0

Figure #1

The Effect Of Pumping On An Aquifer



Dwg 1052

Figure #2

Typical Air Stripper

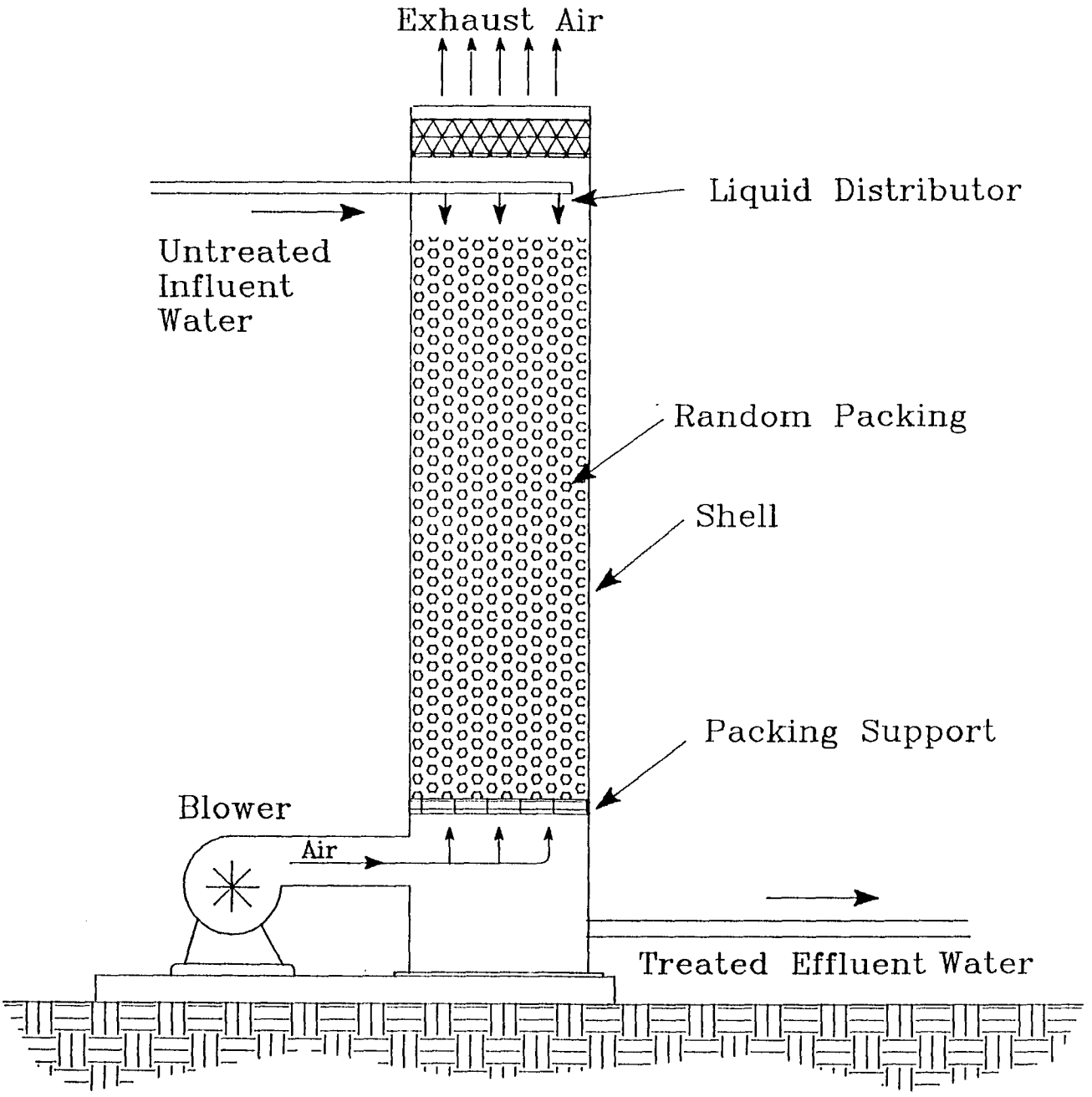
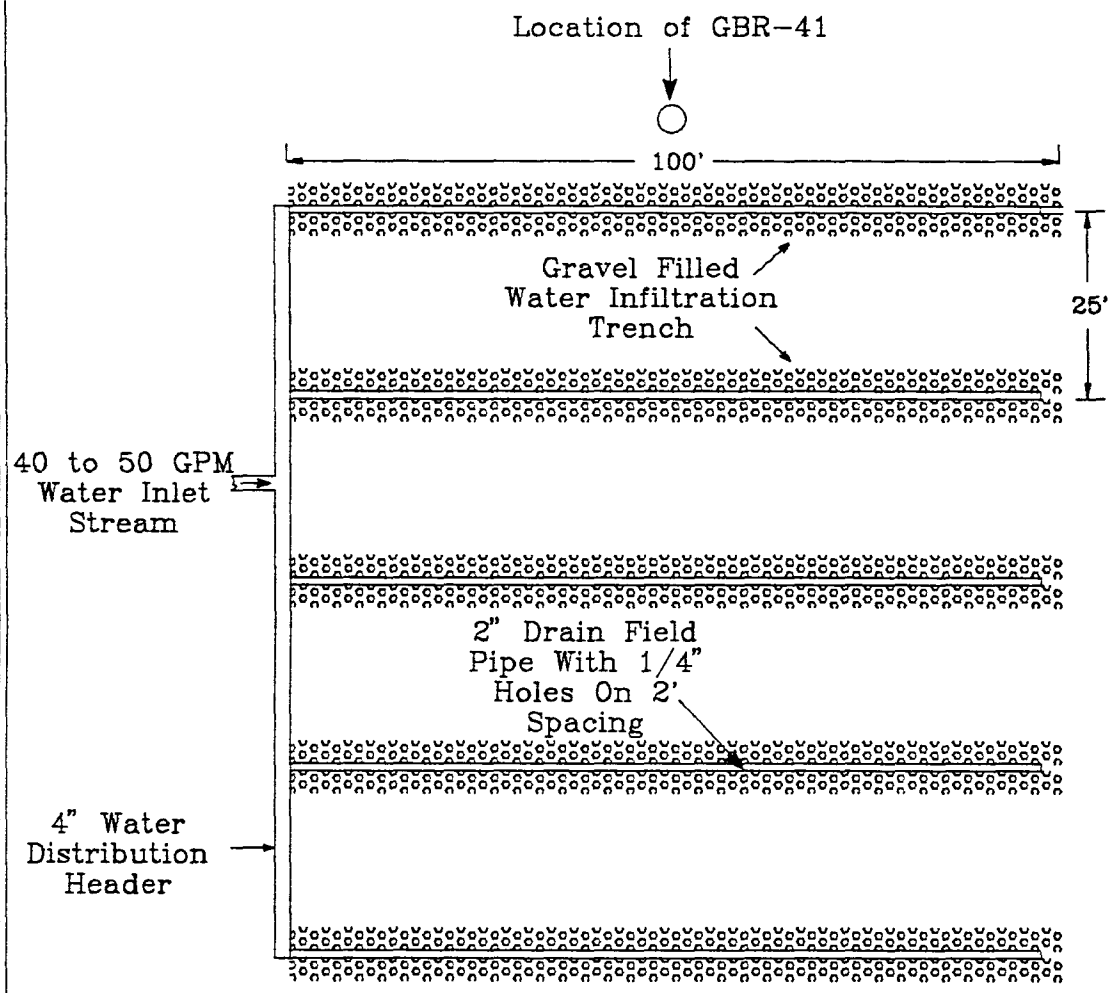


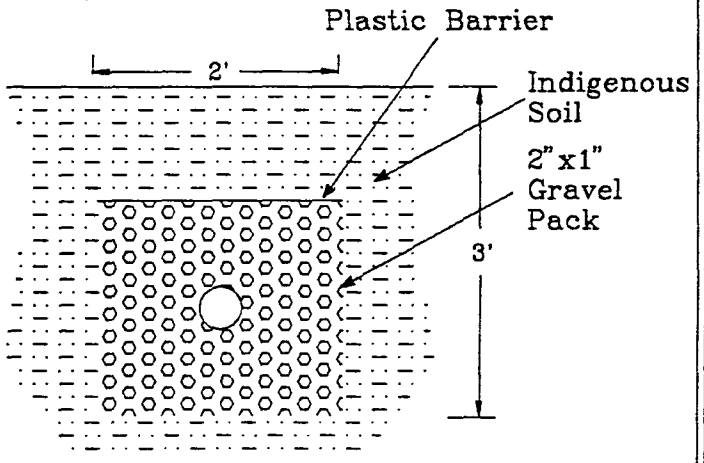
Figure #3

DWG# 1051



Trench Top View
Cut Away At The
Infiltration Line
Depth

Each 2"x 100' infiltration line is designed to distribute up to 10 GPM of treated water.



Cross Section Of A
Typical Infiltration
Trench

GIANT

Storm Water Containment Area Water Infiltration Gallery

Dwg # 1061	By: Tim Kinney	Date: 5/6/91	Rev: 0

Figure #4

Geoscience Consultants, Ltd

WELL LOGGING FORM

Client Montgomery & Andrews Well Number GBR-5

___ ¼ ___ ¼ ___ ¼ ___ ¼ S___ T___ R___ State New Mexico

County San Juan Contractor Western Technology

Spud Date 12/20/85 Completion Date 12/20/85

Logs Run Lithology from cuttings Logged By J.C. Hunter

Elevation 5390'topo Spud In (Fm.) Fill and/or Animas Fm.

Remarks Drilled with Hollow-Stem Auger (CME-55)

Depth	Litho	recov	Samples/footage	Lithology/remarks
0				0.0'-5.0' (5.0') FILL: Very coarse cobbles and small boulders of quartyite; minor sand and gravel; dark gray with strong oily hydrocarbon stain and odor, dry-moist.
10				
20			8512201240/20.0'	5.0'-55.0' (50') SANDSTONE: dark gray-yellow gray; fine grained; poorly sorted; silty; strong hydrocarbon stain and odor 5.0'-25.0'; faint stain and some odor 25.5'- 55.0' ; water level at approximately 33.0', odor persists in saturated sand to total depth.
30				
5/30/86 33'				
40				
50			8512201410/55.0'	
TD=55.0' refused auger				Borehole covered and left open for later ground water sampling. Located below SW corner of south pad.
60				8512201240 : 1VOA, 1 whirlpack, cuttings
				8512201410 : 1VOA, 1 whirlpack, cuttings
				TD 53'6" TOC, screened from 31'6" to 51'6"
				gravel to 26'8", 50 lb. Bentonite @ 26'8"
				Backfill to surface

EQUIPMENT AND OPERATION

Monitor Wells

Numerous monitor wells are located within the refinery and south of the refinery. Monitor wells within the refinery are identified by the acronym GBR (Giant Bloomfield Refinery) followed by a numerical designation. Monitor wells located south of the refinery are identified by the acronym SHS (South Highway Site) followed by a number. Monitor wells are utilized to characterize the aquifer in their respective locations. Plate #1 illustrates the locations of the monitor wells. Each well is unique in construction and geology. Following are informational sheets for each well. The sheets include well logs and completion details for every monitoring well.

Section #III of this manual contains sampling frequency and analytical requirements for applicable wells. Analytical results from various wells help determine the effectiveness and progress of remedial efforts as well as to monitor the movement of the contamination plume. In addition, the water level in each well is determined monthly. This information is tabulated and utilized to prepare potentiometric surface maps. Figure #5 is a typical potentiometric map. The lines on the map represent the elevation of the surface of the ground water. The resulting contours are useful in determining the direction of ground water flow and the effectiveness of the hydraulic control achieved by the recovery well system.

Recovery Wells

Recovery wells are an integral part of the containment and remedial system. Information follows about each well including well logs, completion diagrams, pump depth, pump type, controls, filters, valves, heaters, meters, etc. Recovery wells north of Highway 64 are identified by the acronym GRW (Giant Recovery Well) followed by a numerical designation. Recovery wells south of the highway are identified by their original SHS designation. Analytical results from various wells help determine the effectiveness and progress of remedial efforts as well as to monitor the movement of the contamination plume. Section III contains sampling frequency and analytical requirements for applicable wells. The water level in each well is determined monthly. This information is used for the same purpose as the level information collected from the monitor wells. In addition, it indicates the effectiveness of the well pump and controls. It is important to maintain consistent pumping rates at volumes which draw the maximum amount of contamination into the well to insure the effectiveness of the hydraulic containment barrier.

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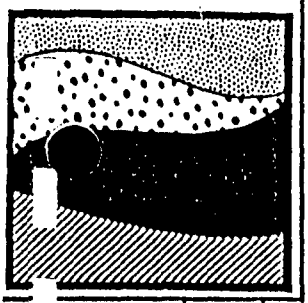


WELL LOGGING FORM

Page ____ of ____

Client Montgomery & Andrews Well Number GBR-6

1/4 1/4 1/4 1/4 S 27 T 29 R 12 State New Mexico

County San Juan Contractor Beeman Bros. Drilling Co.

Spud Date 9/9/86 Completion Date 9/9/86

Logs Run Lith from cuttings Logged By Martin

Elevation ____ Spud In (Fm.) ____

Remarks Drilled with Air Rotary

DEPTH	LITHO.	RECOV.	RUN	FROM	TO	SAMPLE DEPTH	REMARKS
0'							0'-very coarse-grained cobbles, sand and gravel; dark brown with hydrocarbon odor.
10'							10'-coarse-grained sand and gravel with some cobbles; dark brown with hydrocarbon odor.
20'							20'-fine-grained sand; well-sorted; medium brown with hydrocarbon odor.
30'							30'-fine-grained sand; well-sorted; dark brown-black; strong hydrocarbon odor.
							35'-sandstone; mixed gray-green/yellow-brown with hydrocarbon odor.
40'							40'-sandstone; coarse-grained well-sorted; yellow-brown: faint hydrocarbon odor.
							45'-sandstone; coarse-grained, poorly-sorted; yellow-brown with some clay.
50'							50'-fine-grained, poorly-sorted; gray yellow/brown; water present.
							55'-shale; gray.
60'							60'-shale; minor medium-grained gravel, poorly-sorted; dark gray.
							65'-shale; dark brown.
70'							TD of 65'4" from surface, screened from 60'4" to 20'4" gravel to 12', bentonite to 6'5", cement grout w/5% bentonite to surface. Completed as 6" PVC recovery well with identical casing of 1" PVC attached to outside.

GCL

WELL LOGGING FORM

Client Montgomery & Andrews Well Number GBR 7

1/4 1/4 1/4 1/4 S 27 T 29 R 12 State New Mexico

County San Juan Contractor Western Technologies

Spud Date Completion Date 9-24-86

Logs Run Lithology Logged By Martin

Elevation Spud In (Fm.)

Remarks Drilled with Hollow Stem Auger

DEPTH	LITH.	RECOV.	RUN	FROM	TO	SAMPLE DEPTH	REMARKS
0							
						0-5'	COBBLES AND SAND, 1/8"-5" in diam w/minor sand; fn-co gr; mod ylsh brn 10YR5/4
5						5-7.5'	SAND AND GRAVEL, dusky hlsh brn 10YR2/2; med-co gr sand
						7.5-10'	SAND AND GRAVEL, as above; at 10' hit hydrocarbon-stained sand; brnsh blck 5YR2/5
10						10-12.5'	SAND, w/1-2% small gravel; 1/2"-1" in diam; olive gry 5Y4/1; fn-co gr; hydrocarbon odor and stain
						12.5-15'	SAND, w/some gravels; 2-3% gravel, 1/4"-1 1/2" diam; sand olive gry 5Y4/1 and fn-co gr
15						15-16'	SAND, lt olive gry 5Y5/2; v fn-fn gr; slight hydrocarbon odor
						16-17'	SILTY SAND, olive gry 5Y4/1; v fn gr; hydrocarbon odor
						17-17.5'	SAND, olive gry 5Y4/1; v fn gr hydrocarbon odor
20						17.5-18.0	SAND, lt olive gry 5Y5/2; v fn gr; slight hydrocarbon odor
						18-22.5'	SAND, v fn gr w/some silt; lt olive gry 5Y5/2; slight hydrocarbon odor
25						22.5-25.0'	SAND, as above, slight hydrocarbon odor
						25-27'	GRAVEL AND SAND, hydrocarbon-stained
						27-30'	SAND, hydrocarbon-stained; grades from olive blck 5Y2/1 to blck N1; 1/4"-1/2" diam cobbles; fn fr sand
30							
						33-35'	SANDSTONE, weathered lt olive brn 5Y5/6; fn-med gr w/some silt; no hydrocarbon odor, no moisture
35						35-36'	CLAY, olive gry 5Y3/2; hydrocarbon odor; moist; minor sand
						36-40'	SAND AND SOME SILT, fn gr dusky yel 5Y6/4
40						40-41'	SAND, w/some silt, fn gr dk yelsh orng 10YR6/6, some gravel and quartzite at 40'
						41-43.5'	SAND, w/some silt, fn gr minor gravels, quartzite
45						43.5-46'	SAND, grades from med-co gr sand to fn silty sand, dk yelsh orng

GCL

WELL LOGGING FORM

Client Montgomery & Andrews Well Number GBR 7

___1/4___1/4___1/4___1/4 S 27 T 29 R 12 State New Mexico

County San Juan Contractor Western Technologies

Spud Date _____ Completion Date 9-24-86

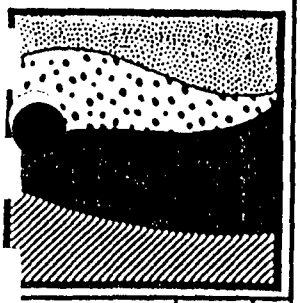
Logs Run Lithology Logged By Martin

Elevation _____ Spud In (Fm.) _____

Remarks

DEPTH	LITHO.	RECOV.	RUN	FROM	TO	SAMPLE DEPTH	REMARKS
45							
							46-47.5' SILTY SANDSTONE, lt gry to lt olive gry N7 to 5Y6/1
50							TD to 48' from surface, screened from 41'7.5" to 31'7.5", 6' blank on bottom, gravel pack to 24'10", bentonite plug to 19'8", cement grout w/5% bentonite to surface. Completed well with 2" PVC.
55							
60							
65							
70							
75							
80							
85							
90							

GCL



WELL LOGGING FORM

Client Montgomery & Andrews Well Number (P-4) GBR 8

1/4 1/4 1/4 1/4 S 27 T 29 R 12 State New Mexico

County San Juan Contractor Western Technologies

Spud Date Completion Date 10-1-86

Logs Run Lithology Logged By Martin

Elevation Spud In (Fm.)

Remarks Drilled with Hollow Stem Auger

DEPTH	LITHO.	RECOV.	RUN	FROM	TO	SAMPLE DEPTH	REMARKS
0							
							0-5' SILTY SAND, w/some cobbles, fn-med gr dk yelsh brn color 10YR4/2
5							5-10' SAND, med-co gr; dk yelsh brn color 10YR4/2
10							10-25' COARSE-GRAINED SAND, dk yelsh brn color 10YR4/2
15							
20							
25							25-30' CLAYEY SAND, fn-med gr; dk yelsh brn color 10YR4/2
30							30-35' SANDY CLAY, v fn-med gr, dk yelsh brn color 10YR4/2
35							35-38' SANDY CLAY, fn-med gr olive gry color 5Y4/1; strong hydrocarbon odor
40							38-38.33' SANDY CLAY, fn-med gr mixed color of mod yelsh brn 10YR5/4 and olive gry 5Y4/1; strong hydrocarbon odor 38.33-39.17' SILTY SAND, fn-med gr olive gry color 5Y4/1 strong hydrocarbon odor 39.17-39.5' SAND, co gr olive gry color 5Y4/1, strong hydrocarbon odor
45							

GCL

WELL LOGGING FORM

Client Montgomery & Andrews Well Number (P-4) GBR 8

1/4 1/4 1/4 1/4 S 27 T 29 R 12 State New Mexico

County San Juan Contractor Western Technologies

Spud Date _____ Completion Date 10-1-86

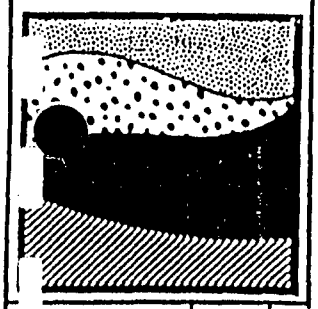
Logs Run Lithology Logged By Martin

Elevation _____ Spud In (Fm.) _____

Remarks

DEPTH	LITHO.	RECOV.	RUN	FROM	TO	SAMPLE DEPTH	REMARKS
45							
							TD to 58' from surface. Screened from 53' to 38', 5' blank on bottom. Gravel pack to 30', bentonite plug to 25', cement grout to surface. Completed with 2" PVC.
50							
55							
60							
65							
70							
75							
80							
85							
90							

GCL



WELL LOGGING FORM

Client Montgomery & Andrews Well Number GBR 9

1/4 1/4 1/4 1/4 S 27 T 29 R 12 State New Mexico

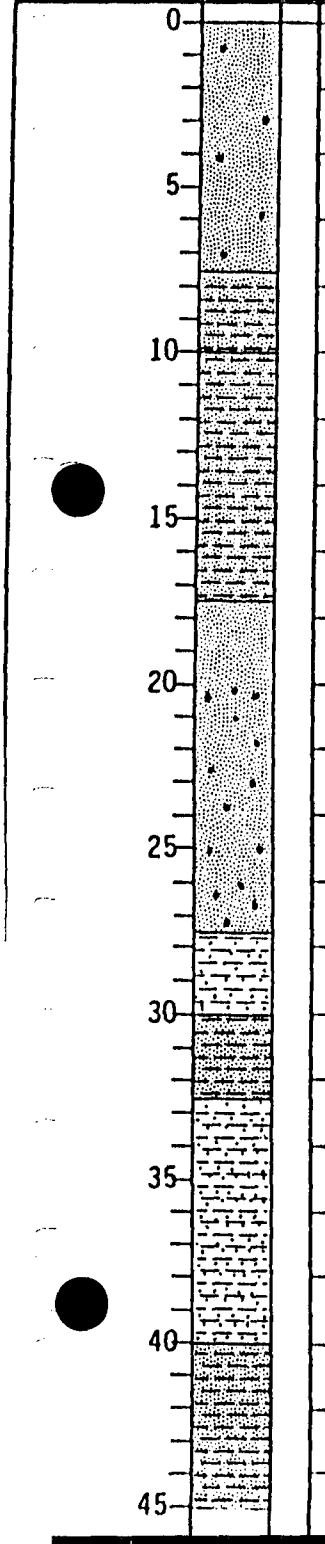
County San Juan Contractor Western Technologies

Spud Date 9-29-86 Completion Date 9-30-86

Logs Run Lithology Logged By Martin/Kaszuba

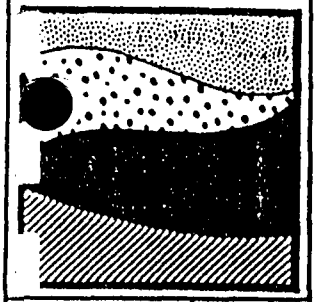
Elevation Spud In (Fm.)

Remarks Drilled with Hollow Stem Auger



RUN	FROM	TO	SAMPLE DEPTH	REMARKS
			0-2.5'	SAND, med-fn gr w/rare pebbles; mod yelsh brn 10YR5/4
			2.5-5'	SAND, med-fn gr w/rare pebbles; mod yelsh brn 10YR5/4
			5-7.5'	SAND, med-fn gr w/rare pebbles; mod yelsh brn 10YR5/4
			7.5-10'	CLAYEY SAND, med-fn gr; mod yelsh brn 10YR5/4
			10-12.5'	CLAYEY SAND, co gr w/1-2% gravels; mod yelsh brn 10YR5/4
			12.5-15'	CLAYEY SAND, med-fn gr; mod yelsh brn 10YR5/4
			15-17.5'	same as above
			17.5-20'	SAND, med gr; mod yelsh brn 10YR5/4
			20-22.5'	SAND, med gr, w/occasional pebbles; mod yelsh brn 10YR5/4
			22.5-25'	same as above
			25-27.5'	SAND, med gr, w/occasional pebbles; mod yelsh brn 10YR5/4
			27.5-30'	SANDY CLAY, med gr sand; dk yelsh brn 10YR4/2, faint HC odor
			30-32.5'	CLAYEY SAND, fn-med gr; dk yelsh brn 10YR4/2, faint HC odor
			32.5-40'	SANDY CLAY, fn-med gr; olive gry 5Y4/1, strong HC odor
			40-45'	CLAY AND SAND, fn gr sand, dk yelsh orng 10YR6/6; clay is lt olive gry 5Y5/2
			45-47.5'	SANDY CLAY/CLAYEY SAND, dusky yel 5Y6/4

GCL



WELL LOGGING FORM

Client Montgomery & Andrews Well Number GBR 9

__1/4__1/4__1/4__1/4 S 27 T 29 R 12 State New Mexico

County San Juan Contractor Western Technologies

Spud Date 9-29-86 Completion Date 9-30-86

Logs Run Lithology Logged By Martin/Kaszuba

Elevation _____ Spud In (Fm.) _____

Remarks

DEPTH	LITHO.	RECOV.	RUN	FROM	TO	SAMPLE DEPTH	REMARKS
45							
							47.5-52.5' SANDY CLAY, med gr sand; lt olive gry 5Y5/2
50							52.5-52.9' SILT, olive gry 5Y4/1
							52.9-57.5' SHALE, grnsh gry 5GY6/1
55							57.5-62.5' SILT, grnsh gry 5GY6/1
60							TD of 65' from TOC. Completed with 2" PVC/ss flush joint. Sand pack to 37', bentonite to 18 1/2' (1.5 bags) cement grout w/5% bentonite to surface. Screened from 50-60', ss up to 35', PVC from 35' to TOC.
65							
70							
75							
80							
85							
90							

GCL

WELL LOGGING FORM

Client Montgomery & Andrews Well Number (P-2) GBR 10

1/4 1/4 1/4 1/4 S 27 T 29 R 12 State New Mexico

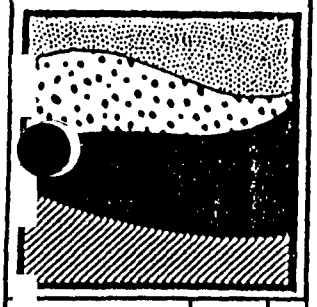
County San Juan Contractor Western Technologies

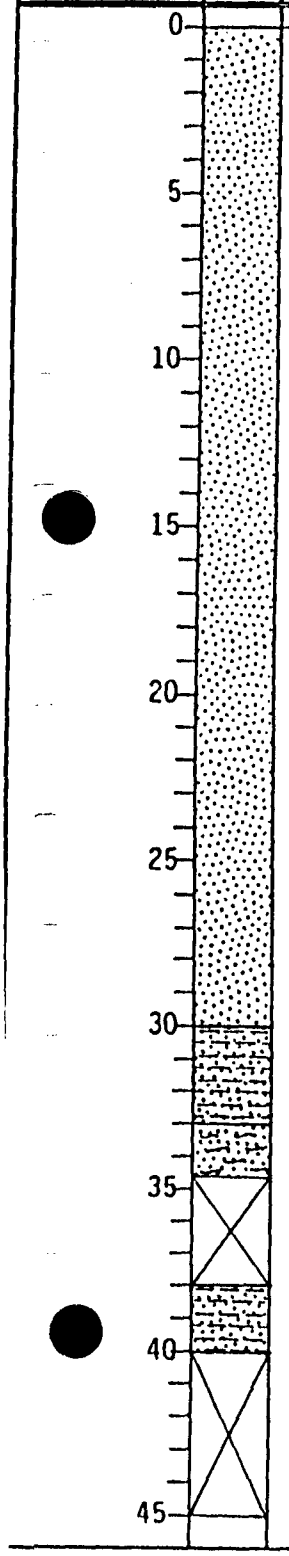
Spud Date _____ Completion Date 9-29-86

Logs Run Lithology Logged By Martin

Elevation _____ Spud In (Fm.) _____

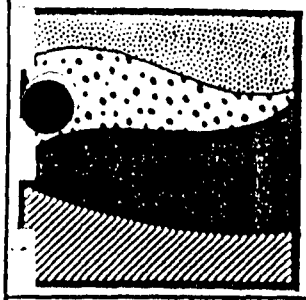
Remarks Drilled with Hollow Stem Auger





DEPTH	LITHO.	RECOV.	RUN	FROM	TO	SAMPLE DEPTH	REMARKS
						0-10'	SAND, med gr poorly sorted w/some cobbles; mod yelsh brn color 10YR5/4
						10-15'	SAND, co-med gr mod yelsh brn color 10YR5/4 poorly sorted
						15-20'	SAND, co-med gr poorly sorted; dk yelsh brn color 10YR4/2
						20-30'	SAND, w/5% gravel co-med gr, poorly sorted; dk yelsh brn color 10YR4/2, faint HC smell
						30-33'	SANDY CLAY, fn-med gr dk yelsh brn color 10YR4/2, faint HC odor
						33-33.33'	SILTY SAND, fn-med gr; olive gry color 5Y4/1 well sorted, strong HC color
						33.33-33.75'	SAND, fn-med gr well sorted; lt olive gry 5Y5/2, strong HC odor
						33.75-34.67'	SILTY SAND, fn-med gr olive gry color 5Y4/1; well sorted; strong HC odor
						38-38.92'	CLAYEY SAND, fn-med gr olive gry color 5Y4/1; strong HC odor
						38.92-39'	SAND, fn-med gr grysh blck color N2; strong HC odor
						39-39.67'	CLAYEY SAND, fn-med gr olive gry color 5Y4/1, strong HC odor
						39.67-39.83'	CLAYEY SAND, co-med gr dusky yel color 5Y6/4; faint HC odor

GCL



WELL LOGGING FORM

Client Montgomery & Andrews Well Number (P-2) GBR 10

__1/4__1/4__1/4__1/4 S 27 T 29 R 12 State New Mexico

County San Juan Contractor Western Technologies

Spud Date _____ Completion Date 9-29-86

Logs Run Lithology Logged By Martin

Elevation _____ Spud In (Fm.) _____

Remarks

DEPTH	LITHO.	RECOV.	RUN	FROM	TO	SAMPLE DEPTH	REMARKS
45							TD to 45' from surface. Screened from 39' to 29' 5' blank on bottom. Gravel pack to 23' bentonite plug to 18.5'; cement grout to surface. Completed with 2" PVC.
50							
55							
60							
65							
70							
75							
80							
85							
90							

Geoscience Consultants, Ltd

WELL LOGGING FORM

Client Montgomery & Andrews Well Number GBR-11

¼ SW ¼ NW ¼ NW ¼ S 27 T 29N R 12W State New Mexico

County San Juan Contractor Western Technologies

Spud Date 4/1/86 Completion Date 4/1/86

Logs Run Lithology from cuttings Logged By J.C. Hunter

Elevation 5388' (topo) Spud In (Fm.) Nacimiento (Tertiary)

Remarks Drilled w/HSA, completed as galv. steel piezometer (2.0") 80.7', 245 to N end of "GIANT" sign

Depth | Litho | Recov

0'-10' (10') SILTY SAND : mod. yellow-brown(10yr 5/4); fine to med grained, poorly sorted, rounded to subrounded, no stain or odor.

10'-40' (30') SAND: med brown (5yr 4/4); med to coarse grained, med. sorted, subround to angular, no stain or odor.

25'-35': Quartzite and granite pebbles, subrounded, 1/8" -1".

W.L. 39.75 4/2/86

40'-50' (10') SAND: Light olive gray (5y 6/1) to olive gray (5y 4/1) med grained, subangular, med sorted; distinct hydrocarbon stain and odor

TD@ 55

50'-55' (5') CLAYEY SAND: Dark yellow brown (10yr 4/2); med grained sand with streaks of blackish red (5r 2/2) to med gray (NG) sticky wet clay; med hydrocarbon odor.

Completed as 2.0" galv steel piezometer
TD=57.2 from top of pipe, stickup=2.7
Screen from 40'-50', 5' blank on bottom
Screen packed w/washed sand, bentonite plug (½sack) @30-35'

50'7"
10' 1½' H20

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WELL LOGGING FORM

Page____ of ____

Client Montgomery & Andrews Well Number GBR 13

____ ¼ ____ ¼ ____ ¼ ____ ¼ S____ T____ R____ State New Mexico

County San Juan Contractor Western Technologies

Spud Date_____ Completion Date_____

Logs Run Lith. from cuttings and cores Logged By J. Hunter

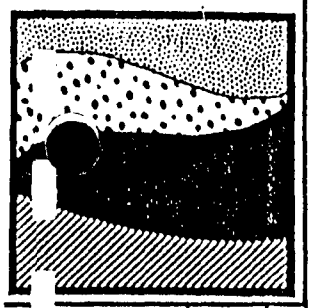
Elevation 5392' topo Spud In (Fm.) Nacimiento

Remarks NW corner, South parking area

Depth	Litho	Recov	
0			
5			0-20' sand: moderate yellowish brn, med to fine grained
10			
15			20-25' clayey sand: mod brown, very fine sand with stringers of yellowish gray clay
20			
25			25-30' sand: mod brown to yellowish brown, fine-med gr., poorly sorted, locally clayey
30			
35			30-35' oil-stained (?) sand: mod gray to yel gray, fine gr., faint HC odor, stain increases w/depth
37'2" ▼			
40			
45			35-48' sand/sandstone: mod yel brn to yel brn, very fine gr; poorly sorted, silty
TD=48'			
50			

Completed as 2.0" PVC piezometer, screen 32'-42'.

GCL



WELL LOGGING FORM

Page ____ of ____

Client Montgomery & Andrews Well Number GBR-14

1/4 1/4 1/4 1/4 S 27 T 29 R 12 State New Mexico

County San Juan Contractor Beeman Bros. Drilling Co.

Spud Date 9/10/86 Completion Date 9/10/86

Logs Run Lith from cuttings Logged By Martin

Elevation ____ Spud In (Fm.) ____

Remarks Drilled with Air Rotary

DEPTH	LITHO.	RECOV.	RUN	FROM	TO	SAMPLE DEPTH	REMARKS
0'							0'-coarse-grained, poorly-sorted sandy; medium brown.
10'							10'-coarse-grained, well-sorted clayey sand; mixed medium brown/dark gray-black; stained; strong hydrocarbon odor
20'							20'-coarse-grained, poorly-sorted clayey sand; light gray brown, no hydrocarbon odor.
30'							30'-coarse-grained, well-sorted clayey sand; medium to dark gray; faint hydrocarbon odor.
							35'-poorly-sorted clayey sand and gravel; medium brown.
40'							40'-poorly-sorted sandy gravel; dark brown.
							45'-poorly-sorted clayey sand and gravel; gray-brown.
50'							50'-poorly-sorted gravel; light gray.
							55'-well-sorted clayey gravel; medium gray.
60'							60'-well-sorted coarse-grained gravel; medium gray-brown.
							65'-poorly-sorted sand and gravel; dark gray.
70'							TD to 65' from surface, screened from 60' to 20', gravel pack 10'10", bentonite plug to 4'4", cement grout w/5% bentonite to surface completed as 6" PVC recovery well with identical 1" PVC casing attached to side.

GCL

WELL LOGGING FORM

Client Montgomery & Andrews Well Number (P-1) GBR 15

__1/4__1/4__1/4__1/4 S 27 T 29 R 12 State New Mexico

County San Juan Contractor Western Technologies

Spud Date _____ Completion Date 9-28-86

Logs Run Lithology Logged By Martin

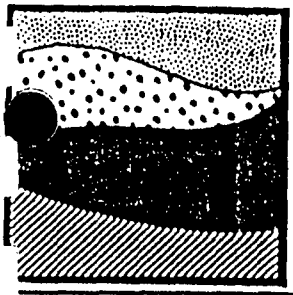
Elevation _____ Spud In (Fm.) _____

Remarks Drilled with Hollow Stem Auger

DEPTH	LITHO.	RECOV.	RUN	FROM	TO	SAMPLE DEPTH	REMARKS
0							
						0-5'	SAND, med gr; mod brn color 5YR4/4
						5-7'	SAND, med gr; mod brn color 5YR4/4, HC stain
5							
						7-10'	SAND, med gr; blck N1; strong HC odor and stain
						10-15'	CLAYEY SAND, med gr, olive gry color 5Y4/1; HC odor
10							
						15-20'	CLAYEY SAND, med gr w/2-5% gravels; olive gry color 5Y4/1, HC odor
15							
						20-25'	SILTY SAND, med gr olive gry color 5Y4/1 faint HC odor
20							
						25-30'	CLAY, fine to med gr, dark greenish-gray color 5GY4/1, HC odor
25							
						30-35'	SANDY CLAY, fn-med gr olive gry 5Y3/2; HC odor
30							
						35-40'	CLAYEY, SILTY SAND, fn gr lt olive gry color 5Y5/2; HC odor
35							
						40-45'	CLAYEY SAND, fn-med gr; grysh olive color 10Y4/2; faint HC odor
40							
						45-60'	SANDY CLAY, fn-med gr; grnsh gry color 5GY6/1; HC odor
45							

l irock and water at 36.0'

GCL



WELL LOGGING FORM

Client Montgomery & Andrews Well Number GBR 15

__1/4__1/4__1/4__1/4 S 27 T 29 R 12 State New Mexico

County San Juan Contractor Western Technologies

Spud Date _____ Completion Date 9-28-86

Logs Run Lithology Logged By Martin

Elevation _____ Spud In (Fm.) _____

Remarks

DEPTH	LITHO.	RECOV.	RUN	FROM	TO	SAMPLE DEPTH	REMARKS
45							TD to 60' from surface. Screened from 55' to 45', 5' blank on bottom. Gravel pack to 35', bentonite plug to 30', cement grout to surface. Completed with 2" PVC.
50							
55							
60							
65							
70							
75							
80							
85							
90							

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WELL LOGGING FORM

Page _____ of _____

Client Montgomery & Andrews Well Number GBR 16

____ ¼ ____ ¼ ____ ¼ ____ ¼ S____ T____ R____ State New Mexico

County San Juan Contractor Western Technologies

Spud Date _____ Completion Date _____

Logs Run Lith. from cuttings and cores Logged By _____

Elevation 5414 topo Spud In (Fm.) Fill

Remarks w end of burn pit

Depth	Litho	Recov	
0			0-12' Fill: Gray to brn gry, very coarse boulders, cobbles and sand, local HC stain & odor
5			
10			
12.25' ▼			12-25' Sandstone: mod yel brn, fine gr, very poor sorted, subrounded, mod HC odor
15			
20			
25			Completed as 2.0" PVC piezometer, screen 10-20'.

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WELL LOGGING FORM

Client Montgomery & Andrews Well Number GBR 17

___ ¼ ___ ¼ ___ ¼ ___ ¼ S 27 T 29 R 12 State New Mexico

County San Juan Contractor Beeman Bros. Drilling Co.

Spud Date 5/28/86 Completion Date 5/28/86

Logs Run Lith from cuttings Logged By NICHOLAS

Elevation _____ Spud In (Fm.) _____

Remarks Drilled With Air Rotary , completed as a 2" flush joint PVC and SS Well

Depth	Litho	recov
		0-5' (5') sand, mod yellowish brn (10YR 5/4), very fine to coarse grained sand
5		
10		5-10' (5') clayey sand, dk yellowish brn (10YR 4/2) fine to coarse grained sand
15		with clay stringers
20		10-20' (10') clayey sand, mod yellowish brn (10YR 5/4) fine to med grained sand
25		with clay stringers
30		20-45' (25') silty sand, mod yellowish brn, (10YR 5/4) fine to med grained sand
33'-6" 5-29-86		
35		grades coarser at 45'
40		45-60' (15') sand, mod yellowish brn (10yr 5/4) to lt olive grey (5Y 5/2), fine to
45		coarse grained sand with some cobbles
50		60-68' (8') silty sand, greenish grey (5GY 6/1), fine to coarse grained sand
55		w/some cobbles (1/2"-3"), 10-15%.
60		TD 68' to TOC, screened from 31'-51' ss screen, ss blanks on bottom,
65		PVC risers. Gravel packed to 28', 100 lb bag Bentonite @ 28', Backfill
		to surface

GCL

WELL LOGGING FORM

Client Montgomery & Andrews Well Number (Obs W2) GBR 19

__1/4__1/4__1/4__1/4 S 27 T 29 R 12 State New Mexico

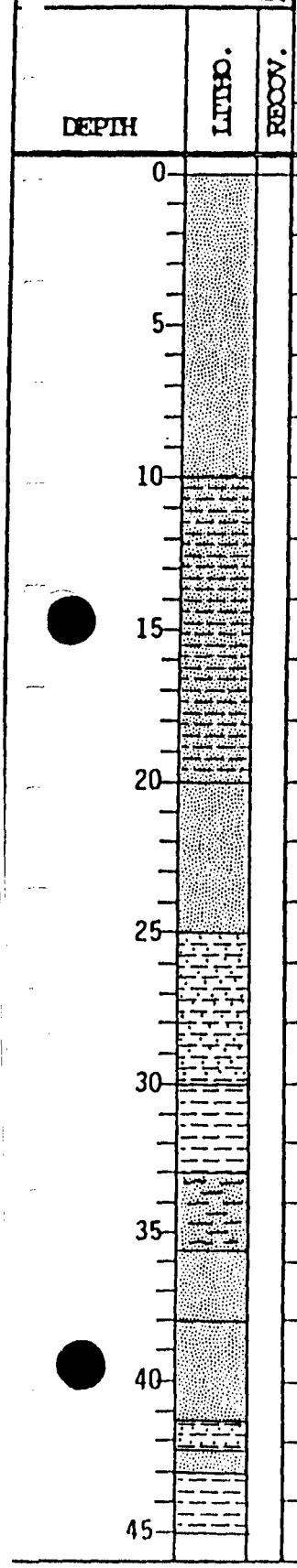
County San Juan Contractor Western Technologies

Spud Date _____ Completion Date 10-1-86

Logs Run Lithology Logged By Martin

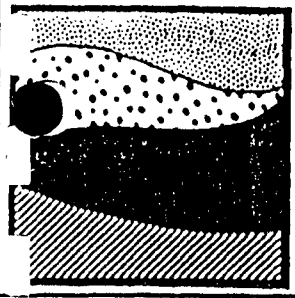
Elevation _____ Spud In (Fm.) _____

Remarks Drilled with Hollow Stem Auger



RUN	FROM	TO	SAMPLE DEPTH	REMARKS
			0-5'	SAND, fn-med gr, mod yelsh brn color 10YR5/4
			5-10'	SAND, med-co gr; mod yelsh brn color 10YR5/4
			10-20'	CLAYEY SAND, med-co gr; mod yelsh brn color 10YR5/4
			20-25'	SAND, med gr; mod yelsh brn color 10YR5/4
			25-30'	SANDY CLAY, v med-co gr; dk yelsh brn color 10YR4/2
			30-33'	CLAY, fn gr; dk yelsh brn color 10YR4/2
			33-35'	SILTY SAND, fn gr lt olive gry color 5Y5/2; HC odor
			35-35.83'	SILTY SAND, fn gr dk grnsh gry color 5GY4/1
			35.83-36.17'	SAND, med gr blck NI; wet w/HC strong HC odor
			36.17-36.5'	SAND, med gr lt olive gry color 5Y5/2; faint HC odor
			36.83-38'	SAND, co gr mod yelsh brn color 10YR5/4; no HC odor
			38-41.33'	SANDY CLAY, fn gr dk yelsh brn color 10YR4/2
			41.33-41.67'	SAND, fn-med gr; dk yelsh brn color 10YR4/2
			41.67-42.33'	CLAYEY SAND, v fn-med gr w/some cobbles and gravels; dk yelsh brn color 10YR4/2

GCL



WELL LOGGING FORM

Client Montgomery & Andrews Well Number GBR 19

1/4 1/4 1/4 1/4 S 27 T 29 R 12 State New Mexico

County San Juan Contractor Western Technologies

Spud Date Completion Date 10-1-86

Logs Run Lithology Logged By Martin

Elevation Spud In (Fm.)

Remarks

DEPTH	LITHO.	RECOV.	RUN	FROM	TO	SAMPLE DEPTH	REMARKS
45							
							42.92-43' SAND, co gr yelsh gry color 5Y7/2
							43-48' CLAY, fn gr; olive gry color 5Y4/1; faint HC odor
50							
							TD to 51' from surface. Screened from 46' to 31', 5' blank on bottom. Gravel pack to 25', bentonite plug to 20' cement grout to surface. Completed with 2" PVC.
55							
60							
65							
70							
75							
80							
85							
90							

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WELL LOGGING FORM

Client Montgomery & Andrews Well Number GBR 20

NW ¼ SE ¼ NW ¼ NW ¼ S 27 T 29N R 12W State New Mexico

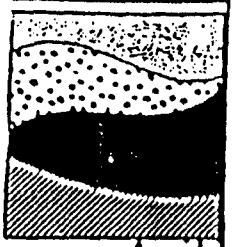
County San Juan Contractor WesternTechnologies

Spud Date 4/18/86 Completion Date 4/18/86

Logs Run lithology from cuttings Logged By Nicholas

Elevation 5394'(topo) Spud In (Fm.) Nacimiento

Remarks Drilled with HSA, no continous sampler used.



Depth	Litho	Recov	
0			0-20' (20') SAND & GRAVEL : Moderate yellowish brown (10yr 5/4), med to coarse grained sand with 5%-30% gravel (⅛"-2"), No HC Odor.
5			
10			
15			
20			20-30' (10') SILTY CLAY: Med light gray (N6) to med dark grey (N4), fine to med grained with some silt, hard drilling at 34', no HC ODOR.
25			
30			30-48.5' (18.5') SANDSTONE: Med lt grey (N6) to med dk grey (N4), fine to med grained with some silt, hard drilling at 34', No HC odor.
35			
5-1 38.0'			
40			
45			
TD=48'			Completed as 2" PVC Piezometer Stickup 1' 10" TD 43'10" from top of casing Screened interval 27'-37' Sand to 25', Bentonite 2/3 Bag @ 25' Backfill to 6', Bentonite 1/3 Bag @ 6'

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WELL LOGGING FORM

Client Montgomery & Andrews Well Number GBR 21

NE ¼ NW ¼ NW ¼ NW ¼ S 27 T 29N R 12W State New Mexico

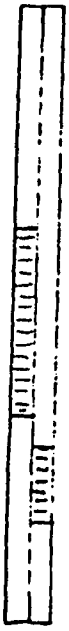
County San Juan Contractor Western Technologies

Spud Date 4/15/86 Completion Date 4/16/86

Logs Run Lithology from cuttings Logged By R Nicholas

Elevation 5398' (topo) Spud In (Fm.) Nacimiento

Remarks Drille with HSA, completed as 2' PVC Piezometer



Depth	Litho.	Recov.	
0			0'-5' (5') SAND: Brown, fine to med grained
5			
10			5'-20' (15') SILTY SAND : Brown, med to coarse grained with minor small cobbles.
15			
18'3"			
20			
25			20'-38' (18') SANDY SHALE: Brown, fine grained, grades to yellowish brown at 25'. HC ODOR.
30			
35			
40			38'-46' (8') SANDSTONE : Med. bluish gray (5B5/1), med to coarse grained with local small cobbles (½"-1½") HC ODOR and sheen in sampler.
45			
50			
55			

Dual Completion as 2" PVC Piezometer
Stickup 3'3" TD 40'3" and 41'3" from top of casing
Screened intervals 17-32' and 33-38'
Caved in snad to 6', Bentonite (3/4 Bag) @ 6'
Bentonite (¼Bag)@ 2'

Geoscience Consultants, Ltd

WELL LOGGING FORM

Client Montgomery & Andrews Well Number GBR 22

NE ¼ NW ¼ NW ¼ NW ¼ S ___ T ___ R ___ State New Mexico

County San Juan Contractor Western Technologies

Spud Date 4/15/86 Completion Date 4/16/86

Logs Run Lithology from cuttings Logged By Hicks/Nicholas

Elevation 5394.5"(topo) Spud In (Fm.) Nacimiento

Remarks Drilled with HSA, continous sampler and spit spoon used completed as 2' PVC Piezometer

Depth | Litho | recov

0-2.5' (2.5') SAND & GRAVEL FILL: Brown, some HC odor from surface spills

2.5'-15.0' (12.5') SAND: Mod yellowish brown (10yr5/4) (2.5'-12.5') grades to Lt. brown at 12.5'(5yr5/6), med grained, well sorted contains gravels (12/5'-15.0') HC Odor

15.0-22.5' (7.5) CLAYEY SAND: Brown, grades to dark brown at 17.5', some clay balls increasing with depth, HC odor.

4/16 32'8"

22.5'-32.5' (10') SAND : Brown, fine to med grained, well sorted, clean , some clay from (22.5'-27.5'), black stained sand at 30', HC Odor.

32.5'-38.0' (5.5') SANDSTONE: Green to yellow green, consolidated grades to yellow brown at 36.5'.

TD = 48'

38'-43' (5') No Returns.

43'-48' SANDSTONE: gray, med to coarse grained, no HC odor

Completed as 2' PVC Piezometer
Stickup 3'5" TD 49.5' from top of casing
Screen from 32'-42', 4' blank on bottom
Sand to 32', Backfill to 26', 3/4 Bag Bentonite @ 26'
Backfill to 2', 1/4 Bag Bentonite @2'

Geoscience Consultants, Ltd

WELL LOGGING FORM

Client Montgomery & Andrews Well Number GBR 23

SW ¼ NE ¼ NW ¼ NW ¼ S 27 T 29N R 12W State New Mexico

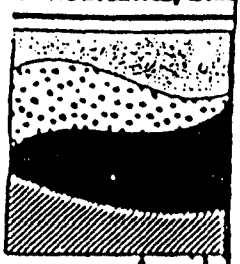
County San Juan Contractor Western Technologies

Spud Date 4/16/86 Completion Date 4/16/86

Logs Run Lithology from cuttings Logged By Nicholas

Elevation 5401'(topo) Spud In (Fm.) Nacimiento

Remarks Drilled With Hsa, continous sampler used 22'-48.5'



Depth | Litho | Recov

0

5

10

15

20

4/16 WL24'4"

25

30

35

40

45

TD = 48.5'

0-15' (15') SILTY SAND: mod yellowish brown (10yr5/4), very fine grained, with small amounts of cobbles (¼"-1") , grades coarser at 10', HC Odor.

15'-22' (7') SAND & GRAVEL: Mod yellowish brown(10yr 5/4) to pale brown (5yr 5/2), med to coarse grained sand with cobbles (¼"-3") , HC Odor

22'-26' (4') SHALE: Grayish Brown (5yr 3/2) to yellowish grey (5y7/2), localized sand lenses, some weathering in shale, no HC Odor.

26'-48.5' (22.5) SANDSTONE: Weathered, light olive gray (5y5/2) from 26-27', med lt gray (N6) to med gray (N5) , fine to med grained, slight HC odor(?) from 26'-27'.

Completed as 2" PVC Piezometer
Stickup 3' TD 41'10" from top of casing
Screen from 23'10" to 33'10" 5' Blank on Bottom
Sand to 23', 2/3 Bag Bentonite @ 23', Backfill to 5', 1/3 Bag Bentonite at5'

Geoscience Consultants, Ltd

WELL LOGGING FORM

Client Montgomery & Andrews Well Number GBR 24

NW ¼ NW ¼ NW ¼ NW ¼ S 27 T 29N R 12 W State New Mexico

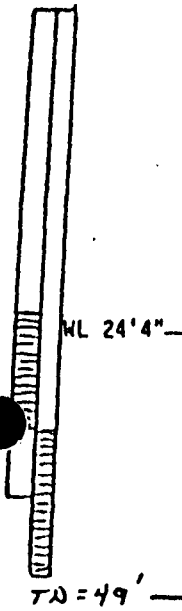
County San Juan Contractor Western Technologies

Spud Date 4/17/86 Completion Date 4/17/86

Logs Run Lithology from cuttings Logged By Nicholas

Elevation 5395'(topo) Spud In (Fm.) Nacimiento

Remarks Drilled with HSA, continous sampler used from 9'-49'



Depth	Litho	recov	
0			0'-9' (9') SAND : Moderate yellowish brown, (10yr5/4), med to coarse grained, No HC Odo
5			
10			9'-14' (5') SILTY SANDSTONE: Moderate yellowish brown (10yr 5/4) to olive gray (5y4/1) weathered, very fine to fine grained, No HC Odor.
15			
20			14'-49' (35') SANDSTONE: lt olive grey (5y 6/1), fine grained, contains minor gravels : 28' (1"-1½"), HC Odor at 29'
25			
30			Dual Completion as 2' PVC Piezometer
			Stickup 3'3" TD41'3" and 46'3" from top of casing
			Screened intervals 23-33' and 33'-43'
35			Caved to 33', sand to 22', Bentonite 2/3 Bag
			@22', Backfill to 6', Bentonite 1/3 Bag @ 6'.
40			

Geoscience Consultants, Ltd

WELL LOGGING FORM

Client Montgomery & Andrews Well Number GBR 25

NE ¼ NW ¼ NW ¼ NW ¼ S 27 T 29N R 12W State New Mexico

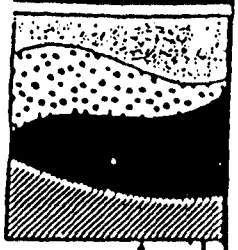
County San Juan Contractor Western Technologies

Spud Date 4/17/86 Completion Date 4/18/86

Logs Run Lithology from cuttings Logged By Nicholas

Elevation 5395'(topo) Spud In (Fm.) Nacimiento

Remarks Drilled with HSA, used continous sampler from 17'-48'



Litho | Recov

Depth

WL 32'

TD = 48'

0'-17' (17') SAND: Mod yellowish brown (10yr5/4) , med to coarse grained with some small cobbles from 5'-17', HC Odor

17'-24' (7') SHALE: Dark yellowish brown, (10yr4/2), with pale yellowish orange stringers (10yr8/6) from 23'-24', soft . slight HC Odor

24'-28' SANDSTONE: Moderate yellowish brown (10yr5/4) with streaks of dark yellowish orange (10yr 6/6), fine to med grained, weathered, NO HC odor.

28'-48' SANDSTONE: Ranges in color from lt gray (N7), to moderate yellowish brown (10yr5/4) from 28-33', greenish gray (5G6/1) to dark yellowish orange (10yr6/6) from 33'-43', med to coarse grained, grades coarser at 38', grades to lt gray (N7) at 43',contains small cobbles from 28-43', shale stringers from 43-48', no HC odor

Completed as 2" PVC Piezometer
Stickup 2' 0" TD 50' to top of casing
Screened interval 33-43', caved to 35', sand to 23'
Bentonite 2/3 Bag @ 23', Backfill to 6'
Bentonite 1/3 Bag at 6'

Geoscience Consultants, Ltd

WELL LOGGING FORM

Client Montgomery & Andrews Well Number GBR 26

NE ¼ NW ¼ NW ¼ NW ¼ S 27 T 29N R 12 W State New Mexico

County San Juan Contractor PSI Western Technologies

Spud Date 4/18/86 Completion Date 4/18/86

Logs Run Lithology from cuttings Logged By Nicholas

Elevation 5396' (topo) Spud In (Fm.) Nacimiento

Remarks Drilled with HSA, continous sampler was not used.

Depth	Litho	recov.	
0			0-7' (7') SAND : moderate yellowish brown (10yr5/4), med to fine grained, well sorted, no HC odor
5			
10			
15			7'-21' (14') SAND: HC stained, ranges from med dark gray (N4), grayish black (N2), to med gray (N5), fine to med grained, contains cobbles at 15', clay lenses from 12'-15' strong HC odor
20			
25			
4/23 WL 31'4" 30			21'-35' (14') CLAYEY SAND: HC stained, ranges in color from med gray (N5) to grayish black (N2), very fine to fine grained, moist, HC odor.
35			
40			35'-50' (15') SANDSTONE: med dark gray (N4), fine to med grained with some clay, wet HC odor.
45			
TD = 50' 50			

Completed as 2" PVC Piezometer
Stickup 1'6" TD 41'6" from top of casing
Screened interval 25-35', caved to 26',
Sand to 23', Bentonite @23 2/3 Bag, Backfill to
5', Bentonite 1/3 Bag at 5'

Geoscience Consultants, Ltd.

WELL LOGGING FORM

Client Montgomery & Andrews Well Number GBR 27

NE ¼ NW ¼ NW ¼ NW ¼ S 27 T 29N R12W State New Mexico

County San Juan Contractor Beeman Brothers

Spud Date 4/23/86 Completion Date 4/23/86

Logs Run Lithology from cuttings Logged By Nicholas

Elevation 5397' (topo) Spud In (Fm.) Nacimiento

Remarks Drilled with Air Rotary, completed as 5" PVC Well

Depth	Litho	Recov	
0			0-5' (5') SAND: Grayish orange (10yr7/4); fine to coarse grained, no HC odor
5			
10			5-15' (10') SAND: Mod yellowish brown (10yr5/4); fine to med grained with some silt, contains some cobbles at 13', (2-3%)
15			
20			15-20' (5') SAND & GRAVEL: Mod yellowish brown (10yr5/4); fine to med grained with some silt, contains 30% gravels
25			20-25' (5') SHALE: Dusky yellow (5y6/4)
30			
35			25-67' (42') SANDSTONE: lt gray (N7), very fine to med grained, grades to mod yellowish brown (10yr5/4) from 32'-34'
40			
45			
50			Completed as 5" PVC well
55			Stickup 1'4" TD 68'4" from top of casing
60			Screen from 22-62', 5' Blank on Bottom
65			Sand to 18', Bentonite (1sack) 1 18'
TD=67'			
70			

5/2 35'10"

Geoscience Consultants, Ltd.

WELL LOGGING FORM

Client Montgomery & Andrews Well Number GBR 28

___ ¼ ___ ¼ ___ ¼ ___ ¼ S 27 T 29 R 12 State New Mexico

County San Juan Contractor Beeman Bros. Drilling Co.

Spud Date 5/27/86 Completion Date 5/27/86

Logs Run Lith from cuttings Logged By NICHOLAS

Elevation _____ Spud In (Fm.) _____

Remarks Drilled With Air Rotary, completed as 6" PVC recovery well

Depth	Litho	Recov	
			0-10' (10') sand, mod. yelish brn (10YR 5/4), med to coarse grained w/some cobbles.
5			
10			10-20' (10') sand, mod. yelish brn (10YR 5/4), coarse to med grained with some cobbles and lt brn clay stringers
15			
20			20-29' (9') sand, mod. yelish brn (10YR 5/4), fine to coarse grained, grades coarser at 27'
25			
30			29-30' (1') silty clay, brown
5' 5-29-86 35			30-32' (2') sandy clay, brown, med. to fine grained sand.
			Silty Sand, greyish black, HC ODOR, fine to med. grained sand w/brn
40			32-35' (3') clay stringers.
45			35-38' (3') sandstone, lt olive grey (5Y 5/2)
50			38-69' (31') sandstone, med. lt grey (N8), graded to dk greenish grey
55			(5GY 4/1) at 58', grades to dk grey (N3) at 63', fine to coarse grained
60			sandstone with some cobbles, grading coarser from 55-57'
65			TD 68' 6" stickup 2', screened from 23'6" to 63'6", Bentonite @ 16'
			(100 lb bag), gravel packed to 16', TD from TOC 70'6"

Geoscience Consultants, Ltd.

WELL LOGGING FORM

Client Montgomery & Andrews Well Number GBR 29

___ ¼ ___ ¼ ___ ¼ ___ ¼ S 27 T 29 R 12 State New Mexico

County San Juan Contractor Beeman Bros. Drilling Co.

Spud Date 5/29/86 Completion Date 5/30/86

Logs Run Lith from cuttings Logged By NICHOLAS

Elevation _____ Spud In (Fm.) _____

Remarks Drilled With Air Rotary, completed as a 6" PVC recovery well

Depth	Litho recov	
		0-5' (5') sand and gravel, pale yellowish brn (10YR 6/2), gravels (1/4"-1'),
5		sand; fine to coarse grained
10		5-15' (10') sand, greyish orange (10YR 7/4), med. to coarse grained
15		w/some cobbles
20		15-35' (20') clayey sand, dk yellowish brn (10YR 4/2), fine to coarse grained
25		sand with increasing clay content from 30-35'
30		35-40' (5') sandstone, greenish grey (5GY 6/1), H.C. ODOR, fine to coarse
35		grained with some silt.
40		40-50' (10') sandstone, mod. yellowish brn (10YR 5/4), fine to coarse grained sand,
4 5-30-86		
45		grades med. to coarse at 45'
50		50-60' (10') silty clay, lt olive grey (5Y 6/1) from 50-55', brownish grey (5YR 4/1)
55		from 55-60, increasing clay content at 55'
60		60-70' (10') sandstone, greenish grey (5 GY 6/1) to med. lt grey (N6), fine to med.
65		grained
70		TD 72' from TOC, screened interval from 25'-65', gravel packed to 15', 100 lb
		bag Bentonite @ 15', backfill to the surface

GCL

WELL LOGGING FORM

Client Montgomery & Andrews Well Number (X-1) GBR 30

__1/4 __1/4 __1/4 __1/4 S 27 T 29 R 12 State New Mexico

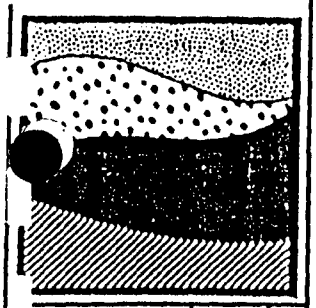
County San Juan Contractor Western Technologies

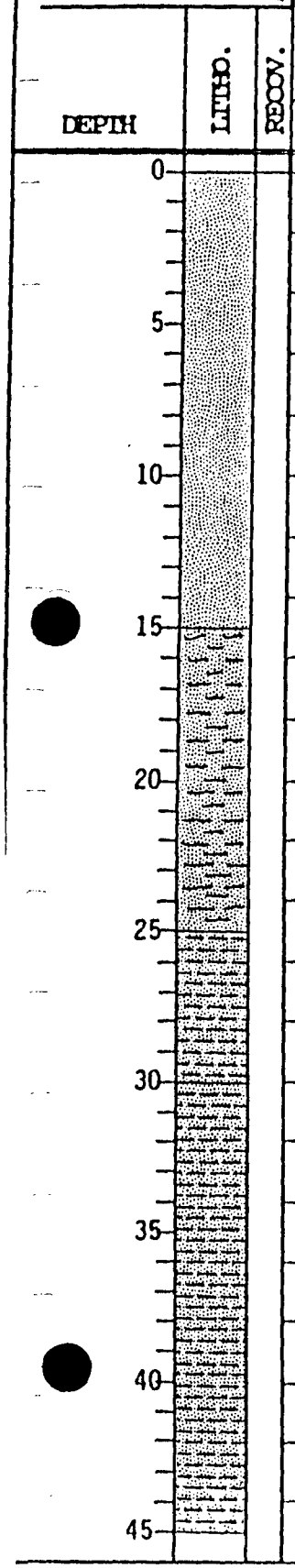
Spud Date _____ Completion Date 9-24-86

Logs Run Lithology Logged By Martin

Elevation _____ Spud In (Fm.) _____

Remarks Drilled with Hollow Stem Auger





RUN	FROM	TO	SAMPLE DEPTH	REMARKS
				0-5' SAND, med gr mod yelsh brn 10YR5/4
				5-10' SAND, med-co gr mod yelsh brn 10YR5/4
				10-15' SAND, w/1-2% gravels; med-co gr mod yelsh brn 10YR5/4
				15-20' SILTY SAND, fn-med gr olive blck 5Y2/1; strong HC odor and stain
				20-25' SILTY SAND, med gr, dk grnsh bry 5GY4/1; strong HC odor and stain
				25-30' CLAYEY SAND, med-gr, olive blck 5Y2/1, strong HC odor and stain
				30-33' SANDY CLAY, fn-med gr, olive gry 5Y4/1; faint HC odor; wet
				33-45' SANDY CLAY, fn-med gr, lt olive gry 5Y5/2; faint HC odor; wet
				TD to 49'. Screened from 40' to 25', sand pack to 19'2"

GCL

WELL LOGGING FORM

Client Montgomery & Andrews Well Number (X-1) GBR 30

___1/4 ___1/4 ___1/4 ___1/4 S 27 T 29 R 12 State New Mexico

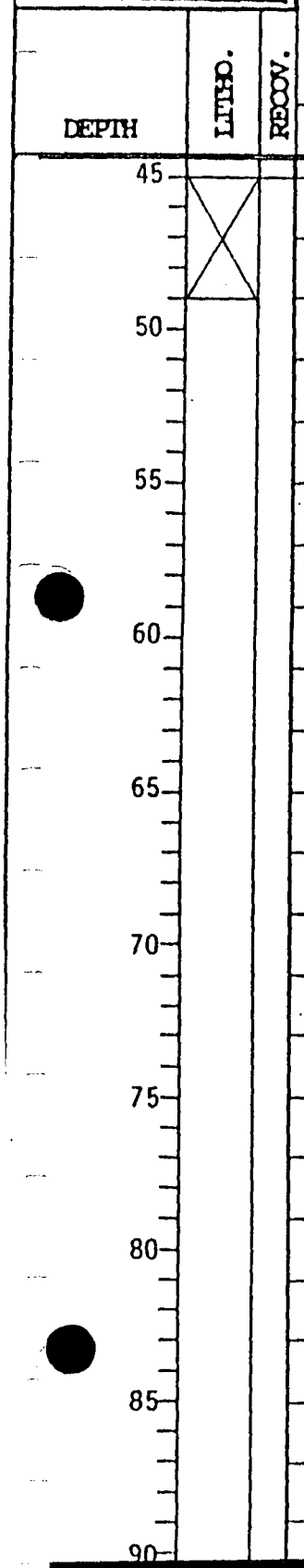
County San Juan Contractor Western Technologies

Spud Date _____ Completion Date 9-24-86

Logs Run Lithology Logged By Martin

Elevation _____ Spud In (Fm.) _____

Remarks



DEPTH	LITHO.	RECOV.	RUN	FROM	TO	SAMPLE DEPTH	REMARKS
	X						5' blank on bottom, bentonite plug to 13'11", cement grout w/5% bentonite to surface. Completed with 2" PVC.

GCL

WELL LOGGING FORM

Client Montgomery & Andrews Well Number (X-2) GBR 31

1/4 1/4 1/4 1/4 S 27 T 29 R 12 State New Mexico

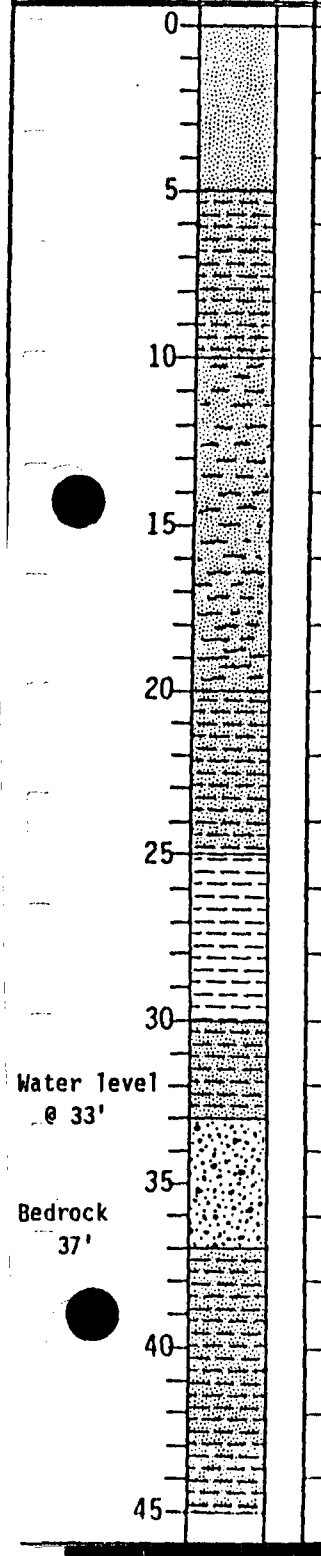
County San Juan Contractor Western Technologies

Spud Date _____ Completion Date 9-25-86

Logs Run Lithology Logged By Martin

Elevation _____ Spud In (Fm.) _____

Remarks Drilled with Hollow Stem Auger

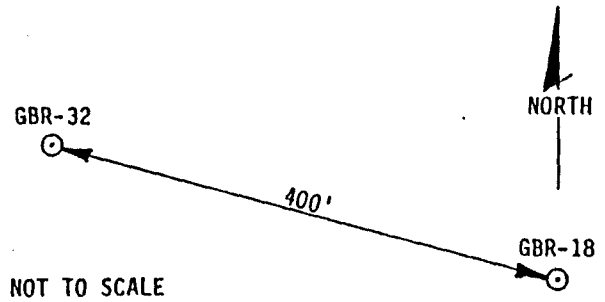


RUN	FROM	TO	SAMPLE DEPTH	REMARKS
				0-5' SAND, med gr, mod yelsh brn 10YR5/4
				5-10' CLAYEY SAND, med-co gr, dk yelsh brn 10YR4/2
				10-20' SILTY SAND, med-co gr, dk yelsh brn 10YR4/2
				20-25' CLAYEY SAND, med-co gr, dk yelsh brn 10YR4/2 HC odor (?), v v faint
				25-30' CLAY, fn gr, dk yelsh brn 10YR4/2
				30-33' SANDY CLAY, fn-med gr, lt olive gry 5Y5/2
				33-37' GRAVEL LAYER
				37-45' SANDY CLAY, fn-med gr lt olive gry 5Y5/2
				TD to 45', screened from 39'7" to 24'7", 5' blank on bottom, sand pack to 19.33', bentonite plug to 13'4" cement grout w/5% bentonite to surface. Completed with 2" PVC.

BOREHOLE LOG (WELL)

GCL

LOCATION MAP:



NOT TO SCALE

___1/4 ___1/4 ___1/4 SW 1/4 S22 T29N R12W

SITE ID: MONT & AND LOCATION ID: (NW) GBR-32

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): 5412 (TOPO)

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: HOLLOW STEM AUGER W/SPLIT SPOONS

DRILLING CONTR.: WESTERN TECH.

DATE STARTED: 4/21/87 DATE COMPLETED: 4/22/87

FIELD REP.: J.P. KASZUBA, S.J. COLARULLO, R.T. HICKS

COMMENTS: 7" BOREHOLE, SPOONS WET AT 33'-36', BEDROCK @ 37.5'. TD=45'

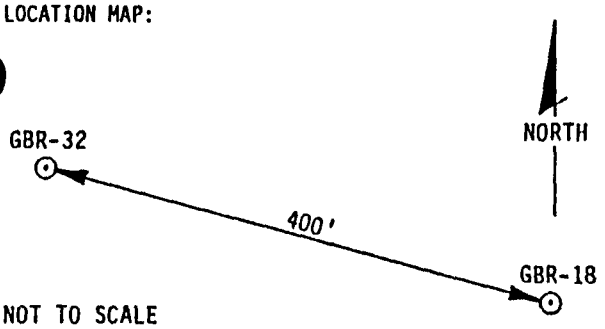
LOCATION DESCRIPTION: _____

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0				1	4.5	6.0				4.5-4.7' SAND, fn- to cs-gr, poor sorting, tan color.
										4.7-5.2' SAND, fn- to med-gr, mod sorting, tan color.
5										5.2-6.0' SAND, med- to cs-gr, mod sorting, tan color.
10				2	9.5	11.0				9.5-11.0' SAND, as above.
				3	14.5	16.0				14.5-16.0' SAND, as above.
15										
20				4	19.5	21.0				19.5-21.0' SAND, as above.
25				5	24.5	26.0				24.5-25.2' SILT, lt brn, includes ~10% fn-gr sand and ~10% clay.
										25.2-26.0' SAND, med- to cs-gr, mod sorting, lt brn
30				6	29.5	31.0				29.5-31.0' SAND, as above, includes ~10% silt

BOREHOLE LOG (WELL)

GCL

LOCATION MAP:



NOT TO SCALE

___1/4 ___1/4 ___1/4 SW 1/4 S22 T29N R12W

SITE ID: MONT & AND LOCATION ID: (NW) GBR-32

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): 5412 (TOPO)

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: HOLLOW STEM AUGER W/SPLIT SPOONS,

DRILLING CONTR.: WESTERN TECH.

DATE STARTED: 4/21/87 DATE COMPLETED: 4/22/87

FIELD REP.: J.P. KASZUBA, S.J. COLARULLO, R.T. HICKS

COMMENTS: 7" BOREHOLE, SPOONS WET AT 33'-36',
BEDROCK @ 37.5'. TD=45'

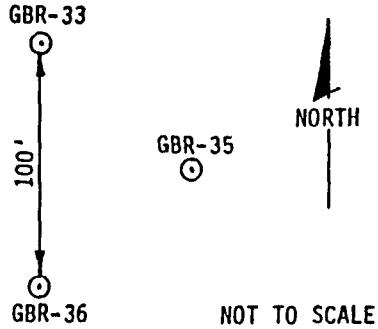
LOCATION DESCRIPTION: _____

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
30										
				7	34.5	36.0				34.5-34.9' SLOUGH, no returns. 34.9-36.0' SAND, cs- to v cs- gr, poor sorting, brn color. Minor granules (3-15 mm), little clay. Saturated, no odor.
35				8	37.5	38.0				37.5-38.0 SANDSTONE, fn- to med- gr, minor cs, mod sorting, friable, poorly cemented (weathered upper portion), mottled tan/white color.
				9	39.5	40.0				39.5-39.7' SANDSTONE, as above. 39.7-40.0' SANDSTONE, as above, but rust-colored w/limonite stain.
40										
				10	44.5	45.0				44.5-45.0' SANDSTONE, as above, but blue-grey color and significant clay (10-20%).
45										TD to 45' 2" SS blank 40'-45', SS 20 slot screen 25'-40', SS blank 20-25', 2" PVC to surface. Sandpack to 17.5', bentonite plug to 11.2', cement grout w/5% bentonite to surface.
50										
55										
60										

BOREHOLE LOG (WELL)

GCL

LOCATION MAP:



___1/4 ___1/4 NW 1/4 NW 1/4 S27 T29N R12W

SITE ID: MONT & AND LOCATION ID: (EX-1) GBR-33

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): 5394 (TOPO)

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: HSA W/CONTINUOUS SAMPLER, 7" BOREHOLE

DRILLING CONTR.: WESTERN TECH.

DATE STARTED: 4/22/87 DATE COMPLETED: 4/23/87

FIELD REP.: J.P. KASZUBA

COMMENTS: CUTTINGS FROM AUGER 0'-5'. BEGIN CONTINUOUS SAMPLING AT 8'.

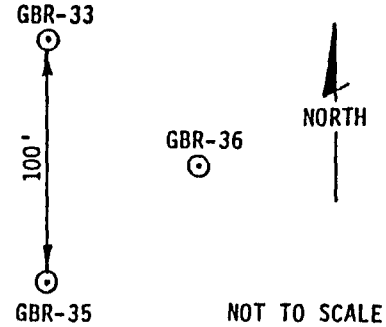
LOCATION DESCRIPTION: _____

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0										0-2' GRAVEL, & sand fill
										~2-5' SAND, med-gr, minor fn and cs, mod sorting, tan brn color. No odor.
5										
				1	8	13				8.0-11.0' No Returns.
10										11.0-11.5' SAND, as above, minor 1 cm dia, rounded pebbles.
										11.5-12.3' SAND, fn- to med- gr, mod sorting, brn color. No odor.
										12.3-13.0' SAND, fn- gr, 10-20% silt, very minor clay, mod sorting, brn color. No odor.
				2	13	18				13.0-15.5' No Returns.
15										15.5-17.2' SAND, med-gr, minor fn and cs, mod sorting, tan brn color. No odor.
										17.2-18.0' SAND, fn- to med-gr, minor 1 cm dia pebbles, poor sorting, brn color. No odor.
				3	18	23				18.0-20.3' No Returns.
20										20.3-20.8' SAND, med-gr, minor fn- and cs, minor 1-5 cm dia pebbles, poor sorting, lt brn color. No odor.
										20.8-21.1' SAND, fn- to med- gr, mod sorting, brn color. No odor.
										21.1-21.4' SAND, as @ 20.3'-20.8'.
										21.4-22.0' SANDY CLAY, brn, sand is fn- gr, well sorted. No odor.
25				4	23	28				22.0-23.0' SAND, as @ 20.3'-20.8'.
										23.0-25.7' No Returns.
										25.7-26.1' SAND, as @ 20.3'-20.8', but pebbles common. No odor.
										26.1-26.2 CLAY, brn, no odor.
										26.2-26.8' CLAYEY SAND, lt olive brn color, sand is fn- to med- gr, well-sorted.
										26.8-28.0' CLAY, brn, no odor.
30				5	28	33				28.0-30.3' No Returns.

BOREHOLE LOG (WELL)

GCL

LOCATION MAP:



___1/4 ___1/4 ___1/4 ___1/4 S___ T___ R___

SITE ID: MONT & AND LOCATION ID: (EX-1) GBR-33

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): 5394 (TOPO)

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: SAME

DRILLING CONTR.: WESTERN TECH.

DATE STARTED: SAME DATE COMPLETED: SAME

FIELD REP.: SAME

COMMENTS: SATURATED @ ~36'. BEDROCK @ 41.2' (~40' BY DRILLER'S RECKONING). TD=49.5'. NO DIESEL NOTED DURING DRILLING.

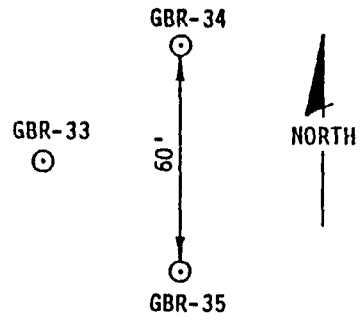
LOCATION DESCRIPTION: _____

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
30										30.3-32.2' CLAY, brn, no odor. Contains minor med- gr sand @ 31.9'-32.0'. No odor.
										32.2-32.7' CLAYEY SAND, olive brn, sand is fn- to med- gr, mod sorting. No odor. Sample placed in clean water yields no floating product.
										32.7-33.0' CLAY, olive color, contains minor fn- gr sand. Faint HC degradation odor.
				6	33	38				33.0-36.2' No Returns.
35										36.2-36.8' SAND, med- to cs- gr, well-sorted. Saturated. Black HC stain @ 36.2-36.3'. Dk grey HC stain @ 36.3'-36.5'. Grey HC stain @ 36.5'-36.8'. Strong HC odor. Sample placed in clean water yields floating HC.
										36.8-37.2' SAND, as above, but brown color (no HC stain). Saturated. Faint HC odor. Sample placed in clean water yields no floating HC.
40										37.2-37.6' SAND, brn, fn- to med- gr, well-sorted. Faint HC odor(?).
										37.6-38.0' SAND, brn, med- to cs- gr, well-sorted. Faint HC odor(?). Sample placed in clean water yields no floating HC.
				7	38	43				38.0-39.6' No Returns.
45										39.6-41.2' SAND, as above. Faint HC odor. Sample placed in clean water yields floating HC.
										41.2-43.0' SANDSTONE, bleached tan color, med- to cs- gr, mod well-sorted. Rare pebbles up to 1 cm in dia. Friable, poorly cemented. Limonite stain @ 42.0'-42.6'. No HC odor. Sample placed in clean water yields no floating HC.
50				8	43	48				43.0-43.2' No Returns.
										43.2-48.0' SANDSTONE, as above, but poorly sorted & brn color. Limonite stain @ 45.8-46.2'. No HC odor.
				9	48	49.5				48-49.5' No Returns.
55										TD=49.5'. 2" PVC blank 43-48.5', PVC screen (20 slot) 27'-43', PVC blank to surface. Sandpack to 22.5', bentonite plug to 17.5', cement grout w/5% bentonite to surface.
60										

BOREHOLE LOG (WELL)

GCL

LOCATION MAP:



NOT TO SCALE

___1/4 ___1/4 NW 1/4 NW 1/4 S27 T29N R12W

SITE ID: MONT & AND LOCATION ID: (EX-2) GBR-34

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): 5394 (TOPO)

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: HSA W/SPLIT SPOONS, 7" BOREHOLE

DRILLING CONTR.: WESTERN TECH.

DATE STARTED: 4/23/87 DATE COMPLETED: 4/24/87

FIELD REP.: J.P. KASZUBA

COMMENTS: CLAY @ 15.5-16.0', SATURATED @ 30-31', BEDROCK @ 37'. TD=48'.

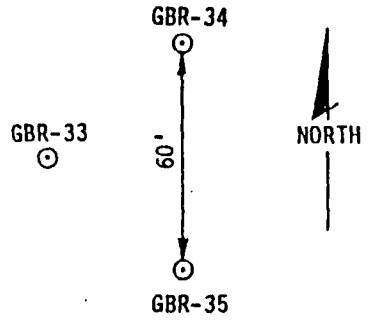
LOCATION DESCRIPTION: _____

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0										
				1	3.0	4.5				3.0-4.5' SAND, tan, fn-to med- gr, mod sorting. Minor cs- gr sand & pebbles up to 0.5 cm. No HC odor.
5										
				2	8.0	9.5				8.0-8.5' No Returns.
										8.5-9.1' SAND, as above except pebbles more common & up to 3.0 cm dia.
10										9.1-9.5' SAND, brn, fn- gr, well-sorted. Minor silt & clay. Rare cs- gr. No HC odor.
				3	13.0	14.5				13.0-13.3' SAND, as above, but significant silt.
										13.3-13.8' SAND, lt brn, med- to fn- gr, minor cs- gr. Poor sorting.
										13.8-14.1' SAND, as @ 13.0'-13.3'.
15										14.1-14.5 SAND, lt brn, fn- gr, minor med- gr, minor silt, rare cs- gr, poorly sorted. No HC odor.
				4	18.0	19.5				18.0-18.3' SAND, as above, but cs- gr more abundant.
										18.3-18.7' CLAY, olive brn color, minor silt & fn- gr sand. No HC odor.
										18.7-19.5' SAND, tan, fn- to med- gr, poorly sorted. No HC odor.
20										
				5	23.0	24.5				23.0-23.3' CLAYEY SAND, brn, sand is med- to cs- gr, poorly sorted
										23.3-23.5' SAND, as @ 18.7'-19.5'.
										23.5-24.5' CLAY, olive brn color, minor silt & fn- gr sand. No HC odor.
25										
				6	28.0	29.5				28.0-28.3' CLAY, as above. No HC odor.
										28.3-29.5' SAND, dk brn, fn- to med- gr, well-sorted. No HC odor.
30										

BOREHOLE LOG (WELL)

GCL

LOCATION MAP:



NOT TO SCALE

___1/4 ___1/4 ___1/4 ___1/4 S___ T___ R___

SITE ID: MONT & AND LOCATION ID: (EX-2) GBR-34

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): 5394 (TOPO)

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: SAME

DRILLING CONTR.: WESTERN TECH.

DATE STARTED: SAME DATE COMPLETED: SAME

FIELD REP.: SAME

COMMENTS: DIESEL ON SPLIT SPOONS IN SATURATED ZONE

LOCATION DESCRIPTION: _____

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
30										
				7	33.0	34.5				33.0-34.5' SAND, med- gr, minor fn- and cs- gr, well-sorted. Saturated. Black HC stain @ 34.2'-34.5'. Strong HC odor.
35										
				8	38.0	38.3				38.0-38.3' SANDSTONE, mottled tan color, fn- to med-gr, mod sorting. Poorly cemented, friable. Strong HC odor.
40										
				9	43.0	43.3				43.0-43.3' SANDSTONE, as above, but abundant cs- gr. No HC odor.
45										TD=48'. 2" PVC blank 43'-48', 20 slot screen 27'-43' (SS & PVC mix), PVC blank to surface. Sandpack to 22', bentonite plug to 17', cement grout w/5% bentonite to surface.
50										
55										
60										

Geoscience Consultants, Ltd.

WELL LOGGING FORM

Page _____ of _____

Client Montgomery & Andrews Well Number GBR 18

____ ¼ ____ ¼ ____ ¼ ____ ¼ S____ T____ R____ State New Mexico

County San Juan Contractor Western Technologies

Spud Date _____ Completion Date _____

Logs Run Lith from cuttings and cores Logged By _____

Elevation _____ Spud In (Fm.) _____

Remarks drilled w/ HSA

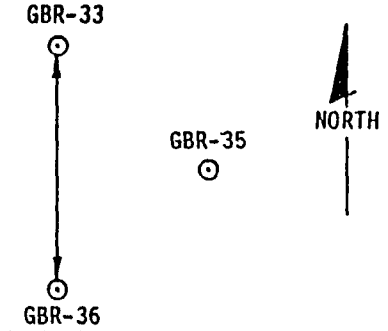
Depth	Litho	Recov	
0			
5			0-10' (10') fill: very coarse cobbles, some sand and gravel
10			
12'4" ▼			
15			
20			10'-12.5' (2.5') sandy shale, yellowish brn
25			
30			12.5-25' (12.5') sandstone: yellowish brn, med to fine grained poorly sorted
35			
40			25'-30' shale: brn gry to rd brn, fissile, clayey, damp
45			30-38' siltstone: gry brn to brn gry; clayey, same thin, irregular sand stringers 1/4"-1/2"; moist
50			38-50' silty sandstone: yel brn to yel gry, very fine grained, poorly sorted, locally clayey

Completed as 2.0" galv. steel piezometer, screen 35'-45'.

BOREHOLE LOG (WELL)

GCL

LOCATION MAP:



___1/4 ___1/4 NW 1/4 NW 1/4 S27 T29N R12W

SITE ID: MONT & AND LOCATION ID: (EX-4) GBR-35

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): 5394 (TOPO)

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: HSA W/SPLIT SPOONS, 7" BOREHOLE.

DRILLING CONTR.: WESTERN TECH.

DATE STARTED: 4/24/87 DATE COMPLETED: 4/24/87

FIELD REP.: J.P. KASZUBA

COMMENTS: SATURATED @ ~ 33.8'. BEDROCK @ 38'. TD=50.
DIESEL ON SPLIT SPOONS FROM SATURATED ZONE.

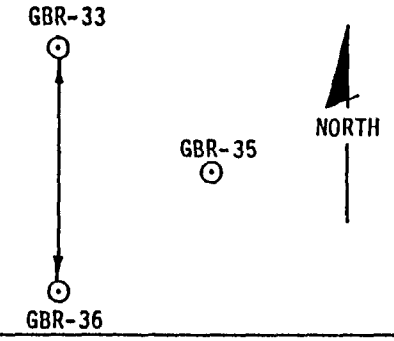
LOCATION DESCRIPTION: _____

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0										
				1	3.0	4.5				3.0-3.2' Road Gravel. 3.2-4.5' SAND, tan, med- gr, minor fn- and cs- gr, poor sorting. No HC odor.
5										
				2	8.0	9.5				8.0-9.5' SAND, lt brn, med- to cs- gr, mod sorting. Pebbles up to 2 cm dia common. No HC odor.
10										
				3	13.0	14.5				13.0-13.2' No Returns. 13.2-14.5' SAND, lt brn, med- gr, minor cs- gr & pebbles up to 2 cm dia, well-sorted. No HC odor.
15										
				4	18.0	19.5				18.0-18.5' SAND, as above. 18.5-19.1' SAND, lt brn, fn- to med- gr, well-sorted. Minor clay. No HC odor. 19.1-19.6' CLAYEY SAND, lt brn, sand is fn- to med- gr, mod sorted. No HC odor.
20										
				5	23.0	24.5				23.0-23.4' SAND, brn, fn- gr, minor med- gr & clay, well-sorted. No HC odor. 23.4-23.9' SAND, tan, med- gr, minor fn-, cs- gr, & pebbles up to 2 cm dia, poorly sorted. No HC odor. 23.9-24.5' CLAY, olive brn, no HC odor. Sandy (fn- to med- gr) @ 24.1-24.2'.
25										
				6	28.0	29.5				28.0-28.5' CLAY, as above. 28.5-28.8' SAND, brn, fn- gr, well-sorted. Pebbles (up to 3 cm dia) @ 28.7-28.8'. No HC odor. 28.8-29.5' CLAYEY SAND, brn, sand is fn- gr, well-sorted. Minor silt. Faint HC odor(?).
30										

BOREHOLE LOG (WELL)

GCL

LOCATION MAP:



NOT TO SCALE

___1/4 ___1/4 ___1/4 ___1/4 S___ T___ R___

SITE ID: MONT & AND LOCATION ID: (EX-4) GBR-35

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): 5394 (TOPO)

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: SAME

DRILLING CONTR.: WESTERN TECH.

DATE STARTED: SAME DATE COMPLETED: SAME

FIELD REP.: SAME

COMMENTS: _____

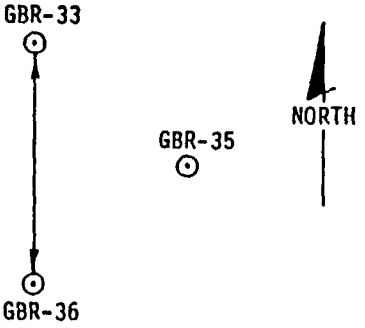
LOCATION DESCRIPTION: _____

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
30										
				7	33.0	34.5				33.0-33.8' No Returns
										33.8-34.5 SAND, olive brn, fn- to med- gr, well-sorted. Saturated. Black HC stain @ 33.9-34.5'. Strong HC odor.
35										
				8	38.0	38.3				38.0-38.3' SANDSTONE, mottled tan/brn, med- gr, minor fn- and cs- gr, minor pebbles up to 1 cm dia, poorly sorted. Friable, poorly cemented. Saturated. No HC odor (?).
40										TD=50'. 2" PVC bottom blank 41'-46', PVC 20 slot screen 25'-41', PVC blank to surface. Sand pack to 19.7', bentonite plug to 12.7', cement grout w/5% bentonite to surface.
45										
50										
55										
60										

BOREHOLE LOG (WELL)

GCL

LOCATION MAP:



NOT TO SCALE

___1/4 ___1/4 NW 1/4 NW 1/4 S27 T29N R12W

SITE ID: MONT & AND LOCATION ID: (X5)GBR-36

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): 5394 (TOPO)

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: AIR ROTARY, 10" BOREHOLE.

DRILLING CONTR.: BEEMAN BROTHERS

DATE STARTED: 4/29/87 DATE COMPLETED: 4/30/87

FIELD REP.: J.P. KASZUBA

COMMENTS: BEGIN USING WATER FOR LUBRICATION @ 25'. SATURATED @ ~33'. POOR RETURNS PAST 45'. TD=75'.

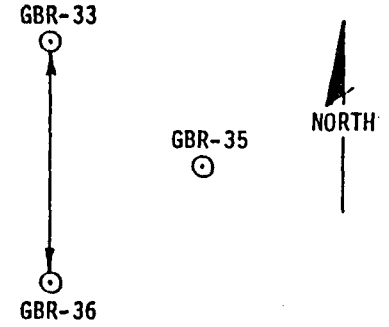
LOCATION DESCRIPTION: _____

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION	
0				1	0	5				0-5'	SAND, lt brn, fn- to cs- gr, poorly sorted. Rounded pebbles < 1 cm dia (<1%). No HC odor.
5				2	5	10				5-10'	SAND, as above.
10				3	10	15				10-15'	SAND, brn, fn- to med-gr, minor cs- gr, mod sorting. No HC odor.
15				4	15	20				15-20'	SAND, as above.
20				5	20	25				20-25'	SAND, brn, fn- to cs- gr, poor sorting. Rounded pebbles, ≤ 1 cm dia (<5%). No HC odor.
25				6	25	30				25-30'	SAND, lt brn, med- to cs- gr, minor fn- gr, mod sorting. Olive brn clay nod (<1%).
30											

BOREHOLE LOG (WELL)

GCL

LOCATION MAP:



NOT TO SCALE

___1/4 ___1/4 ___1/4 ___1/4 S___ T___ R___

SITE ID: MONT & AND LOCATION ID: (X5)GBR-36

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): 5394 (TOPO)

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: SAME

DRILLING CONTR.: SAME

DATE STARTED: SAME DATE COMPLETED: SAME

FIELD REP.: SAME

COMMENTS: SAME

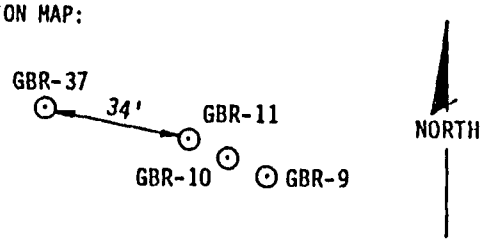
LOCATION DESCRIPTION: _____

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION	
30				7	30	35				30-35'	SAND, as above. Saturated (?). Faint HC odor (?). Olive brn clay nod (~15%).
35				8	35	40				35-40'	CLAY, brn, black & grey HC stain, strong HC odor.
40				9	40	45				40-45'	CLAY, as above.
45				10	45	50				45-50'	CLAY, as above (50%), but slight grey HC stain in places, faint HC odor. Rounded pebbles (50%), ≤ 5 cm dia, various lith: qtzite, sandstone, granite.
50				11	50	55				50-55'	CLAY, as above (30%), brn, no HC odor. Rounded pebbles (70%), as above.
55				12	55	60				55-60'	PEBBLES, as above.
60											TD=75'. 6" PVC blank 65'-70', 20 slot PVC screen 25-65', PVC blank to surface. 1" PVC screen 25-65', PVC blank 0-25'. Pea gravel (3/8") to 20', bentonite plug to 15, cement grout w/5% bentonite to surface.

BOREHOLE LOG (WELL)

GCL

LOCATION MAP:



NOT TO SCALE

___1/4 ___1/4 NW 1/4 NW 1/4 S27 T29N R12W

SITE ID: MONT & AND LOCATION ID: (X1)GBR-37

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): 5388 (TOPO)

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: AIR ROTARY, 10" BOREHOLE.

DRILLING CONTR.: BEEMAN BROTHERS

DATE STARTED: 4/28/87 DATE COMPLETED: 4/28/87

FIELD REP.: J.P. KASZUBA, S.J. COLARULLO

COMMENTS: BEGIN USING WATER FOR LUBRICATION @ 20'. CONTAMINATION @ ~34.

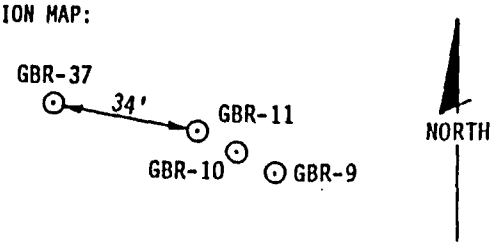
LOCATION DESCRIPTION: _____

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION	
0				1	0	5'				0-5'	SAND, brn, med- to cs- gr, minor fn- gr & angular pebbles (≤ 1 cm dia). Mod sorting. No HC odor.
5				2	5	10'				5-10'	SAND, as above.
10				3	10	15'				10-15'	SAND, lt brn, med-gr, minor cs- and fn- gr, mod sorting. Clay nodules (~1%). Sub-rounded, ≤ 5 cm dia pebbles (~1%). No HC odor.
15				4	15	20'				15-20'	SAND, lt brn, med- to cs- gr, minor fn-, mod sorting. Angular pebbles, <1 cm dia (~1%). No HC odor.
20				5	20	25'				20-25'	SAND, tan, cs- gr, minor med- and fn- gr, mod sorting. Rounded pebbles, ≤ 1 cm dia (5%), ≤ 4 cm (1%). No HC odor.
25				6	25	30'				25-30'	SAND, as above, except 10% rounded pebbles (1-4 cm dia). No HC odor.
30											

BOREHOLE LOG (WELL)

GCL

LOCATION MAP:



NOT TO SCALE

___1/4 ___1/4 ___1/4 ___1/4 S___ T___ R___

SITE ID: MONT & AND LOCATION ID: (X1)GBR-37

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): 5388 (TOPO)

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: SAME

DRILLING CONTR.: SAME

DATE STARTED: SAME DATE COMPLETED: SAME

FIELD REP.: SAME

COMMENTS: SATURATION @ ~ 34', BEDROCK @ 54', TD=73',

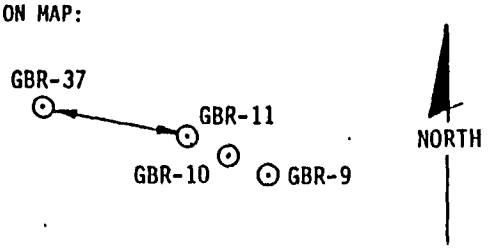
LOCATION DESCRIPTION: _____

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
30				7	30	35				30-35' SAND, as above, but fn- gr more abundant. Pebbles (30%) now sub-rounded to sub-angular. Brn clay nod (<5%), some (<1%) w/HC odor & stain. Saturated (?).
35				8	35	40				35-40' SAND, as above, but grey HC stain & strong HC odor. Sub-rounded pebbles (~30%). ~0.5 cm dia, rare 3 cm dia. No clay.
40				9	40	45				40-45' SAND, as above, but lt grey HC stain, faint HC odor.
45				10	45	50				45-50' SAND, as above, but abundant fn- & med- gr, poorly sorted. Sub-rounded pebbles (20%), 0.5 cm dia. Lt brn color, no HC stain or odor.
50				11	50	55				50-54' SANDY CLAY, golden brn, sand is fn- gr, minor med- gr, mod sorting. No HC odor. 54-55' SANDSTONE, grey brn, med- to cs- gr, mod sorting. Poorly cemented, friable. No HC odor.
55				12	55	60				55-60' CLAYSTONE, blue grey, minor fn- gr sand. Poorly cemented, friable. No HC odor.
60										

BOREHOLE LOG (WELL)

GCL

LOCATION MAP:



NOT TO SCALE

___1/4 ___1/4 ___1/4 ___1/4 S___ T___ R___

SITE ID: MONT & AND LOCATION ID: (X1)GBR-37

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): 5388 (TOPO)

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: SAME

DRILLING CONTR.: SAME

DATE STARTED: SAME DATE COMPLETED: SAME

FIELD REP.: SAME

COMMENTS: SAME

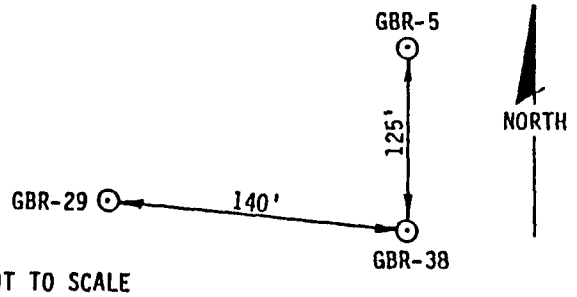
LOCATION DESCRIPTION: _____

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
60				13	60	65				60-65' CLAYEY SANDSTONE, blue grey, fn- gr, well sorted. Significant clay (up to 50%). Some fragments display brick red and blue grey color.
65				14	65	70				65-70' CLAYEY SANDSTONE, as above, but sand is fn- to cs- gr, poorly sorted; less clay (25%). Fragments lack red color.
70										TD=73'. 6" PVC blank 66'-69', 20 slot PVC screen 26'-66', PVC to surface. 1" PVC screen 28'-68', PVC blank 0'-28'. Pea gravel (3/8"), to 23', bentonite plug to 17', cement grout w/5% bentonite to surface.
75										
80										
85										
90										

BOREHOLE LOG (WELL)

GCL

LOCATION MAP:



NOT TO SCALE

__1/4 __1/4 NW 1/4 NW 1/4 S27 T29N R12W

SITE ID: MONT & AND LOCATION ID: (X4)GBR-38

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): 5393 (TOPO)

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: AIR ROTARY, 10" BOREHOLE.

DRILLING CONTR.: BEEMAN BROTHERS

DATE STARTED: 4/28/87 DATE COMPLETED: 4/29/87

FIELD REP.: J.P. KASZUBA

COMMENTS: BEGIN USING WATER FOR LUBRICATION @ 15'.
SATURATED @ ~37', BEDROCK @ 49', TD=75'.

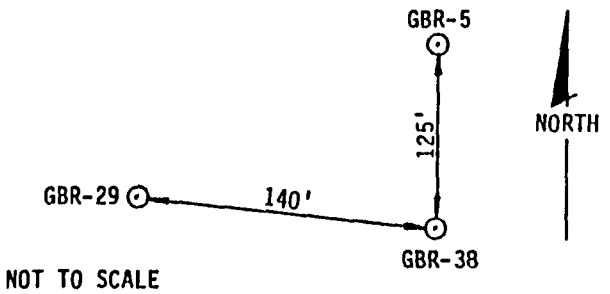
LOCATION DESCRIPTION: _____

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION	
0				1	0	5				0-5'	SAND, brn, fn- gr, minor med- gr, well sorted. No HC odor.
5				2	5	10				5-10'	SAND, grey brn, fn- to med- gr, mod sorting. Brn clay nodules (<1%). Sub-rounded pebbles, 0.5 cm dia (<1%). No HC odor.
10				3	10	15				10-15'	SAND, as above, but brn. Lacks clay. No HC odor.
15				4	15	20				15-20'	CLAY, brn, minor fn- gr sand. No HC odor.
20				5	20	25				20-25'	CLAY, as above, but no sand. No HC odor.
25				6	25	30				25-30'	SAND, lt brn, fn- to cs- gr, poorly sorted. Saturated (?). No HC odor.
30											

BOREHOLE LOG (WELL)

GCL

LOCATION MAP:



NOT TO SCALE

___1/4 ___1/4 ___1/4 ___1/4 S___ T___ R___

SITE ID: MONT & AND LOCATION ID: (X4)GBR-38

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): 5393 (TOPO)

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: SAME

DRILLING CONTR.: SAME

DATE STARTED: SAME DATE COMPLETED: SAME

FIELD REP.: SAME

COMMENTS: SAME

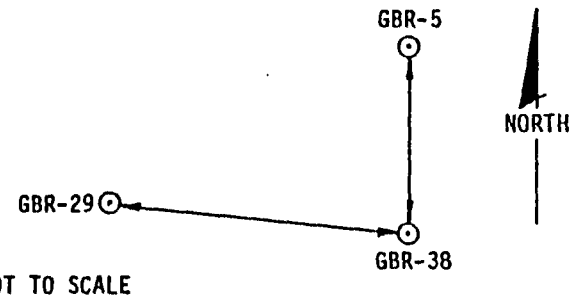
LOCATION DESCRIPTION: _____

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
30				7	30	35				30-35' SAND, as above.
35				8	35	40				35-40' SAND, as above, but includes <1% sandstone. Sandstone is mottled tan/brn, med- to cs-gr, mod sorting. No HC odor.
40				9	40	45				40-45' SAND, as above, ≤10% of total. Angular, ≤5 cm dia qtzite chips (90%). No sandstone. No HC odor.
45				10	45	50				45-49' SAND, as above (90%). Large pebbles absent, small (≤0.5 cm) pebbles present (~10%). No HC odor.
										49-50' SANDSTONE, mottled lt brn, med- to cs- gr, poorly sorted. Poorly cemented, friable. No HC odor.
50				11	50	55				50-55' SANDSTONE, as above, but mottled blue-grey color (~5%). Blue-grey clay (<1%). Sand & pebbles as @ 45'-49' (~90%).
55				12	55	60				55-60' SANDSTONE, as above.
60										

BOREHOLE LOG (WELL)

GCL

LOCATION MAP:



NOT TO SCALE

___1/4 ___1/4 ___1/4 ___1/4 S___ T___ R___

SITE ID: MONT & AND LOCATION ID: (X4)GBR-38

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): 5393 (TOPO)

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: SAME

DRILLING CONTR.: SAME

DATE STARTED: SAME DATE COMPLETED: SAME

FIELD REP.: SAME

COMMENTS: SAME

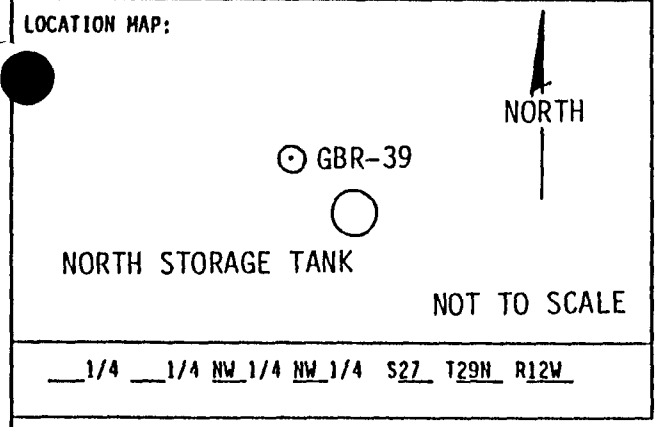
LOCATION DESCRIPTION: _____

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
60				13	60	65				60-65' CLAY, blue-grey & brick red. Claystone (<1%) in same colors.
65				14	65	70				65-70' CLAYSTONE, as above (25%), contains minor fn-gr sand & silt. Sandy claystone (75%), blue-grey & brick red, sand is fn- gr.
70				15	70	75				70-75' SANDY CLAYSTONE, as above (70%). Clayey sandstone (25%), mottled white & blue-grey color, sand is med- to cs- gr, poorly sorted. Qtzite & sand (~5%) as @ 40-45'.
75										TD=75'. 6" PVC blank 67'-72', PVC 20 slot screen 27'-67', PVC blank to surface. 1" PVC screen, 27'-67', PVC blank 0'-27'. Pea gravel (3/8") to 20', bentonite plug to 15, cement grout w/5% bentonite to surface.
80										
85										
90										

BOREHOLE LOG (WELL)

GCL

LOCATION MAP:



__1/4 __1/4 NW 1/4 NW 1/4 S27 T29N R12W

SITE ID: MONT & AND LOCATION ID: (EX-3) GBR-39

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): 5394 (TOPO)

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: HSA W/SPLIT SPOONS, 7" BOREHOLE

DRILLING CONTR.: WESTERN TECH.

DATE STARTED: 4/23/87 DATE COMPLETED: PLUGGED 4/24/87

FIELD REP.: J.P. KASZUBA

COMMENTS: BOREHOLE NOT COMPLETED AS A WELL. GRAVELS @ 32'. SATURATED @ ~ 33.5'. BEDROCK @ ~ 38'. TD=43'.

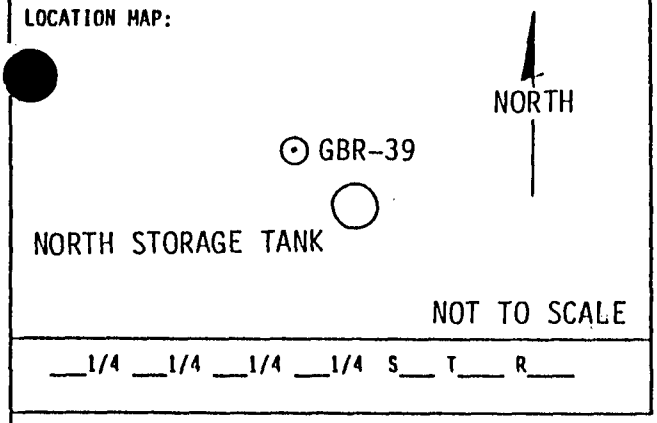
LOCATION DESCRIPTION: _____

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0										
				1	3.0	4.5				3.0-4.5' SAND, tan, fn- to med- gr, minor cs- gr, mod sorting. No HC odor..
5										
				2	8.0	9.5				8.0-9.1' SAND, lt brn, fn- gr, minor med- gr, well-sorted. No HC odor. 9.1-9.4' SAND, brn, fn- gr, well-sorted. Abundant silt & clay. No HC odor. 9.4-9.5' SAND, as @ 8.0-9.1'.
10				3	13.0	14.5				13.0-13.4' No Returns. 13.4-13.8 SAND, lt brn, med- gr, poor sorting. Minor cs- gr. No HC odor. 13.8-14.1' SAND, brn, fn- to cs- gr, poorly sorted. Abundant silt & clay. No HC odor. 14.1-14.2' SAND, lt brn, med- to cs- gr, poorly sorted. No HC odor. 14.2-14.5' SAND, brn, fn- gr, well-sorted. Abundant silt & clay. No HC odor.
15										
				4	18.0	19.5				18.0-18.8' CLAY, brn, minor fn- gr sand. No HC odor. 18.8-19.5 SAND, lt brn, fn- gr, well-sorted. No HC odor.
20										
				5	23.0	24.5				23.0-23.2' CLAY, brn, minor cs- gr sand & <0.5 cm dia pebbles. No HC odor. 23.2-23.7' SAND, lt brn, med- to cs- gr, poor sorting. No HC odor. 23.7-24.5' CLAY, as @ 23.0-23.2'. Sandy @ 24.2-24.3'. No HC odor.
25										
				6	28.0	29.5				28.0-29.5' CLAY, as @ 23.0-23.2', but lacks pebbles. No HC odor.
30										

BOREHOLE LOG (WELL)

GCL

LOCATION MAP:



___1/4 ___1/4 ___1/4 ___1/4 S___ T___ R___

SITE ID: MONT & AND LOCATION ID: (EX-3) GBR-39

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): 5394 (TOPO)

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: SAME

DRILLING CONTR.: WESTERN TECH.

DATE STARTED: SAME DATE COMPLETED: SAME

FIELD REP.: SAME

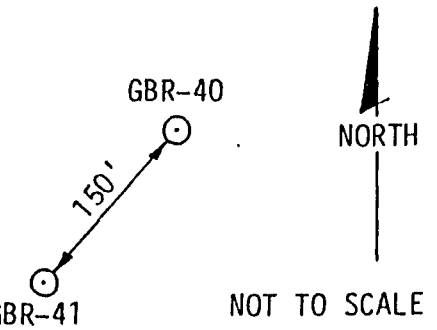
COMMENTS: NO DIESEL NOTED DURING DRILLING.

LOCATION DESCRIPTION: _____

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
30				7	33.0	34.5				33.0-33.4' CLAY, as above. No HC odor. 33.4-33.5' GRAVEL, rounded, 2-5 cm dia. 33.5-34.5' SAND, lt brn, med- gr, well-sorted. Minor pebbles (up to 2 cm dia). Saturated. Strong HC odor. Black HC stain @ 33.5-34.0. Grey HC stain @ 34.0-34.2'. Lt grey stain @ 34.2-34.5'.
35				8	38.0	38.3				38.0-38.3' SANDSTONE, med- gr, minor fn-, cs- gr, pebbles (2-4 cm dia), mod sorting. Friable, poorly cemented. Limonite stain. Saturated. Faint HC odor (?).
40				9	43.0	43.3				43.0-43.3' SANDSTONE, as above, but lt brn color, cs-gr more abundant.
45										
50										
55										
60										

BOREHOLE LOG (WELL)

LOCATION MAP:



___1/4 ___1/4 NW 1/4 NW 1/4 S27 T29N R12W

SITE ID: MONT & AND LOCATION ID: (EX-5)GBR-40

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): 5394 (TOPO)

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: HSA W/SPLIT SPOONS, 7" BOREHOLE.

DRILLING CONTR.: WESTERN TECH.

DATE STARTED: 4/24/87 DATE COMPLETED: PLUGGED4/24/87

FIELD REP.: J.P. KASZUBA

COMMENTS: BOREHOLE NOT COMPLETED AS A WELL. SATURATED @ 33.0-34.5', TD=38'.

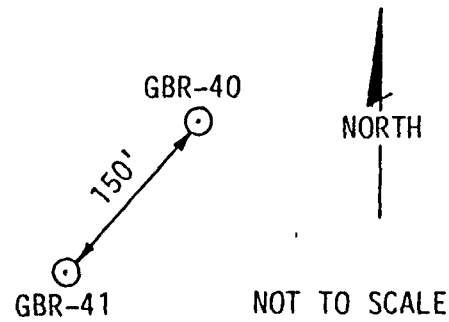
LOCATION DESCRIPTION: _____

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0										
				1	3.0	4.5				3.0-3.3' Road Gravel. 3.3-4.5' SAND, tan, med- to cs- gr, mod sorting. No HC odor.
5										
				2	8.0	9.5				8.0-9.5' No Returns.
10										
				3	13.0	14.5				13.0-13.6' SAND, lt brn, med- to cs- gr, mod sorting. No HC odor. 13.6-14.5' SAND, lt brn, fn- to med- gr, minor cs- gr, mod sorting. No HC odor.
15										
				4	18.0	19.5				18.0-18.9' SAND, brn, med- to cs- gr, mod sorting. Angular pebble fragments (up to 2 cm across) @ 18.7-18.9'. No HC odor. 18.9-19.5' SAND, lt brn, fn- to med- gr, mod sorting. No HC odor.
20										
				5	23.0	24.5				23.0-23.5 SAND, lt brn, fn- to cs- gr, minor silt & pebbles (up to 2 cm across), poorly sorted, no HC odor. 23.5-24.1' SAND, tan, fn- to med- gr, minor silt & cs- gr, mod sorting. No HC odor. 24.1-24.5' SAND, tan, med- to cs- gr, minor fn- gr, well-sorted. No HC odor.
25										
				6	28.0	29.5				28.0-29.5' CLAY, olive brn. No HC odor.
30										

BOREHOLE LOG (WELL)

GCL

LOCATION MAP:



__1/4 __1/4 __1/4 __1/4 S__ T__ R__

SITE ID: MONT & AND LOCATION ID: (EX-5) GBR-40

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): 5394 (TOPO)

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: SAME

DRILLING CONTR.: WESTERN TECH.

DATE STARTED: SAME DATE COMPLETED: SAME

FIELD REP.: SAME

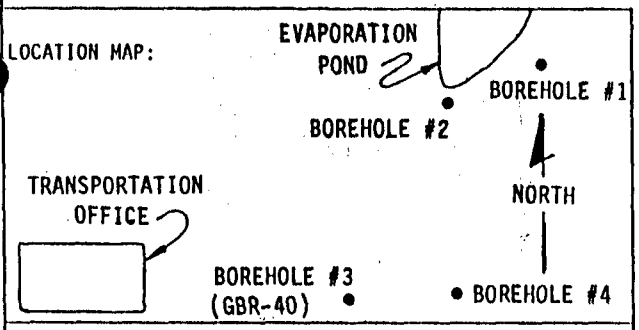
COMMENTS: MINOR DIESEL ON SPLIT SPOONS FROM SATURATED ZONE.
BEDROCK @ 39'.

LOCATION DESCRIPTION: _____

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
30										
				7	33.0	34.5				33.0-33.8' CLAYEY SAND, dark olive brn, sand is fn-gr, well-sorted. Saturated. Faint HC odor.
										33.8-34.5 CLAY, as @ 28.0-29.5, but saturated & faint HC odor(?).
35										
				8	38.0	39.5				38.0-38.9' CLAYEY SAND, brn, sand is fn- to med- gr, mod sorting. Saturated. Faint HC odor(?).
										38.9-39.5' SANDSTONE, mottled tan/brn, med- gr, minor cs- gr, mod sorting. Poorly cemented, friable. Saurated.
40										
45										
50										
55										
60										

LITHOLOGIC LOG

LOCATION MAP:



___1/4 ___1/4 ___1/4 ___1/4 S22 T29N R12W

SITE ID: GJDR M&A LOCATION ID: BOREHOLE #3 GBR-40

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): _____

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: HOLLOW STEM AUGER, 7" BIT

DRILLING CONTR.: WESTERN TECH

DATE STARTED: 10/6/87 DATE COMPLETED: 10/7/87

FIELD REP.: J.P. KASZUBA

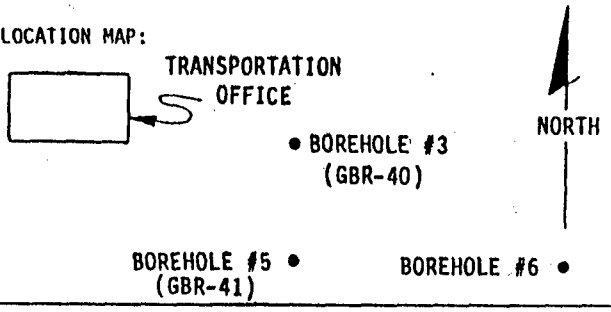
COMMENTS: SPLIT SPOONS AND CUTTINGS. BEDROCK @ ~30½'. TD=40'. SATURATED @ ~23½'. CONTAMINATED W/HC @ ~32' - 35'.

LOCATION DESCRIPTION: _____

Depth	Visual %	Lith	Blow Counts	Sample Type and Interval	Lithologic Description
					0'0" - 5'5" SAND: brn; med-grained, minor fn-, crs-, silt; sbrndd; well-sorted. No HC stain or odor.
5			3, 2, 4	5'0"-6'6"	5'5" - 7'6" SAND: dk brn; fn-grained, minor silt, well sorted. No HC stain or odor.
10			3, 3, 5	10'0"-11'6"	7'6" - 17'6" SAND: lt brn; med- to fn-grained; sbrndd, mod sorting.
15			3, 3, 2	15'0"-16'6"	17'6" - 23'6" SILTY SAND: brn, sand is fn-grained, well sorted. No HC odor.
20			2, 3, 4	20'0"-21'6"	23'6" - 27'0" SILTY SAND: as above, but more silt, saturated. Pebbles & cobbles up to 1" dia @ ~25'.
25			50	25'0"-25'3"	27'0" - ~30'6" CLAY: dk brn; minor fn sand. No HC stain or odor. Saturated.
			7, 9, 5	30'0"-31'6"	30'6" - 35'0" SAND: brn; med-grained; minor fn, crs-, silt; sbrndd; mod well sorted; lithified(?), saturated; HC stain, @ ~32' - 35'. Faint HC odor?
30			50	35'0"-35'3"	35'0" - 35'3" SANDSTONE: mottled tan-brn, med- to crs-, minor fn-, silt. Poorly sorted. Lithified, friable. Not saturated. No HC odor.
35					
40					TD 40'. Completed W2" PVC. Blank 36' - 39', 020 screen 26' - 36', blank to surface. Sand (10/40) 39' - 22', bentonite 17' - 22', sand (10/40) 16' - 17', cement grout w 5% bentonite to surface.
45					
50					

LITHOLOGIC LOG

LOCATION MAP:



__1/4 __1/4 ___1/4 __1/4 S22 T29N R12W

SITE ID: ~~GDR~~ M&A LOCATION ID: BOREHOLE #5 GBR-41

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): _____

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: HOLLOW STEM AUGER, 7" BIT

DRILLING CONTR.: WESTERN TECH

DATE STARTED: 10/6/87 DATE COMPLETED: 10/7/87

FIELD REP.: J.P. KASZUBA

COMMENTS: SPLIT SPOONS AND CUTTINGS. BEDROCK @ ~30½'. TD=35'. SATURATED @ ~27'.

LOCATION DESCRIPTION: _____

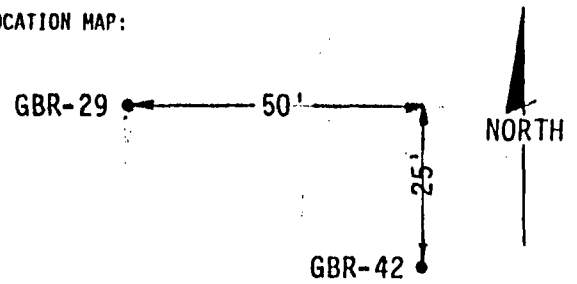
Depth	Visual %	Lith	Blow Counts	Sample Type and Interval	Lithologic Description
5			2, 4, 4	5'0"-6'6"	0' - 5'6" SAND: lt brn; fn- to med- grain, minor coarse-, granules to 1/8"; mod sorting. No HC stain or odor.
10			3, 5, 4	10.0"-11'6"	5'6" - 10'5" SAND: brn; fn- to med- grain, minor silt; mod sorting. No HC stain or odor.
15			3, 3, 3	15'0"-16'6"	10'5" - 12'6" SAND: lt brn (grysh), fn-grain, minor silt. Med. sorted. No HC stain or odor.
20			3, 3, 5	20'0"-21'6"	12'6" - 30'0" SAND: brn, fn-grain w/minor med. grain. Mod sorting. No HC stain or odor.
25			5, 5, 6	25'0"-26'6"	20'0" - 21'3" SAND: geenish gray. Fn- to med-grain. Minor clay, mod sorting. Faint HC odor (?).
30			50	30'0"-30'5½"	21'3" - 22'6" SAND: brn, med-grain w/minor fn & crs grains. Mod sorting. Faint HC odor (?).
35			18, 50	35'0"-36'1"	22'6" - 26'4" SAND: dk gray, med-grained w minor fn-, crs-; mod sorting; HC stain and odor.
40					26'4" - ~27'6" SAND: brnsh gray; med-grained, minor crs- mod sorting. HC stain & odor.
45					~27'6" - 30'3" SAND: mottled gray & brn, fn-grained w minor crs, clay; mod sorting. HC stain, faint HC odor. Saturated.
50					30'3" - ~32'6" SANDSTONE: mottled gray and brn; fn-grained, minor med-brn clay lenses; mod sorting; lithified, poorly-cemented. Faint HC odor no HC stain. Not saturated.
					32'6" - 35'1" SANDSTONE: lt brn, fn-grained, minor med-, crs-; mod sorting. No HC stain, no HC odor. Lithified, poorly cemented. Not saturated.
					35'1" - 35'8" SANDSTONE: lt brn, fn-grained, well sorted, lithified. Moderately cemented. Minor Fe-oxide stain. Minor black, carbon stain. No HC stain or odor. Not saturated.

LOCATION ID: GBR-41
BOREHOLE #5

Depth	Visual %	Lith	Blow Counts	Sample Type and Interval	Lithologic Description
50					35'8" - 36'1" SANDSTONE: mottled gray & brn, fn- to med-grained, minor crs-; poorly sorted; lithified, mod cemented. No HC stain or odor. Not saturated.
55					TD=35'. Completed w 2" PVC & stainless steel. PVC blank 32'-35', 020 stainless steel screen 2'6"-32', PVC blank to surface sand (10/40) 16'6" - 35', bentonite 11'6" - 16'6", sand (10/40) 11'0" - 11'6", cement grout w 5% bentonite to surface.
60					
65					
70					
75					
80					
85					
90					
95					
100					
105					
110					
115					

LITHOLOGIC LOG

LOCATION MAP:



1/4 SW1/4 NW1/4 NW1/4 S27 T29N R12W

SITE ID: GIANT LOCATION ID: GBR-42

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): 5293 (topo)

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: AIR ROTARY W/ CASING DRIVER

DRILLING CONTR.: BEEMAN BROTHERS DRILLING COMPANY

DATE STARTED: 12/15/87 DATE COMPLETED: 12/15/87

FIELD REP.: J.P. KASZUBA, J.F. KIRBY

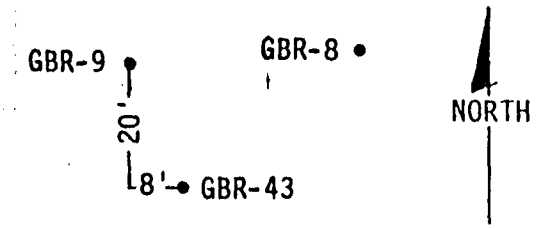
COMMENTS: STEAM CLEAN ALL DRILLING EQUIP. BOREHOLE = 9 7/8". BEGAN USING WATER @25'. CONTAMINATION @38'. BEDROCK @57'. TD = 63'

LOCATION DESCRIPTION: _____

Depth	Visual %	Lith	Drilling Time Scale	Sample Type and Interval	Lithologic Description
5 10 15 20 25 30 35 40 45 50				0' - 63' cuttings	0' - 10' SAND - lt brn; med-grain, well sorted, uncons. minor clays (<10%). No hydrocarbon stain/odor. 10' - 15' CLAYEY SAND - lt brn, med-grain, mod sorting. Minor (<10%) crs grains. No. HC stain-/odor. 15' - 25' CLAYEY SAND - lt to med brn, med-grain, well sorted. No HC stain/odor. 25' - 30' CLAY - lt brn, minor (<15%) sand. Sand is med- to fn-grain with moderate sorting. No HC stain/ odor. 30' - 35' CLAY - lt brn, 30% cobbles up to 1" diam. No HC stain/odor. 35' - 40' SAND - Blk, med grain, well to very well sorting. Hydrocarbon stain/strong hydrocarbon odor. 40' - 50' SAND - blk. fn grain, very well sorted, strong HC stain/odor. 50' - 57' GRAVELLY SAND - lt brn. fn to crs grain, poorly sorted. Gravels up to 1/2" diameter. No noticable stain/odor. 57' - 63' CLAYSTONE - brnsh grey, cons. No HC stain/odor. Completed as 6-inch recovery well with flush joint pipe. TD well = 62.6, SS blank 52.3' - 62.6', SS screen (020 slot) 36.6' - 52.3', SS blank 31.6' - 36.6', PVC blank 0' - 31.6'. SS centralizers @ 36.6' and 52.3'. Sand (10120) 27.8' - 63', bentonite powder 21.8' - 27.8', sand (10120) 21.0' - 21.8', cement grout w/5% bentonite to surface.

LITHOLOGIC LOG

LOCATION MAP:



1/4 SW1/4 NW1/4 NW1/4 S27 T29N R12W

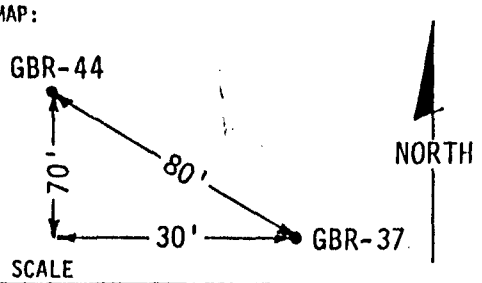
SITE ID: GIANT LOCATION ID: GBR-43
SITE COORDINATES (ft.):
N E
GROUND ELEVATION (ft. MSL): 5389 (topo)
STATE: NEW MEXICO COUNTY: SAN JUAN
DRILLING METHOD: AIR ROTARY W/ CASING DRIVER
DRILLING CONTR.: BEEMAN BROTHERS DRILLING COMPANY
DATE STARTED: 12/16/87 DATE COMPLETED: 12/17/87
FIELD REP.: J.P. KASZUBA,
COMMENTS: BOREHOLE = 9 7/8". BEGIN USING WATER @20'. HC CONTAMINATION @ 33'. BOULDERS/COBBLES @ 38'. BEDROCK @55'. TD = 62'

LOCATION DESCRIPTION:

Depth	Visual %	Lith	Drilling Time Scale	Sample Type and Interval	Lithologic Description
5 10 15 20 25 30 35 40 45 50				0' - 62' cuttings	0' - 10' SAND - lt brn; fn- to med-grain, sbrndd to sbang poorly sorted. Minor silt (<10%) pebbles (<10%) w/max. dia. 1 inch. Uncons. No HC stain/ odor. 10' - 20' SAND - as above, but more tan in color and gravel fraction decreases w/depth. 20' - 28' SAND - tan, med-grain, rndd to sbang, mod sorting. Minor silt (<10%) and crs-grain sand (<10%). Unconsolidated. No HC stain or odor. 28' - 32' CLAY - brn, uncons. No HC stain/ odor. 32' - 34' SAND - brn, fn- to med-grain, sbrndd, mod sorting. Uncons. HC stain and odor 33' - 34'. 34' - 37' CLAY - brn, unconsolidated. HC stain and odor 34' - 35'. 37' - 55' GRAVELLY SAND - olive brn crs-grain, sbrndd sand to ang pebble fragments w/1 inch max dia. Poorly sorted. Unconsolidated. Faint HC stain and odor (?). 55' - 62' CLAYSTONE - blue-gray, cons. No HC stain or odor. Completed as 6-inch recovery well, with flush joint pipe. TD well = 60.5, SS blank 50.2' - 60.5'; SS screen (020 slot) 34.5' - 50.2', SS blank 29.5' - 34.5', PVC blank to surface. SS centralizers @ 34.5' and 50.2'. Sand (10/20) 50' - 62', sand (8/12) 29' - 50', bentonite powder 23' 29', native backfill 19.8 - 23', cement grout w/5% bentonite to surface.

LITHOLOGIC LOG

LOCATION MAP:



NOT TO SCALE

1/4 SW1/4 NW1/4 NW1/4 S27 T29N R12W

SITE ID: GIANT LOCATION ID: GBR-44

SITE COORDINATES (ft.):

N _____ E _____

GROUND ELEVATION (ft. MSL): 5390 (topo)

STATE: NEW MEXICO COUNTY: SAN JUAN

DRILLING METHOD: AIR ROTARY W/ CASING DRIVER

DRILLING CONTR.: BEEMAN BROTHERS DRILLING COMPANY

DATE STARTED: 12/17/87 DATE COMPLETED: _____

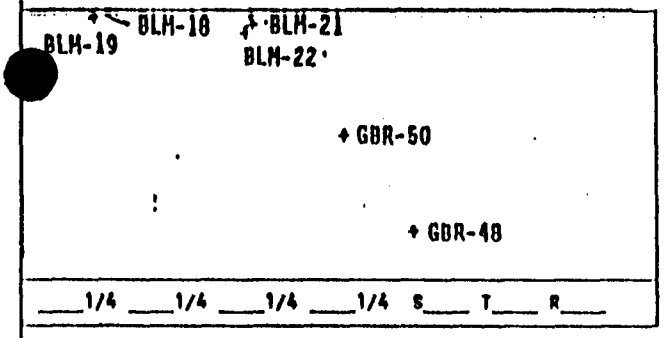
FIELD REP.: J.P. KASZUBA

COMMENTS: BOREHOLE = 9 7/8". BEGIN USING WATER @12'. HC CONTAMINATION @ 38'. BEDROCK @ 56. TD = 59'.

LOCATION DESCRIPTION: _____

Depth	Visual %	Lith	Drilling Time Scale	Sample Type and Interval	Lithologic Description
5 10 15 20 25 30 35 40 45 50				0' - 59' cuttings	0' - 12' SAND - brn, fn- to med-grain, sbang to sbrndd, mod sorting. Uncons. No HC stain or odor. Becomes coarser-grained and poorly sorted w/depth. 12' - 30' GRAVELLY SAND - tan, fn-grain sand to pebbles w/max dia of 1 inch, sbrndd, poorly sorted. Unconsolideated. No HC stain or odor. 30' - 34' CLAY - brn, uncons. No Hc stain or odor. 34' - 38' SAND - brn, fn- to med-grain, sbrndd, mod sorting. Unconsolidated. HC odor and stain @37' - 38'. 38' - 40' CLAY - brn, unconsolidated. Faint HC stain and odor 38' - 39'. 40' - 45' GRAVELLY SAND - grysh tan, fn-grain sand to pebbles w/max dia of 1 inch sbrndd poorly sorted. Uncons. Faint HC stain and odor (?). 45' - 50' SAND - yelsh brn, fn- to med-grain sbrndd to sbang, mod sorting. Uncons. No HC stain or odor. 50' - 56' GRAVELLY SAND - tan, fn-grain sand to pebbles w/max dia of 1 inch, sbrndd, poorly sorted. Unconsolidated. No HC stain or odor. 56' - 59' CLAYSTONE - blueish gray, consolidated. No HC stain or odor. Completed as 6-inch recovery well, with flush joint pipe. TD well = 58.6, SS blank 48.3' - 58.6'; SS screen (020 slot) 32.6' - 48.3', SS blank 27.6' - 32.6', PVC blank 0' - 27.6', SS centralizers @ 32.6' and 48.3'. Sand (8/12) 27' - 59', bentonite powder 21' 27', cement grout w/5% bentonite to surface.

BOREHOLE LOG (SOIL)



___1/4 ___1/4 ___1/4 ___1/4 S___ T___ R___

Giant Bloomfield

SITE ID: Refinery LOCATION ID: GBR-48

SITE COORDINATES (ft.):

N 12159.02 E 11142.65

GROUND ELEVATION (ft. MSL): 5416.14

STATE: New Mexico COUNTY: San Juan

DRILLING METHOD: Hollow Stem Auger/Continuous Sampler

DRILLING CONTR.: Western Technologies

DATE STARTED: 17 Oct 1988 DATE COMPLETED: 18 Oct 1988

FIELD REP.: Martin Nee

COMMENTS:

LOCATION DESCRIPTION:

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0				1	0	3			SP	0'-23' Sand - Mod yelsh brn, 10 YR 5/4, v fn to crs sand, uncons, subangular to subrounded, well sorted moist from 13-14', v minor grv at 23'.
				2	3	8				
5										
				3	8	13				
10										
				4	13	18				
15										
				5	18	23				
20										
				6	23	28			SM	23'-26.5' Silty Sand - Mod yelsh brn, 10 YR 5/4, 75% v fn to med sand, 20% silt, 5% clay, uncons, subangular to subrounded, mod well sorted.
25										
				7	28	33			SC	26.5'-27.5' Clayey Sand - Mod yelsh brn, 10 YR 5/4, 70% v fn to med grained sand, 20% clay, 10% silt, uncons, subangular to subround, mod well sorted.
30										
									CL	27.5'-31' Silty Clay - Mod yelsh brn, 10 YR 5/4, 80% clay, 15% silt, 5% v fn sand.
				8	33	38				
35									SP	31'-35' Sand - Mod yelsh brn, 10 YR 5/4, fn to coarse grained sand, uncons, mod well sorted, subangular to subrounded, minor gravel <3%.
				9	38	43				35'-37' Cobbles/Gravel Refusal - No core.
40										37'-44' Shale - Light olive grey, 5 YR 2/2.
										TD = 44.0', 2" ss blank 43.6' to 38.4', ss 20 slot screen 38.4-28.4', 2" ss to 3' above surface, 10-20 sand to 23', bentonite to 17.5', grout w/5% bentonite to surface, 5"x6' cement filled steel guard pipe. 4'x4' concrete slab.
45										
50										

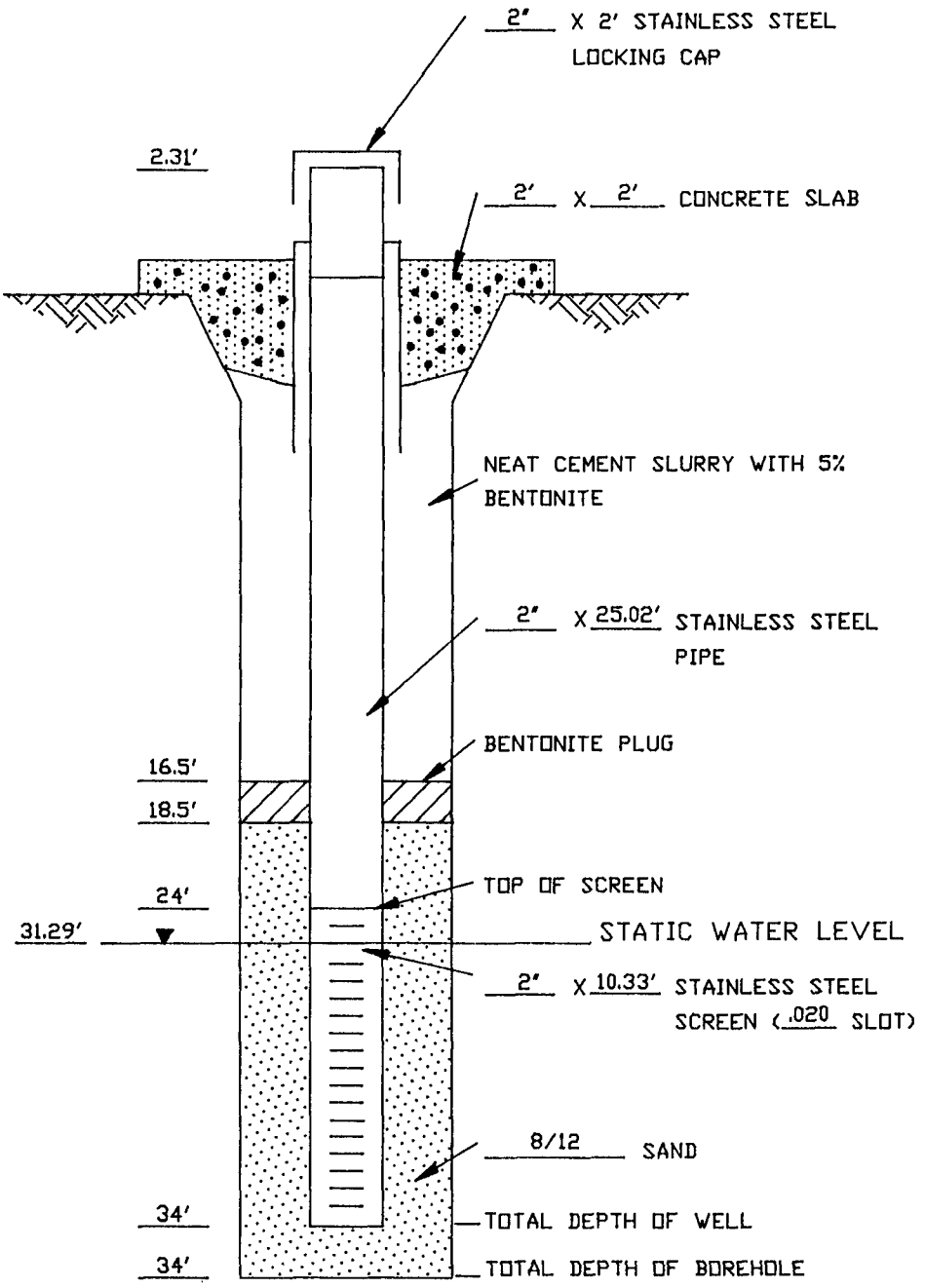
BOREHOLE LOG (SOIL)

SITE ID: GIANT BLOOMFIELD LOCATION ID: GBR-48R
SITE COORDINATES (ft.):
N E
GROUND ELEVATION (ft. MSL):
STATE: NEW MEXICO COUNTY: SAN JUAN
DRILLING METHOD: HOLLOW STEM AUGER
DRILLING CONTR.: WESTERN TECHNOLOGIES INC.
DATE STARTED: 01/07/90 DATE COMPLETED: 01/07/90
FIELD REP.: LINLEY
COMMENTS:

___1/4 ___1/4 ___1/4 ___1/4 S___ T___ R___

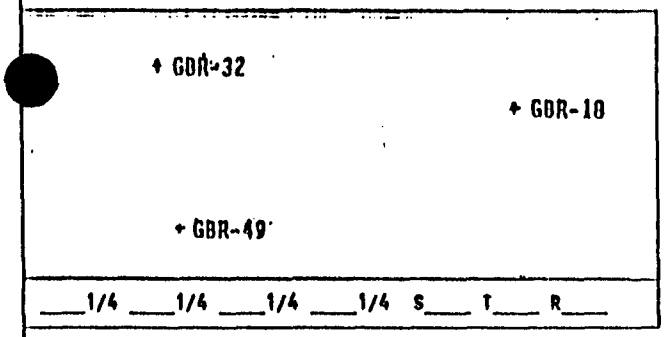
LOCATION DESCRIPTION:

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0									SW	0-4' SAND: Dk yelsh orange (10 YR 6/6) fn to med crs sand, poorly sorted, uncons, sbang to sbrndd.
5									SM	4-6' SANDY CLAY: Dk yelsh orange (10 YR 6/6) v fn to med grained, poorly sorted, semi consol, sbang to sbrndd, moist, sand fraction 35-40%.
10									SW	6-26' SAND: Dk yelsh orange (10 YR 6/6) fn to med crs, poorly sorted, uncons, sbang to sbrndd, Grv lens ≈7' BGL (6" thick) (4" diam), clay lens ≈11' BGL (≈6" thick), Grv at 12' BGL 1" diam (≈3-6" thick). NOTED GROUT at ≈21' BGL (i.e. grout chips). Silt fraction to ≈20% at 22' BGL intbd Grv through depth, ≈3-6" thick, up to 1-2" diam and fn ___ 0.25" diam. Clay fraction w/depth to ≈20% intbd clay & sand.
15										
20									SM	26-32' SANDY CLAY: Mod yelsh brn (10 YR 5/4) v fn to fn grained, mod sorted, semiconsol, sbang to sbrndd, moist. Sand fraction ≈25%. Grout chips at 28' BGL - cuttings bcm v moist.
25									SC	32-34' CLAYEY SAND: Pale yelsh brn (10 YR 6/2) v fn to med sand, poorly sorted, uncons, sbang to sbrndd, sat. Auger refusal at 34' BGL.
30										
35										
40										
45										
50										



COMPLETION DIAGRAM GBR-48R

BOREHOLE LOG (SOIL)



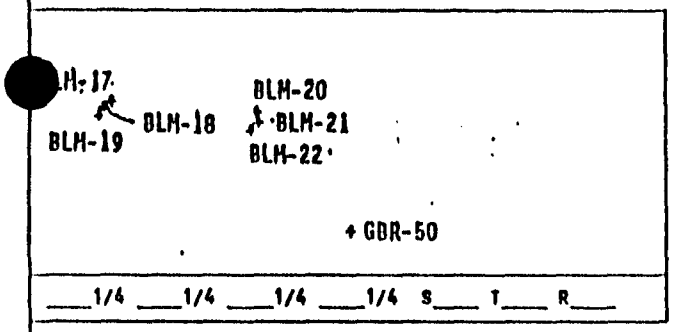
___1/4 ___1/4 ___1/4 ___1/4 S___ T___ R___

Giant Bloomfield
SITE ID: Refinery LOCATION ID: GBR-49
SITE COORDINATES (ft.):
N 11900.13 E 11160.02
GROUND ELEVATION (ft. MSL): 5410.76
STATE: New Mexico COUNTY: San Juan
DRILLING METHOD: Hollow Stem Auger/Continuous Sampler
DRILLING CONTR.: Western Technologies
DATE STARTED: 17 Oct 1988 DATE COMPLETED: 17 Oct 1988
FIELD REP.: Martin Nee
COMMENTS:

LOCATION DESCRIPTION:

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0				1	0	3			SP	0'-22' Sand - Mod yelsh brn, 10 YR 5/4, v fn to coarse sand, uncons, sbang to sbrndd, minor silt.
				2	3	8				
5										
				3	8	13				7'-9' As above w/cobblers or boulders.
10										
				4	13	18				
15										15'-16' Same as 0-22 with 5% fn to med pebble gravel.
				5	18	23				
20										
				6	23	28			SM	22'-25' Silty Sand - Mod yelsh brn, 10 YR 5/4, 70% sand, v fn to coarse, moderately well sorted, uncons, sbang to sbrndd, 20% silt, 10% clay, minor, v fn to med pebble gravel.
25										
				7	28	33			SC	25'-33' Clayey Silty Sand - Silty sand and stringers (6") of silty clay, mod yelsh brn, 10 YR 5/4, v fn to med grained sand, uncons, sbang to sbrndd.
30										28' Appears moist.
									SM	33'-36.5' Silty Sand - Dk yelsh or, 10 YR 6/6, 80% sand, v fn to crs, uncons, sbang to sbrndd, well sorted, 20% silt, v minor clay.
35										
									SM	36.5'-40' Silty Sand - Lt olv brn, 5 YR 5/6, v fn to med grained sand, uncons, mod well sorted, sbang to sbrndd, 5% clay, 15% silt.
40									SC	40'-42.5' Clay - Lt blsh grey, 5B 7/11.
										TD = 42.5', 2" ss blank 38.5' to 36.3', ss 20 slot screen 36.3' to 25.9' 2" ss blank to 2.1' above surface, 10-20 sand to 21.0', bentonite to 16.45', grout with 5% bentonite to surface. 5"x6' cement filled steel guard pipe. 4'x4' concrete slab.
45										
50										

BOREHOLE LOG (SOIL)



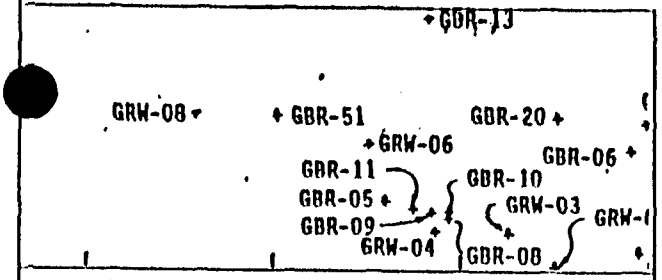
___1/4 ___1/4 ___1/4 ___1/4 S___ T___ R___

Giant Bloomfield
SITE ID: Refinery LOCATION ID: GBR-50
SITE COORDINATES (ft.):
N 12257.74 E 11067.82
GROUND ELEVATION (ft. MSL): 5413.13
STATE: New Mexico COUNTY: San Juan
DRILLING METHOD: Hollow Stem Auger/Continuous Sampler
DRILLING CONTR.: Western Technologies/Continuous Sampler
DATE STARTED: 19 Oct 1988 DATE COMPLETED: 19 Oct 1988
FIELD REP.: Martin Nee
COMMENTS:

LOCATION DESCRIPTION:

DEPTH	LITH.	REC	SAN	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0				1	0	3			SM	0'-15' Silty Sand - Mod yelsh brn, 10 YR 5/4, v fn to coarse sand, <5% fn to med pebble gravel, approx 15% silt, uncons, well sorted, sbang to sbrndd.
				2	3	8				
5										
				3	8	13				
10										
				4	13	18				
15										15'-23' Same as 0-15 with no gravel.
				5	18	23				
20										
				6	23	28			CL	23'-31' Clayey Sand - Mod yelsh brn, 10 YR 5/4, 20% clay, 10% silt, v fn to coarse sand, uncons, well sorted, sbang to sbrndd.
25										
				7	28	33				
30										
									SP	31'-37' Sand - Mod yelsh brn, 10 YR 5/4, <5% silt, <5% gravel, fn to coarse sand, uncons, mod well sorted, sbang to sbrndd.
				8	33	38				
35										
										37'-43.0' Carbonaceou Shale - dusty yelsh brn, 10 YR 2/2, mod well cons, minor Fe staining, <2% gravel.
				9	38	42.5				
40										
										TD = 43.0', 2" ss blank 42.5' to 37.26', ss 20 slot screen 37.26' to 26.91' 2" ss blank to 4.14' above surface, 10-20 sand to 20.19', bentonite to 15.44', grout with 5% bentonite to surface, 5"x6' cement filled steel guard pipe, 4'x4' concrete slab.
45										
50										

BOREHOLE LOG (SOIL)



Giant Bloomfield
SITE ID: Refinery LOCATION ID: GBR-51
SITE COORDINATES (ft.):
N 10265.77 E 11304.3
GROUND ELEVATION (ft. MSL): 5388.72
STATE: New Mexico COUNTY: San Juan
DRILLING METHOD: Air Rotary-Casing Driver
DRILLING CONTR.: Beeman Brothers
DATE STARTED: 12 Sept 1988 DATE COMPLETED: 13 Sept 1988
FIELD REP.: Martin Nee
COMMENTS:

LOCATION DESCRIPTION:

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0				1	0	5			SW	0'-10' Sand - Mod yelsh br, 10 YR 5/4, 95% med to v fn sand, well graded, sbrndd, uncons, 5% silt.
5				2	5	10				
10				3	10	15			SW	10'-15' Sand - Mod yelsh br, 10 YR 5/4, 90% med to v fn sand, well graded, sbrndd, uncons, 5% med to fn pebble gravel, 5% silt.
15				4	15	20			SW	15'-35' Sand - Mod yelsh br 10 YR 5/4, med to v fn grained, well graded, sbrndd, uncons.
20				5	20	25				
25				6	25	30				
30				7	30	35				
35				8	35	40			SC	35'-50' Clayey Sand - Mod yelsh br 10 YR 5/4, med to v fn sand, well graded, sbrndd, uncons. 85% sand, 10% clay, 5% silt.
40				9	40	45				
45				10	45	50				
50				11	50	55			SC	50'-62' Silty, Clayey Sand - Lt olive gray, 5 Y 5/2, 90% med sand to clay, well graded, sbang to sbrndd. 10% med to v fn pebble gravel, uncons.

BOREHOLE LOG (SOIL)

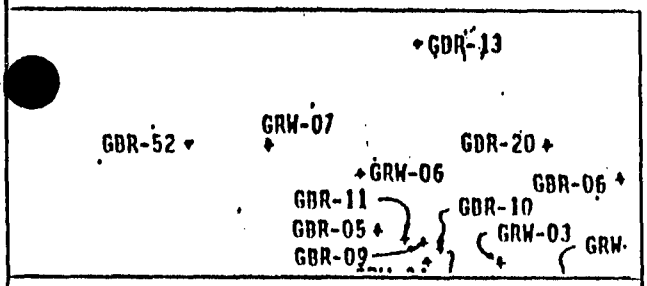
Giant Bloomfield
SITE ID: Refinery LOCATION ID: GBR-51
SITE COORDINATES (ft.):
N 10265.77 E 11304.3
GROUND ELEVATION (ft. MSL): 5308.72
STATE: New Mexico COUNTY: San Juan
DRILLING METHOD: Air Rotary-Casing Driver
DRILLING CONTR.: Beeman Brothers
DATE STARTED: 12 Sept 1988 DATE COMPLETED: 13 Sept 1988
FIELD REP.: Martin Nee
COMMENTS:

___1/4 ___1/4 ___1/4 ___1/4 S___ T___ R___

LOCATION DESCRIPTION:

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
50				12	50	55			SC	50'-62' Silty, Clayey Sand - Lt olive gray, 5 Y 5/2, 90% med sand to clay, well graded, sbang to sbrndd. 10% med to v fn pebble gravel, uncons.
55				13	55	60				
60				14	60	65				
65				15	65	70				TD = 62', 6" ss blank 59.5' to 54.25', 6" ss 20 slot 54.25 to 38.50' 6" blank 38.5' to 28.5', 6" PVC blank to surface, 6"x3' ss finish w/cap 8-12 sand to 32.5', bentonite to 27.42' cement with 5% bentonite to surface 10"x12' cement filled steel guard pipe, 4'x4' concrete slab.
70				16	70	75				
75				17	75	80				
80				18	80	85				
85				19	85	90				
90				20	90	95				
95				21	95	100				
100				22	100	105				

BOREHOLE LOG (SOIL)



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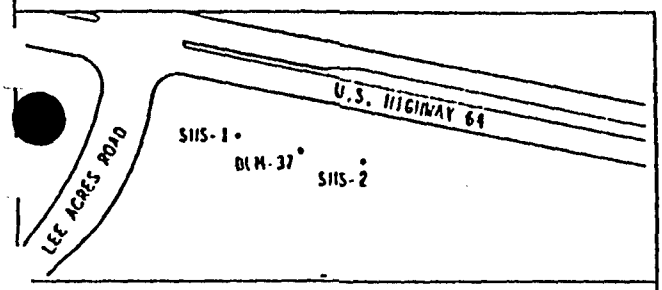
Giant Bloomfield
SITE ID Refinery LOCATION ID: GDR-52
SITE COORDINATES (ft.):
N 10267.32 E 11215.25
GROUND ELEVATION (ft. MSL): ~5383
STATE: New Mexico COUNTY: San Juan
DRILLING METHOD: Air Rotary-Casing Driver
DRILLING CONTR.: Beeman Brothers
DATE STARTED: 13 Sept 1988 DATE COMPLETED: 14 Sept 1988
FIELD REP.: Martin Nee
COMMENTS:

LOCATION DESCRIPTION:

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0				1	0	5			SW	0'-30' Sand - Mod yelsh br 10 YR 5/4 90% med to v fn sand, sbang to sbrndd, well graded, uncons, 10% pebble gravel, crs to fn, uncons.
5				2	5	10				
10				3	10	15				
				4	15	20				
20				5	20	25				
25				6	25	30				
30				7	30	35			SW	30'-45' Clayey Sand - Mod yelsh br 10 YR 5/4, 80% sand, med to fn grained, 10% clay, 5% fn pebble gravel, sbang to sbrndd, uncons, mod well graded.
35				8	35	40				
40				9	40	45				
45				10	45	50			SC	45'-54' Silty, Clayey Sand - Lt olive gray 5 Y 5/2 70% med sand to clay well graded, sbang to sbrndd, uncons, 10% med to fn pebble gravel.
				11	50	54				TD = 54', 6" ss blank 50.78 to 45.75, 6" ss 20 slot screen 45.75 to 30.08', 6" ss blank 30.08 to 20.08, 6" PVC blank to surface, 6" x 3' ss finish w/cap/8-12 sand to 45' .16", 10-20 sand to 24.5, bentonite to 18.33', cement w/5% bentonite to surface, 10" x 12' cement filled steel guard pipe, 4'x4' concrete slab.

BOREHOLE LOG (SOIL)



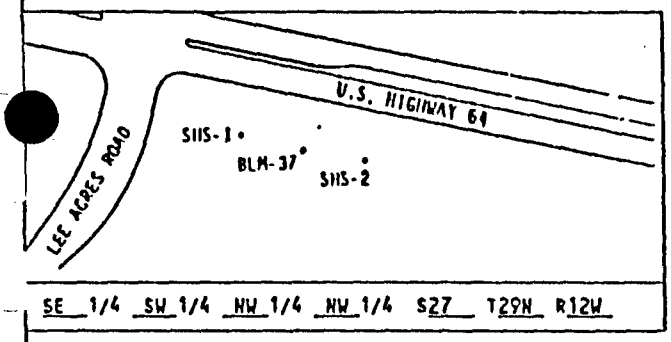
SE 1/4 SW 1/4 NW 1/4 NW 1/4 S 27 T29N R12W

SITE ID: Lee Acres Community LOCATION ID: SHS-1
SITE COORDINATES (ft.): Coordinates are local to GBR
N 9896-34 E 11406.67
GROUND ELEVATION (ft. MSL): Approximately 5381
STATE: New Mexico COUNTY: San Juan
DRILLING METHOD: Hollow Stem Auger
DRILLING CONTR.: Western Tech
DATE STARTED: 7/31/89 DATE COMPLETED: 8/1/89
FIELD REP.: M. Nee
COMMENTS:

LOCATION DESCRIPTION: South of Giant's Bloomfield refinery on NMSR 64 right of way, 100 ft west of BLM-37

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0			2	1	0	3			SW	0-28' Sand Mod Brn, 10 YR 4/4, v fine to fine grained, well sorted, unconsol., slightly moist at approx. 13'. Minor pebble gravel at 11'-13'.
			5	2	3	8			CL	silty clayey sand stringer, moderate brown, 10 YR 4/4, at approx. 15'-15.5'.
5									GP	Minor small pebble gravel 22-28'.
			3	3	8	13				28'-30' Clay, moderate olive brn, 5 Y 4/4, minor fine to coarse sand.
10									SW	30'-30.5' Sand as above (0'-28'), no gravel.
			3	4	13	18			CL	6" clay to 31' grading to v fine sand at 33' olive gray, 5 Y 3/2.
15									SC	33'-36' Silty Sandy Clay, moderate olive brn, 5 Y 4/4, approx. 33% clay, 33% sand, 33% silt.
			0	5	18	23				36'-37' as above only stained, olive gray, 5Y 3/2. Fine to coarse sand interval 37' to 37-1/2' then to silty clay olive gray, 5 Y 3/2.
20										
			3	6	23	28			CL	37'-1/2-39' Silty clay, olive gray 5 Y 3/2.
25									SM	39'-40' Silty sand, olive gray, 5 Y 3/2 unconsol., MW sorted.
			5	7	28	33			CL	40'-41.5' Clay, mottled, mod yllsh brn, 10 YR 5/4 - olive gray. 5 YR 3/2.
30									SW	41.5'-42.5' Sand, mod. olive brn 5 Y 4/4, f-m sand, unconsol., MW sorted.
			0	8	33	38			SC	42.5'-43.5' Sandy clay, mod brn, 5 YR 4/4.
35									SW	43'-50' Sand, mod yllsh brn, 10 YR 5/4, fine to med sand. unconsol. MW sorted, saturated
			2	9	38	43			NA	50'-51.5' mudstone/claystone, dusky yellow 5 Y 6/4 to light olive brn, 5 Y 5/6 mod well consolidated, carbonaceous shale present, weathered, shale present.
40										
			0	10	43	48			NA	51.5'-52' Sandstone, dusky yellow, 5 Y 6/4 to light olive brn, 5 Y 5/6, fine to med grained, well consolidated, well sorted.
45										
			3	11	48	52				

BOREHOLE LOG (SOIL)



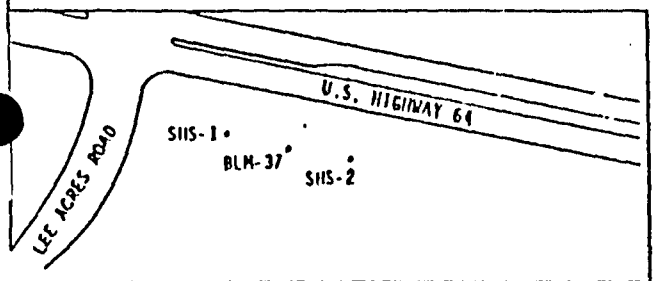
SE 1/4 SW 1/4 NW 1/4 NW 1/4 S27 T29N R12W

SITE ID: Lee Acres Community LOCATION ID: SHS-2
SITE COORDINATES (ft.): Coordinates are local to GBR
N 9854.92 E 11609.55
GROUND ELEVATION (ft. MSL): Approx. 5382
STATE: New Mexico COUNTY: San Juan
DRILLING METHOD: Hollow Stem Auger
DRILLING CONTR.: Western Technology
DATE STARTED: 8/2/89 DATE COMPLETED: 8/2/89
FIELD REP.: M. Nee
COMMENTS:

LOCATION DESCRIPTION: South of Giants Bloomfield Refinery on NMSR 64 right of way, 100 ft east of BLM-37

DEPTH	LITH.	REC	SAK	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0				1	0	3.5				0-1' Soil, Silty sand w/organics, mod. yllsh, brn 10 YR 5/4, 40% silt, 60% f sand, unconsolidated, mod well sorted, sub angular to sub rounded.
			3.5	2	3.5	3.5				1'-26' Gravelly Sand, Dark yellowish orange, 10 YR 6/6, 90% v fine - fine pred. quartz, unconsol., well sorted, sub ang to sub rounded, 10% gravel is fine to coarse pebble gravel, rounded.
5			2							
				3	8.5	13.5				26'-30' Sandy gravel, Dark yllsh orange, 10 YR 6/6, unconsol., rounded, pebble gravel to cobbles.
10										
			3	4	13.5	18.5				30'-33.5' Clayey Silty Sand, mod yllsh brn, 10 YR 5/4. Clay to fine sand, unconsol. poorly sorted.
15										
										33.5'-36' Sand, mod yllsh brn, 10 YR 5/4, fine to mod sand, unconsol. sub ang to sub rounded, mod well.
			3	5	18.5	23.5				
20										36'-37' Clayey Silt, dark yllsh brn, 10 YR 4/4, unconsol. MW sorted.
			0	6	23.5	28.5				37'-39.5' Gravelly Sand, dark yllsh brn, 10 YR 4/2, to olive black, 5 Y 2/1, at 38.5'.
25										
										80% fine sand, 20% small cobbles, ps, unconsol. sand is sub ang to sub rounded, cobbles are rounded.
			0	7	28.5	33.5				
30										39.5'-40.5' Sandstone, olive black 5 Y 2/1, MW consolidated, stained, appears to be Naciamento.
			2.5	8	33.5	38.5				40.5'-40.8' Claystone, olive gray, 5 Y 4/1, mod well consolidated.
35										
										40.8'-41.1' Sandstone, dark yllsh orange, 10 YR 6/6, med sand, MW sorted, unconsolidated.
			5	9	38.5	43.5				
40										41.1'-41.3' Claystone, olive gray, 5 Y 4/1. mod well consolidated.
										41.8'-42' Sandstone, grayish orange, 10 YR 7/4, med sand, mod consol., subang, calcium cement, moist.
			5	10	43.5	48.5				
45										
			5	11	48.5	53.5				
50										

BOREHOLE LOG (SOIL)



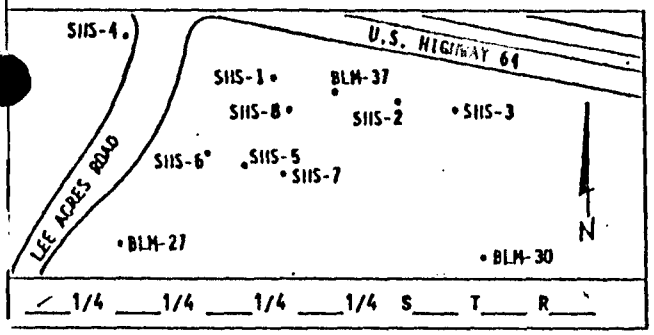
SE 1/4 SW 1/4 NW 1/4 NW 1/4 S27 T29N R12W

SITE ID: Lee Acres Community LOCATION ID: SHS-2
SITE COORDINATES (ft.): Coordinates are local to GBR
N 9854.92 E 11609.55
GROUND ELEVATION (ft. MSL): Approx. 5382
STATE: New Mexico COUNTY: San Juan
DRILLING METHOD: Hollow Stem Auger
DRILLING CONTR.: Western Technology
DATE STARTED: 8/2/89 DATE COMPLETED: 8/2/89
FIELD REP.: M. Wee
COMMENTS:

LOCATION DESCRIPTION: South of Giants Bloomfield Refinery on NMSR 64 right of way, 100 ft east of BLM-37

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0				1	0	3.5				0-1' Soil, Silty sand w/organics, mod. yllsh, brn 10 YR 5/4, 40% silt, 60% f sand, unconsolidated, mod well sorted, sub angular to sub rounded.
			3.5	2	3.5	3.5				
			2							1'-26' Gravelly Sand, Dark yellowish orange, 10 YR 6/6, 90% v fine - fine pred. quartz, unconsol., well sorted, sub ang to sub rounded, 10% gravel is fine to coarse pebble gravel, rounded.
5				3	8.5	13.5				
										26'-30' Sandy gravel, Dark yllsh orange, 10 YR 6/6, unconsol., rounded, pebble gravel to cobbles.
10										
			3	4	13.5	18.5				30'-33.5' Clayey Silty Sand, mod yllsh brn, 10 YR 5/4. Clay to fine sand, unconsol. poorly sorted.
15										
										33.5'-36' Sand, mod yllsh brn, 10 YR 5/4, fine to mod sand, unconsol. sub ang to sub rounded, mod well.
			3	5	18.5	23.5				
20										36'-37' Clayey Silt, dark yllsh brn, 10 YR 4/4, unconsol. MW sorted.
			0	6	23.5	28.5				37'-39.5' Gravelly Sand, dark yllsh brn, 10 YR 4/2, to olive black, 5 Y 2/1, at 38.5'.
25										
										80% fine sand, 20% small cobbles, ps, unconsol. sand is sub ang to sub rounded, cobbles are rounded.
			0	7	28.5	33.5				
30										39.5'-40.5' Sandstone, olive black 5 Y 2/1, MW consolidated, stained, appears to be Naciamento.
			2.5	8	33.5	38.5				40.5'-40.8' Claystone, olive gray, 5 Y 4/1, mod well consolidated.
35										
										40.8'-41.1' Sandstone, dark yllsh orange, 10 YR 6/6, med sand, MW sorted, unconsolidated.
			5	9	38.5	43.5				
40										41.1'-41.3' Claystone, olive gray, 5 Y 4/1. mod well consolidated.
			5	10	43.5	48.5				41.8'-42' Sandstone, grayish orange, 10 YR 7/4, med sand, mod consol., subang, calcium cement, moist.
45										
			5	11	48.5	53.5				
50										

BOREHOLE LOG (SOIL)



___1/4 ___1/4 ___1/4 ___1/4 S___ T___ R___

SITE ID: OFFSITE GIANT LOCATION ID: SHS-3
SITE COORDINATES (ft.):
N E
GROUND ELEVATION (ft. MSL):
STATE: NEW MEXICO COUNTY: SAN JUAN
DRILLING METHOD: HOLLOW STEM AUGER
DRILLING CONTR.: WESTERN TECHNOLOGIES INC.
DATE STARTED: 11/29/89 DATE COMPLETED: 11/30/89
FIELD REP.: LINLEY
COMMENTS:

LOCATION DESCRIPTION:

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0									SW	0-6' SAND: Yelsh orange (10 YR 6/6) fn to med fn grained, uncons, mod poorly sorted, sbang to sbrndd, fill.
5									SM	6-8' CLAYEY SAND: Dark yelsh brn (10 YR 4/2) v fn to fn grained, uncons, mod poorly sorted, sbang to sbrndd.
10									SW	8-35' SAND: Dark yelsh orange (10 YR 6/6) fn to med grained, uncons, mod sorted, sbang to sbrndd. At 25' BGL cobbles (intbd w/depth). Clay fraction <10%, Grv fraction ≈15% to 25%.
20										
25										
30										
35									SW	35-38' SAND: (Silty wthd Sst), mod redsh brn (10 R 4/6) to dk yelsh orange (10 YR 6/6), fn to med sand, mod sorting, semiconsol, fri.sbang to sbrndd. (v dns) Clay fraction incr w/depth to ≈20%.
40									Pt	38-38.5' COAL: Blk (N1), flaky to leaf like layering, fri, consol.
45									GM	38.5-39.5' GRAVELLY SANDY CLAY: Gnsh gry (5 GY 6/1) to dk yelsh orange (10 YR 6/6) v fn to med grained, poorly sorted, semiconsol, sbang to sbrndd. Grv fraction ≈10-15% & up to 1/8" diam. Sand fraction ≈20-25%.
									GM	39.5-44' GRAVELLY SAND: Dk yel orange (10 YR 6/6) med to crs grained, uncons, poorly sorted, sbang to sbrndd, wet.

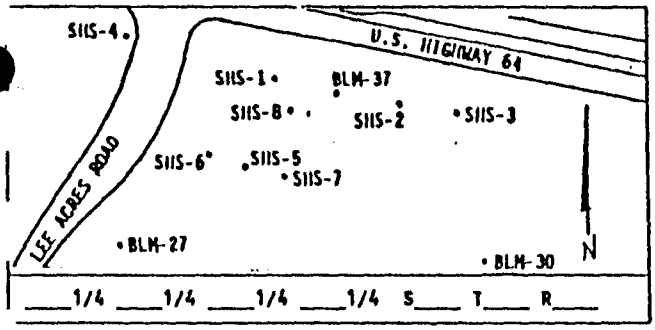
BOREHOLE LOG (SOIL)

(Continued)

LOCATION ID: SHS-3

FH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
50									ML	44-54' CLAY (SHALE): Lt olv gry (5 Y 6/1) v fn grained, consol, intbd med crs sand horizons (dk yelsh orange (10 YR 6/6) mod sorting, sbang to sbrndd, wet upper 4" of sample & becoming dry w/depth.
55										
60										
65										
70										
75										
80										
85										
90										
95										
100										
105										
110										

BOREHOLE LOG (SOIL)



SITE ID: OFFSITE GIANT LOCATION ID: SHS-4
SITE COORDINATES (ft.):
N E
GROUND ELEVATION (ft. MSL):
STATE: NEW MEXICO COUNTY: SAN JUAN
DRILLING METHOD: HOLLOW STEM AUGER
DRILLING CONTR.: WESTERN TECHNOLOGIES INC.
DATE STARTED: 11/27/89 DATE COMPLETED: 11/28/89
FIELD REP.: LINLEY
COMMENTS:

LOCATION DESCRIPTION:

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0									SW	0-27' SAND: Grysh orange (10 YR 7/4): v fn to med fn grained, sbang to sbrndd, uncons, mod sorted, moist at ≈15' BGL. 20-21' BGL Grv horizon, well rndd, ≈0.5" diam. Overall grain size incr w/depth to med-med crs sand. Grv fraction incr in Lith at ≈25' BGL.
5										
10										
20										
25									GM	27-32' GRAVELLY CLAYEY SAND: Grysh orange (10 YR 7/4) v fn to crs grained, poorly sorted, sbang to sbrndd, semi to uncons, moist. Grv content ≈10-15%, clay fraction ≈25-30%.
30									GC	32-37' GRAVELLY SANDY CLAY: As above w/color change to grysh orange (10 YR 7/4) to mod yelsh brn (10 YR 5/4). Grv fraction decr w/depth to ≈5%, clay fraction ≈50% incr w/depth to ≈75%, Grv fraction 0% at 37' BGL.
35									SC	37-44' SANDY CLAY: Grysh orange (10 YR 7/4) v fn to med fn grained, poorly sorted, semiconsol, sbang to sbrndd, moist. Sand fraction ≈20-25% & decr w/depth to 15-20% & bcm fn grained.
40									SM	44-45' CLAYEY SAND: Grysh orange (10 YR 7/4) to mod yelsh brn (10 YR 5/4). V fn to med fn grained, uncons, sbang to sbrndd, poorly sorted, moist.
45									SC	45-50' SANDY CLAY: Grysh orange (10 YR 7/4) to mod yelsh brn (10 YR 5/4) v fn to med grained, poorly sorted, sbang to sbrndd, semiconsol, moist. Sand fraction ≈20% incr w/depth to ≈30-35% at 48' BGL, then decr to ≈15% & bcm fn grained. Grv horizon at 47-49' BGL.

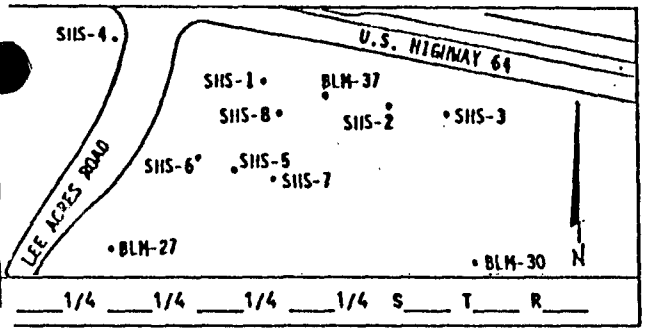
BOREHOLE LOG (SOIL)

(Continued)

LOCATION ID: SHS-4

TH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
50									ML	50-60' SHALE: Lt olv (10 Y 5/4) to dk gnsh yel (10 Y 6/6) v fn grained, consol, well sorted, sbrndd to rndd.
55										
60										
65										
70										
75										
80										
85										
90										
95										
100										
105										
110										

BOREHOLE LOG (SOIL)

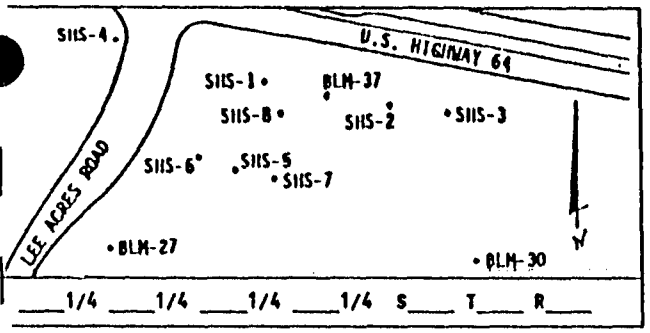


SITE ID: OFFSITE GIANT LOCATION ID: SHS-5
SITE COORDINATES (ft.):
N E
GROUND ELEVATION (ft. MSL):
STATE: NEW MEXICO COUNTY: SAN JUAN
DRILLING METHOD: HOLLOW STEM AUGER
DRILLING CONTR.: WESTERN TECHNOLOGIES INC.
DATE STARTED: 1/7/90 DATE COMPLETED: 1/8/90
FIELD REP.: LINLEY
COMMENTS:

LOCATION DESCRIPTION:

DEPTH	LITH.	REC	SAH	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0		100%	1	1	0	3'			SW	0-31' SAND: Grysh orange (10 YR 7/4), v fn to med fn sand, poorly sorted, uncons, sbang to sbrndd, abd rootlets. Cobbles at 10' BGL -up to 4" diam, sbrndd *1' thick at 13-14' BGL -at *18' BGL 6" thick lens of clayey silt -intbd Grv through depth up to 1" diam sbang to sbrndd.
		0%	2	2	3	8'				
5										
		4%	3	3	8	14'				
10										
		40%	4	4	14	18'				
		0%	5	5	18	23'				
20										
		75%	6	6	23	27'				
25										
		100%	7	7	27	33'				
30									SC	31-32' CLAYEY SILT: Mod yelsh brn (10 YR 5/4) v fn to fn med sorting uncons to semiconsol, sbang to sbrndd.
		100%	8	8	33	38'			SH	32-38' SILTY SAND: Grysh orange (10 YR 7/4), fn to med fn grained semi to uncons sbang to sbrndd, mod poorly sorted incr grain size w/depth to med sand.
35										
		30%	9	9	38	42'			SP	38-42' SAND: Pale yelsh orange (10 YR 8/6) fn to med crs, poorly sorted, uncons sbang to sbrndd, v moist.
40										
		20%	10	10	42	47'			SC	42-43' CLAYEY SILT: Pale yelsh brn (10 YR 6/2) v fn to fn, mod sorted, semiconsol, sbang to sbrndd, sat.
45										
		20%	11	11	47	52'			SW	43-58' SAND: Pale yelsh brn (10 YR 6/2) fn to med crs sand, poorly sorted, uncons, sbang to sbrndd, sat.
		10%	12	12	52	57'				

BOREHOLE LOG (SOIL)

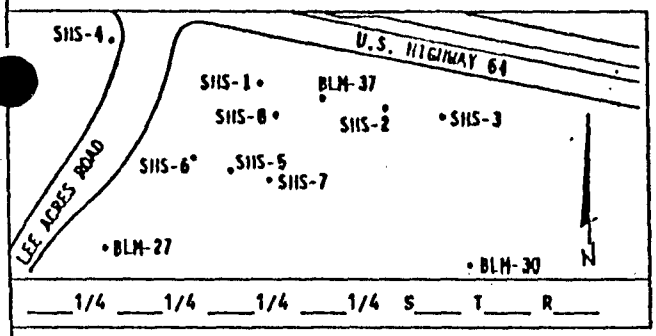


SITE ID: OFFSITE GIANT LOCATION ID: SHS-6
SITE COORDINATES (ft.):
N E
GROUND ELEVATION (ft. MSL):
STATE: NEW MEXICO COUNTY: SAN JUAN
DRILLING METHOD: HOLLOW STEM AUGER
DRILLING CONTR.: WESTERN TECHNOLOGIES INC.
DATE STARTED: 01/03/90 DATE COMPLETED: 01/03/90
FIELD REP.: LINLEY
COMMENTS:

LOCATION DESCRIPTION:

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0		75%	1	1	0	3'			SW	0-24' SAND: Dk yelsh orange (10 YR 6/6) med fn to med crs grained, sbang to sbrndd, uncons, poorly sorted minor rootlets, Grv fraction 1-3% up to 1.5" diam. Bcm med to fn grained w/depth, clay - silt fraction ≈15-20% intbd (cobbles @ ≈8' BGL) - at 20' BGL back to med crs to crs sand. 21' BGL cobbles - out by 22' BGL.
		50%	2	2	3	9'				
5										
		75%	3	3	9	17'				
10										
		40%	4	4	13	17'				
		40%	5	5	17	22'				
20										
		75%	6	6	22	26'				
25									SM	24-26' SANDY CLAY: Lt olv gry (5 Y 5/2) v fn grained, mod sorted, sbang to sbrndd, semiconsol, moist. Sand fraction ≈15% med fn grained - Grv layer just at contact of sand - clay interface (24') clasts up to 1.5-2" diam, sbrndd, at 24.5' BGL 0.5' sand lens med crs as above.
		80%	7	7	26	31'				
30										
		60%	8	8	31	36'			SW	26-45' SAND: Dusky yel (15 Y 6/4) to yellsh gry (5 Y 7/2) med crs sand, sbang to sbrndd, uncons, poorly sorted grading into med fn sand at 28' BGL. ≈3" silt layer at 27.5" BGL. At 34' BGL Grv lens ≈0.5-1.5" diam sbrndd 3-4" thick. Intbd of silty sands at 44' BGL cobbles 0.5" diam in sample. Sat at ≈37-38' BGL. No trace of HC in sampler - intbd Grv up to 2" diam sbang to sbrndd.
35										
		60%	9	9	36	41'				
40										
		40%	10	10	41	46'			SW	45-48.5' BEDROCK-SANDSTONE: Mod yel (5 Y 7/6) to dusky yel (5 Y 6/4), med to fn grained, consol, mod sorting sbang to sbrndd, intbd silty clays. TD 48.5 auger refusal.
45										
		20%	11	11	46	48'				
50										

BOREHOLE LOG (SOIL)



___1/4 ___1/4 ___1/4 ___1/4 S___ T___ R___

SITE ID: OFFSITE GIANT LOCATION ID: SHS-7
SITE COORDINATES (ft.):
N E
GROUND ELEVATION (ft. MSL):
STATE: NEW MEXICO COUNTY: SAN JUAN
DRILLING METHOD: HOLLOW STEM AUGER
DRILLING CONTR.: WESTERN TECHNOLOGIES INC.
DATE STARTED: 01/04/90 DATE COMPLETED: 01/06/90
FIELD REP.: LINLEY
COMMENTS:

LOCATION DESCRIPTION:

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0		100%	1	1	0	4'			SW	0-36' SAND: Dk yelsh orange (10 YR 6/6) fn to med fn grained, mod poorly sorted, uncons, sbang to sbrndd. Rootlets in upper 18", sand bcm more crs grained w/depth to a med to med crs grained, rootlets at 10-12' BGL, encountered cobbles at ≈16' BGL, cobbles at 26' GBL, med crs to crs sand, cobbles up to 5" diam, rootlets at 27' BGL. Grv up to 2.5" diam w/med crs sand at 30-35' BGL.
5		100%	2	2	4	9'				
10		50%	3	3	9	14'				
15		70%	4	4	14	18'				
20		0%	5	5	18	22'				
25		50%	6	6	22	27'				
30		60%	7	7	27	32'				
35		80%	8	8	32	37'				
40		30%	9	9	37	41'			SM	36-37' SAND SILT: Dk yelsh orange (10 YR 6/6) v fn to fn grained semiunconsol, sbang to sbrndd mod poorly sorted, clay fraction ≈15% sand fraction ≈30%, 37' BGL noted HC odor from drilling cuttings at 38' BGL noted (bottom of sampler) blk horizon w/HC odor noted H_2O at ≈42' BGL - cuttings have blk staining (?) w/HC odor. HC horizon _____.
45		40%	10	10	41	45'			SC	37-40' CLAYEY SAND: Grysh olv, v fn to med crs, poorly sorted, semi to uncons sbang to sbrndd, sat. HC odor.
50		50%	11	11	45	50'			SC	40-41' CLAYEY SILT: Grysh orange (10 YR 7/4) v fn to fn mod poorly sorted, semi to consol sbang to sbrndd, moist, no odor.

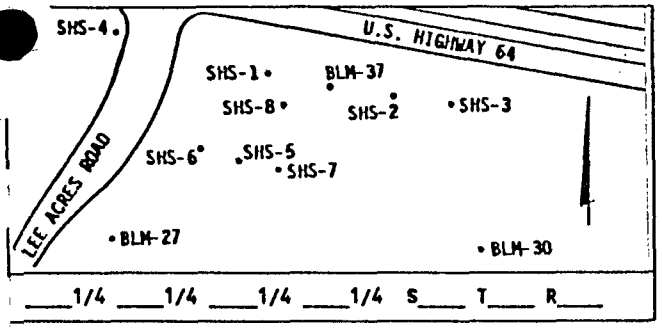
BOREHOLE LOG (SOIL)

(Continued)

LOCATION ID: SHS-7

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
50										41-54' SAND: Pale to lt olv (10Y 6/2-5/4) med crs, mod sorted uncons, sbang to sbrndd, v moist. No odor silt fraction ≈25% decr w/depth, noted dk HC stained horizon at ≈49' BGL ≈4 to 6" thick TD 54' BGL.
55										
60										
65										
70										
75										
80										
85										
90										
95										
100										
105										
110										
115										

BOREHOLE LOG (SOIL)



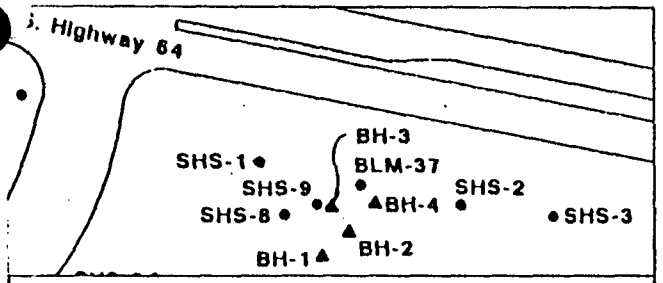
____1/4 ____1/4 ____1/4 ____1/4 S____ T____ R____

SITE ID: OFFSITE GIANT LOCATION ID: SHS-8
SITE COORDINATES (ft.):
N E
GROUND ELEVATION (ft. MSL):
STATE: NEW MEXICO COUNTY: SAN JUAN
DRILLING METHOD: HOLLOW STEM AUGER
DRILLING CONTR.: WESTERN TECHNOLOGIES INC.
DATE STARTED: 01/09/90 DATE COMPLETED: 01/09/90
FIELD REP.: LINLEY
COMMENTS:

LOCATION DESCRIPTION:

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0		60%	1	1	0	4'			SM	0-6' SANDY SILT: Dk yelsh orange (10 YR 6/6) v fn to fn grained uncons, mod sorted, sbang to sbrndd, rootlets.
5		80%	2	2	4	9'			SW	6-15' SAND: Mod yelsh brn (10 YR 5/4) fn to med crs, poorly sorted, uncons sbang to sbrndd, Grv at ≈8' BGL and ≈1' thick, up to 1-2" diam, sbrndd to sbang, rootlets.
10		70%	3	3	9	14'				
15		30%	4	4	14	19'			SM	15-17' SANDY SILT: Pale yelsh brn (10 YR 6/2) v fn to med fn grained, poorly sorted semi to uncons, sbang to sbrndd.
20		60%	5	5	19	24'			SW	17-37' SAND: Mod yelsh brn (10 YR 5/4) fn to med crs, poorly sorted, uncons, sbang to sbrndd, moist, at ≈37' BGL noted blk stain in cuttings w/HC odor.
25		50%	6	6	24	29'				
30		70%	7	7	29	34'				
35		100%	8	8	34	39'				
40		70%	9	9	39	41'			SM	37-39' SILTY SAND: Dk gnsh gry (5 GY 4/1) to grysh blk (N 2) (HC staining ?) v fn to med fn sand, semi to uncons, mod poorly sorted, sbang to sbrndd, v moist, HC odor w/staining, HNu = 120, LEL = 74%.
		0%	10	10	41	45'			SW	39-41' SAND: Dk gnsh gry (5 GY 4/1) fn to med grained, poorly sorted, uncons, sbang to sbrndd, sat.
45		10%	11	11	45	50'			SM	41-53' SANDY SILT: Gnsh gry (5 GY 6/1) v fn to fn grained, mod poorly sorted, semi to uncons, sbang to sbrndd, sat.
50		20%	12	12	50	53'				

BOREHOLE LOG (SOIL)



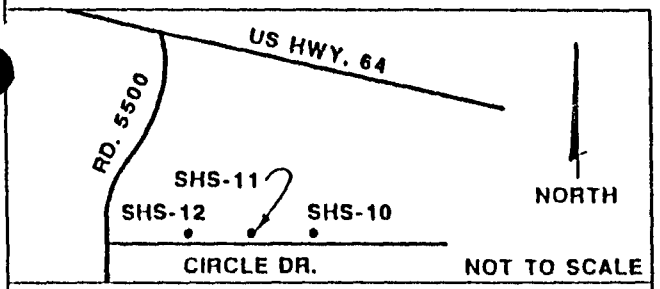
____1/4 ____1/4 ____1/4 ____1/4 S____ T____ R____

SITE ID: OFFSITE GIANT LOCATION ID: SHS-9
SITE COORDINATES (ft.):
N_____ E_____
GROUND ELEVATION (ft. MSL):
STATE: NEW MEXICO COUNTY: SAN JUAN
DRILLING METHOD: ROTARY (AIR)
DRILLING CONTR.: MOTE
DATE STARTED: 04/25/90 DATE COMPLETED: 04/25/90
FIELD REP.: MARTIN NEE, KYLE SUMMERS
COMMENTS:

LOCATION DESCRIPTION:

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0							0-5'			Backfill, dark yllsh brn 10 YR 4/2, sand-80%, clay-20%, v. fine to med sand, subang, unconsolidated.
5							5-10'			Sand, mod yllsh brn 10 YR 5/4, clay-5%, sand-v. fine-med crs, subang., uncons.
10							10-25'			Sand, mod yllsh brn 10 YR 5/4, v. fine - medium, subang.
15										
20										
25							25-38'			Sandy clay, mod yllsh brn 10 YR 5/4 to dark yllsh brn 10 YR 4/2, v. fine-medium sand 40%, clay-60%, uncons, subang.
30										
35										
40							38-45'			Sandy clay, mod olive brn 5 Y 4/4, v. fine sand-10% clay-90%, some cobbles at 42-43', uncons., subang.
45							45-50'			Claystone, med blsh gray 5 B 5/1 to mod brn 5 YR 3/4, inter bedded with F. rich clays dk yllsh orange 10 YR 66.
50										TD = 50'

LITHOLOGIC LOG (SOIL)



___1/4 SW 1/4 NW 1/4 NW 1/4 S 27 T 29N R 12W

SITE ID: OFFSITE GIANT LOCATION ID: SHS-10
SITE COORDINATES (ft.): 150' EAST of SHS-11
N 9748.99 E 11415.36
GROUND ELEVATION (ft. MSL): 5378.77
STATE: NM COUNTY: SAN JUAN
DRILLING METHOD: HOLLOW STEM AUGER
DRILLING CONTR.: WESTERN TECHNOLOGIES
DATE STARTED: 6/18/90 DATE COMPLETED: 6/20/90
FIELD REP.: KYLE SUMMERS
COMMENTS:

LOCATION DESCRIPTION:

Depth	Lith	Drilling Time Scale:	Sample Type and Interval	Org. Vap ppm	Lithologic Description / Remarks
			Soil headspace		
5			5-7'	0	0-10' Sand, Mod yelsh brn 10 YR 5/4, v fn to med crs mix, ang to sbang uncons, poorly sorted.
10			10-12'	0	10-15' Sand, Mod yelsh brn 10 YR 5/4 to dk yelsh orange 10 YR 6/6, v fn med grained, uncons, ang to sbang sand, poorly sorted.
15			15-17'	0	15-21' Sand, Mod yelsh brn 10 YR 5/4, v fn to med, uncons, ang to sbang sand, poorly sorted.
20			20-22'	0	22-22.5' Silty Sand, Mod olv brn 5 Y 4/4, Sltst-? -partially consol, some clay ≈10%, sli Cbls, poorly sorted, some grading.
25			22-24.5'	0	22.5-24.5' Silty Sand, Lt olv brn 5 Y 5/6, fn to v fn sand - 80%, some semi-consol silt Intvls which are tight drilling, poorly sorted, some graded bedding.
					24.5-30' Silty Sand, Lt olv brn 5 Y 5/6, silt to med sand, occ Grv <1% tight but not consol, silt well sorted, some grading.
30			30-32'	0	30-34.5' Sand, Mod yelsh brn, 10 YR 5/4, to grysh orange 10 YR 7/4, v fn sand 10%, fn to med - 80-90% Qtz sand, fairly well sorted, some grading.
35					34.5-35.5' Sand, Dk mod yelsh brn 10 YR 4/2 to lt olv brn 5 Y 5/6, clay 5% to med sand 90%, fairly well sorted, some grading.
			35.5-36.5'	140	35.5-36.5' Sand, Lt olv brn 5 Y 5/6, v fn sand to med sand, v fn ≈10%, fairly well sorted
40			36.5-38.5'	180	36.5-38.5' Clayey Sand, HC staining at 37' grysh blk, N2, to med gry, N5, v fn sand ≈20%, fn to med 70%, clay/silt ≈10%, sand is ang to sbang uncons clay layer at 38', fairly sorted, graded.
45					38.5-40' Sand, Lt olv brn 5 Y 5/6, v fn to med sand fairly drk uncons to semi consol, fairly well sorted, graded.
50			40-42'	40	40-42' Gravelly Sand, Lt olv brn 5 Y 5/6, to med dk gry, N 3, some Fe stains at 42' cobbles seem to be sbrndd ≈ Sst and Qtz, poorly sorted.
					42-45' Gravelly Sand, Dk yelsh orange 10 YR 6/6, lge Cbls, sand, poorly sorted.

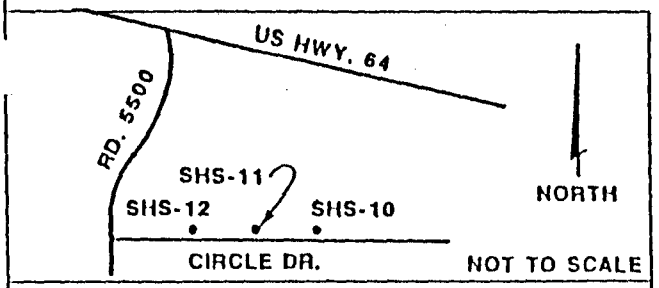
LITHOLOGIC LOG (SOIL)

(continued)

Location ID SHS-10

Depth	Lith	Drilling Time Scale:	Sample Type and Interval	Org. Vap ppm	Lithologic Description / Remarks
50					45-48' No sample - plug in auger stem.
					48' = TD
55					
60					
65					
70					
75					
80					
85					
90					
95					
100					
105					
110					
115					

LITHOLOGIC LOG (SOIL)



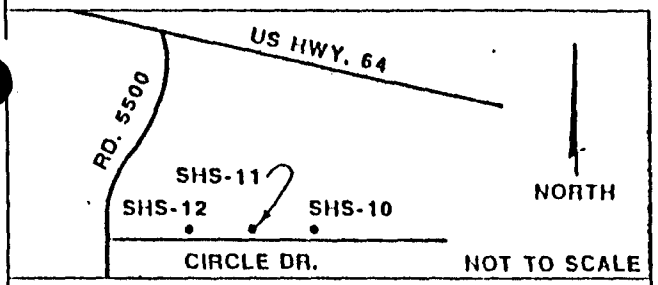
SITE ID: M&A OFFSITE LOCATION ID: SHS-11
SITE COORDINATES (ft.): 150' WEST OF SHS-10
N 9763.57 E 11358.35
GROUND ELEVATION (ft. MSL): 5378.36
STATE: NM COUNTY: SAN JUAN
DRILLING METHOD: HOLLOW STEM AUGER
DRILLING CONTR.: WESTERN TECH.
DATE STARTED: 6/20/90 DATE COMPLETED: 6/21/90
FIELD REP.: M. MOHORCICH
COMMENTS: T.D. AT 55', DRILLED FIRST W/ 7" AUGER THEN REAMED W/ 10".

1/4 SW 1/4 NW 1/4 NW 1/4 S 27 T 29N R 12W

LOCATION DESCRIPTION:

Depth	Lith	Drilling Time Scale:	Sample Type and Interval	Org. Vap ppm	Lithologic Description / Remarks
		1110	0-5'	0	0-5' Sand, mod yelsh brn 10 YR 4/2, med-crs, uncons.
5					5-32' Sand, yelsh brn 10 YR 5/4, abdt qtz, subrnd, uncons, med-crs grn
			Soil headspace		
10			10-12'	0	
15			15-17'	0	
20			20-22'		
25			25-27'	0	
30			30-32'	0	
					32-33' Cobbly sand, sand as above w/ minor cobbles.
35			35-37'	>30	33-41' Sand, olv gry 5 Y 3/2, med-crs grnd from 33-38' w/ noticed HC stain & odor at 36'. Noticably drker HC stain from 38'-40'; with lighter dusky yel grn 5 GY 5/2 from 40-41'. H_2O at 38-40'.
			37-39'	>30	
			39-41'	2	
40					41-43' Cobbly sand, lght olv gry 5 Y 5/2, saturated, well sorted, crs grn sand w/ few 1" size cobbles, uncons.
					43-45' Sand, lght olv gry 5 Y 5/2, saturated.
45					45-55' Cobbly sand, lght olv gry 5 Y 5/2, saturated same as above (SAA) w/ minor cobbles, uncons. Pulled out 7" bit & reamed w/ 10" flights.
50					T.D. at 55'

LITHOLOGIC LOG (SOIL)



1/4 SW 1/4 NW 1/4 NW 1/4 S 27 T 29N R 12W

SITE ID: OFFSITE GIANT M&A LOCATION ID: SHS-12
SITE COORDINATES (ft.): 150' WEST OF SHS-11
N 9778.01 E 11300.38
GROUND ELEVATION (ft. MSL): 5378.17
STATE: NM COUNTY: SAN JUAN
DRILLING METHOD: HOLLOW STEM AUGER
DRILLING CONTR.: WESTERN TECHNOLOGIES
DATE STARTED: 6/21/90 DATE COMPLETED: 6/22/90
FIELD REP.: M. MOHORCICH
COMMENTS: T.D. 55'

LOCATION DESCRIPTION:

Depth	Lith	Drilling Time Scale:	Sample Type and Interval	Org. Vap ppm	Lithologic Description / Remarks
			Soil headspace		0-15' Sand, lt olv brn 5 Y 5/6, med grain sand, sbrndd, prim uncons.
5					
10					
15					15-37' Sand, pale yellow orange 10 YR 8/6, med-coarse grain, uncons.
20					
25					
30					No split at 30-32', just pushing a rock w/spoon down through uncons sand. Lost sand downhole, cavity at ≈ 32'.
35			*35' HNU=0ppm	0	Sand seemed to get moist from 36-37' split.
					37-39' Gravelly, Clayey sand, 10 YR 8/6, med-coarse qtz sand, 37-37.4' few 1/2-1" Grvl & minor amt of Cly at 37.2". No H_2O yet, maybe a bit more moist than above at 35'.
40					39-43' Sand, dusky yel 5 Y 6/4, med-crs gr, uncons, split from 40-42 gave H_2O at 41'.
					43-43.8' Clayey Sand, dusky yel 5 Y 6/4, minor amt cly.
					43.8-45' Sand, dusky yel 5 Y 6/4, unconsol.
45					45-50' Cobbly Sand, SAA w/minor cobbles surfacing.
50					50-55' Sand, SAA.

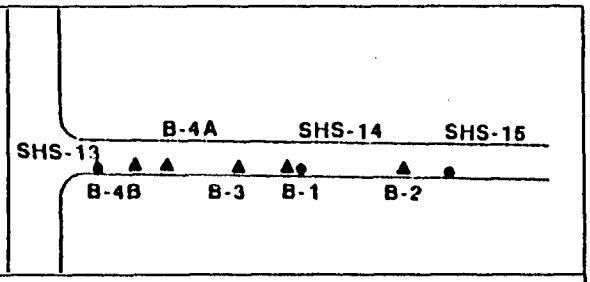
LITHOLOGIC LOG (SOIL)

(continued)

Location ID SHS-12

Depth	Lith	Drilling Time Scale:	Sample Type and Interval	Org. Vap ppm	Lithologic Description / Remarks
50					
55					T.D. 55' w/ 10" flights.
					Split 55-57' Sand, saa w/ cly zone from 56.6-57'.
60					
65					
70					
75					
80					
85					
90					
95					
100					
105					
110					
115					

BOREHOLE LOG (SOIL)



___1/4 SW 1/4 NW 1/4 NW 1/4 S 27 T 29N R 12W

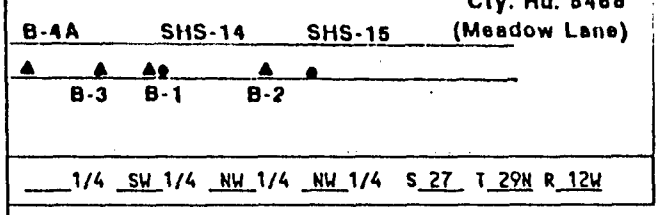
SITE ID: OFFSITE GIANT LOCATION ID: SHS-13 Cty Rd 5468
SITE COORDINATES (ft.):
N E
GROUND ELEVATION (ft. MSL):
STATE: NEW MEXICO COUNTY: SAN JUAN
DRILLING METHOD: AIR/WATER ROTARY
DRILLING CONTR.: MOTE
DATE STARTED: 08/22/90 DATE COMPLETED: 08/22/90
FIELD REP.: M. MOHORCICH
COMMENTS: 37' east of Lee Acres Rd., 7 3/8" bit

LOCATION DESCRIPTION: South of NM 64, East of County Road 5500, HNU bkground = .04 ppm

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0							Split Spoon 0-6	HNU bkg = .04 ppm	SM	Sand, mod yelsh brn 10YR 5/4, unconsolidated, moist, f-med gr w/ a few small cobbles ≈7.
5										
10							9-16	bkg	SW	Cobbly sand, small cobbles w/ sand as above.
15							16-21	bkg	SC	Clayey sand, increase in cly, minor amounts. w/ loss of cly at 21'.
20										
25							24-26	bkg	SM	Sand, moist, uconsolidatd 10 YR 4/2, fn-med grn.
30							30-32		SW	Cobbly sand, cobbles at 30-32, 1/2-2".
							32-40		SM	Sand, 10 YR 4/2, unconsolidated, poorly sorted.
35										
40							40-50		SW	Cobbly sand, small cobbles, rig chattered down through 50'.
									SM	Sand, T.D. 58' w/ cave in of ≈10' to 48'.
45										Comment: HNU readings were taken from bore done w/ hollowstem split spoon ≈5' east of SHS-13.
50										

BOREHOLE LOG (SOIL)

SITE ID: OFFSITE GIANT LOCATION ID: SHS-14, Cty, Rd, 5468
SITE COORDINATES (ft.): 250' E of LEE ACRES RD.
N E
GROUND ELEVATION (ft. MSL):
STATE: NEW MEXICO COUNTY: SAN JUAN
DRILLING METHOD: HOLLOW STEM AUGER
DRILLING CONTR.: WESTERN TECH INC.
DATE STARTED: 08/16/90 DATE COMPLETED: 08/17/90
FIELD REP.: M. MOHORCICH
COMMENTS: South side of row, time 1400
HNU background = .02 ppm

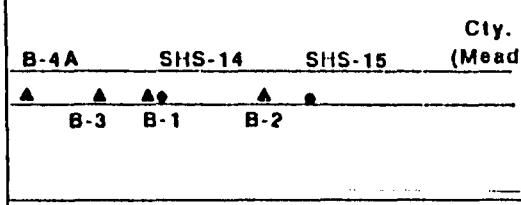


1/4 SW 1/4 NW 1/4 NW 1/4 S 27 T 29N R 12W

LOCATION DESCRIPTION: South of NM 64, East of County Road 5500

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0							Split Spoon 0-4	HNU bkg = .02 ppm	SM	Sand, mod yelsh brn 10 YR 5/4, poorly sorted, med gr, moist at 3' minor cobbles.
5							4-9	bkg	SM	drk yelsh brn 10 YR 4/2, f gr moist, poorly sorted unconsolidated.
10							9-14	bkg	SM	10 YR 4/2, slily moist, med gr incr in qtz gr, poorly sorted.
15							14-19	bkg	SC	Cobbly sand, same as above w/cobbles at 16-17, no odor or stain.
20							19-24	bkg	SM	Sand, same as above w/out cobbles, moist.
25							24-29	bkg		Sand, same as above
30							29-34	25		29-33, same as above. 34 HC stain, soil came up & gave borehole HNU of 25 ppm olv gry 5YR 3/2.
35							34-39	174		34-39, blk soil & H2O table. Open borehole of 12 ppm.
40							39-44	250	SM	Sand, olv gry 5Y 3/2. Stained & odor med gr sat sand.
45							44-49			Same as above, med gr sat.
50							49-54			Cobbly sand Felt & drilled like cobbles. Same as above w/ 2" cobbles. TD at 54'

BOREHOLE LOG (SOIL)



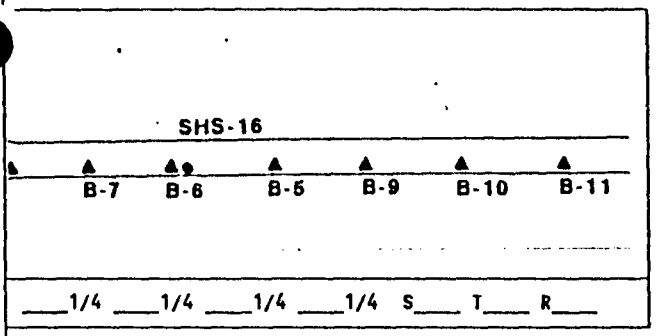
SITE ID: OFFSITE GIANT LOCATION ID: SHS-15, Cty Rd 5468
SITE COORDINATES (ft.):
N E
GROUND ELEVATION (ft. MSL):
STATE: NEW MEXICO COUNTY: SAN JUAN
DRILLING METHOD: HOLLOW STEM AUGER
DRILLING CONTR.: WESTERN TECH INC.
DATE STARTED: 08/18/90 DATE COMPLETED: 08/19/90
FIELD REP.: M. MOHORCICH
COMMENTS: T.D. 48.7, HNU background = .04 ppm

1/4 SW 1/4 NW 1/4 NW 1/4 S 27 T 29N R 12W

LOCATION DESCRIPTION: South of NM 64, East of County Road 5500, 400' east of Lee Acre Rd, 150' east of SHS-14

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0							Split Spoon 0-7	HNU bkg = .04 ppm	SM	Sand, vry f gr, grysh or 10 YR 7/4 dry. At 7' color changes to mod yelsh brn 10 YR 5/4, f gr, moist, unconsolidated.
5										
10							9'	.04		
15							14-16	.08	SW	Cobbly sand, at 10'-12' cobbles in sand as above, cobbles up to 2".
20							19-21	.04	SM	Sand, 12-19, change back to or 10 YR 7/4. 19-33 dusky yel 5Y 6/4. f-med gr, dry unconsolidated, poorly sorted.
25							24-26	.04		
30							33-35	.08		33-35 sand as above, H_2O at 35'.
35										35-48.7 no cuttings due to slow speed of drilling but drilled like sand.
40										
45										
50										T.D. at 48.7'

BOREHOLE LOG (SOIL)



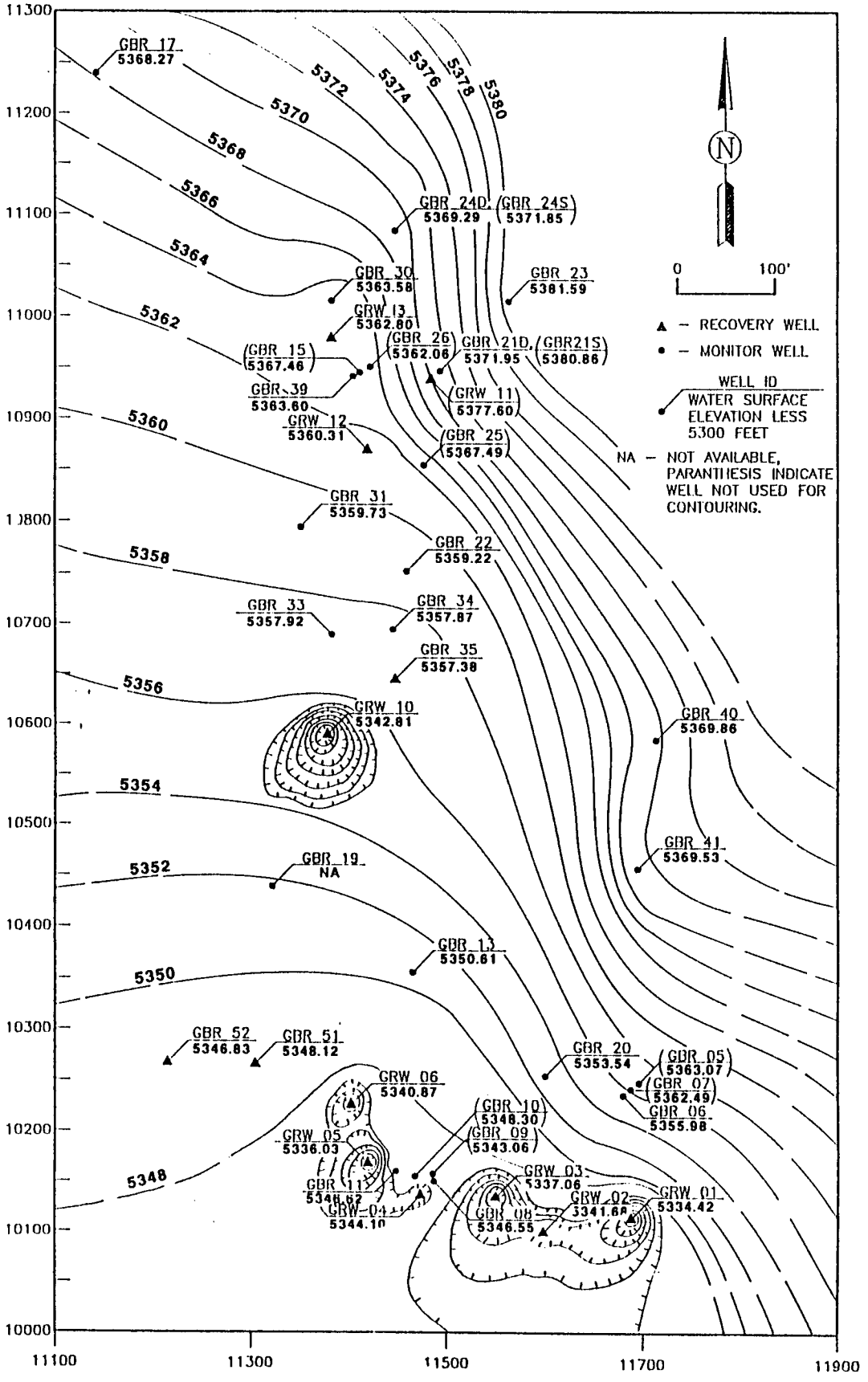
___1/4 ___1/4 ___1/4 ___1/4 S___ T___ R___

SITE ID: OFFSITE GIANT LOCATION ID: SHS-16, Cty Rd 5470
SITE COORDINATES (ft.): 200' EAST OF LEE ACRES ROAD ROW
N_____ E_____
GROUND ELEVATION (ft. MSL):_____
STATE: NEW MEXICO COUNTY: SAN JUAN
DRILLING METHOD: AIR/H_2O ROTARY
DRILLING CONTR.: MOTE
DATE STARTED: 08/21/90 DATE COMPLETED: 08/21/90
FIELD REP.: M. MOHORCICH
COMMENTS: Drilled 10' east of bore 6 at NE corner of woodsided shed. T.D. 50'

LOCATION DESCRIPTION: South of NM 64, East of County Road 5500, HNU Bkg = .04 ppm

DEPTH	LITH.	REC	SAM	RUN #	RUN FROM	RUN TO	SAMPLE I.D.	SAMPLE TYPE	USCS	VISUAL CLASSIFICATION
0							Split Spoon 0-9	HNU bkg = .04 ppm	SM	Sand, f-med gr, dusky yel 5Y 6/4, unconsolidated, slily moist, poorly sorted.
5										Color change to drk yelsh brn 10 YR 4/2 at 12-16.
10										
15							14-16	1.6		
20							19-21	1		
25							24-26	1.6	SC	Clayey sand, 24-29, clayey sand, drk yelsh brn 10 YR 4/2, sandy clay balls coming to surface.
30							29-31	1.4	SM	Sand, split 29-31 - med gr, dusky yel 5Y 6/4, poorly sorted w/ H_2O at 30'.
35									SW	Cobbly sand, 35-40, med gr, 1/2-1" cobbles.
40									SM	Sand, 40-50' med gr sand, dusky yel, 5Y 6/4, poorly sorted. T.D. at 50'
45										Comment: HNU readings were taken at Bore 6-5' east of SHS-16 w/ hollow stem auger split spoon.
50										

Figure #5



December 1990

Water Surface Contour Map Giant--Bloomfield Refinery

Air Stripper

Although the air stripper is designed to strip dissolved volatile hydrocarbon from the influent water to levels within government effluent standards, all water is air stripped twice before discharge to the aquifer. Double air stripping provides a greater degree of certainty as to the quality of effluent discharged.

Following are details of the air stripper:

Manufacturer	Oil Recovery Systems Environmental Equipment 4 Mill Street Greenville, New Hampshire 03048 (603) 878-2500 1-800-228-2310
Size	24" OD x 22'6" Vertical
Material	Fiberglass
Rated Water Capacity	60 GPM
Rated Air Capacity	1,000 scfm
Packing type	Jaeger Tri-Pac
Packing size and height	3' of 3" and 16' of 1"
Packing volume	3" $10ft^3$ 1" $50ft^3$

Connections

Air Inlet	5" SLIP
Water Outlet	3" FNPT
Sight Glass	1" 150 RF
Water Inlet	2" FNPT
Level Switch	1" FNPT - two
Manometer	1/4" FNPT
Drain	1/4" FNPT

Blower

Manufacturer	New York Blower Company (219) 362-1531 La Porte, IN c/o Viking Sales Company, Inc. P. O. Box 80065 Albuquerque, New Mexico 87198 (505) 268-8939
Model Number	Compact GI fan Shop #: D-5453-100 Size 146
Motor Information	2 HP 1750 RPM 230/VAC/3/60 TEFC motor Nema frame size 145T 1.0 Service Factor

Figure #6 is the air capacity table for the blower. The cross shaft of the blower requires lubrication on a monthly basis. Use a grease suitable for bearing lubrication.

Figure #6

BELT-DRIVE CAPACITY TABLES

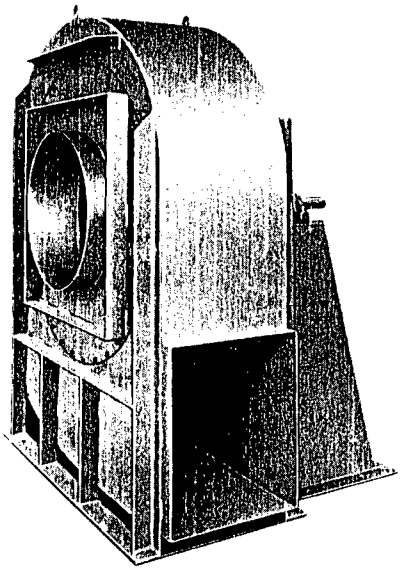
Wheel diameter: 12" Inlet: 8" OD Outlet area: .255 sq. ft.

CFM	OV	¼"SP		½"SP		¾"SP		1"SP		2"SP		3"SP		4"SP		5"SP		6"SP		7"SP		8"SP		9"SP		10"SP	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
153	600	606	0.04	817	0.06	987	0.08	1135	0.10	1595	0.19	1952	0.30	2256	0.41	2521	0.52	2764	0.65	2987	0.78	3191	0.91	3388	1.05	3573	1.20
255	1000	703	0.05	890	0.08	1043	0.10	1177	0.12	1616	0.23	1962	0.34	2258	0.47	2522	0.60	2763	0.73	2980	0.88	3190	1.03	3382	1.18	3564	1.34
357	1400	820	0.07	990	0.10	1130	0.13	1254	0.16	1663	0.28	1993	0.40	2280	0.54	2538	0.68	2771	0.83	2989	0.98	3191	1.14	3383	1.31	3562	1.48
459	1800	949	0.11	1105	0.14	1237	0.18	1352	0.21	1736	0.34	2049	0.48	2324	0.63	2573	0.78	2797	0.94	3013	1.11	3211	1.28	3393	1.45	3575	1.64
561	2200	1086	0.15	1229	0.19	1352	0.23	1461	0.27	1824	0.42	2122	0.57	2386	0.73	2624	0.90	2843	1.07	3047	1.25	3241	1.43	3425	1.63	3598	1.82
663	2600	1229	0.21	1360	0.26	1476	0.30	1580	0.35	1925	0.52	2212	0.69	2463	0.87	2694	1.05	2903	1.23	3101	1.42	3289	1.62	3467	1.82	3636	2.03
765	3000	1376	0.29	1497	0.34	1605	0.39	1704	0.44	2034	0.63	2311	0.83	2554	1.02	2775	1.22	2979	1.42	3168	1.62	3349	1.83	3525	2.05	3689	2.27
867	3400	1529	0.39	1638	0.44	1737	0.50	1832	0.56	2149	0.77	2415	0.98	2650	1.19	2864	1.41	3060	1.62	3247	1.85	3424	2.07	3589	2.30	3749	2.53
969	3800	1683	0.50	1782	0.57	1875	0.63	1966	0.69	2272	0.93	2526	1.16	2753	1.39	2960	1.63	3154	1.86	3332	2.10	3505	2.34	3668	2.59	3822	2.83
1071	4200	1839	0.65	1930	0.71	2018	0.78	2101	0.85	2395	1.11	2644	1.37	2863	1.62	3065	1.87	3254	2.13	3428	2.39	3595	2.64	3752	2.90	3907	3.17
1173	4600	1996	0.81	2083	0.89	2162	0.96	2242	1.03	2520	1.32	2762	1.60	2975	1.87	3173	2.15	3355	2.42	3527	2.70	3691	2.98	3844	3.25	3994	3.54
1275	5000	2157	1.01	2234	1.09	2310	1.17	2383	1.25	2650	1.56	2886	1.86	3097	2.16	3287	2.46	3463	2.75	3636	3.06	3793	3.35	3941	3.64		
1377	5400	2317	1.24	2388	1.33	2462	1.41	2530	1.49	2784	1.83	3014	2.16	3214	2.47	3403	2.80	3578	3.12	3739	3.43	3900	3.76				

Wheel diameter: 14" Inlet: 8" OD Outlet area: .293 sq. ft.

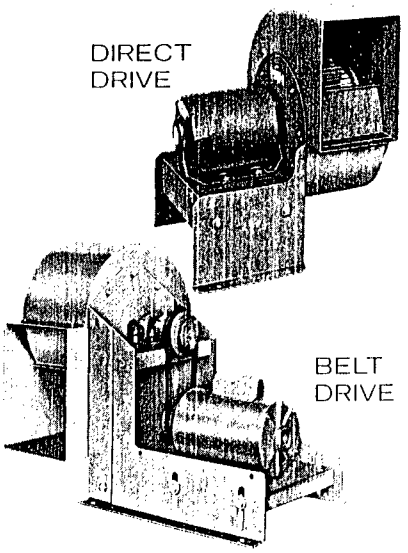
CFM	OV	¼"SP		½"SP		¾"SP		1"SP		2"SP		3"SP		4"SP		5"SP		6"SP		7"SP		8"SP		9"SP		10"SP	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
176	600	499	0.03	667	0.05	803	0.07	922	0.09	1298	0.17	1590	0.26	1837	0.36	2056	0.47	2254	0.58	2435	0.69	2603	0.81	2760	0.94	2911	1.07
293	1000	594	0.05	738	0.07	857	0.10	964	0.12	1313	0.22	1595	0.32	1837	0.43	2052	0.55	2247	0.68	2425	0.81	2593	0.94	2753	1.08	2903	1.23
410	1400	706	0.08	836	0.11	945	0.14	1040	0.17	1361	0.28	1624	0.40	1856	0.53	2061	0.66	2252	0.80	2429	0.94	2596	1.09	2751	1.25	2898	1.40
527	1800	826	0.12	946	0.16	1047	0.19	1137	0.23	1433	0.37	1679	0.50	1897	0.65	2095	0.80	2278	0.95	2447	1.10	2607	1.27	2762	1.44	2903	1.61
645	2200	952	0.18	1063	0.22	1157	0.26	1242	0.31	1522	0.47	1753	0.63	1961	0.80	2147	0.96	2323	1.13	2483	1.30	2640	1.48	2786	1.66	2928	1.85
762	2600	1083	0.25	1185	0.31	1274	0.36	1354	0.41	1621	0.60	1842	0.78	2037	0.97	2216	1.15	2384	1.34	2540	1.54	2686	1.73	2828	1.93	2964	2.13
879	3000	1218	0.35	1311	0.41	1395	0.47	1470	0.53	1725	0.74	1938	0.96	2125	1.17	2297	1.38	2457	1.59	2605	1.80	2750	2.02	2885	2.23	3016	2.45
996	3400	1356	0.48	1439	0.54	1517	0.61	1589	0.67	1837	0.92	2041	1.16	2221	1.40	2385	1.63	2538	1.86	2683	2.10	2823	2.34	2952	2.57	3077	2.81
1113	3800	1496	0.63	1573	0.71	1644	0.78	1714	0.85	1948	1.12	2147	1.39	2322	1.65	2481	1.91	2629	2.17	2769	2.43	2904	2.70	3030	2.95	3152	3.22
1231	4200	1638	0.82	1708	0.90	1775	0.98	1839	1.06	2067	1.36	2259	1.66	2427	1.95	2582	2.24	2727	2.52	2864	2.81	2992	3.09	3116	3.38	3233	3.66
1348	4600	1781	1.05	1845	1.13	1908	1.22	1967	1.30	2186	1.63	2372	1.96	2538	2.28	2687	2.59	2829	2.91	2961	3.22	3087	3.53	3206	3.84	3321	4.15
1465	5000	1925	1.31	1983	1.40	2042	1.49	2098	1.58	2307	1.95	2488	2.30	2648	2.65	2794	2.99	2934	3.34	3062	3.67	3184	4.01	3301	4.34		
1582	5400	2069	1.62	2125	1.72	2178	1.81	2232	1.91	2430	2.30	2606	2.68	2764	3.07	2908	3.44	3041	3.80	3170	4.18	3284	4.52	3400	4.89		

BHP shown does not include belt drive losses. Performance shown is for Compact GI Fans with inlet and outlet ducts.



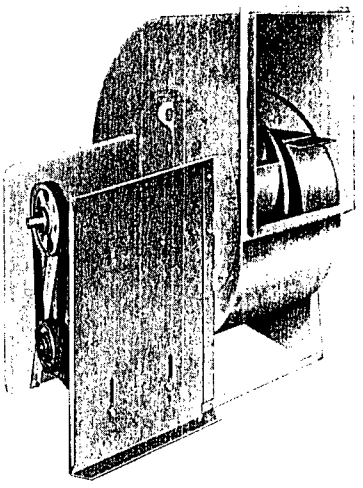
SERIES 20 GI FANS

The Series 20 GI Line extends radial-blade design performance beyond the Compact GI range to 76,000 CFM and 22"SP. Arrangement 10 packaged units are available to about 10,000 CFM and 15"SP.



JUNIOR FANS

Compact packages available in direct- or belt-drive arrangements. Forward-curve wheel design provides slow speed, quiet operation. Capacities to 4600 CFM and static pressures to 2½" WG. Heat fan available to 450°F.



GPA FANS

Available with airfoil or single-thickness, backwardly inclined wheels which provide efficient, quiet, packaged fans for capacities to 15,500 CFM and static pressures to 3"WG. Available with weather cover for outdoor mounting.

Refer to separate bulletin on each product line.

TANK 102

Tank 102 acts as an intermediate storage tank for the water treatment system. It has a capacity of 500 barrels or 21,000 gallons. The tank stores water before it is pumped to the air stripper for treatment. Separation of any free phase hydrocarbon from the recovered water takes place in the tank. Free product is periodically skimmed from the tank and stored in a separate vessel. See Figure #8. Since the air stripper operates most efficiently within a specific range of water flow rates (30-60 GPM), and, since the recovery wells are not capable of continuous rates in this range, water is accumulated and periodically pumped from Tank 102 to the Air Stripper at a rate of 30-60 GPM. Piping and instrumentation associated with Tank 102 is illustrated by Figure #7. Water is pumped from Tank 102 to the Air Stripper by Pump #1, P1. The operation of Pump #1 and Pump #2 is based on the level of water in Tank 102. Level switches LS-1 and LS-2 are utilized by the Control Panel, located in the old Dispatch Office, to determine the water level and consequently the run status of Pump #1. The function of the Control Panel is described elsewhere in this manual. When the water level in the tank reaches the setpoint of LS-1, Pump #1 starts. When the tank is pumped down to the set point of LS-2, Pump #1 stops. Level safety switches LSH-1 and LSL-1 indicate abnormally high or low water level conditions in Tank 102 and initiate control panel alarm and shutdown functions.

Control Valve 9, CV-9, is located in the Tank 102 building. It serves to isolate the air stripper from Tank 102. CV-9 closes any time that Pump #1 is not operating. To prevent freezing of the Air Stripper influent line during the winter, CV-12, located in the Tank 101 building, automatically drains the Air Stripper water influent line between CV-9 and the Air Stripper into Tank 101 whenever Pump #1 is off. The Air Stripper line will not drain if Tank 102 is not isolated from the stripper influent line by CV-9.

Meter #1 serves to indicate the Tank 102 effluent rate. By utilizing the globe valve downstream of the meter, the processing rate for the whole system can be adjusted. The suggested rate is 40 to 60 GPM. The Tank 102 influent volume is controlled by the control panel discussed in the Control Panel section of this manual.

There is a level control LC-2, located in Tank 101 which automatically maintains the maximum water pumping rate from Pump #1 by partially closing CV-9 as the water level in Tank 101 rises to the setpoint of LC-1.

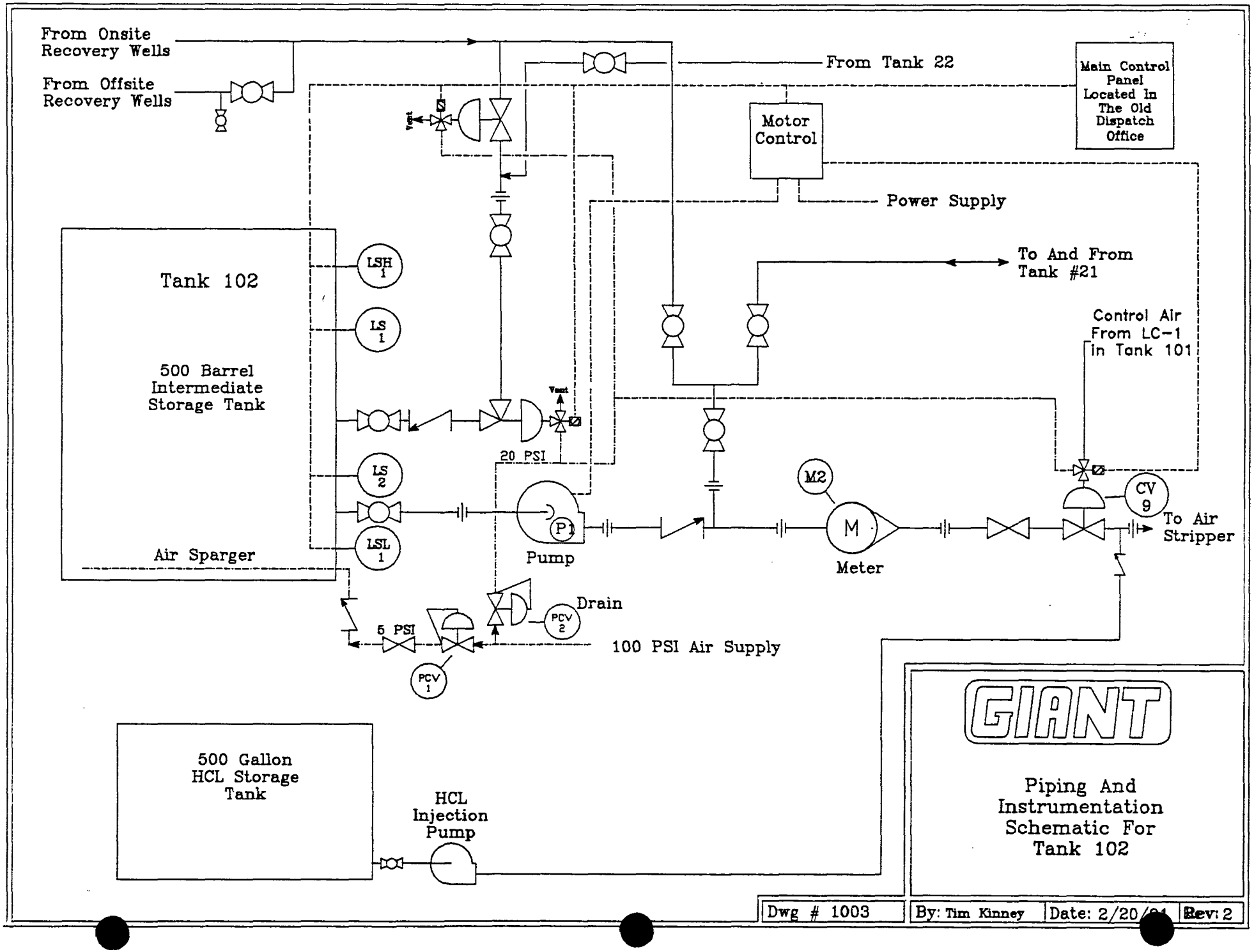
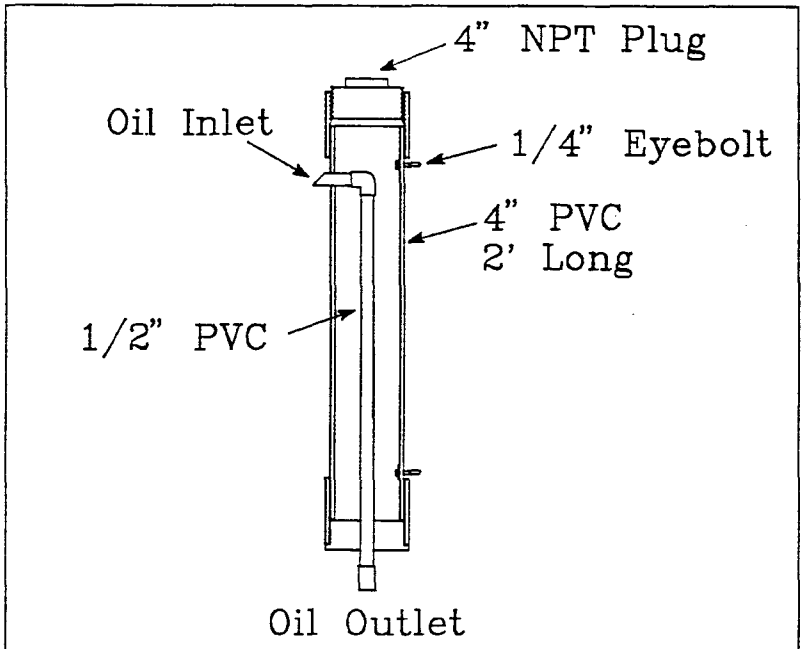
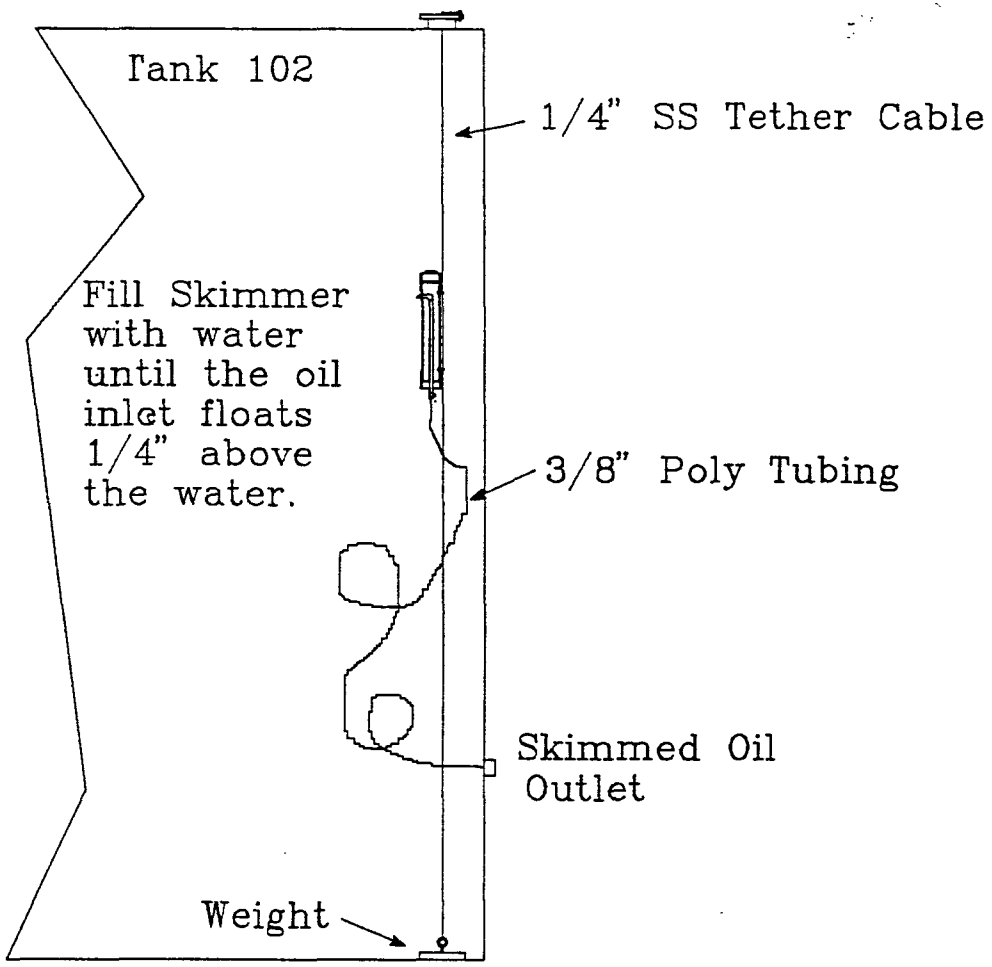

From Onsite Recovery Wells
From Offsite Recovery Wells
From Tank 22
Main Control Panel Located In The Old Dispatch Office
Motor Control
Power Supply
To And From Tank #21
Control Air From LC-1 In Tank 101
Tank 102
500 Barrel Intermediate Storage Tank
LSH 1
LS 1
LS 2
LSL 1
Air Sparger
Vent
20 PSI
P1
Pump
M2
M
Meter
CV 9
To Air Stripper
Drain
PCV 2
5 PSI
PCV 1
100 PSI Air Supply
500 Gallon HCL Storage Tank
HCL Injection Pump
GIANT
Piping And Instrumentation Schematic For Tank 102
Dwg # 1003
By: Tim Kinney
Date: 2/20/91
Rev: 2

Figure #7



Oil Skimmer Detail



GIANT

Floating Continous
Oil Skimmer
For Tank 102

Dwg #053	By: Jim Kinney	Date: 3/12/91	Rev: 0

Figure #8

TANK 101

Tank 101 serves as the Air Stripper transfer pump run tank. It is a 400 gallon vertical fiberglass tank. The tank is entirely housed within a building known as the Tank 101 Building. Plate #1 indicates the location of the building. Tank 101 serves to accumulate the de-aerate water prior to feeding it to the Air Stripper transfer pump. See Figure #9. The Air Stripper Transfer Pump is designated as P2 in Figure #9. It will be described as Pump #2 in this manual. Also housed in the Tank 101 Building are several valves associated with the batch processing of water. They will be described in the Control Panel section of the manual. The operation of CV-12 is discussed in the Tank 102 section of the manual. Meter #3, M3, indicates the twice-stripped effluent volume from the remediation system. Figure #10 illustrates the physical layout of the Tank 101 Building. There is a level control, LC-1, located in Tank 101 which controls the maximum pumping rate of Pump #2 by partially closing CV-10 when the water level in Tank 101 drops to the setpoint of LC-2.

ACID INJECTION

To prevent scale deposition in piping, pumps, and valves downstream of the Air Stripper, a small quantity of 28% HCL is injected in the Tank 102 effluent stream. A 500 gallon HCL storage tank is located adjacent to Tank 102. An acid injection pump is located in the Tank 102 Building. The pump operates any time that Pump #1 is operating. Approximately 2 gallons of HCL are injected for every 10,000 gallons of water processed.

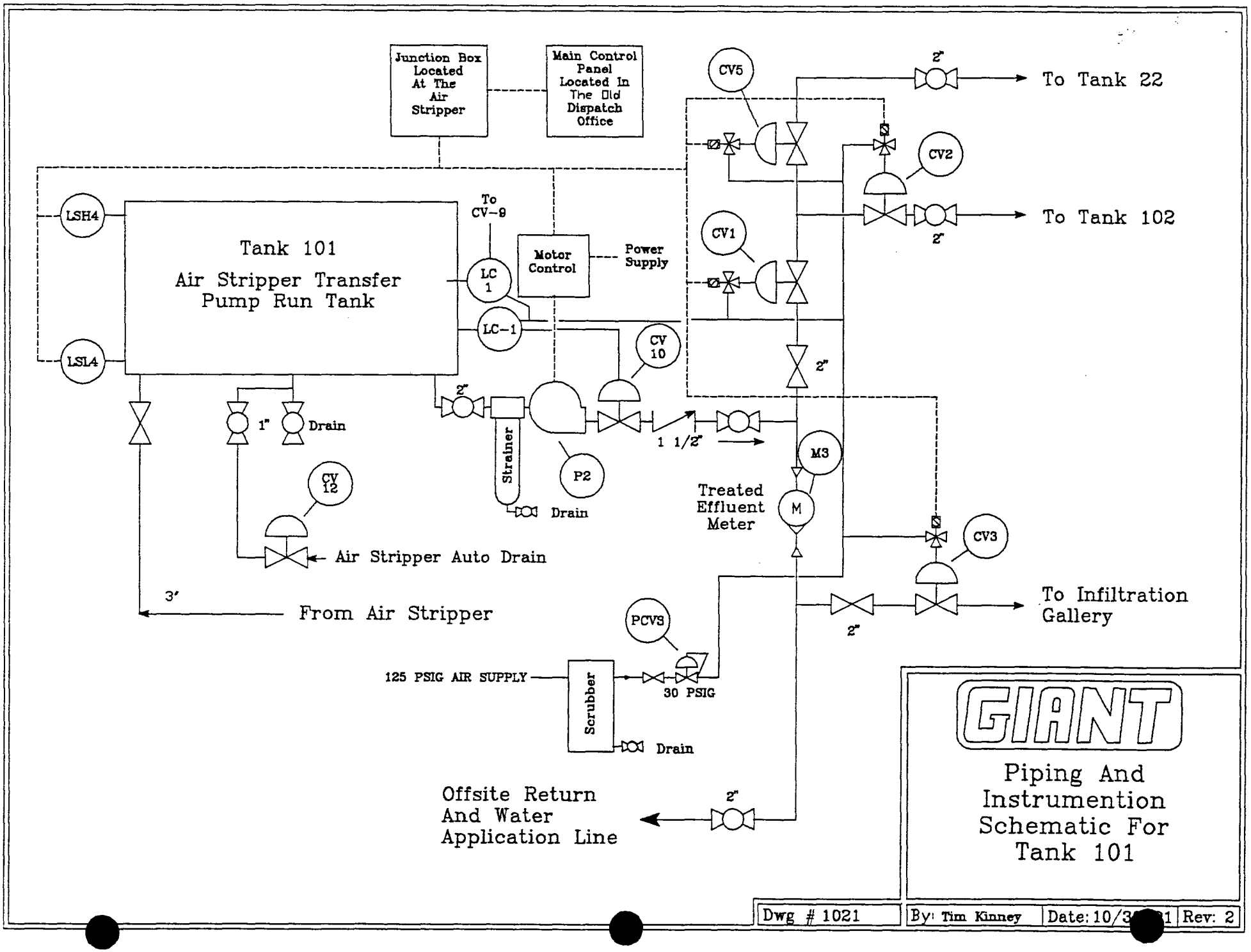
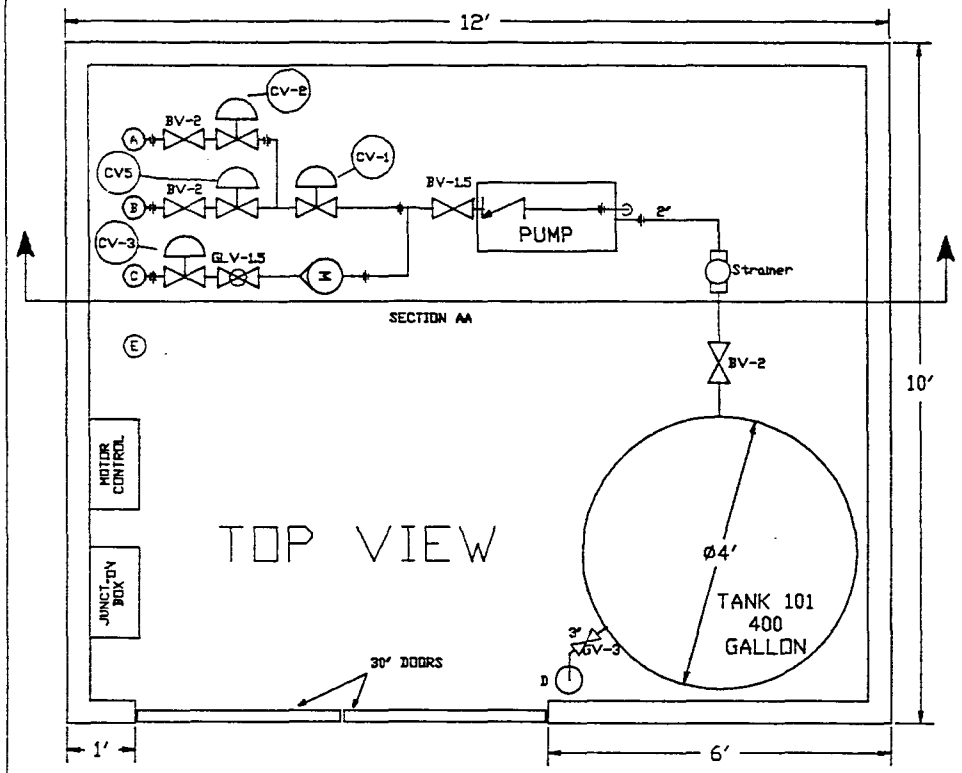

Junction Box Located At The Air Stripper
Main Control Panel Located In The Old Dispatch Office
CV5
2"
To Tank 22
CV2
To Tank 102
2"
CV1
LSH4
LSL4
Tank 101
Air Stripper Transfer Pump Run Tank
To CV-9
LC 1
LC-1
Motor Control
Power Supply
CV 10
2"
1" Drain
2"
Strainer
P2
Drain
1 1/2"
M3
Treated Effluent Meter
M
CV 12
Air Stripper Auto Drain
CV3
3'
From Air Stripper
To Infiltration Gallery
2"
PCV3
125 PSIG AIR SUPPLY
Scrubber
30 PSIG
Drain
Offsite Return And Water Application Line
2"
GIANT
Piping And Instrumention Schematic For Tank 101
Dwg # 1021
By: Tim Kinney
Date: 10/3
Rev: 2

Figure #9



A - To Tank 102

B - To Tank 22

C - To Infiltration Gallery

D - From Air Stripper

E - Conduit Entrance

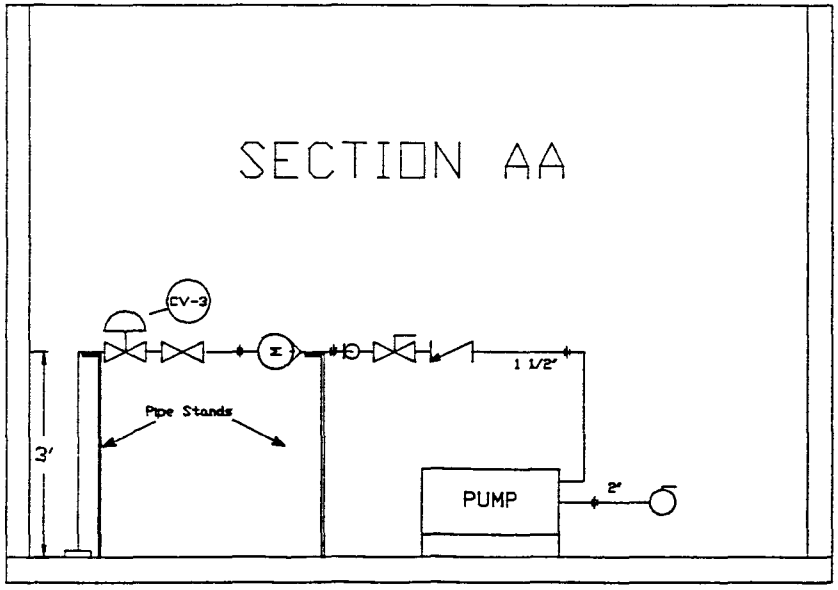
GIANT

Tank 101
Building Layout

DWG# 1022	Date: 2/21/91

Rev: 1

NOTE:
- PUMP DISCHARGE PIPING TO BE 1 1/2" SCH 80 PVC
  PUMP SUCTION PIPING TO 2" SCH 80 PVC
  TANK INLET PIPING TO BE 3" SCH 80 PVC
- BV-1.5 IS A 1.5" BRONZE BALL VALVE
- GLV-1.5 IS A 1.5" BRONZE GLOBE VALVE
- GV-3 IS A 3" BRONZE GATE VALVE



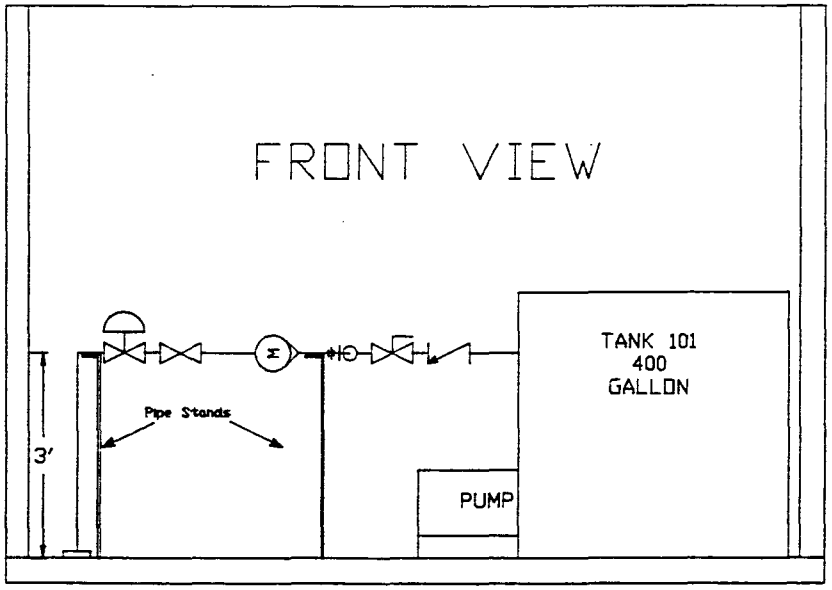


Figure #10

TANK 21

Tank 21 is located in the central part of the refinery. See Plate #1. The tank serves as the collection point for untreated recovery water. See Figure #11 for a schematic of the valves and controls located at Tank 21. Pump #3, referred to as P3 in Figure #11, serves to transfer water out of Tank 21 during Mode 1. Operational modes are described in the Control Panel section of this manual. Control valve CV-8 closes while Pump #3 is operating. This prevents pumped water from looping around the pump. When Pump #3 is off, CV-8 opens allowing water to enter or exit the tank based on the current operational mode. The opening and closing of this valve corresponds with the run status of Pump #3 and is not directly controlled by the Control Panel. There is a high level alarm switch, LSH-3, located at Tank 21. See the Control Panel portion of the manual for an explanation of its function. As a part of normal operation, Tank 21 may operate at very low water levels. Therefore, there is not a low level safety switch in the tank. A low level switch, LS-7 is located in Tank 21. The electrical contacts of the level switch are wired in series with the Pump #3 motor control circuit. The Pump #3 control circuit originates at the Control Panel. In the event of low water level in the tank, Pump #3 will not start even though the Control Panel may be calling for it to run as a normal function of the current operational mode. This feature prevents Pump #3 from running dry when Tank 21 exhibits a low water level. The pump will go back to normal automatic run status when sufficient water is present. There is an elevated level limiting trap and siphon break at Tank 21. This device prevents any accumulated scum or hydrocarbon from exiting the tank into the system as the water level is drawn down close to the outlet level. For this reason, there will always be a least 3-4 feet of water in the tank. See Figure #11 for a detail of the siphon break.

RAINBOW SPRINGS

In the vicinity of the Refinery Burn Pit there is an underground water collection gallery. See Plate #1. It drains into a covered agricultural stock tank. The gallery and tank are referred to as Rainbow Springs. During the spring, summer, and fall, contaminated water accumulates in the tank. Approximately once a week, water must be pumped from the tank into the water treatment system. There is a pump for this purpose located in the GBR-6/GRW-9 well enclosure. Water from Rainbow Springs is metered into the system through the GRW-9 water meter. Emptying the Rainbow Springs tank is a manual operation which requires monitoring. Care should be taken to prevent the tank from running dry in the course of monitoring and draining. During the winter, operation of Rainbow Springs is terminated by capping the end of the gallery's effluent pipe which protrudes from the side of the hill above the tank.

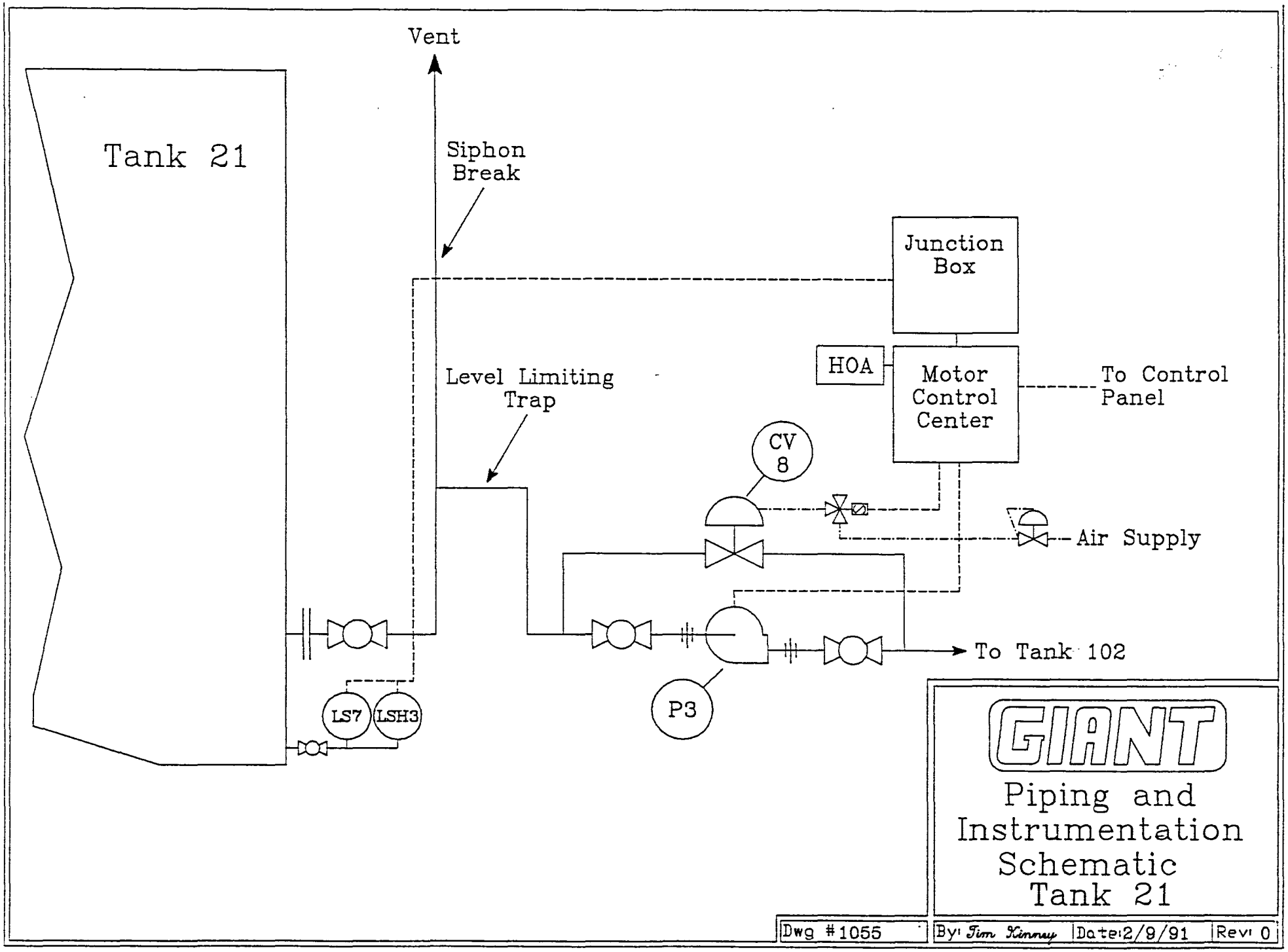

Vent
Tank 21
Siphon Break
Junction Box
HOA
Motor Control Center
To Control Panel
Level Limiting Trap
CV 8
Air Supply
To Tank 102
LS7
LSH3
P3
GIANT
Piping and Instrumentation Schematic Tank 21
Dwg #1055
By: Tim Kinney
Date: 2/9/91
Rev: 0

Figure #11

TANK 22

Tank 22 is located in the central part of the refinery. See Plate #1. The tank serves as the collection point for water which has been air stripped for the first time. See Figure #12 for a schematic of the valves and controls located at Tank 22. Pump #4, located at Tank 22 and referred to as P4 in Figure #12, serves to transfer water out of Tank 22 during Mode 3. Operational modes are described in the Control Panel section of this manual. Control valve CV-7 closes while Pump #4 is operating and opens during Mode 1 when water is being transferred into the tank. The opening and closing of this valve correspond with the run status of Pump #4 and are not directly controlled by the Control Panel. There is a high level alarm switch, LSH-2, and a low level alarm switch, LSL-2, located in Tank 22. See the Control Panel portion of the manual for an explanation of their function. Level switches LS-5 and LS-6 are located in the tank. As noted in the Control Panel section of this manual, these switches serve to indicate operational tank levels. The Control Panel monitors these switches to determine the correct operational mode for the batch processing system.

AIR COMPRESSOR

The Air Compressor is an integral part of the remediation system. It is located in the Dispatch Office. The compressor pumps air for the operation of control valves and air sparging in various tanks. Without compressed air the system will not function. PSL-2 is located on the air compressor. It monitors the system air pressure. If the air pressure in the system drops below 50 psig an alarm is annunciated by the Control Panel. Weekly, the oil level in the compressor should be checked and oil added as required. Monthly, the compressor oil should be changed and the motor lubricated as required. Several times a week, accumulated water should be drained from the compressor tank. The air compressor valves should be examined in accordance with the manufacturer's instructions every 90 days.

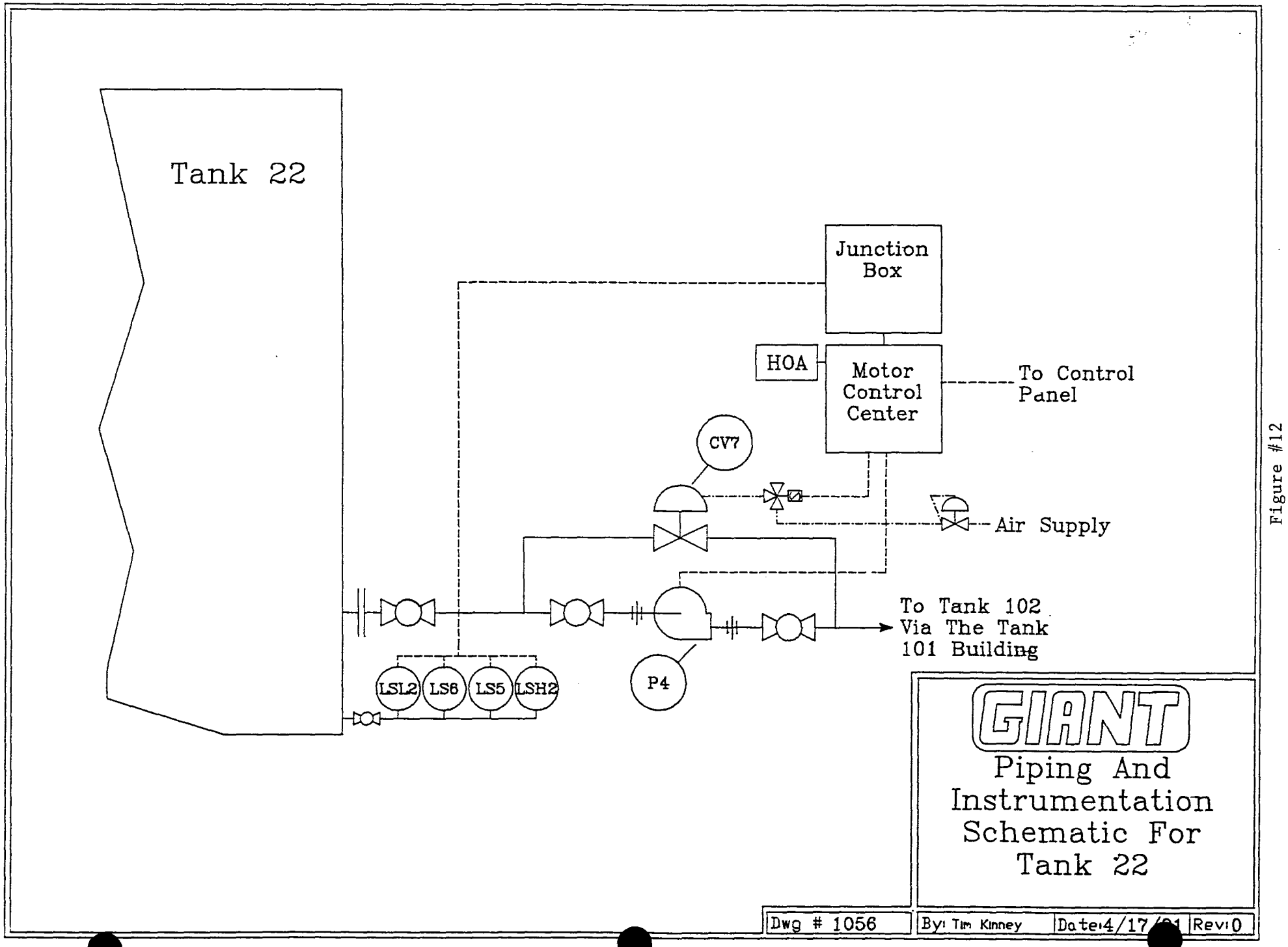

Tank 22
Junction Box
HOA
Motor Control Center
To Control Panel
CV7
Air Supply
To Tank 102 Via The Tank 101 Building
LSL2
LS6
LS5
LSH2
P4
GIANT
Piping And Instrumentation Schematic For Tank 22
Dwg # 1056
By: Tim Kinney
Date: 4/17/01
Rev: 0

Figure #12

CONTROL PANEL

As noted in the Air Stripper section of this manual, all water is air stripped twice before discharged to the aquifer. Since there is only one air stripper, this necessitates that the water be treated in batches. The heart of the batch water processing system is the microprocessor based Control Panel located in the Dispatch Office in the refinery. See Plate #1 for the location of the Dispatch Office. The Control Panel serves to monitor and control the operation of the batch processing system, while providing alarm and shutdown functions to safeguard against spills and other undesirable events. Figure #13 illustrates the basic process flow scheme of the batch processing system. There are three modes of operation which occur during the water treatment process before clean effluent water is discharged. Operational modes are described in the following paragraphs.

In the first mode, Mode 1, untreated water from the Recovery Wells and untreated water stored in Tank 21 during modes 2 & 3, enters Tank 102. From Tank 102 the water is pumped to the Air Stripper. The Air Stripper effluent flows to Tank 101 and is subsequently pumped by Pump #2, P2, to Tank 22. Mode 1 accomplishes the first air stripping of the contaminated water and stores this water in Tank 22 for use in Mode 3. Mode 1 continues until Tank 22 is full, as indicated by level switch LS-5.

Once the microprocessor Control Panel detects that Tank 22 is full of once air stripped water, Mode 2 commences. Level switch LS-5 indicates to the control panel that Tank 22 is full. In Mode 2, water is discharged from Tank 102, through the Air Stripper, into Tank 101 and back to Tank 102 in a continuous loop. This operation continues for 8 hours. The purpose of recirculating water is to insure that all water contained in Tank 102 is air stripped at least twice prior to the start of clean effluent discharge, which occurs in Mode 3. Recovered water is pumped directly from the Recovery Wells to Tank 21 during Mode 2.

At the end of the 8 hours of Mode 2, Mode 3 automatically commences. Recovered water undergoes its final air stripping in Mode 3. During Mode 3, once stripped water, stored in Tank 22, is pumped into Tank 102, pumped through the Air Stripper, flows into Tank 101, and is discharged through the effluent meter into either an infiltration gallery or the controlled water application system as determined by manual valve switching. Recovered water is pumped directly to Tank 21 during Mode 3.

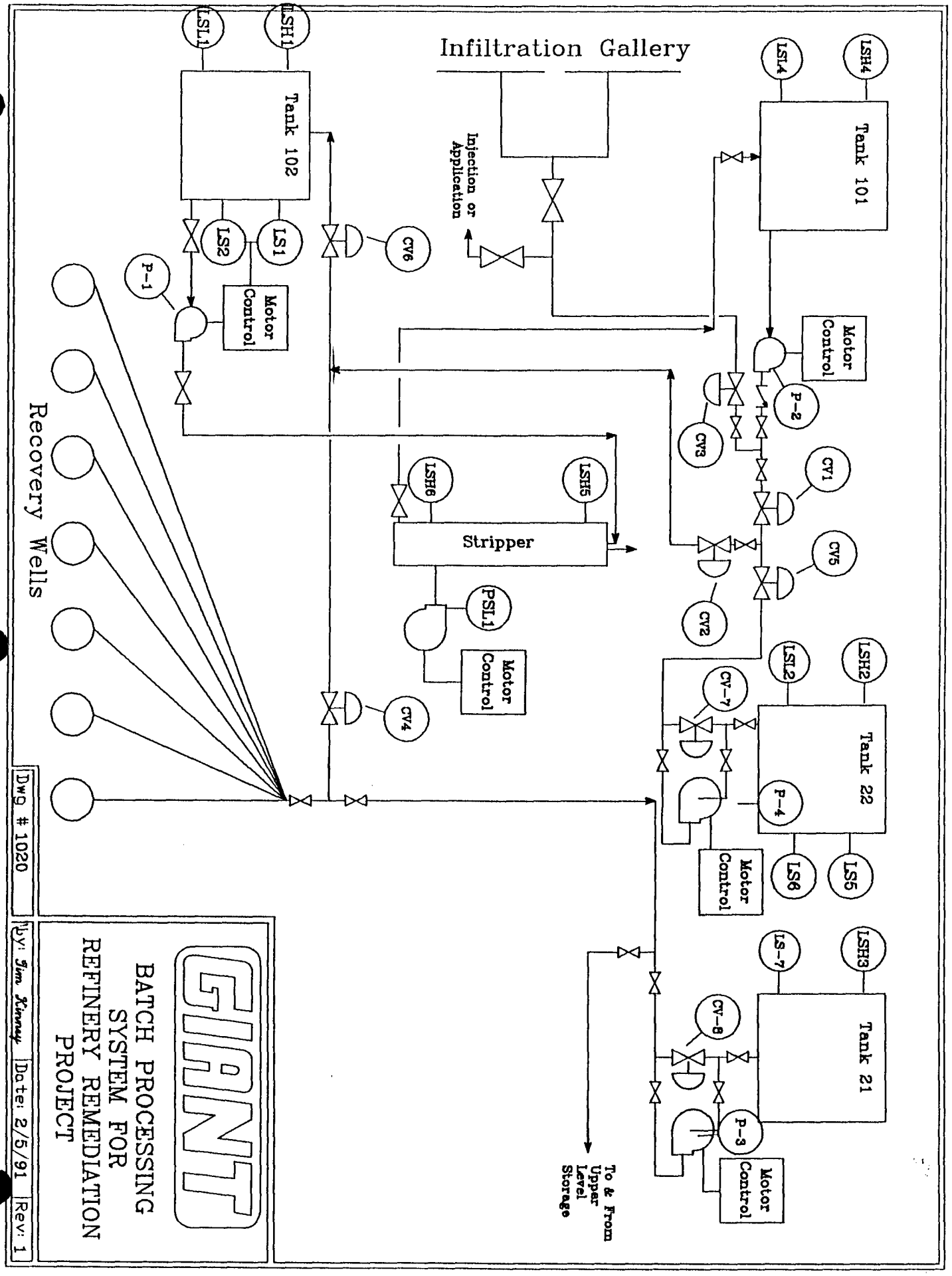

Infiltration Gallery
Injection or Application
Tank 101
Tank 102
Tank 22
Tank 21
Stripper
Recovery Wells
Motor Control
LSH1
LSL1
LSH2
LSL2
LSH3
LS-7
LSH4
LSL4
LSH5
LSH6
LS1
LS2
LS5
LS6
P-1
P-2
P-3
P-4
CV1
CV2
CV3
CV4
CV5
CV6
CV-7
CV-8
PSL1
To & From Upper Level Storage
GIANT
BATCH PROCESSING SYSTEM FOR REFINERY REMEDIATION PROJECT
Dwg # 1020
By: Jim Kinney
Date: 2/5/91
Rev: 1

Figure #13

Safety, alarm and shutdown functions are also initiated by the Control Panel. Tanks 101, 102, 21 & 22, and the air stripper are monitored for undesirable water levels. See Figure #13 for the safety device nomenclature for each piece of equipment. A low pressure switch monitors the Air Stripper blower status. Figure #14 identifies and locates the devices noted in Figure #13. Figure #15 provides a brief operational description of the batch processing system and an abbreviated valve function matrix.

Excessively cold ambient conditions reduce the efficiency of the Air Stripper. A temperature switch, TSL-1, located on the exterior of the Dispatch Office, monitors the ambient air temperature. The switch is set at 15-25 degrees Fahrenheit. When the ambient temperature drops below the preset limit, the panel interrupts the batch processing sequence and initiates a low temperature delay. A yellow light on the face of the control panel indicates that a low temperature delay is in progress. During the interruption, the recovery wells are diverted to Tank 21. The system returns to its original status when the ambient temperature returns to levels above the setpoint. If a delay occurs continuously for several days in a row, the water level in Tank 21 should be carefully monitored. Since water from the recovery wells continues to accumulate in Tank 21 during low temperature delays, a high water level alarm in Tank 21 will shut down the entire system including the power to the On-Site Recovery Wells if the delay lasts long enough. Each well house is electrically heated to prevent freezing. If power to the wells is interrupted by a shutdown, the on-site recovery well system may freeze. When the water level approaches the upper limits of Tank 21, the recovery wells should be shut down and the well house heaters left on until ambient temperatures allow the system to process sufficient water to reduce the water level in Tank 21 to operable levels. Off-Site wells have separate circuits for heating and pumping, and although the Control Panel may shut off the pumps, heat to the well houses will remain on unless a power failure occurs.

Figure #16 illustrates the layout of the face of the Control Panel. The green status indication lights across the first three rows of the panel display the condition of key individual devices within the system. A burning light indicates that the device is on or open. The two rows of red lights below the green lights indicate alarm conditions within the system. The lone yellow light indicates that a low temperature delay is in progress. The panel annunciates the first alarm condition which occurs by flashing the corresponding red light. Subsequent alarm conditions that may occur are indicated by a steady red light. This first out flashing light feature allows the operator to determine the cause of malfunctions with greater ease. Alarm conditions initiate shut-down of devices as indicated by Figure #14.

Once the undesirable condition within the system is corrected, the system can be restarted by pressing the manual reset button on the face of the control panel. The system will not automatically restart after an alarm. Alarms cannot be cleared from the panel before the actual condition is corrected. The manual reset button on the face of the panel will only clear alarm indications if the actual condition is corrected.

In the event of a power failure, the system will shut down. It will return to normal operation after the power is restored. The system will return to the operational mode in progress prior to the power failure. No manual reset is required after a power failure.

A red emergency shutdown palm button is located on the face of the panel Depressing this button shuts down the system. To restart after an emergency shutdown, pull the red palm button out. All the red lights should be flashing. Depress the manual reset button. All alarms will clear and the system will return to its pre-shutdown status unless uncorrected alarm conditions exist.

Operational timing sequences related to the operation of the Air Stripper blower are also initiated by the Control Panel. Whenever Pump #1 starts, there is a one minute delay before the Air Stripper Blower starts. The delay prevents the Air Stripped Water Effluent line from becoming blocked by air from the blower discharge prior to water entering the line. When Pump #1 is turned off, the blower continues to operate for five minutes. This feature insures that untreated water still falling through the column is air stripped before exiting.

Six hand, off, automatic (HOA) selector switches are located on the face of the Control Panel. Figure #16 illustrates their location and function. The devices referenced can be manually turned on, off, or left to the control of the microprocessor. Normally, the switches should be left in the automatic position.

Figure #17 and Figure #18 illustrate the set points of various level switches.

The system operational logic is based on the program which is installed in the microprocessor within the Control Panel. The program listing follows.

Safety Device Function Matrix

DWG# 1050

Safety Device and Location	Description, Location, and Status of Equipment																	
	Pump #1 Tank 102	Pump #2 Tank 101	Pump #3 Tank 21	Pump #4 Tank 22	Recovery Wells	Air Stripper	CV-1 Tank 101	CV-2 Tank 101	CV-3 Tank 101	CV-4 Tank 102	CV-5 Tank 101	CV-6 Tank 102	CV-7 Tank 22	CV-8 Tank 21	HCL Pump Tank 102	CV-9 Tank 102	CV-10 Tank 101	CV-12 Tank 101
LSL-1 Tank 102	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		O
LSH-1 Tank 102	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		O
LSL-2 Tank 22	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		O
LSH-2 Tank 22	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		O
LSH-3 Tank 21	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		O
LSL-4 Tank 101	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		O
LSH-4 Tank 101	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		O
LSH-5 Stripper	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		O
LSH-6 Stripper	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		O
PSL-1 Stripper	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		O
LS-7 Tank 21			X															

X – Device is shutdown or closed O – Device is on or open Blank – Device operating normally

Figure #14

There are three operational modes in the batch processing sequence. In the first mode, water from the recovery wells as well as water from tank 21 is being air stripped and stored in tank 22. In the second mode, water from the recovery wells is being stored in tank 21 while water remaining in tank 102 is being processed for 8 hours in a continous loop prior to the start of mode three. This insures that the remaining untreated water in tank 102 is processed at least twice prior to discharge.
In the third mode, water from the recovery wells is being stored in tank 21 while water from tank 21 is being air stripped for the second time and pumped into the infiltration gallery.

Drawing #1020 illustrates the basic process flow, including the valve and switch numbers noted in the following description of the process sequence, for each mode.

During mode 1, water from the recovery wells and tank 21 is being air stripped and pumped into tank 22. Valves CV1, CV4, CV5, and CV6 are open and valves CV2, and CV3 are closed during mode 1. When tank 22 is full of once stripped water, as indicated by LS5 (level switch 5), mode 2 is initiated.

The purpose of mode 2 is to prevent untreated water contained in tank 102 from entering the infiltration gallery after being air stripped only once. To accomplish this, the water contained in tank 102 is processed in a continous loop for 8 hours prior to the start of mode 3. At the end of the 24 hour time period, mode 3 commences. During mode 2, CV1, CV2, and CV6 are open, CV3, CV4, and CV5 are closed.

During mode 3, water from the recovery wells is diverted to tank 21 while water from tank 22 is air stripped for the second time prior to injection into the infiltration gallery. When tank 22 is empty, as indicated by LS6, mode 1 is initiated and the sequence is started again. During mode 3 CV1, and CV4 are closed and CV2, CV3, CV5, and CV6 are open.

Pump operation at tank 101 and 102 as well as the stripper operation are based on water levels, regardless of the operational mode.

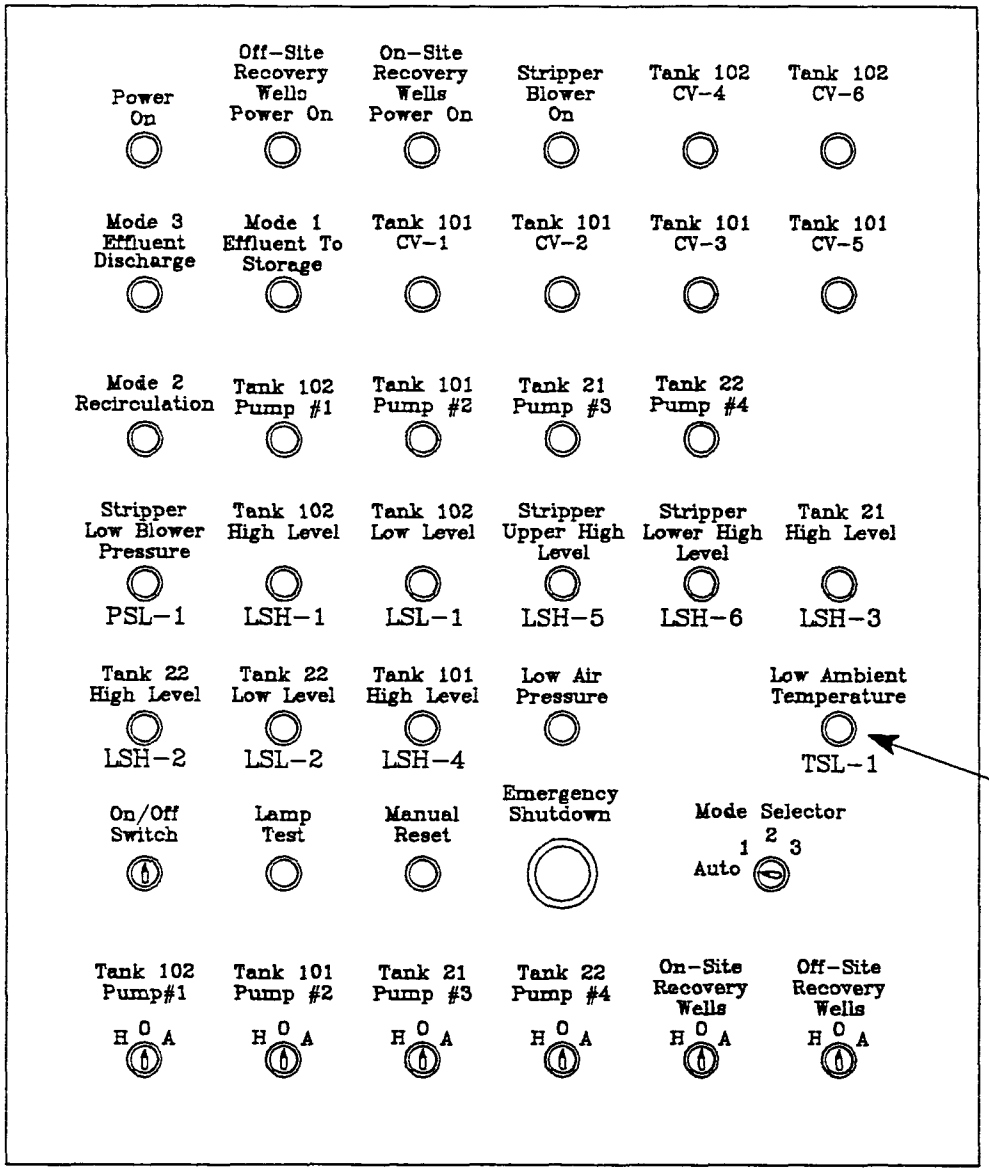
Valve Status			
	Mode 1	Mode 2	Mode 3
CV-1	Open	Open	Closed
CV-2	Closed	Open	Open
CV-3	Closed	Closed	Open
CV-4	Open	Closed	Closed
CV-5	Open	Closed	Open
CV-6	Open	Open	Open

GIANT

Batch Processing System Operational Sequence

Dwg # 1028	By: Tim Kinney	Date: 2/21/91	Rev: 1

Figure #15



GIANT

Control Panel Face Layout

Dwg # 1054	By: Tim Kinney	Date: 3/26/91	Rev:0

Figure #16

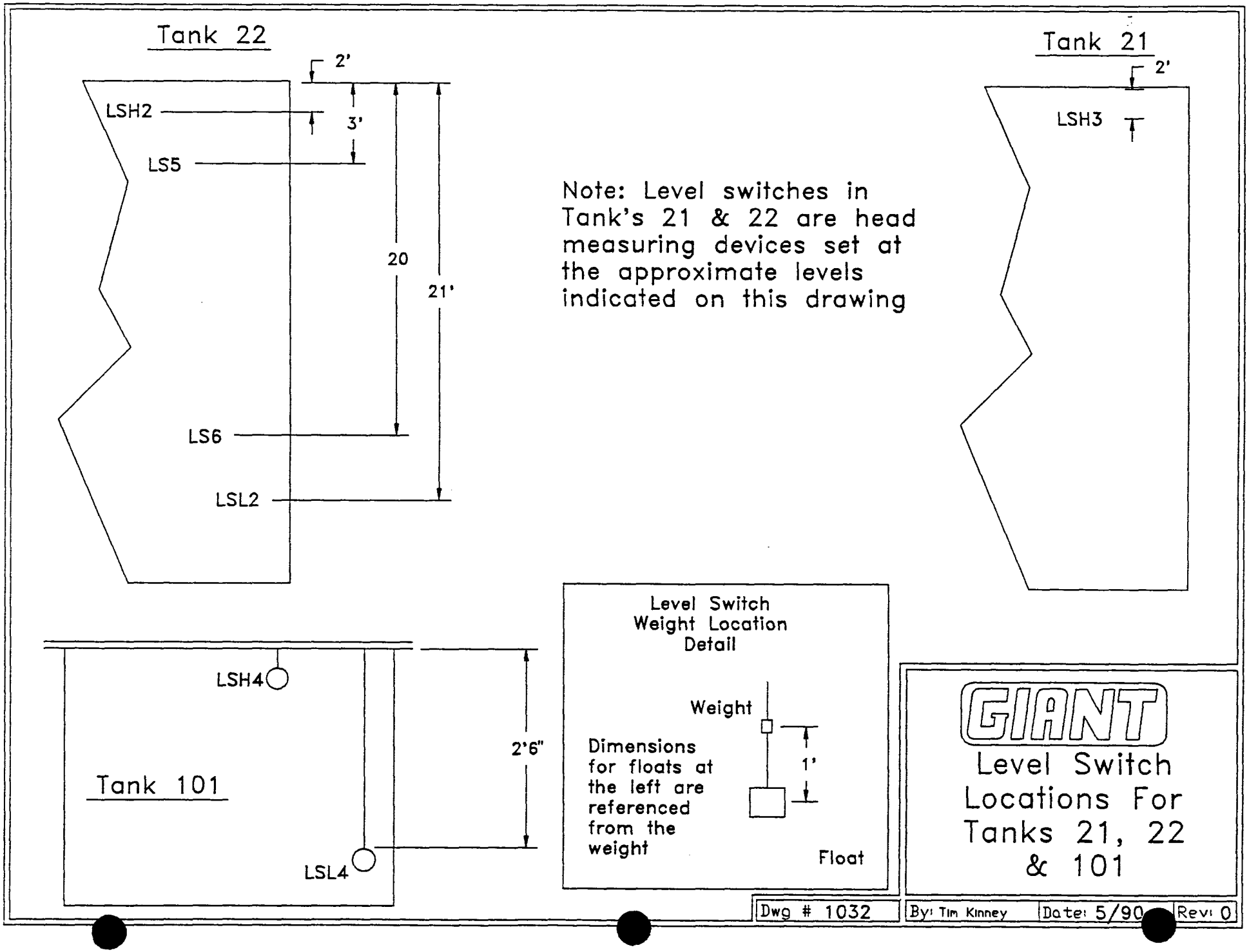
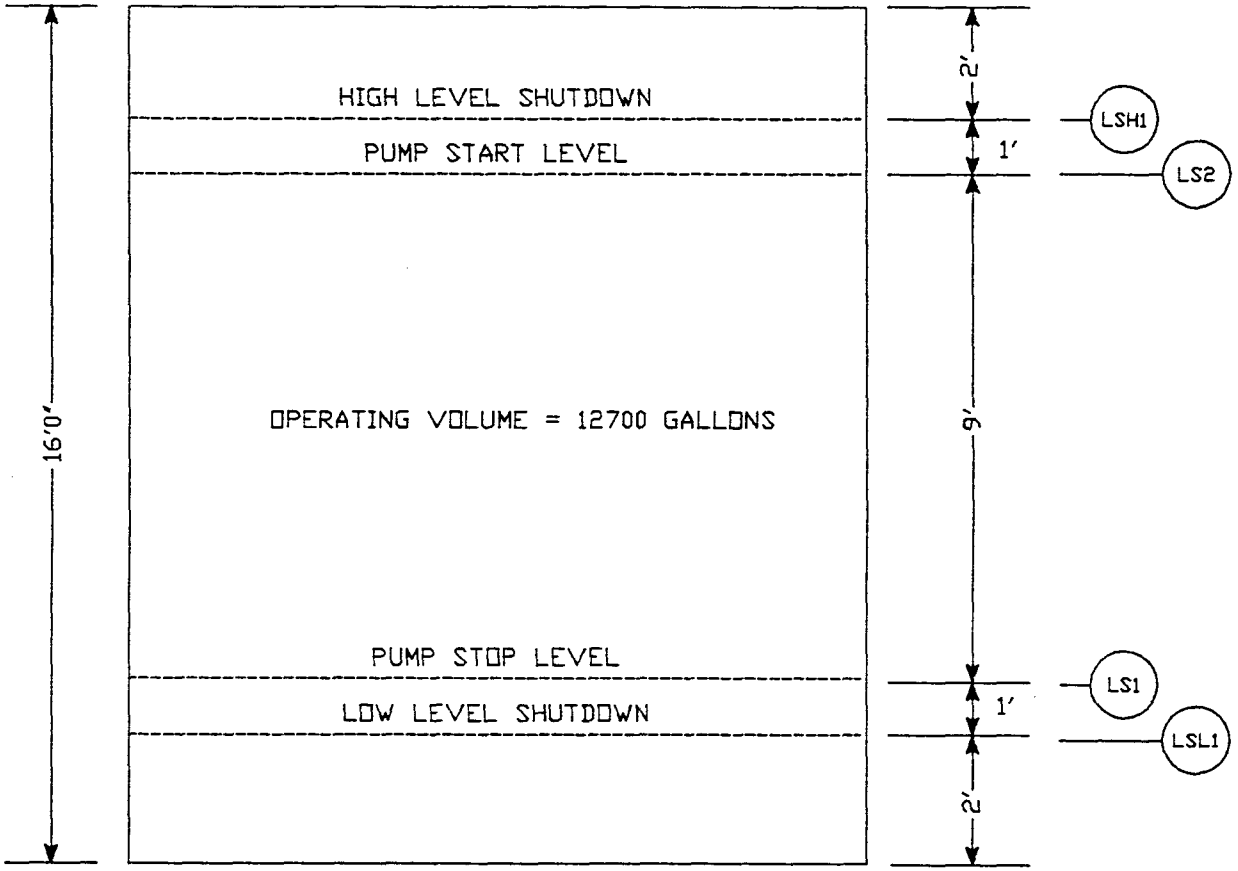

Tank 22
2'
LSH2
3'
LS5
20
21'
LS6
LSL2
Tank 21
2'
LSH3
Note: Level switches in Tank's 21 & 22 are head measuring devices set at the approximate levels indicated on this drawing
LSH4
2'6"
Tank 101
LSL4
Level Switch Weight Location Detail
Weight
1'
Dimensions for floats at the left are referenced from the weight
Float
GIANT
Level Switch Locations For Tanks 21, 22 & 101
Dwg # 1032
By: Tim Kinney
Date: 5/90
Rev: 0

Figure #17



Tank switches are actually head measuring devices set at the approximate levels indicated.

GIANT

LEVEL SWITCH LOCATIONS FOR TANK #102

Dwg # 1005	By: Tim Kinney	Date: 11/13/89	Rev: 0

Figure #18

GIANT REFINING COMPANY
BLOOMFIELD REFINERY
REMEDIATION PROJECT
PLC CONTROL PANEL
INPUT LIST

Input	Device	Location
1	Alarm Lamp Test	Control Panel
2	Emergency Shutdown	Control Panel
3	Alarm Reset	Control Panel
4	Low Ambient Temperature Switch TSL-1	Dispatch Office North Side
5	Open	
6	Open	
7	Tank 102 Low Level Switch LSL-1	Tank 102
8	Tank 102 Pump Stop Switch LS-2	Tank 102
9	Tank 102 Pump Start Switch LS-1	Tank 102
10	Tank 102 High Level Switch LSH-1	Tank 102
101	Open	
102	Open	
103	Air Stripper Lower High Level Switch LSH-6	Air Stripper
104	Air Stripper Upper High Level Switch LSH-5	Air Stripper
105	Air Stripper Low Blower Pressure Switch PSL-1	Air Stripper
106	Open	
107	Open	
108	Open	
109	Open	
110	Open	

Input	Device	Location
201	Tank 101 High Level Switch LSH-4	Tank 101
202	Power On	Control Panel
203	Tank 22 High Level Switch LSH-2	Tank 22
204	Mode 2 Start Level Switch (Upper) LS-5	Tank 22
205	Mode 3 Stop Level Switch LS-6	Tank 22
206	Tank 22 Low Level Switch LSL-2	Tank 22
207	Tank 21 High Level Switch LSH-3	Tank 21
208	Open	
209	Open	
210	Low Compressed Air Pressure Switch PSL-2	Dispatch Office
301	Automatic Mode Selection	Control Panel
302	Manual Mode 1 Selection	Control Panel
303	Manual Mode 2 Selection	Control Panel
304	Manual Mode 3 Selection	Control Panel
305	Open	
306	Open	
307	Open	
308	Open	
309	Open	
310	Open	

GIANT REFINING COMPANY
BLOOMFIELD REFINERY
REMEDIATION PROJECT
PLC CONTROL PANEL
OUTPUT LIST

Output	Device	Location
11	Pump #1 Motor Starter and Run Light	Pump #1-Tank 102 Light-Control Panel
12	Open	
13	Tank 102 High Level Alarm Light LSH-1	Control Panel
14	Tank 102 Low Level Alarm Light LSL-1	Control Panel
15	Control Valve CV-6 and Status Light	Valve-Tank 102 Light-Control Panel
16	Open	
111	Onsite Recovery Well Contactor and Light	Contactor-Tank 102 Light-Control Panel
112	Air Compressor Low Pressure Light PSL-2	Control Panel
113	Open	
114	Open - Defective	
115	Air Stripper Low Blower Pressure Light PSL-1	Control Panel
116	Air Stripper Upper High Level Light LSH-5	Control Panel
211	Pump #4 Motor Starter and Light	Pump #4-Tank 22 Light-Control Panel
212	Air Stripper Lower High Level Light LSH-6	Control Panel
213	Power On Light	Control Panel
214	Low Ambient Temperature Light	Control Panel
215	Mode 3 Indication Light	Control Panel

Output	Device	Location
216	Mode 1 Indication Light	Control Panel
311	Air Stripper Blower Motor Starter and Light	Blower-Air Stripper Light-Control Panel
312	Off-site Recovery Well Contactor and Light	Contactor-Southern Control Building Light-Control Panel
313	Mode 2 Indication Light	Control Panel
314	Open	
315	Open	
316	Open	
411	Tank 21 High Level Alarm Light LSH-3	Control Panel
412	Tank 22 High Level Alarm Light LSH-2	Control Panel
413	Tank 22 Low Level Alarm Light LSL-2	Control Panel
414	Tank 21 Low Level Alarm Light LSL-4	Control Panel
415	Open	
416	Control Valve CV-1 and Status Light	Valve-Tank 101 Light-Control Panel
511	Control Valve CV-2 and Status Light	Valve-Tank 101 Light-Control Panel
512	Control Valve CV-3 and Status Light	Valve-Tank 101 Light-Control Panel
513	Control Valve CV-4 and Status Light	Valve-Tank 102 Light-Control Panel
514	Control Valve CV-5 and Status Light	Valve-Tank 101 Light-Control Panel
515	Pump #3 Motor Starter and Run Light	Pump #3-Tank 21 Light-Control Panel
516	Pump #2 Motor Starter and Run Light	Pump #2-Tank 101 Light-Control Panel

```
Rung: 001 Master control relay

EMERG                                                          MASTR
STOP                                                           CONTR
 002
+--] [-----------------------------------------------------------(MCR)----+

Rung: 002 Initiate start of pump #1, Tank-102

LS-1                                                           LEVEL
HIGH                                                           T-102
 009                                                            701
++-] [-+---------------------------------------------------------( L )----+
|      |
|MODE  |
| #2   |
| 747  |
+-] [-+

Rung: 003 Initiate stop of pump #1, Tank-102

LS-2  MODE                                                     LEVEL
LOW    #2                                                      T-102
 008   747                                                     701
+--]\[---]\[-----------------------------------------------------( U )----+

Rung: 004 Pump #1, Motor Starter

LEVEL TSL-1 FIRST                                              PUMP
T-102  LOW   OUT                                               #1
 701   004   800                                               011
+--] [---] [---] [-------------------------------------------------(   )----+

Rung: 005 Delay start of Blower, 1 minute

PUMP                                                           RTO
 #1                                                            1MIN
 011                                                           901
+--] [-----------------------------------------------------------(RTO)----+
                                                               PR 0600

Rung: 006 Delay shutdown of Blower, 5 minute

RTO                                                            RTF
1MIN                                                           5MIN
 901                                                           902
+--] [-----------------------------------------------------------(RTF)----+
                                                               PR 3000

Rung: 007 Reset Blower start timer.

PUMP                                                           RTO
 #1                                                            1MIN
 011                                                           901
+-]\[-----------------------------------------------------------(RST)----+
                                                               RE 0000
```

```
Rung: 008 Reset Blower shutdown timer

 RTF                                                              RTF
 5MIN                                                             5MIN
  902                                                              902
+--]\[-----------------------------------------------------------(RST)----+
|                                                                RE 0000   |

Rung: 009 Blower's motor starter, and light.(Air stripper)

 RTF   TSL-1 FIRST                                                BLOW-
 5MIN   LOW   OUT                                                 ER
  902   004   800                                                 311
+--] [---] [---] [-----------------------------------------------(   )----+

Rung: 010 Pump #3, Motor Starter

 MODE  FIRST TSL-1 LS-1                                           PUMP
  #1    OUT   LOW  HIGH                                           #3
  746   800   004   009                                           515
+--] [---] [---] [---]\[-----------------------------------------(   )----+

Rung: 011 Pump #4, Motor Starter

 MODE  FIRST TSL-1 LS-1                                           PUMP
  #3    OUT   LOW  HIGH                                           #4
  748   800   004   009                                           211
+--] [---] [---] [---]\[-----------------------------------------(   )----+

Rung: 012 Pump #2, Motor Starter

 LEVEL TSL-1 FIRST                                                PUMP
 T-102  LOW   OUT                                                 #2
  701   004   800                                                 516
+--] [---] [---] [-----------------------------------------------(   )----+

Rung: 013 Initiate start of mode-1, End of mode-3

 LS-6                                                             MODE2
 LOW                                                              LATCH
  205                                                              703
+--]\[-----------------------------------------------------------( U )----+

Rung: 014 Initiate start of Mode-2, End of mode-1

 LS-5                                                             MODE2
 HIGH                                                             LATCH
  204                                                              703
+--]\[-----------------------------------------------------------( L )----+

Rung: 015 Counter converted to timer, 1 hour

 MODE2 TIMER                                                      TIMER
 LATCH 1-SEC                                                      1 HR.
  703   875                                                       903
+--] [---] [-----------------------------------------------------(CTU)----+
|                                                                PR 3600   |
```

Rung: 016 Initiate start of mode-3, end of mode-2

```
TIMER                                                          TIMER
1 HR.                                                          8 HRS
 903                                                            904
+--] [-------------------------------------------------------------(CTU)-----+
|                                                              PR 0008       |
```

Rung: 017 Self resetting timer, on the hour

```
TIMER                                                          TIMER
1 HR.                                                          1 HR.
 903                                                            903
++-] [-+-----------------------------------------------------------(RST)-----+
||      |                                                       RE 0000       |
||MODE2 |                                                                     |
||LATCH |                                                                     |
|| 703  |                                                                     |
+-]\[-+                                                                      |
```

Rung: 018 Reset 8 hour timer

```
MODE2                                                          TIMER
LATCH                                                          8 HRS
 703                                                            904
+--]\[-------------------------------------------------------------(RST)-----+
|                                                              RE 0000       |
```

Rung: 019 Mode driven sequencer, for soleniod valves and mode lights

```
                                                               VALVE
                                                                SEQ.
                                                               E 905
+--------------------------------------------------------------(SQO)-----+
|                                                              GRP 21        |
```

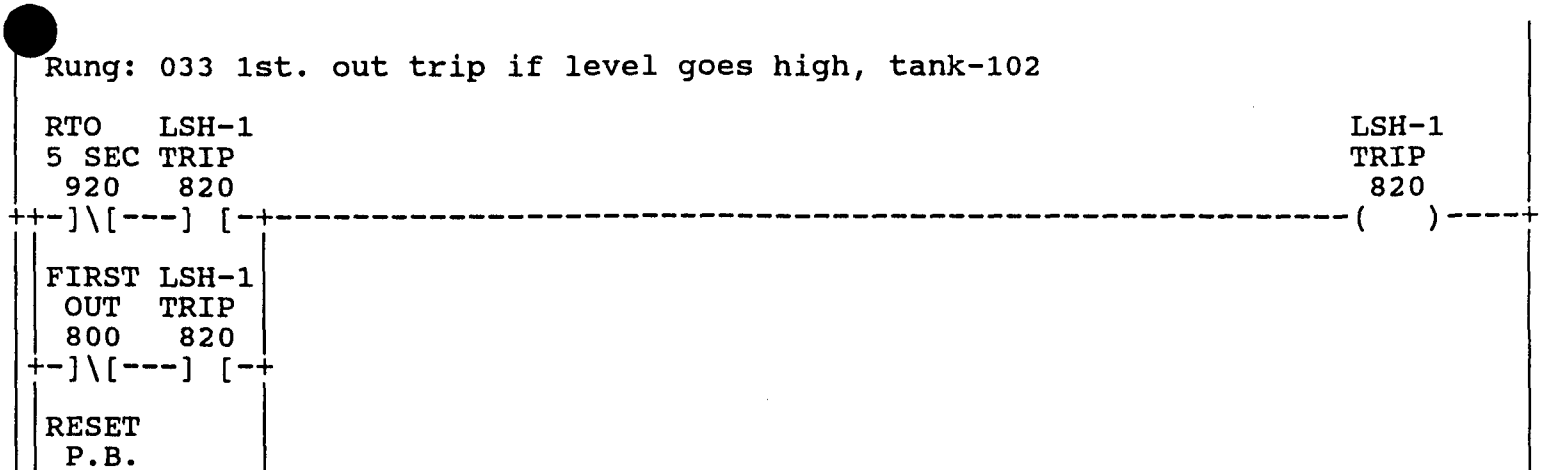
Rung: 020 Mode-3

```
AUTO  TIMER                                                    VALVE
 SW.  8 HRS                                                     SEQ.
 301   904                                                      905
++-] [---] [-+-----------------------------------------------------(RST)-----+
||           |                                                  RE 0002       |
||AUTO  MODE3|                                                                |
|| SW.   SW. |                                                                |
|| 301   304 |                                                                |
+-]\[---] [-+                                                                 |
```

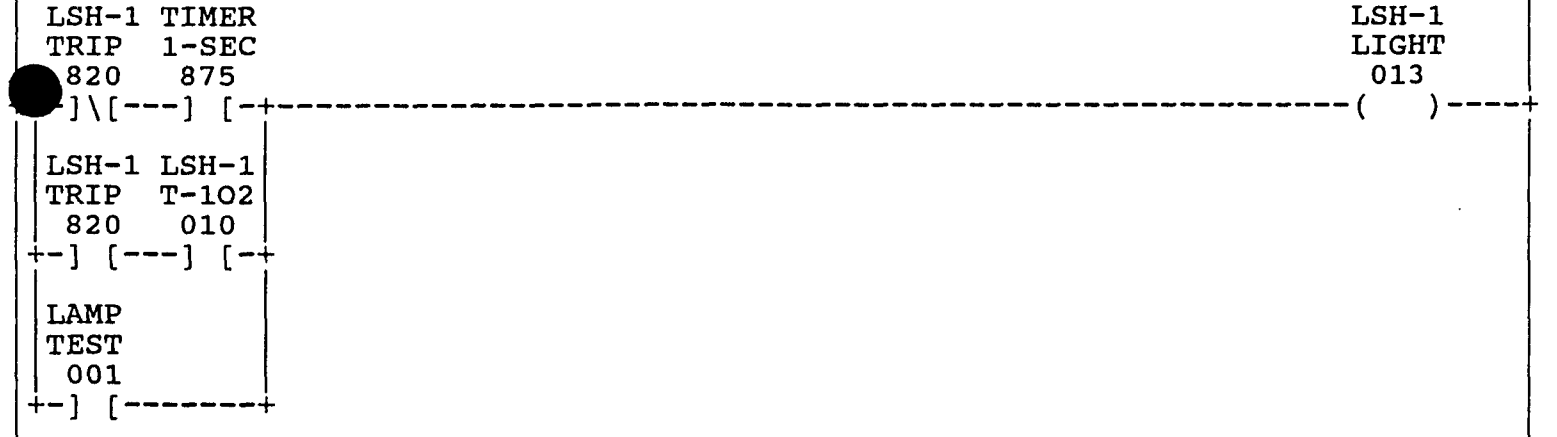
```
 Rung: 021 Mode-2

 AUTO  MODE2 TIMER                                                  VALVE
  SW.  LATCH 8 HRS                                                   SEQ.
  301   703   904                                                    905
++-] [---] [---]\[-+-------------------------------------------------(RST)----+
||                 |                                                RE 0001
||AUTO  MODE2      |
| SW.   SW.        |
| 301   303        |
+-]\[---] [--------+

 Rung: 022 Mode-1

 AUTO  MODE2                                                        VALVE
  SW.  LATCH                                                         SEQ.
  301   703                                                          905
++-] [---]\[-+-------------------------------------------------------(RST)----+
||           |                                                      RE 0000
||AUTO  MODE1|
| SW.   SW.  |
| 301   302  |
+-]\[---] [-+

 Rung: 023 Control valve-1, from sequencer

 CV-1  FIRST                                                         CV-1
 SEQ.   OUT                                                           SOL.
  741   800                                                           416
+--] [---] [---------------------------------------------------------(    )----+

 Rung: 024 Control valve-2, from sequencer

 CV-2  FIRST                                                         CV-2
 SEQ.   OUT                                                           SOL.
  742   800                                                           511
+--] [---] [---------------------------------------------------------(    )----+

 Rung: 025 Control valve-3, from sequencer

 CV-3  FIRST                                                         CV-3
 SEQ.   OUT                                                           SOL.
  743   800                                                           512
+--] [---] [---------------------------------------------------------(    )----+

 Rung: 026 Control valve-4, from sequencer

 CV-4  FIRST                                                         CV-4
 SEQ.   OUT                                                           SOL.
  744   800                                                           513
+--] [---] [---------------------------------------------------------(    )----+
```

```
Rung: 027 Control valve-5, from sequencer

CV-5  FIRST                                                    CV-5
SEQ.   OUT                                                     SOL.
 745   800                                                     514
+--] [---] [-----------------------------------------------------(   )----+

Rung: 028 Control valve-6

LS-1  FIRST TSL-1                                              CV-6
HIGH   OUT   LOW                                               SOL.
 009   800   004                                               015
++-]\[-+-] [---] [-----------------------------------------------(   )----+
|       |
|MODE   |
| #2    |
| 747   |
+-] [-+

Rung: 029 Anti-splash, level must be high for 5 seconds

LSH-1                                                          RTO
T-102                                                          5 SEC
 010                                                           920
+--] [-------------------------------------------------------------(RTO)----+
                                                               PR 0050

Rung: 030 Self resetting if level not high for 5 seconds

LSH-1                                                          RTO
T-102                                                          5 SEC
 010                                                           920
+--]\[-------------------------------------------------------------(RST)----+
                                                               RE 0000

Rung: 031 Anti-splash, level must be low for 5 seconds

LSL-1                                                          RTO
T-102                                                          5-SEC
 007                                                           921
+--]\[-------------------------------------------------------------(RTO)----+
                                                               PR 0050

Rung: 032 Self resetting if level not low for 5 seconds

LSL-1                                                          RTO
T-102                                                          5-SEC
 007                                                           921
+--] [-------------------------------------------------------------(RST)----+
                                                               RE 0000
```

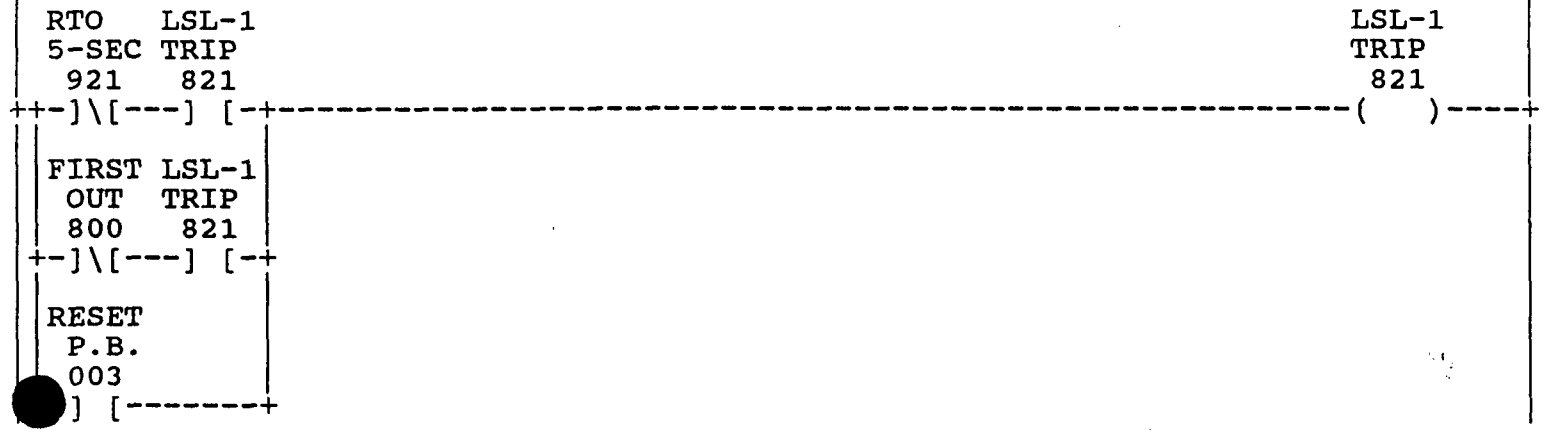
Rung: 033 1st. out trip if level goes high, tank-102

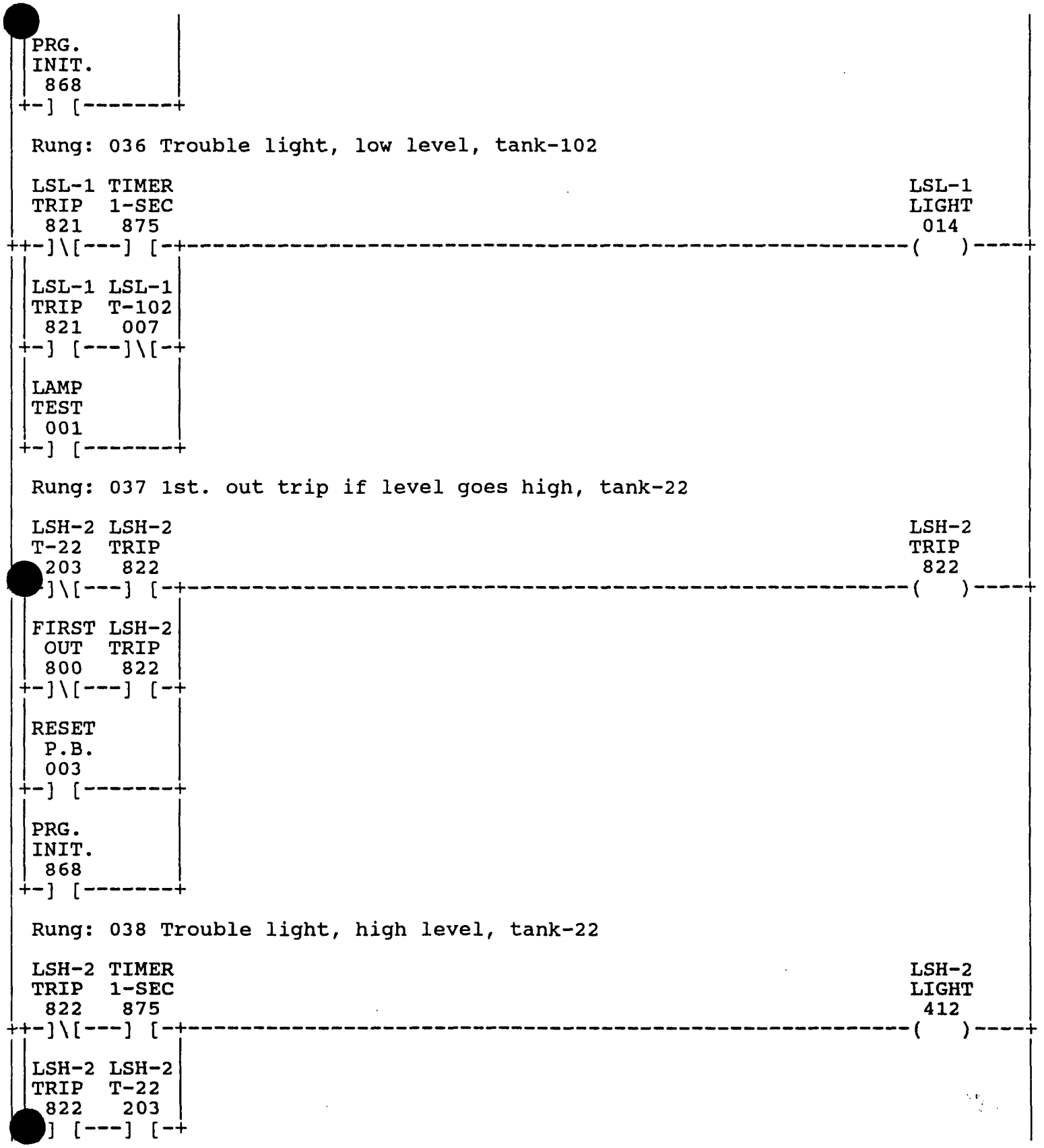


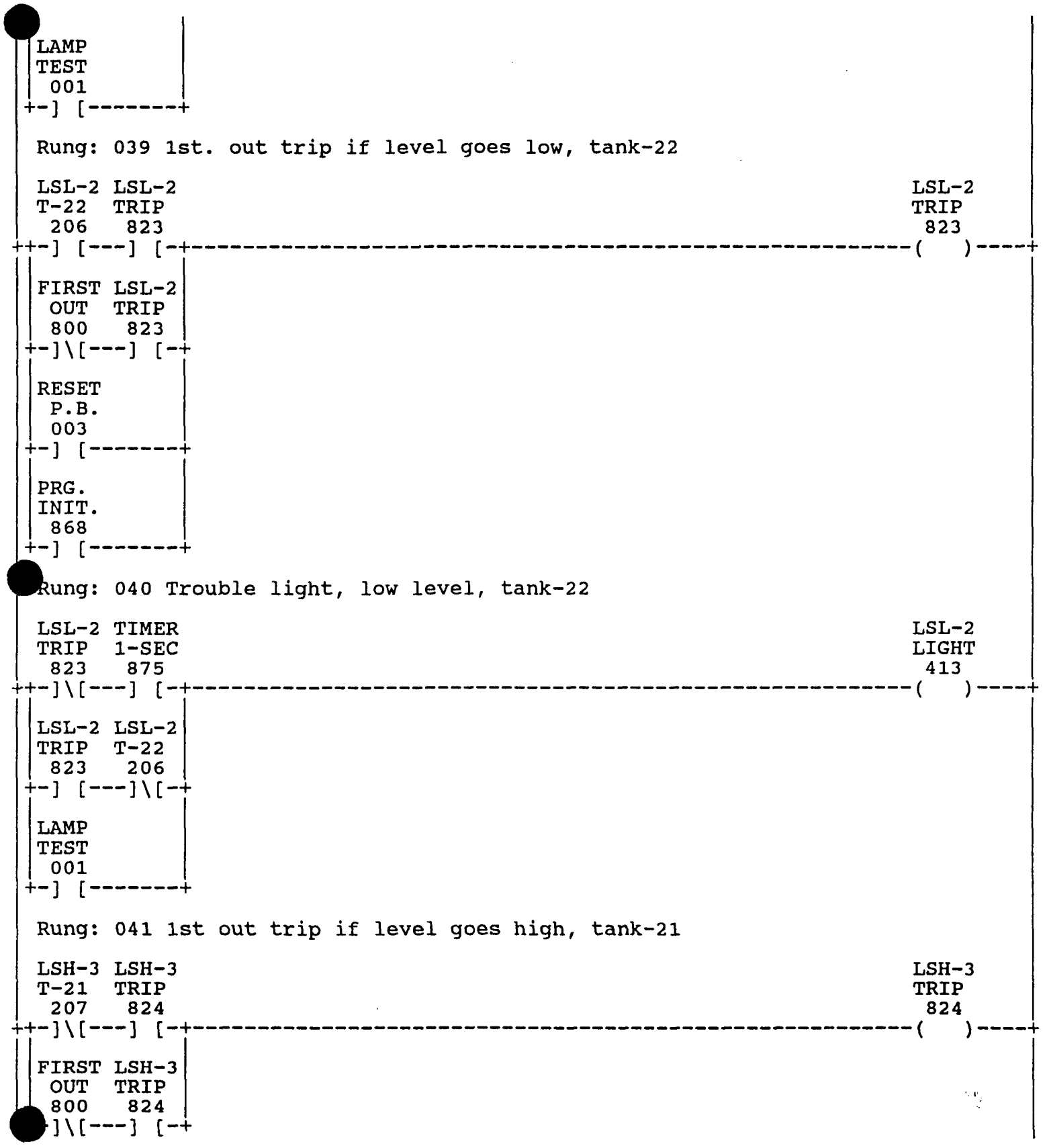
Rung: 034 Trouble light, high level, tank-102



Rung: 035 1st. out trip if level goes low, tank-102




PRG.
INIT.
868
Rung: 036 Trouble light, low level, tank-102
LSL-1 TIMER
TRIP 1-SEC
821 875
LSL-1
LIGHT
014
LSL-1 LSL-1
TRIP T-102
821 007
LAMP
TEST
001
Rung: 037 1st. out trip if level goes high, tank-22
LSH-2 LSH-2
T-22 TRIP
203 822
LSH-2
TRIP
822
FIRST LSH-2
OUT TRIP
800 822
RESET
P.B.
003
PRG.
INIT.
868
Rung: 038 Trouble light, high level, tank-22
LSH-2 TIMER
TRIP 1-SEC
822 875
LSH-2
LIGHT
412
LSH-2 LSH-2
TRIP T-22
822 203


LAMP TEST 001
Rung: 039 1st. out trip if level goes low, tank-22
LSL-2 T-22 206
LSL-2 TRIP 823
LSL-2 TRIP 823
FIRST OUT 800
LSL-2 TRIP 823
RESET P.B. 003
PRG. INIT. 868
Rung: 040 Trouble light, low level, tank-22
LSL-2 TRIP 823
TIMER 1-SEC 875
LSL-2 LIGHT 413
LSL-2 TRIP 823
LSL-2 T-22 206
LAMP TEST 001
Rung: 041 1st out trip if level goes high, tank-21
LSH-3 T-21 207
LSH-3 TRIP 824
LSH-3 TRIP 824
FIRST OUT 800
LSH-3 TRIP 824

```
|
|RESET
| P.B.
| 003
+-] [-------+
|
|PRG.
|INIT.
| 868
+-] [-------+
```

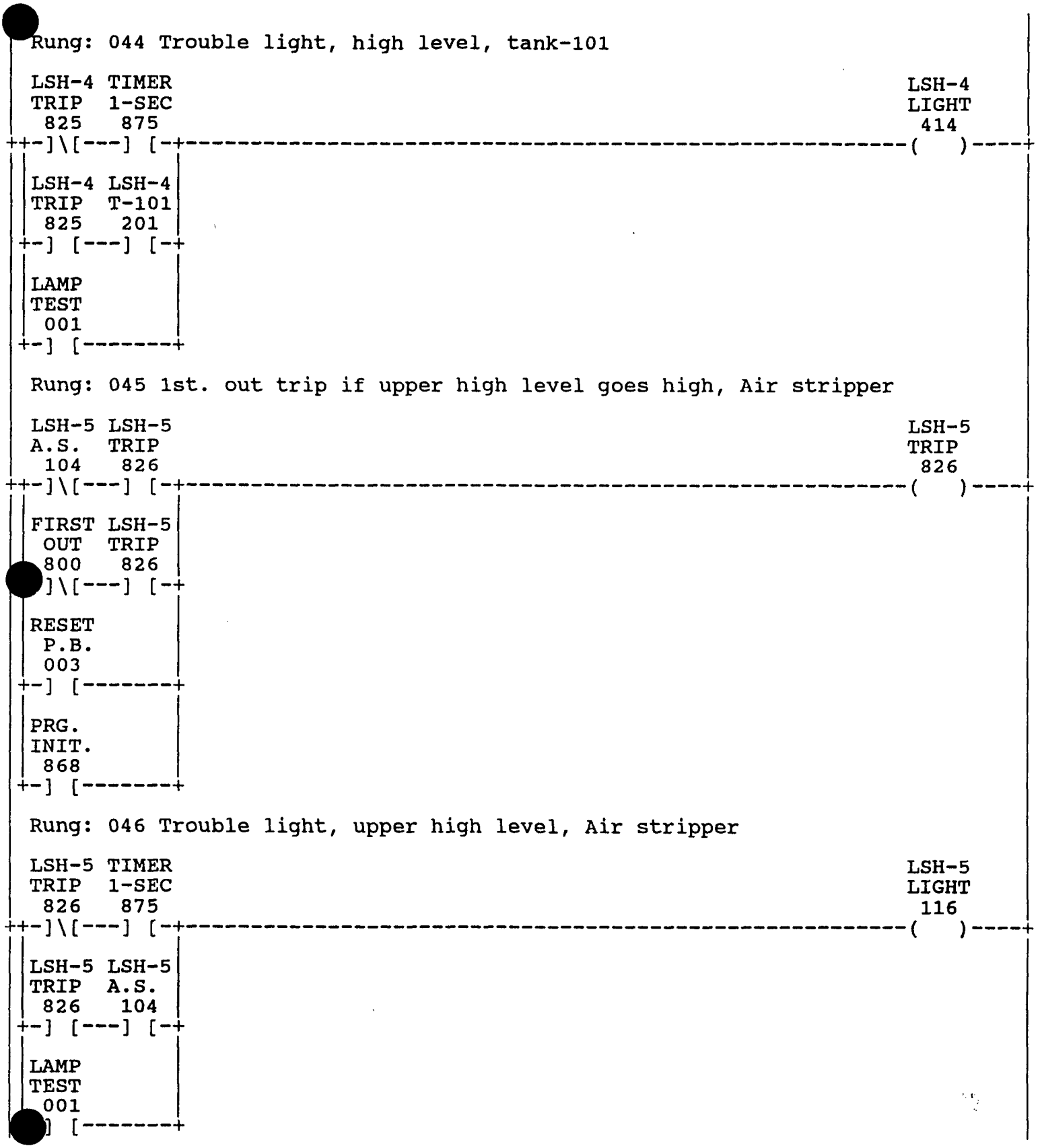
Rung: 042 Trouble light, high level, tank-21

```
LSH-3 TIMER                                                    LSH-3
TRIP  1-SEC                                                    LIGHT
 824   875                                                      411
++-]\[---] [-+-----------------------------------------------------(   )----+
|            |                                                             |
|LSH-3 LSH-3 |                                                             |
|TRIP  T-21  |                                                             |
| 824   207  |                                                             |
+-] [---] [-+                                                             |
|            |                                                             |
|LAMP        |                                                             |
|TEST        |                                                             |
| 001        |                                                             |
+-] [-------+                                                             |
```

Rung: 043 1st. out trip if level goes high, tank-101

```
LSH-4 LSH-4                                                    LSH-4
T-101 TRIP                                                     TRIP
 201   825                                                      825
++-]\[---] [-+-----------------------------------------------------(   )----+
|            |                                                             |
|FIRST LSH-4 |                                                             |
| OUT  TRIP  |                                                             |
| 800   825  |                                                             |
+-]\[---] [-+                                                             |
|            |                                                             |
|RESET       |                                                             |
| P.B.       |                                                             |
| 003        |                                                             |
+-] [-------+                                                             |
|            |                                                             |
|PRG.        |                                                             |
|INIT.       |                                                             |
| 868        |                                                             |
+-] [-------+                                                             |
```

Rung: 044 Trouble light, high level, tank-101



Rung: 045 1st. out trip if upper high level goes high, Air stripper

Rung: 046 Trouble light, upper high level, Air stripper

Rung: 047 1st. out trip if lower, high level goes high, Air stripper

LSH-6 A.S. 103 | LSH-6 TRIP 827 | LSH-6 TRIP 827 (OTE)

FIRST OUT 800 | LSH-6 TRIP 827 (XIC)

RESET P.B. 003 (XIC)

PRG. INIT. 868 (XIC)

Rung: 048 Trouble light, lower high level, Air stripper

LSH-6 TRIP 827 | TIMER 1-SEC 875 (XIC) | LSH-6 LIGHT 212 (OTE)

LSH-6 TRIP 827 | LSH-6 A.S. 103 (XIC)

LAMP TEST 001 (XIC)

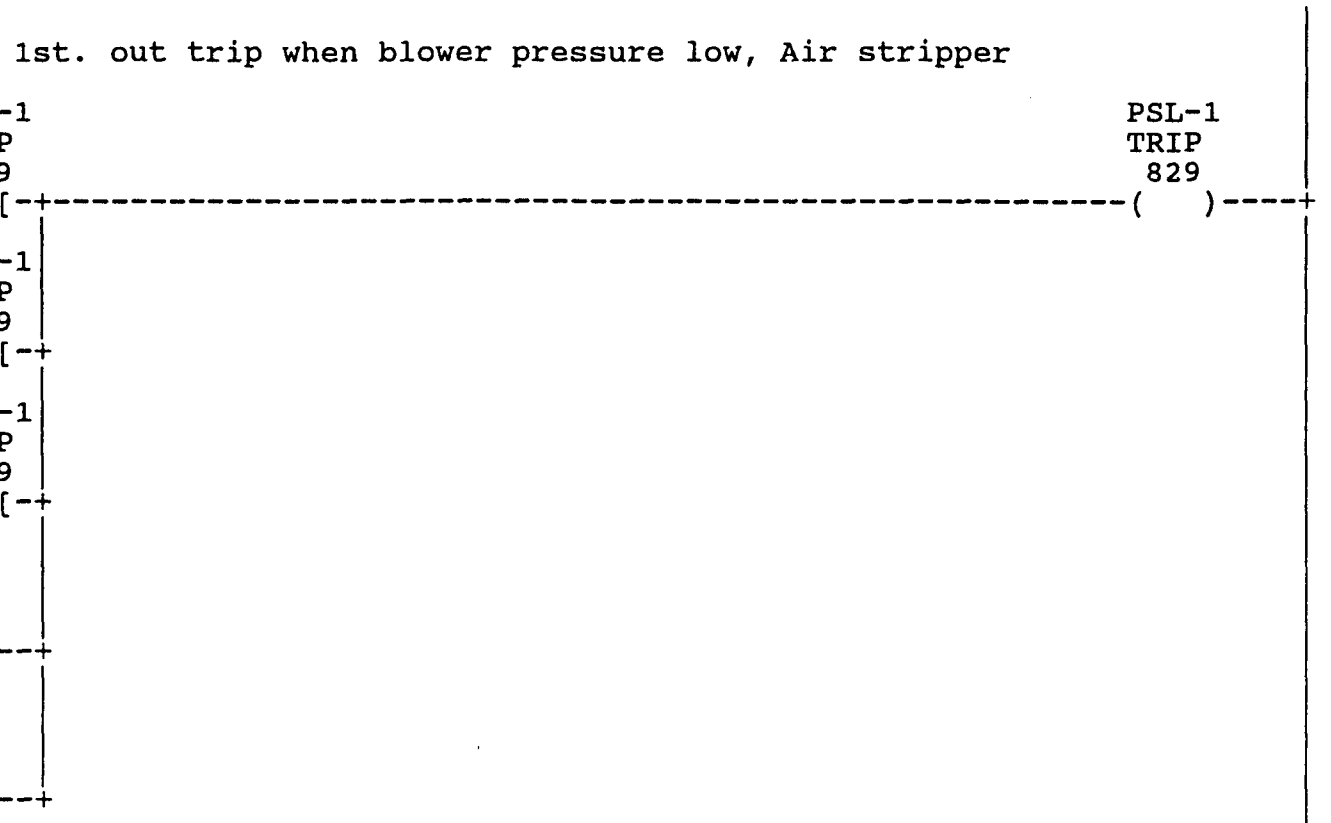
Rung: 049 Over-ride PSL-1, 10 sec. untill blower comes up to speed

BLOWER 311 | RTO 10SEC 929 (RTO) PR 0100

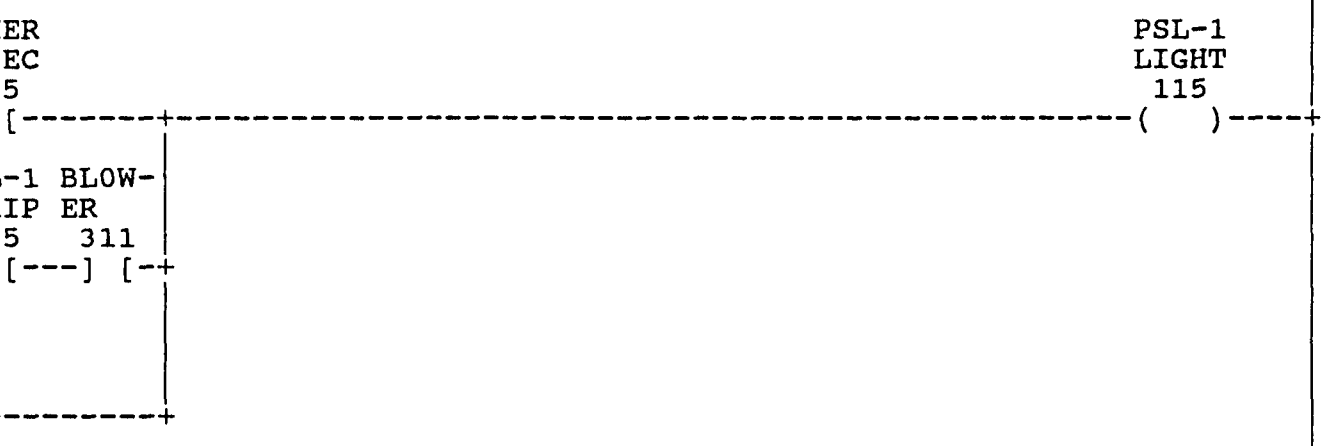
Rung: 050 Reset timer when blower is shutdown

BLOWER 311 (XIO) | RTO 10SEC 929 (RST) RE 0000

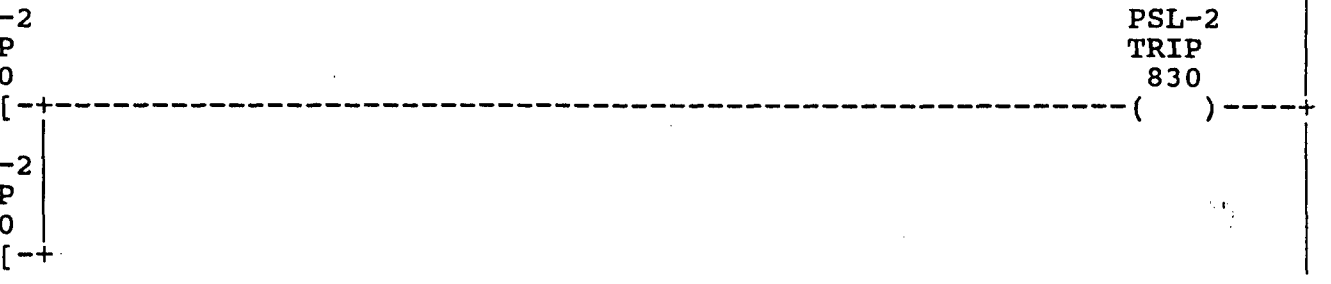
Rung: 051 1st. out trip when blower pressure low, Air stripper



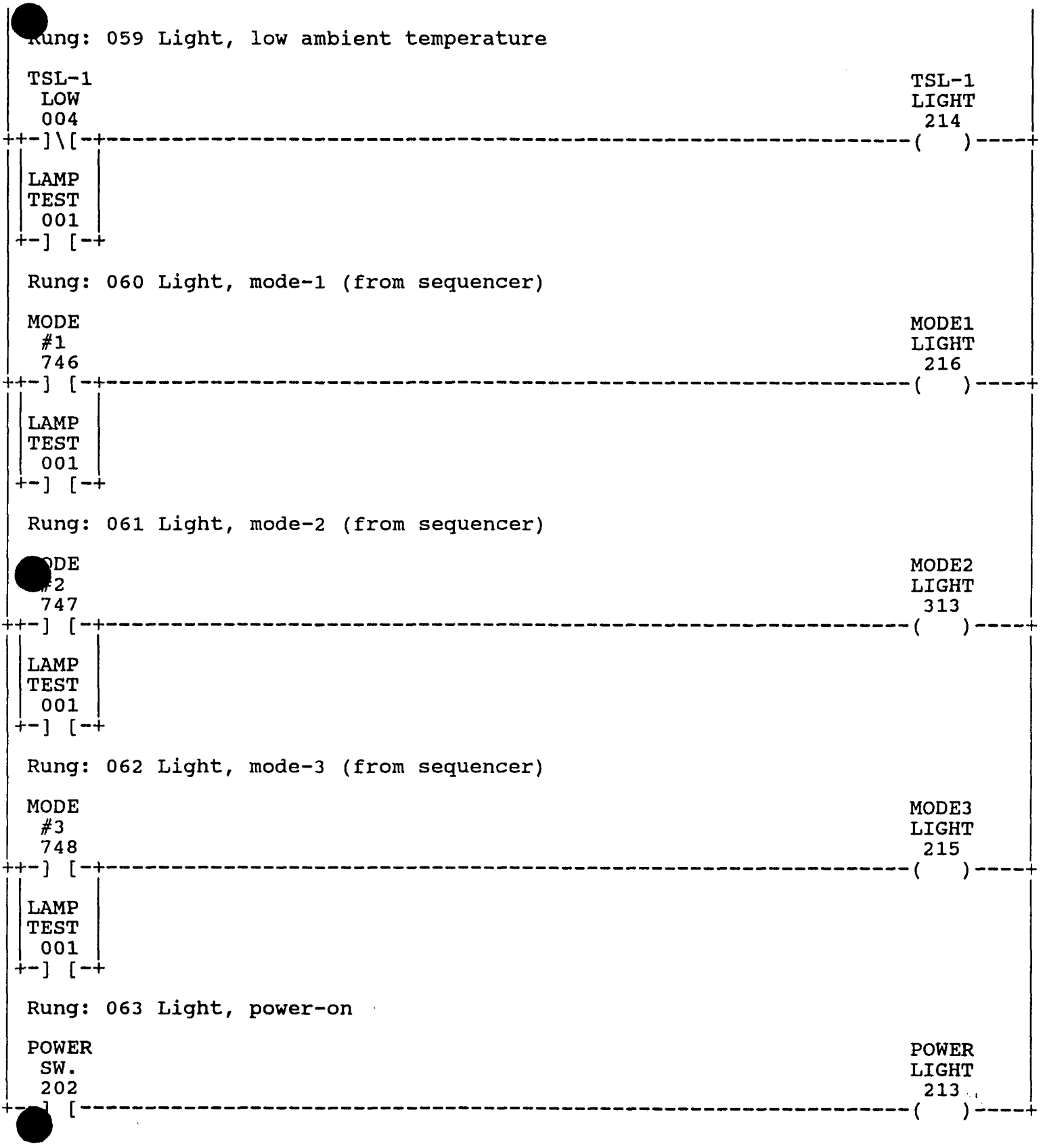
Rung: 052 Trouble light, blower low pressure at stripper



Rung: 053 1st. out trip, air supply low, from compressor



```
 | |RESET      |
 | | P.B.      |
 | | 003       |
 |+-] [-------+
 | |           |
 | |PRG.       |
 | |INIT.      |
 | | 868       |
 |+-] [-------+

 | Rung: 054 Trouble light, compressed air supply low

 | PSL-2 TIMER                                                         PSL-2
 | TRIP  1-SEC                                                         LIGHT
 |  830   875                                                           112
++-]\[---] [-+-------------------------------------------------------(    )----+
 | |           |
 | |PSL-2 PSL-2|
 | |TRIP  COMP.|
 | | 830   210 |
 |+-] [---]\[-+
 | |           |
 | |LAMP       |
 | |TEST       |
 | | 001       |
 |+-] [-------+

 | Rung: 055 First out system

 | LSH-1 LSL-1 LSH-2 LSL-2 LSH-3                                       FIRST
 | TRIP  TRIP  TRIP  TRIP  TRIP                                        -OUT-
 |  820   821   822   823   824                                         801
+--] [---] [---] [---] [---] [----------------------------------------(    )----+

 | Rung: 056 First out system con't

 | FIRST LSH-4 LSH-5 LSH-6 PSL-1 PSL-2                                 FIRST
 | -OUT- TRIP  TRIP  TRIP  TRIP  TRIP                                   OUT
 |  801   825   826   827   829   830                                   800
+--] [---] [---] [---] [---] [---] [----------------------------------(    )----+

 | Rung: 057 Shutdown recovery wells when tank-21 high ( off-site )

 | LSH-3                                                               OFF
 | T-21                                                                WELLS
 |  207                                                                 312
+--]\[------------------------------------------------------------------(    )----+

 | Rung: 058 Shutdown recovery wells when tank-21 high ( on-site )

 | LSH-3                                                               ON
 | T-21                                                                WELLS
 |  207                                                                 111
+--]\[------------------------------------------------------------------(    )----+
```


Rung: 059 Light, low ambient temperature
TSL-1 LOW 004
TSL-1 LIGHT 214
LAMP TEST 001
Rung: 060 Light, mode-1 (from sequencer)
MODE #1 746
MODE1 LIGHT 216
LAMP TEST 001
Rung: 061 Light, mode-2 (from sequencer)
MODE #2 747
MODE2 LIGHT 313
LAMP TEST 001
Rung: 062 Light, mode-3 (from sequencer)
MODE #3 748
MODE3 LIGHT 215
LAMP TEST 001
Rung: 063 Light, power-on
POWER SW. 202
POWER LIGHT 213

```
|Rung: 064 Emergency stop Master Control - from rung # 1                     |
|                                                                            |
|                                                                            |
+-------------------------------------------------------------------(MCR)----+
|                                                                            |
+------------------ End of Ladder --- Words used = 00404 -------------------+
```

Rung: 019 Event Driven | VALVE SEQ. 905 -(SQO)- GRP 21

I/O Address :	748	747	746	745	744	743	742	741
Hex Mask :			F			F		
Binary Mask :	1	1	1	1	1	1	1	1

Step #	Hex Data	Binary Data								Preset Value
00	39	0	0	1	1	1	0	0	1	0001
01	43	0	1	0	0	0	0	1	1	0001
02	96	1	0	0	1	0	1	1	0	0001

OUT

Address	Element	Rung Number(s)	Instruction Comment	
001	-] [-	034, 036, 038, 040, 042, 044, 046, 048, 052, 054, 059, 060, 061, 062	LAMP TEST :	
002	-] [-	001	EMERG STOP :	Emergency shutdown
003	-] [-	033, 035, 037, 039, 041, 043, 045, 047, 051, 053	RESET P.B.:	
004	-] [-	004, 009, 010, 011, 012, 028	TSL-1 LOW :	
004	-]\[-	059	TSL-1 LOW :	
007	-] [-	032	LSL-1 T-102:	
007	-]\[-	031, 036	LSL-1 T-102:	
008	-]\[-	003	LS-2 LOW :	LS-2, Level sw. Low
009	-] [-	002	LS-1 HIGH :	Level sw. high, tank-102
009	-]\[-	010, 011, 028	LS-1 HIGH :	Level sw. high, tank-102
010	-] [-	029, 034	LSH-1 T-102:	
010	-]\[-	030	LSH-1 T-102:	
103	-] [-	047	LSH-6 A.S. :	
103	-]\[-	048	LSH-6 A.S. :	
104	-] [-	046	LSH-5 A.S. :	
104	-]\[-	045	LSH-5 A.S. :	
105	-] [-	051	PSL-1 STRIP:	
105	-]\[-	052	PSL-1 STRIP:	
201	-] [-	044	LSH-4 T-101:	
201	-]\[-	043	LSH-4 T-101:	
202	-] [-	063	POWER SW. :	
203	-] [-	038	LSH-2 T-22 :	
203	-]\[-	037	LSH-2 T-22 :	
204	-]\[-	014	LS-5 HIGH :	
205	-]\[-	013	LS-6 LOW :	
206	-] [-	039	LSL-2 T-22 :	
206	-]\[-	040	LSL-2 T-22 :	
207	-] [-	042	LSH-3 T-21 :	
207	-]\[-	041, 057, 058	LSH-3 T-21 :	
210	-] [-	053	PSL-2 COMP.:	
210	-]\[-	054	PSL-2 COMP.:	
301	-] [-	020, 021, 022	AUTO SW. :	
301	-]\[-	020, 021, 022	AUTO SW. :	
302	-] [-	022	MODE1 SW. :	
303	-] [-	021	MODE2 SW. :	
304	-] [-	020	MODE3 SW. :	

TPUT

Address	Element	Rung Number(s)	Instruction Comment
011	-] [-	005	PUMP #1 :
011	-]\[-	007	PUMP #1 :
011	-( )-	004	PUMP #1 :
013	-( )-	034	LSH-1 LIGHT:
014	-( )-	036	LSL-1 LIGHT:
015	-( )-	028	CV-6 SOL.: Output to CV-6, soleniod
111	-( )-	058	ON WELLS: on-site recovery wells
112	-( )-	054	PSL-2 LIGHT:
115	-( )-	052	PSL-1 LIGHT:
116	-( )-	046	LSH-5 LIGHT:
211	-( )-	011	PUMP #4 :
212	-( )-	048	LSH-6 LIGHT:
213	-( )-	063	POWER LIGHT:
214	-( )-	059	TSL-1 LIGHT:
215	-( )-	062	MODE3 LIGHT:
216	-( )-	060	MODE1 LIGHT:
311	-] [-	049, 052	BLOW- ER :
311	-]\[-	050	BLOW- ER :
311	-( )-	009	BLOW- ER :
312	-( )-	057	OFF WELLS: off-site recovery wells
313	-( )-	061	MODE2 LIGHT:
411	-( )-	042	LSH-3 LIGHT:
412	-( )-	038	LSH-2 LIGHT:
413	-( )-	040	LSL-2 LIGHT:
414	-( )-	044	LSH-4 LIGHT:
416	-( )-	023	CV-1 SOL.: Output to CV-1, soleniod
511	-( )-	024	CV-2 SOL.: Output to CV-2, soleniod
512	-( )-	025	CV-3 SOL.: Output to CV-3, soleniod
513	-( )-	026	CV-4 SOL.: Output to CV-4, soleniod
514	-( )-	027	CV-5 SOL.: Output to CV-5, soleniod
515	-( )-	010	PUMP #3 :
516	-( )-	012	PUMP #2 :

TERNAL

Address	Element	Rung Number(s)	Instruction Comment
701	-] [-	004, 012	LEVEL T-102: Latch pump # 1
701	-(L)-	002	LEVEL T-102: Latch pump # 1
701	-(U)-	003	LEVEL T-102: Latch pump # 1
703	-] [-	015, 021	MODE2 LATCH:
703	-]\[-	017, 018, 022	MODE2 LATCH:
703	-(L)-	014	MODE2 LATCH:
703	-(U)-	013	MODE2 LATCH:
741	-] [-	023	CV-1 SEQ. :
742	-] [-	024	CV-2 SEQ. :
743	-] [-	025	CV-3 SEQ. :
744	-] [-	026	CV-4 SEQ. :
745	-] [-	027	CV-5 SEQ. :
746	-] [-	010, 060	MODE #1 :
747	-] [-	002, 028, 061	MODE #2 : mode-2
747	-]\[-	003	MODE #2 : mode-2
748	-] [-	011, 062	MODE #3 :
800	-] [-	004, 009, 010, 011, 012, 023, 024, 025, 026, 027, 028	FIRST OUT :
800	-]\[-	033, 035, 037, 039, 041, 043, 045, 047, 051, 053	FIRST OUT :
800	-( )-	056	FIRST OUT :
801	-] [-	056	FIRST -OUT-:
801	-( )-	055	FIRST -OUT-:
820	-] [-	033, 034, 055	LSH-1 TRIP :
820	-]\[-	034	LSH-1 TRIP :
820	-( )-	033	LSH-1 TRIP :
821	-] [-	035, 036, 055	LSL-1 TRIP :
821	-]\[-	036	LSL-1 TRIP :
821	-( )-	035	LSL-1 TRIP :
822	-] [-	037, 038, 055	LSH-2 TRIP :
822	-]\[-	038	LSH-2 TRIP :
822	-( )-	037	LSH-2 TRIP :
823	-] [-	039, 040, 055	LSL-2 TRIP :
823	-]\[-	040	LSL-2 TRIP :
823	-( )-	039	LSL-2 TRIP :
824	-] [-	041, 042, 055	LSH-3 TRIP :
824	-]\[-	042	LSH-3 TRIP :
824	-( )-	041	LSH-3 TRIP :
825	-] [-	043, 044, 056	LSH-4 TRIP :
825	-]\[-	044	LSH-4 TRIP :
825	-( )-	043	LSH-4 TRIP :
826	-] [-	045, 046, 056	LSH-5 TRIP :
826	-]\[-	046	LSH-5 TRIP :
826	-( )-	045	LSH-5 TRIP :
827	-] [-	047, 048, 056	LSH-6 TRIP :
827	-]\[-	048	LSH-6 TRIP :
827	-( )-	047	LSH-6 TRIP :
829	-] [-	051, 052, 056	PSL-1 TRIP :
829	-]\[-	052	PSL-1 TRIP :
829	-( )-	051	PSL-1 TRIP :

TERNAL

Address	Element	Rung Number(s)	Instruction Comment
830	-] [-	053, 054, 056	PSL-2 TRIP :
830	-]\[-	054	PSL-2 TRIP :
830	-( )-	053	PSL-2 TRIP :
868	-] [-	033, 035, 037, 039, 041, 043, 045, 047, 051, 053	PRG. INIT.:
875	-] [-	015, 034, 036, 038, 040, 042, 044, 046, 048, 052, 054	TIMER 1-SEC:

IER/COUNTER/SEQUENCER/RESET

Address	Element	Rung Number(s)	Instruction Comment
901	-] [-	006	RTO 1MIN :
901	-(RTO)-	005	RTO 1MIN :
901	-(RST)-	007	RTO 1MIN :
902	-] [-	009	RTF 5MIN :
902	-]\[-	008	RTF 5MIN :
902	-(RTF)-	006	RTF 5MIN :
902	-(RST)-	008	RTF 5MIN :
903	-] [-	016, 017	TIMER 1 HR.:
903	-(CTU)-	015	TIMER 1 HR.:
903	-(RST)-	017	TIMER 1 HR.:
904	-] [-	020	TIMER 8 HRS:
904	-]\[-	021	TIMER 8 HRS:
904	-(CTU)-	016	TIMER 8 HRS:
904	-(RST)-	018	TIMER 8 HRS:
905	-(RST)-	020, 021, 022	VALVE SEQ.:
905	-(SQO)-	019	VALVE SEQ.:
920	-]\[-	033	RTO 5 SEC:
920	-(RTO)-	029	RTO 5 SEC:
920	-(RST)-	030	RTO 5 SEC:
921	-]\[-	035	RTO 5-SEC:
921	-(RTO)-	031	RTO 5-SEC:
921	-(RST)-	032	RTO 5-SEC:
929	-]\[-	051	RTO 10SEC:
929	-(RTO)-	049	RTO 10SEC:
929	-(RST)-	050	RTO 10SEC:
	-(MCR)-	001	MASTR CONTR:
	-(MCR)-	064	

FILTERS

On at least a monthly basis, all water filter elements should be replaced. Some filter elements will require more frequent maintenance. There are filters in each recovery well enclosure, and in the southern control building.

STRAINERS

Pump suction strainers are located at pumps #2, #3 & #4. The strainer bodies are transparent. A visual inspection should be made regularly. Clean as required. Make certain that air is purged from the strainer after cleaning. Air in the strainer may cause the pump to vapor lock on restart. Particular attention should be given to the Pump #2 strainer. A Tank 101 High Level alarm will occur if the strainer becomes sufficiently clogged to inhibit the performance of Pump #2.

ELECTRICAL SYSTEM

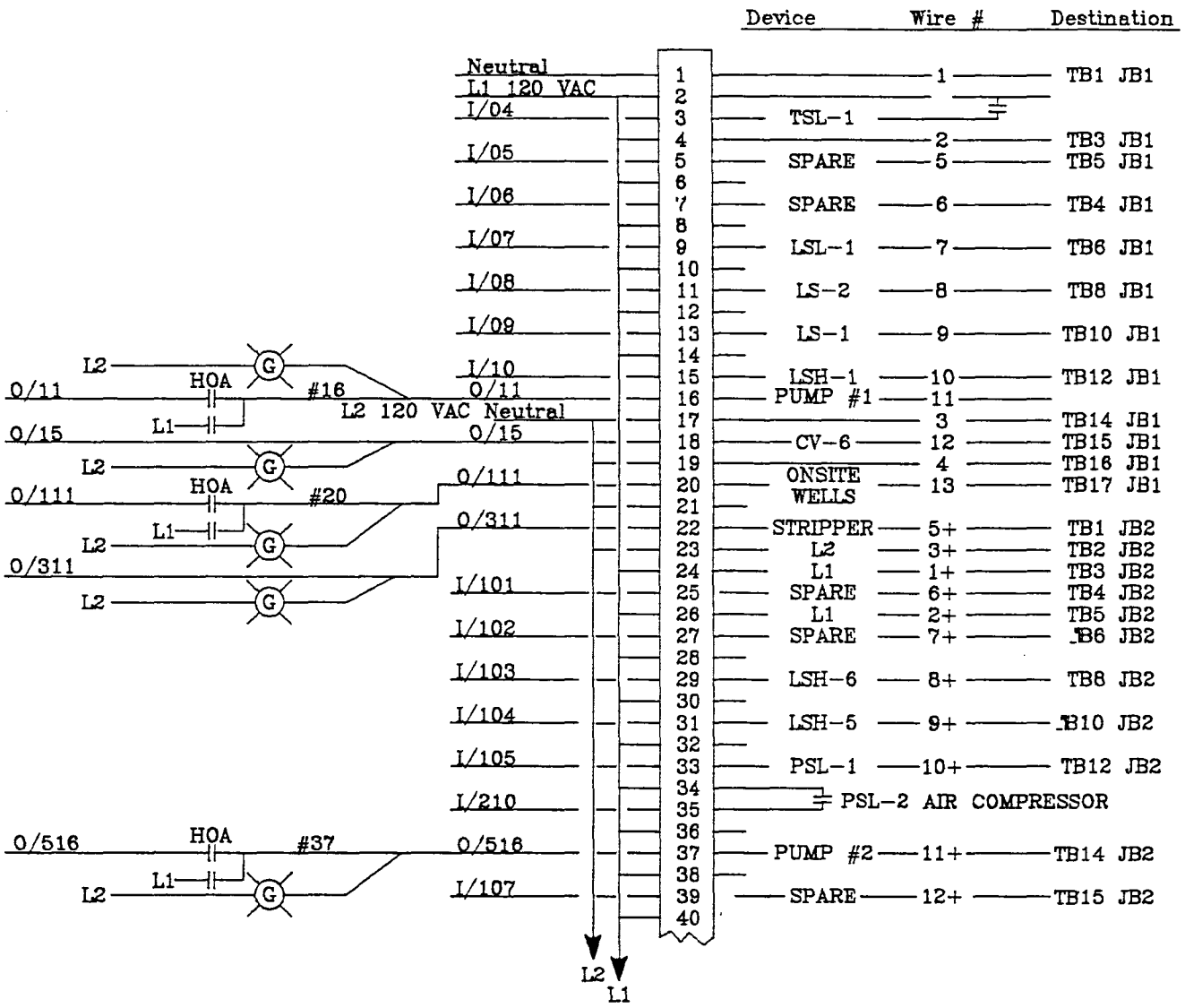
There are three separate electrical services in use in the system. Therefore, extra care should be taken to insure that all power is off before servicing electrical devices. Each source of power should be checked before it is assumed that all circuits are dead and the device is safe for maintenance.

Most control circuits originate at the control panel located in the Dispatch Office. Its power supply is the Dispatch Office service. The circuit breaker for the panel is located adjacent to the panel and is marked. The air compressor power supply also originates in the Dispatch Office.

The power for Tank 101, Tank 102, Tank 22,Tank 106, the Air Stripper, and all recovery wells located north of the highway is fed from the power drop at Tank 102. Three phase 230 VAC as well as single phase power are available at Tank 102. Local disconnects are found at each recovery well located on-site with the exception of GRW-8. Its disconnect is located in the GRW-7 well enclosure. This is because GRW-8 is a subsurface completion and no well enclosure exists for housing the disconnect. Recovery wells GRW-1 through 6 and 9 can be disconnected by circuit breakers in the Tank 106 building. Recovery wells GRW-11, 12, and 13 have a common circuit breaker located in the GRW-11 well enclosure as well as individual breakers in each well. GRW-7, 8, and 10 have a common circuit breaker located west of the main refinery gate.

A separate power drop for pumps south of the highway and the road crossing heat tracing is located at the Southern Control Building. See Plate #1. The power drop is 200 amp 240 VAC/1/60. Keep in mind that the recovery well control circuits located in the Southern Control Building are a part of the Control Panel power supply originating at the Dispatch Office. A circuit breaker for recovery well pumps in SHS-11, 14, 7 and 9 is located in the Southern Control Building. A separate circuit breaker for each of the well enclosure heaters located at the recovery wells SHS-7, 11, and 14 is also found in the Southern Control Building. Recovery well SHS-9 is a subsurface connected well and has no local disconnect or heated well enclosure.

Figures #19 through #24 represent the wiring of various junction boxes and the Control Panel. Figure #25 illustrates the physical layout and electrical devices found on the east wall of the Southern Control Building.



Legend

TB = Terminal Block
JB = Junction Box
I/xxx = Input Number
O/xxx = Output Number
HOA = Hand Off Automatic

Notes

See Drawing 1058B for remainder of the terminal strip.

Control Panel is located in the Dispatch Office

GIANT

Control Panel Terminal Block Wiring Diagram #1-40

Dwg # 1058A	By: Tim Kinney	Date: 4/29/91	Rev: 0

Figure #19

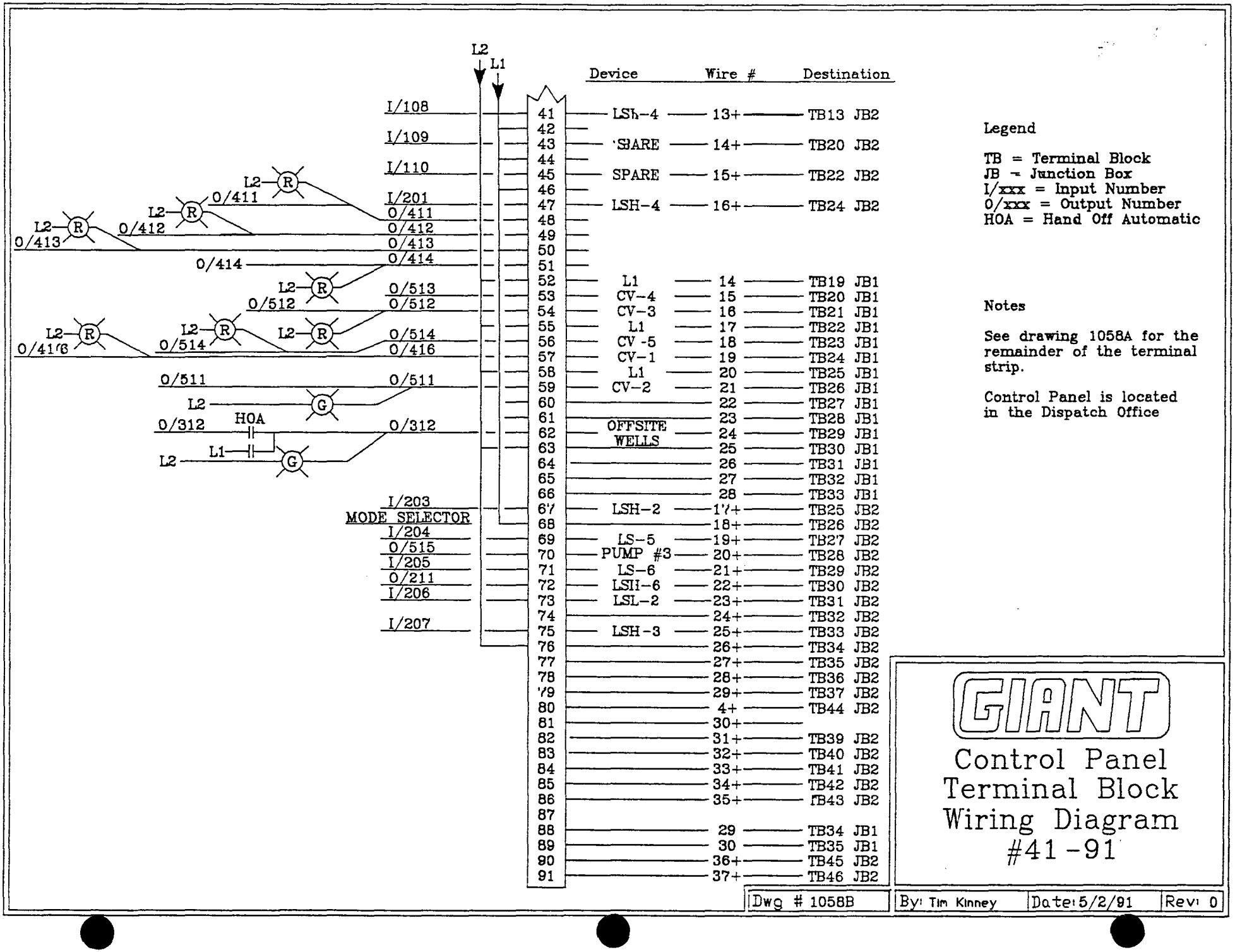
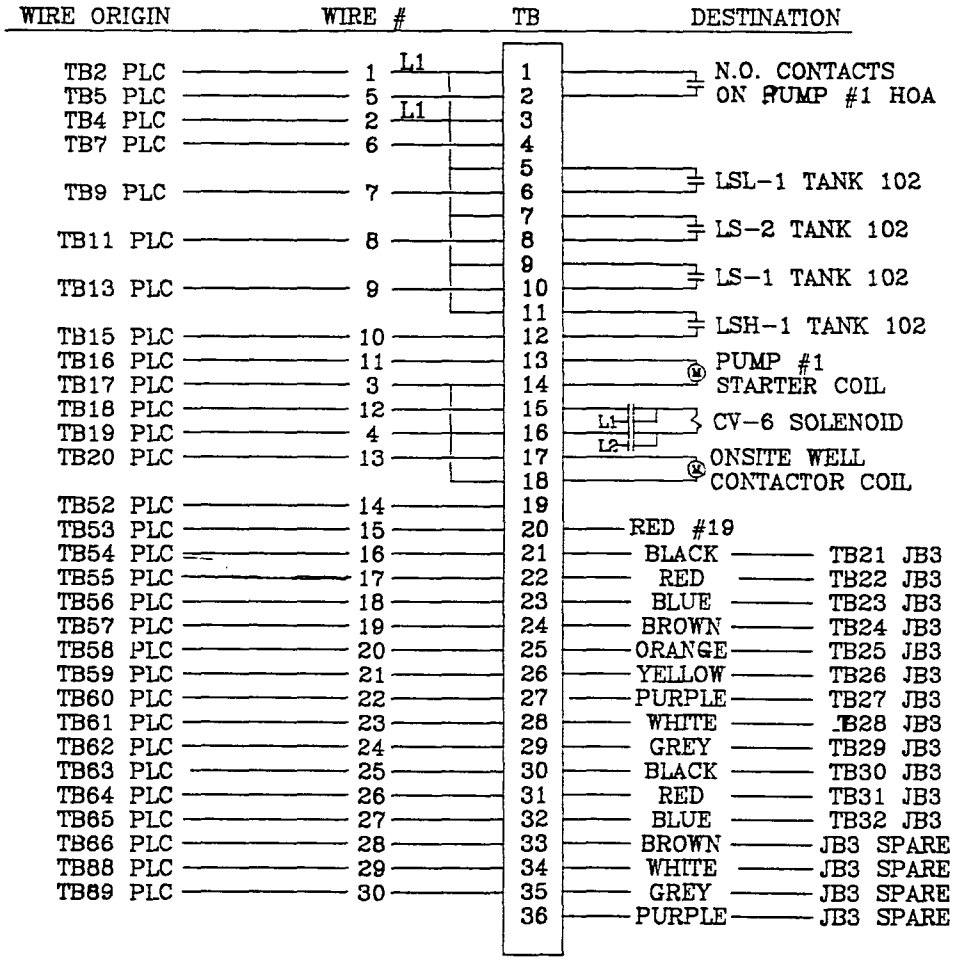

L2
L1
Device
Wire #
Destination
I/108
I/109
I/110
I/201
0/411
0/412
0/413
0/414
0/513
0/512
0/514
0/416
0/511
0/312
HOA
I/203
MODE SELECTOR
I/204
0/515
I/205
0/211
I/206
I/207
41 LSh-4 13+ TB13 JB2
42
43 SPARE 14+ TB20 JB2
44
45 SPARE 15+ TB22 JB2
46
47 LSH-4 16+ TB24 JB2
48
49
50
51
52 L1 14 TB19 JB1
53 CV-4 15 TB20 JB1
54 CV-3 16 TB21 JB1
55 L1 17 TB22 JB1
56 CV-5 18 TB23 JB1
57 CV-1 19 TB24 JB1
58 L1 20 TB25 JB1
59 CV-2 21 TB26 JB1
60 22 TB27 JB1
61 23 TB28 JB1
62 OFFSITE WELLS 24 TB29 JB1
63 25 TB30 JB1
64 26 TB31 JB1
65 27 TB32 JB1
66 28 TB33 JB1
67 LSH-2 17+ TB25 JB2
68 18+ TB26 JB2
69 LS-5 19+ TB27 JB2
70 PUMP #3 20+ TB28 JB2
71 LS-6 21+ TB29 JB2
72 LSH-6 22+ TB30 JB2
73 LSL-2 23+ TB31 JB2
74 24+ TB32 JB2
75 LSH-3 25+ TB33 JB2
76 26+ TB34 JB2
77 27+ TB35 JB2
78 28+ TB36 JB2
79 29+ TB37 JB2
80 4+ TB44 JB2
81 30+
82 31+ TB39 JB2
83 32+ TB40 JB2
84 33+ TB41 JB2
85 34+ TB42 JB2
86 35+ TB43 JB2
87
88 29 TB34 JB1
89 30 TB35 JB1
90 36+ TB45 JB2
91 37+ TB46 JB2
Legend
TB = Terminal Block
JB = Junction Box
I/xxx = Input Number
O/xxx = Output Number
HOA = Hand Off Automatic
Notes
See drawing 1058A for the remainder of the terminal strip.
Control Panel is located in the Dispatch Office
GIANT
Control Panel Terminal Block Wiring Diagram #41-91
Dwg # 1058B
By: Tim Kinney
Date: 5/2/91
Rev: 0

Figure #20



Legand

TB = Terminal Block
JB = Junction Box
I/xxx = Input Number
O/xxx = Output Number
HOA = Hand Off Automatic
PLC = Control Panel (PROGRAMMABLE LOGIC CONTROLLER)

Notes

Junction Box #1 (JB1) is located in the Tank 102 Building.

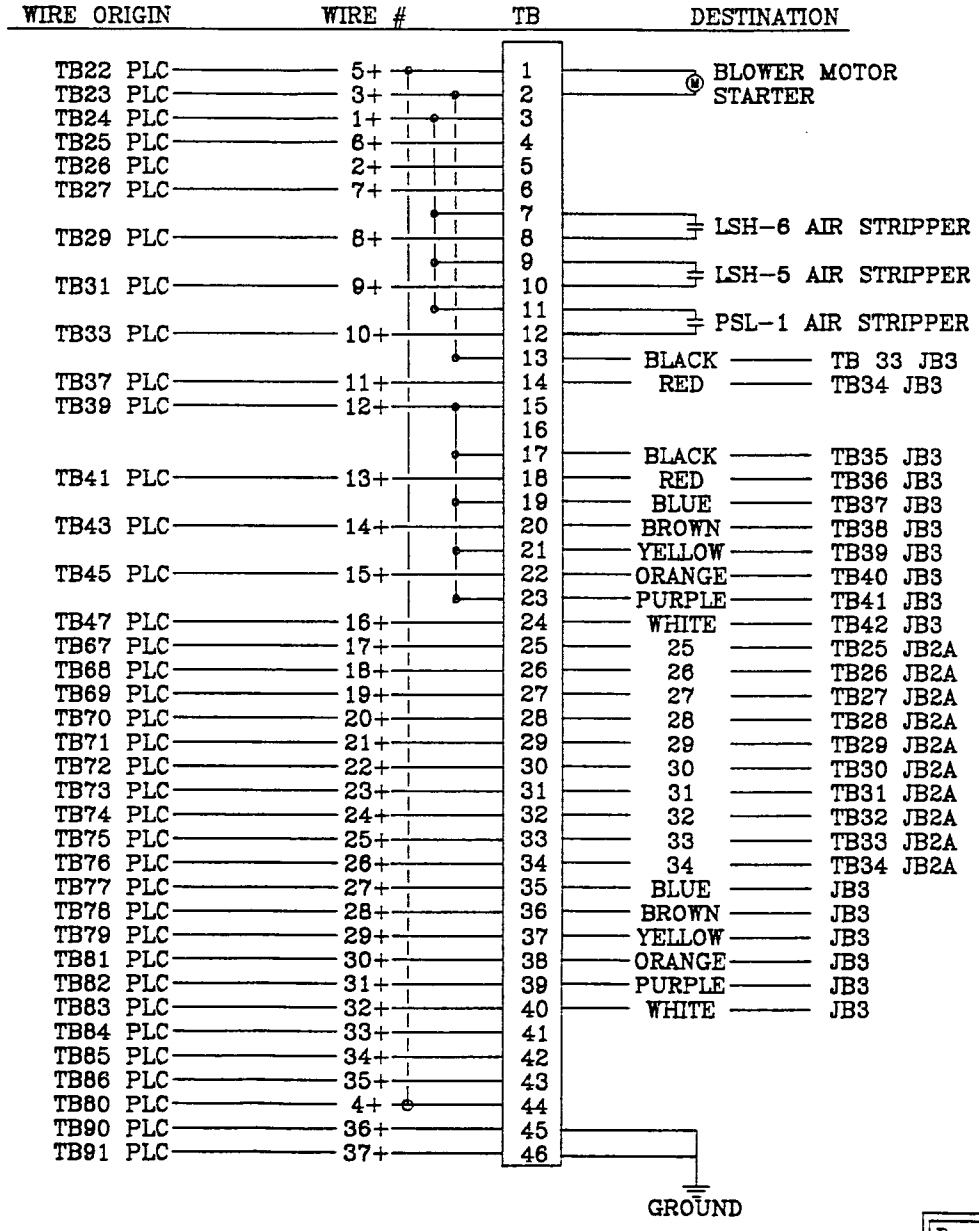
Control Panel is located in the Dispatch Office

GIANT

JB1 Terminal Strip Wiring Diagram

Dwg #1059	By: Tim Kinney	Date: 5/3/91	Rev: 0

Figure #21



Legend

TB = Terminal Block
JB = Junction Box
I/xxx = Input Number
O/xxx = Output Number
HOA = Hand Off Automatic
PLC = Control Panel

Notes

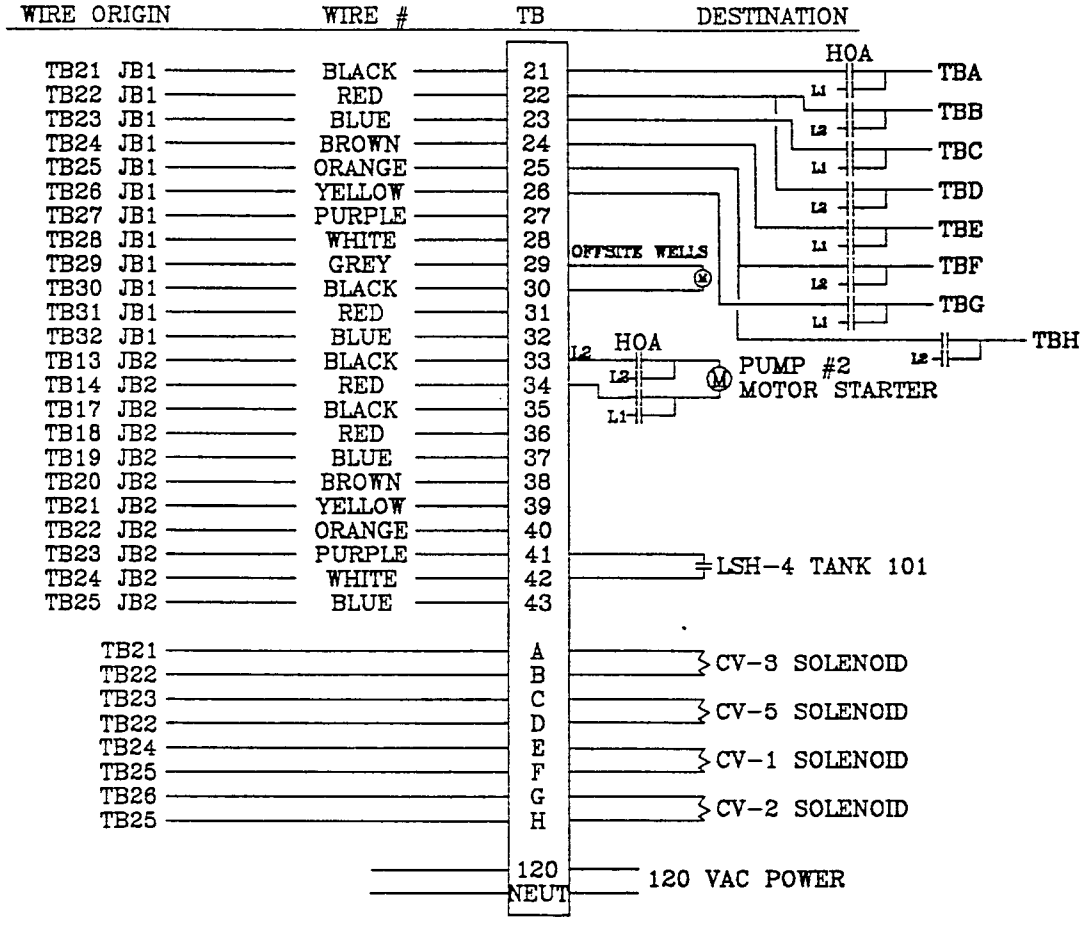
JB2 is located at the air stripper.

GIANT

JB2 Terminal Strip Wiring Diagram

Dwg # 1060	By: Tim Kinney	Date: 5/9/91	Rev: 0

Figure #22



Legend

TB = Terminal Block
JB = Junction Box
I/xxx = Input Number
O/xxx = Output Number
HOA = Hand Off Automatic
PLC = Control Panel

Notes

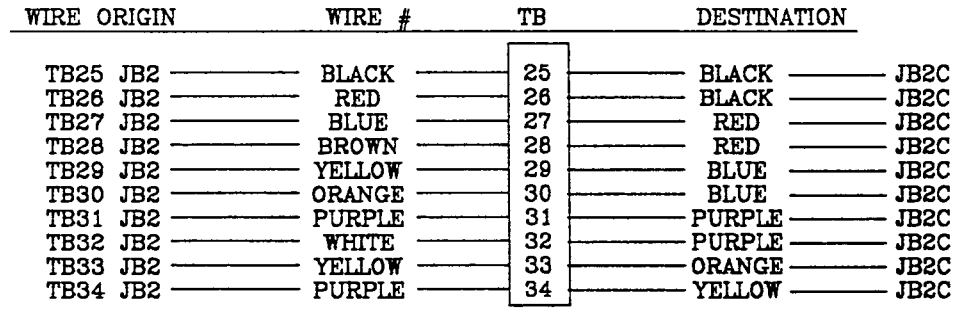
JB3 is located in the Tank 101 Building

Figure #23

GIANT

JB3 Terminal Strip Wiring Diagram

Dwg # 1063	By: Jim Kinney	Date: 5/9/91	Rev: 0

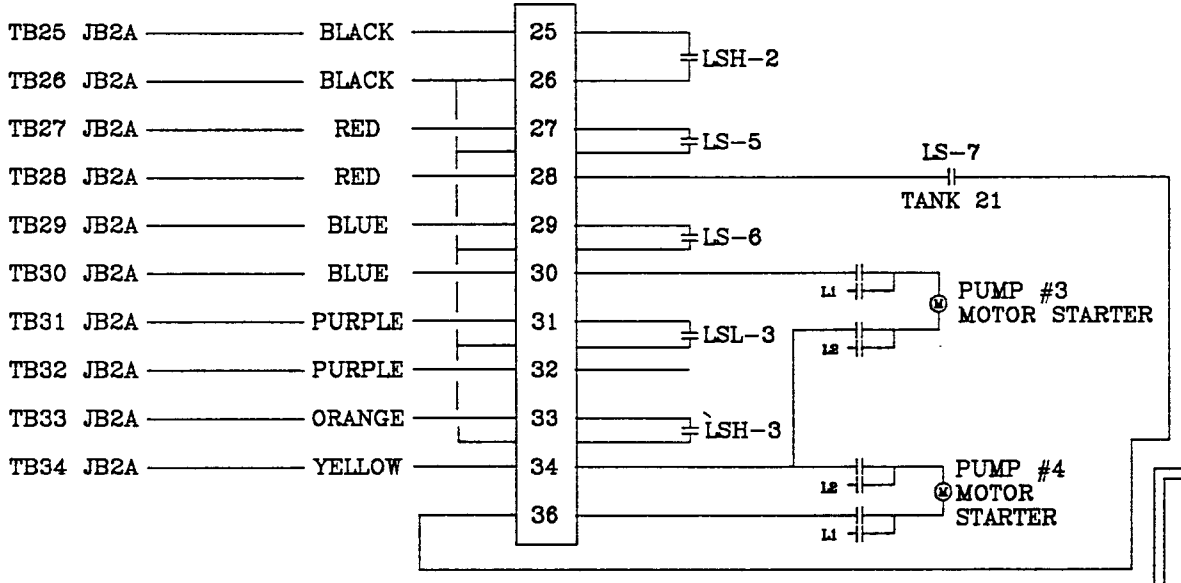


Legend

TB = Terminal Block
JB = Junction Box
I/xxx = Input Number
O/xxx = Output Number
HOA = Hand Off Automatic
PLC = Control Panel

Notes

JB2A and JB2C are located in the vicinity of Tank 22

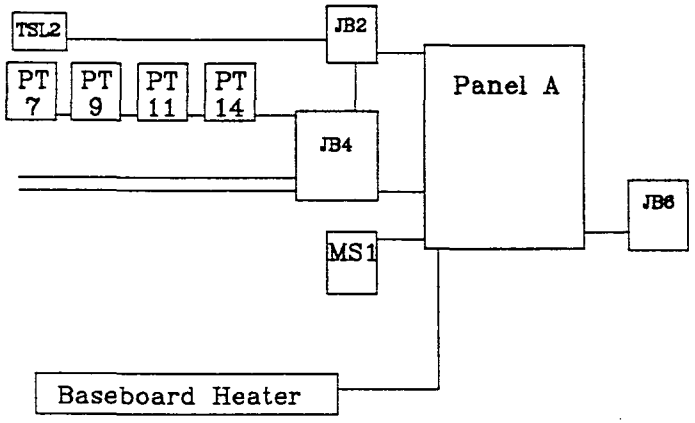


GIANT

JB2A, JB2C Terminal Strip Wiring Diagram

Dwg # 1062	By: Jim Kinney	Date: 5/9/91	Rev: 0

Figure #24



JB4 TERMINAL STRIP

1 Heat Trace	1 Spare
2 Spare	2 "
3 Spare	3 "
4 Spare	4 "
5 SHS9	5 "
6 SHS9	6 "
7 SHS11	7 "
8 SHS11	8 "
9 SHS14	9 "
10 SHS14	10 "
11 Spare	11 MS1
12 Spare	12 MS1
13 Spare	

Description:

Panel A – Single phase 120/240VAC 200 amp distribution panel including circuit breakers.

JB4 – Junction box for control wiring and pump motor interfacing. Contains terminal strips for wire connections as noted above.

JB5 – Junction box containing control relay for electric heat tracing on highway crossing. Relay coil is controlled by a thermostat (TSL-2) located on the north wal exterior of the building. A green light indicates the heat tracing status.

MS1 – Motor contactor for recovery well pumps. Coil is 120 VAC.

PT-7,9,11,14 – Pump Tech brand current sensing submersible pump motor controllers energized by MS1.

JB6 – Junction box for recovery wells SHS-11 and SHS-14. Motor lead wiring as well as a separate circuit for well house heaters traverse through this junction box.

GIANT

Southern Control Building Electrical Layout

Dwg #1064	By: Tim Kinney	Date: 5/15/91	Rev: 0

Figure #25

HEAT TRACING

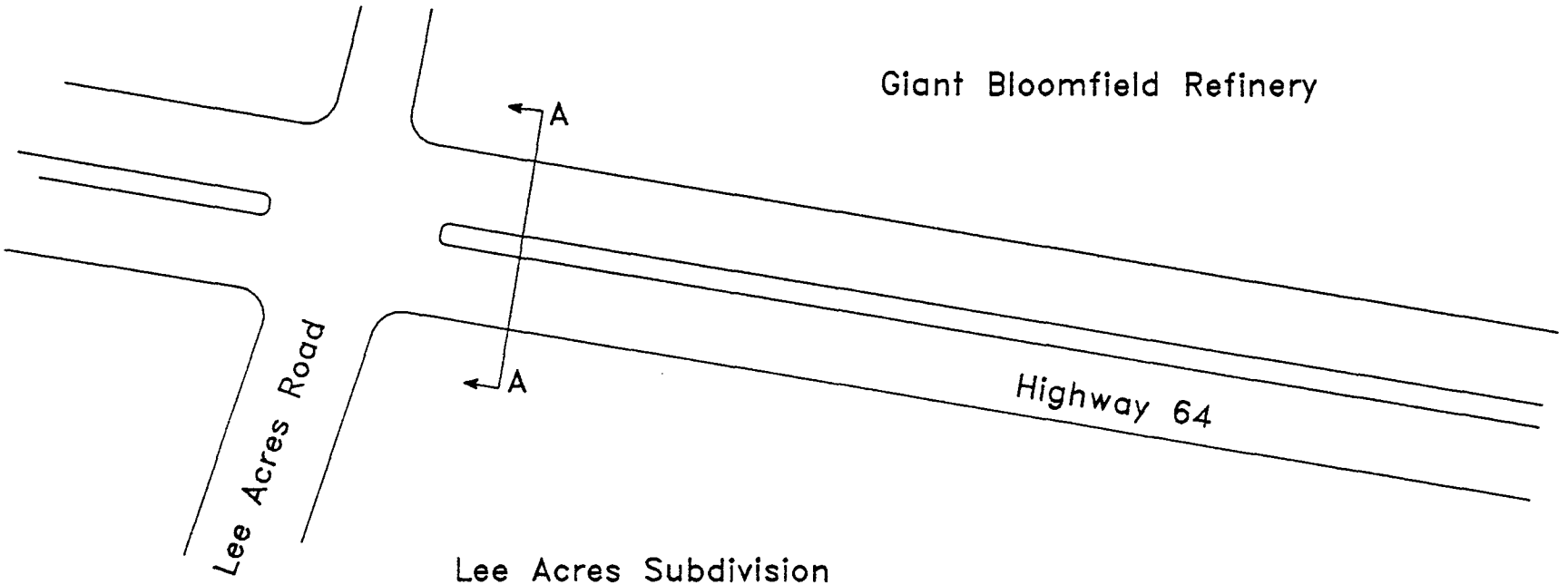
Water piping, which connects the On-Site and Off-Site systems, crosses through a culvert under US highway 64. The highway parallels the southern boundary of the refinery property. The exposed water piping is insulated and further protected from freezing by heat tracing. The heat tracing is switched on and off based on the ambient temperature as determined by the temperature sensor located on the north side of the Southern Control Building. The heat tracing system does not interface with the Control Panel. It is controlled strictly based on the ambient temperature. A green pilot light, located on the east wall inside the Southern Control Building, indicates the status of the heat tracing. The light should be on whenever the heat tracing is in operation. A local disconnect switch can be found at the southern end of the road crossing where the heat tracing terminates. It should remain locked in the "on" position and be periodically checked to make certain that it has not been tampered with.

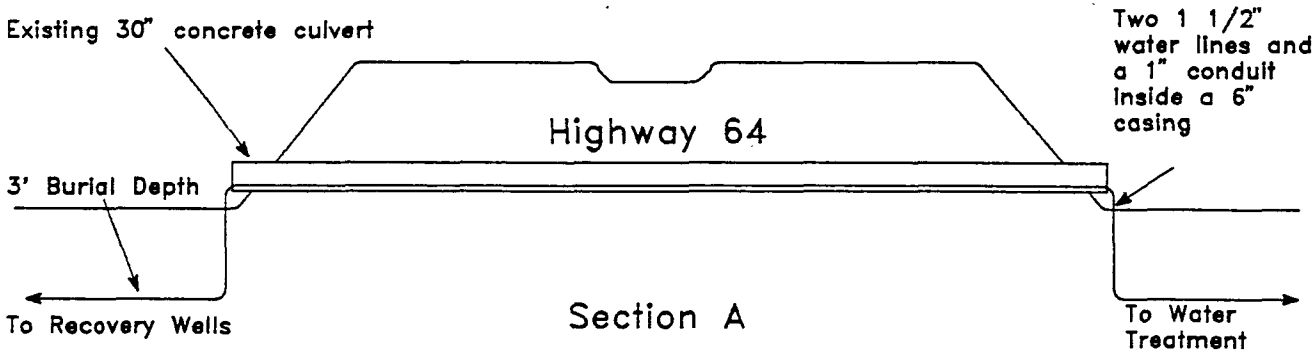
SECURITY

Reasonable security measures should be observed. Refinery gates should remain locked after normal business hours. Strict control of keys should be maintained. All wells, monitor and recovery, should remain locked except when being monitored or repaired. Buildings at Tanks 21, 22, 101, 102, and 106 are to be locked. The Southern Control Building as well as its chain link gate are to be locked. The Dispatch Office should be locked after normal business hours. All padlocks are keyed alike.

OFFSITE INSTALLATION

Figures #26 through #31 illustrate various aspects of the Offsite installation.



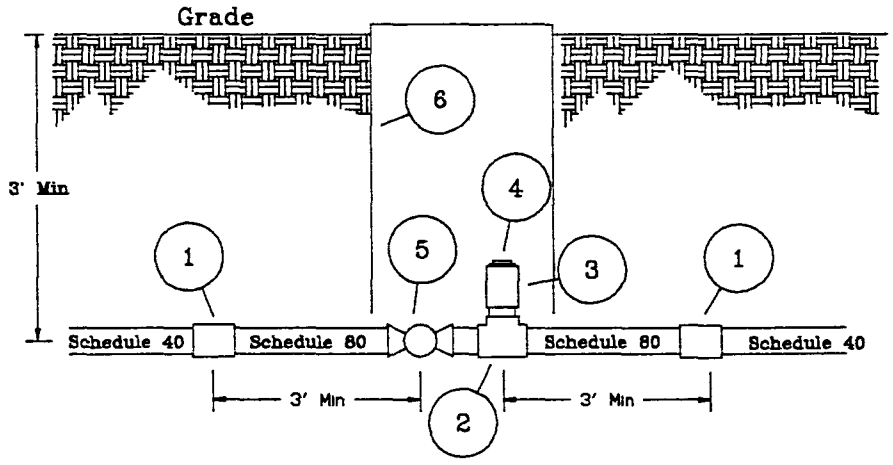


GIANT

Detail of the Utility Crossing of State Highway 64 for Groundwater Remediation Project

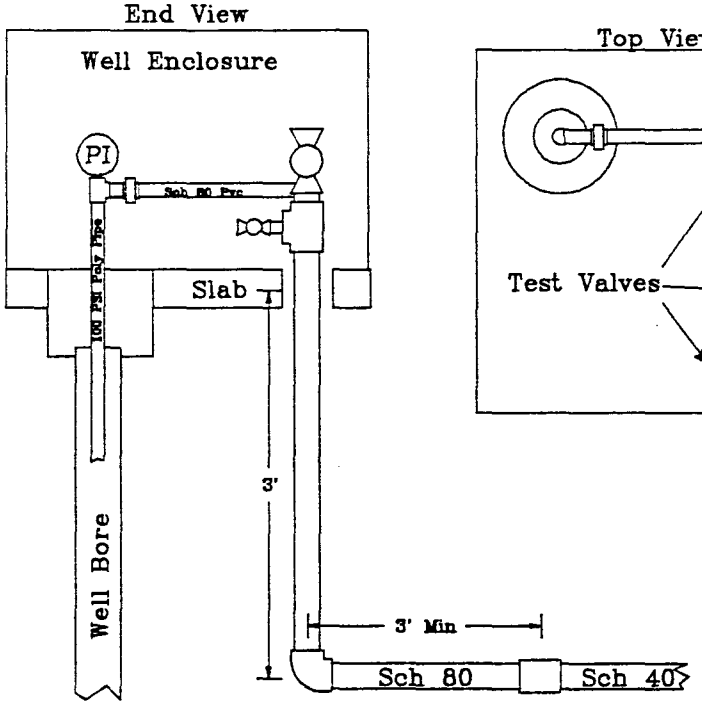
Dwg # 1023R1	By: Tim Kinney	Date: 5/29/90	Rev: 1

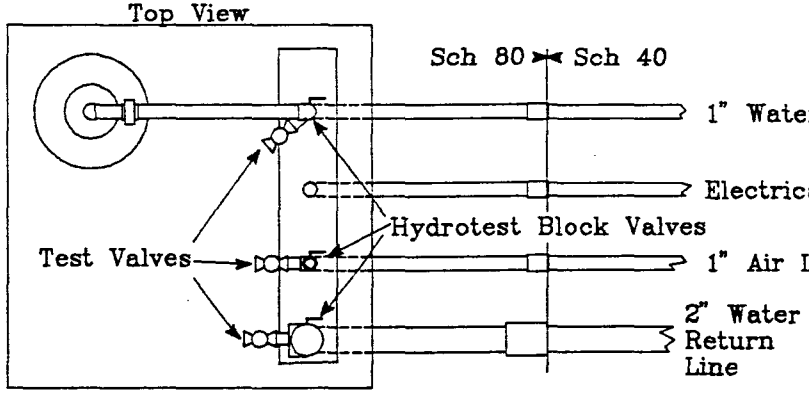
Figure #26



1 2" Sch 80 CPLG
2 2" Sch 80 Tee
3 2" Sch 80 Female Adapter
4 2" Sch 80 NPT Plug
5 2" Brass Curbstop Valve
6 Vault

Piping Detail
For Return Line
Underground Vaults





Piping Detail
For Well Enclosures
SHS-11, SHS-14,
SHS-7

GIANT

Miscellaneous
Piping Details
For The Off-Site
Project Expansion

Dwg # 1049	By: Tim Kinney	Date: 2/11/91	Rev: 0

Figure #27

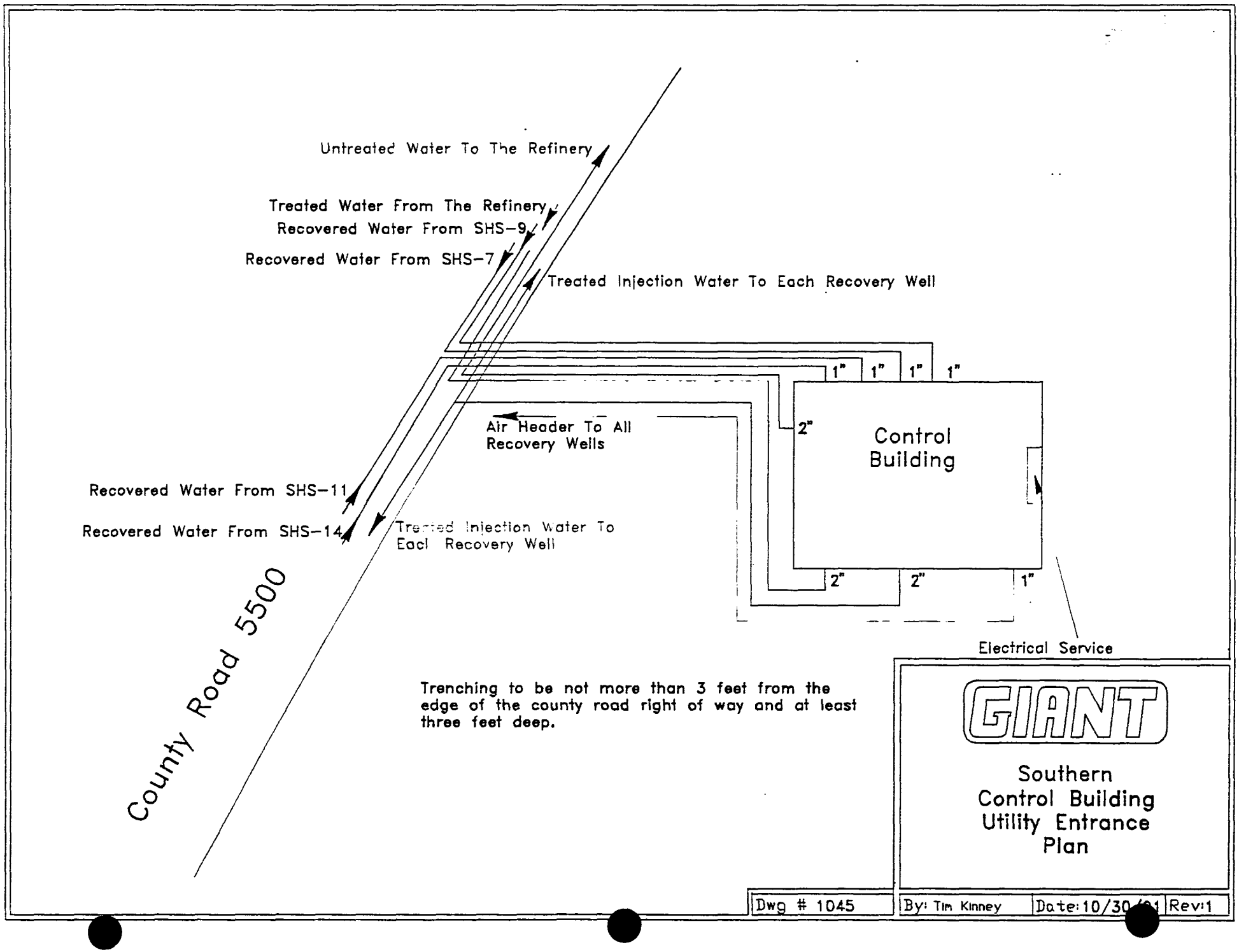
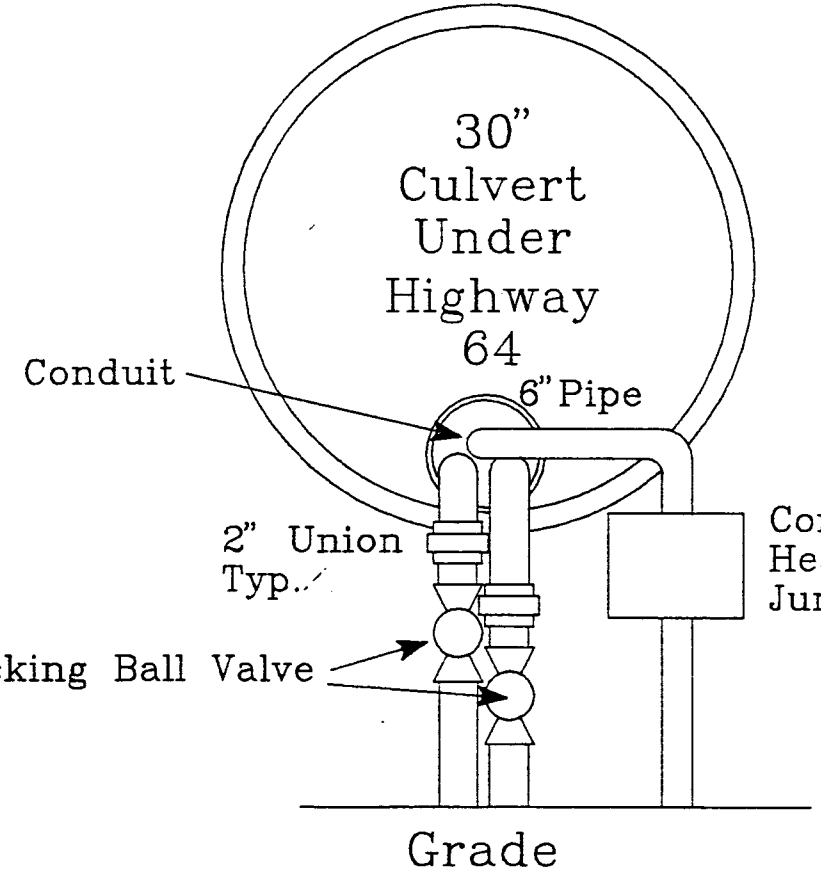

Untreated Water To The Refinery
Treated Water From The Refinery
Recovered Water From SHS-9
Recovered Water From SHS-7
Treated Injection Water To Each Recovery Well
1"
1"
1"
1"
2"
Control Building
Air Header To All Recovery Wells
Recovered Water From SHS-11
Recovered Water From SHS-14
Treated Injection Water To Each Recovery Well
2"
2"
1"
Electrical Service
County Road 5500
Trenching to be not more than 3 feet from the edge of the county road right of way and at least three feet deep.
GIANT
Southern Control Building Utility Entrance Plan
Dwg # 1045
By: Tim Kinney
Date: 10/30/01
Rev: 1

Figure #28



Typical End View North And South Of State Highway 64

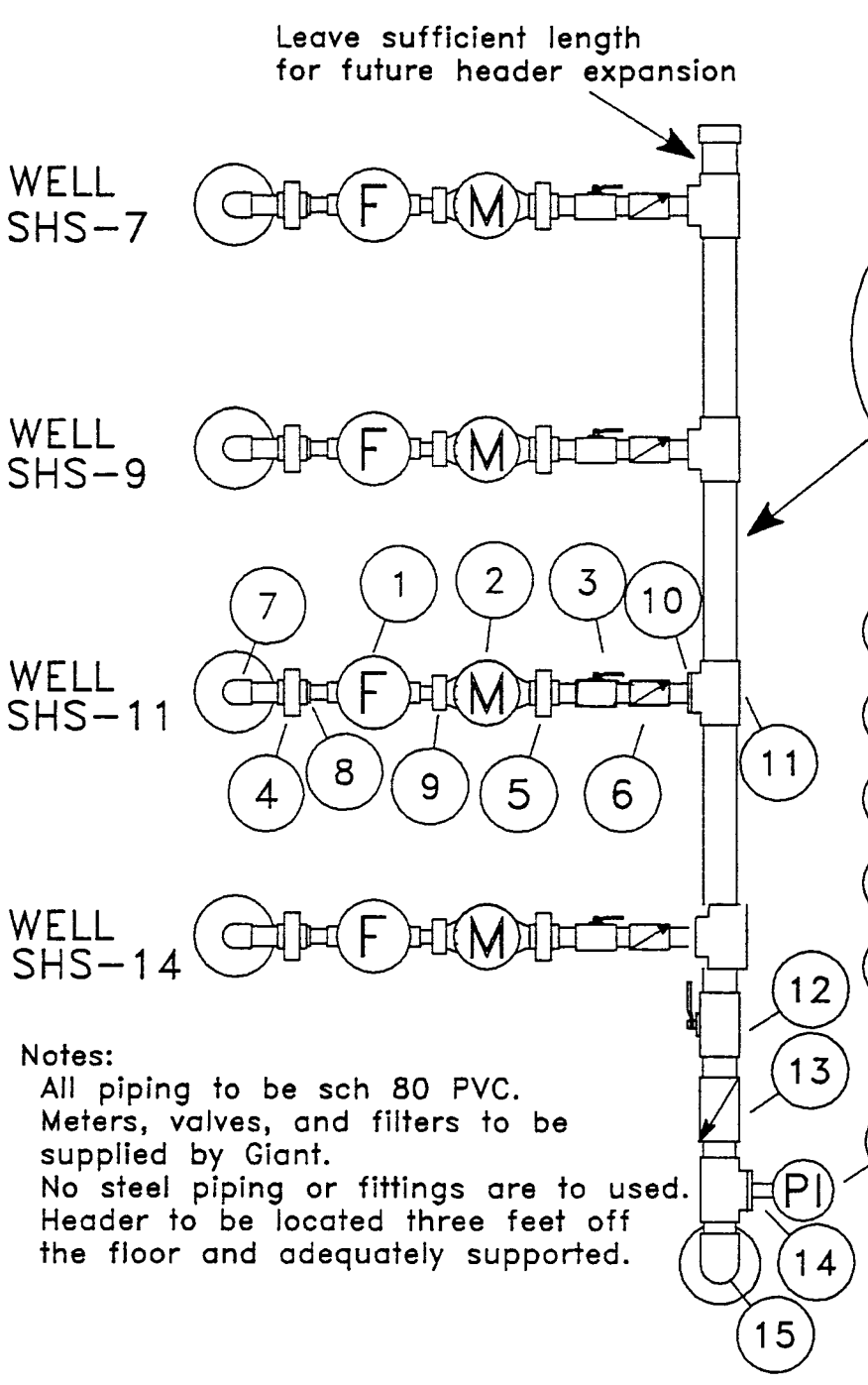
Note:
Turn valve handles to the side to allow for conduit clearance

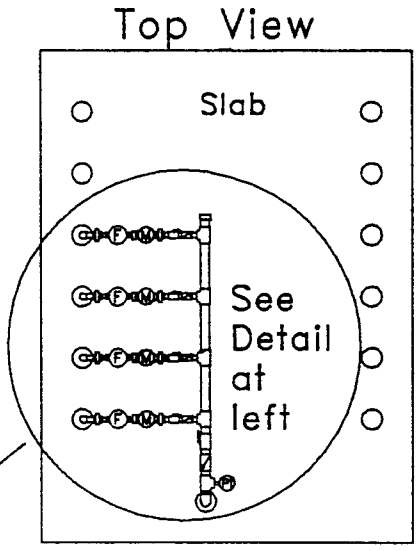
GIANT

Piping Detail For Road Crossing

Dwg # 1047	By: Tim Kinney	Date: 1/31/91	Rev: 0

Figure #29





1. Water filter 3/4" NPT
2. Water meter 5/8"x3/4"
3. Brass ball valve 1" NPT
4. Union 1" Sch 80 SxS PVC
5. Union 1" TxT NPT
6. Brass check valve 1" NPT
7. El 90 deg 1" sch 80 PVC
8. Bushing 1"x1/4" SxT PVC
9. Meter union 3/4"
10. Bushing 2"x1" SxT PVC
11. Tee 2" SxSxS sch 80 PVC
12. Brass ball valve 2" NPT
13. Brass check valve 2" NPT
14. Bushing 2"x1/4" SxT PVC
15. El 90 deg 2" sch 80 PVC
16. Pressure gage 0-150 psig

Notes:
All piping to be sch 80 PVC.
Meters, valves, and filters to be supplied by Giant.
No steel piping or fittings are to used.
Header to be located three feet off the floor and adequately supported.

Figure 4

GIANT

Control Building
Recovered Water
Collection Header
Detail

Dwg # 1042	By: Tim Kinney	Date: 1/9/91	Rev: 0

Figure #30

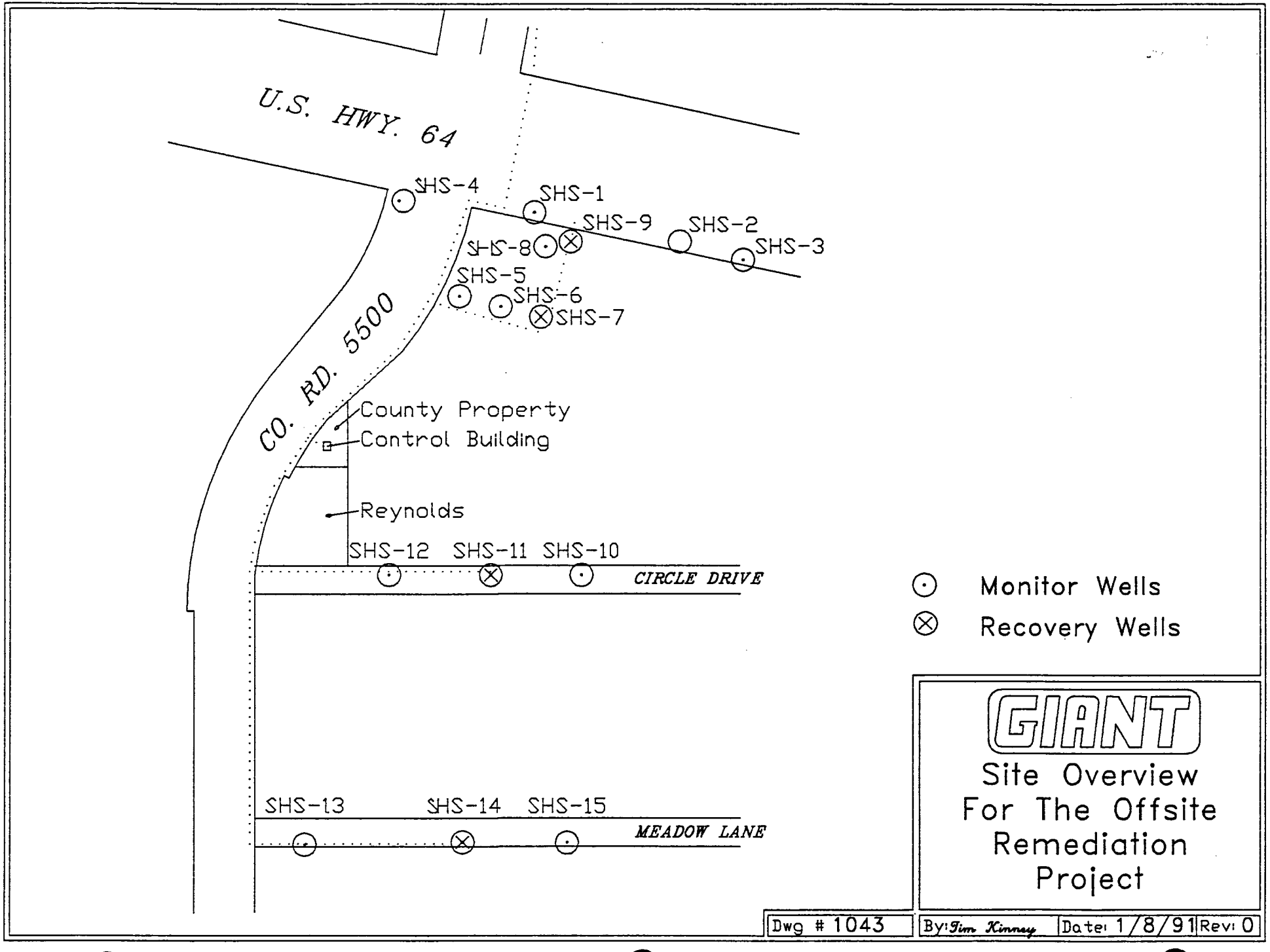

U.S. HWY. 64
CO. RD. 5500
SHS-4
SHS-1
SHS-9
SHS-2
SHS-3
SHS-8
SHS-5
SHS-6
SHS-7
County Property
Control Building
Reynolds
SHS-12
SHS-11
SHS-10
CIRCLE DRIVE
SHS-13
SHS-14
SHS-15
MEADOW LANE
Monitor Wells
Recovery Wells
GIANT
Site Overview
For The Offsite
Remediation
Project
Dwg # 1043
By: Jim Kinney
Date: 1/8/91
Rev: 0

Figure #31

SECTION III

THE MONITORING AND SAMPLING PROGRAM

MONITORING, SAMPLING AND REPORTING PROGRAM

Monitoring, sampling and analysis, and reporting are an integral part of the remediation project. Monitoring provides information critical to the safe and efficient operation of the system. Sampling and analytical work is the barometer by which the effectiveness of the project is determined. The results of monitoring, sampling, and analysis are reported to appropriate government agencies. The reported information becomes the basis of the government's assessment of project's compliance with the appropriate regulations. A great deal of emphasis needs to be placed on correct monitoring, sampling, and analysis.

Following are portions of the discharge plan, and other current operating procedures related to monitoring, and sampling and analysis.

MONITORING

Monitoring the system is critical for efficient operation. On a regular basis, during the workweek, the system operation should be monitored. Visual observations should be made each day, looking for leaks, equipment malfunctions and the status of the control system. Observations are to be recorded in a bound field logbook with the date, time, and person recording the information noted. This book is to be kept as a permanent part of the project records. A new book is to be used for each year.

An inspection in the control building at each tank, the southern area, and each recovery well should be made at least three times a week. All equipment should be inspected for leaks and malfunctions. The operator should be familiar with the location of underground lines and note any surface indication of underground leaks. Plate #1 indicates the location of remediation related underground pipes and conduits. Leaks of any size should be noted and repaired. Leaks should be reported to the project manager. Leaks of a sufficient quantity may have to be reported to the appropriate governmental agency. Readings from all meters are to be observed and recorded in the log book at least three times a week. Note in the logbook whether the readings are in gallons or in barrels. Comparisons of previous readings should be made. Abnormal meter readings can indicate problems within the system. Figure #32 illustrates the report that is generated and submitted to the appropriate government agency based on the recorded meter data.

Levels in all active tanks within the system are to be observed and the depth from the tank opening to free floating product, and to water, recorded in the log book on a weekly basis. Figure #33 illustrates the report

that is generated and submitted to the appropriate government agency based on the recorded tank level data. While observing levels, the tank should receive a visual inspection for leaks or other defects and any observations recorded in the logbook.

On a monthly basis, the level of water and product should be determined for each well. This includes both monitoring and recovery wells. The information is used to determine the direction of ground water flow. Knowledge of the ground water flow direction is useful in determining the effectiveness of the recovery well network. An electronic water/oil detection tape is to be used to determine levels. Record collected data in the logbook noting the depth to water and the depth to product as well as the time, date and person recording the observations. All measurements are to be recorded in feet and tenths of feet. A mark on the north side of the top of each well casing serves as the measurement reference point. It is necessary to decontaminate the detection tape between each well. See the section on decontamination in this manual for details. Figure #34 is an example of the reporting form containing the water level data. Water level data, recorded in the logbook, is to be transferred to this form and inserted in the quarterly data report.

SAMPLING

Water samples are collected from a variety of wells on a regular basis. The samples are analyzed for various components. The results are included as a part of quarterly reports. Strict adherence to the following sampling procedures is essential. Figure #35 is the sample matrix for the project. It illustrates the required analyses and the frequency for various wells and points in the system.

PURGING

Wells must be properly purged prior to collection of samples. The water found standing in a well prior to purging has been in contact with air and does not represent the aquifer in the area. To obtain a representative sample it is necessary to withdraw at least 3-5 casing volumes of water from monitoring wells before sample collection. A casing volume is the volume of water standing in the well casing when the well is at equilibrium. Water is withdrawn using a Teflon or stainless steel bailer. The bailer is repeatedly lowered into the well, withdrawn and emptied until sufficient water has been purged from the well. Use the following formula to determine the purge volume of the well:

$$\text{Purge Volume} = (\text{DTF-DTB}) \times \text{CVF} \times 3$$

Where:

DTF = Depth to fluid from the top of the well casing in feet
DTB = Depth to bottom of the well from the top of the casing in feet
CVF = Casing volume factor from the following chart

CASING VOLUME FACTORS

Nominal Casing Diameter	CVF
2"	.174
4"	.661
5"	1.02
6"	1.5

The temperature, Ph, and conductivity of the purged water should be monitored at regular intervals as the well is purged. This will help to determine if enough water has been purged to insure a representative ground water sample. As the well is purged, these three parameters should stabilize. If it does not stabilize after 3 casing volumes have been purged, additional water will have to be purged until it does. To determine the monitoring interval, divide the purge volume by four and determine the temperature, Ph, and conductivity at each purge interval. For example, if the purge volume of the well is eight gallons, divide the eight gallon purge volume by four. The resulting answer is two gallons. This means that at two gallon intervals, the temperature, Ph, and conductivity should be determined and recorded in the log book. If the temperature, Ph, and conductivity have not stabilized after purging three casing volumes, continue to purge water until they do stabilize.

Some wells will purge dry. If a well purges dry and does not recover in a reasonable period of time, allow the well to recover and collect samples. Do this even though three to five volumes may not have been purged from the well.

If the well to be sampled has an active recovery pump, collect the sample directly from the pump discharge after allowing a small volume of water to purge the sample valve and line. It is not necessary to purge active recovery wells.

DECONTAMINATION

To prevent contamination of ground water samples or monitor wells, all sampling equipment must be thoroughly cleaned prior to each use. Since regulatory limits for numerous compounds are measured in parts per billion, cross contamination between samples and other sources must be carefully avoided. The following decontamination procedure is to be strictly adhered to.

1. Disassemble and thoroughly wash all sampling equipment with non-phosphate detergent and water.
2. Rinse several times with deionized water.
3. Rinse once with laboratory grade methanol.
4. Rinse again with deionized water.
5. Wrap the cleaned equipment with aluminum foil or plastic if it is not used immediately.

Plastic gloves should be worn during sampling. They must be disposed of or decontaminated per the above procedure between samples. Do not attempt to decontaminate the rope used with the bailer. Discard it and replace the rope with new rope for each well. Use new nylon, polypropylene or similar rope.

SAMPLE CONTAINERS AND SHIPMENT

Laboratory supplied sample containers are to be used for all samples. All samples will be collected and placed in tightly sealed glass or polyethylene containers, as appropriate, and preserved in accordance with the requirements of EPA document SW-846 and the standard practices of the laboratory contracted to perform the analyses. The container and preservation technique will be specified by the laboratory. Immediately upon collection, label each container with an adhesive label clearly indicating, in waterproof ink, the project and site identification, sample number, method of sample preservation, date and time of sampling, and the name of the sample collector. The sample number is a unique ten digit code indicating the date and time of sampling. The first two digits represent the year, the third and fourth digits, the month, the fifth and sixth, the day, and the seventh, eighth, ninth, and tenth, the time based on a twenty four hour clock. For example, a sample collected on December 10, 1990 at 1:45 PM would be assigned a sample number of 9012101345. Each sample container is to be sealed with a chain of custody seal. The seal is an adhesive strip which contains the sample number, project and site designation, date and the signature and printed name of the sampler. The seal is affixed to the sample container in such a way that the container can

only be opened by breaking the seal. Seals are to be removed only by the laboratory. Samples should be placed on ice as soon as possible and chilled to below 4 degrees Celsius.

SHIPMENT

Samples are to be shipped via Federal Express or similar overnight air freight to the laboratory. Samples are to be shipped packed in ice, in suitable coolers supplied by the laboratory. The samples must arrive at the laboratory no warmer than 4 degrees Celsius. Wrap the samples in Styrofoam, foam rubber, plastic bubble pack, or similar materials suitable for fragile shipment. The laboratory can supply appropriate packing material.

CHAIN OF CUSTODY FORMS

All samples collected for analysis are to be accompanied by a chain of custody form. Do not ship samples without a separate chain of custody form in each shipping container. The document records the transfer of custody as the samples are processed. It is essential that the form be completed and shipped or hand delivered with the corresponding samples. Figure #36 is an example of a properly filled out chain of custody form. The form is prepared in triplicate. One copy is to be retained by Giant prior to shipment. The original and the remaining copy are to be included with the samples in a waterproof bag. The original chain of custody, as noted on the sample form, is to be returned to Giant after the laboratory accepts custody of the sample shipment. Chain of custody forms are to be kept on file with the corresponding laboratory report.

Giant Refining Co. Bloomfield Refinery
Quarterly Recovery Well
Volume Tabulation

Third Quarter of 1991

Well	Month #1	Month #2	Month #3	Total
GRW-1	13340	13050	14120	40510
GRW-2	4220	8090	6840	19150
GRW-3	22080	14140	17050	53270
GRW-4	23540	24420	26840	74800
GRW-5	65080	60310	69080	194470
GRW-6	23540	16700	18790	59030
GRW-9	11770	9460	11050	32280
GRW-10	300450	196160	262500	759110
GRW-11	47420	62800	67280	177500
GRW-12	6290	10660	6930	23880
GRW-13	40740	37200	41270	119210
SHS-9	5822	6089	7483	19394
SHS-11	5635	7571	5683	18889
SHS-14	177954	119607	184746	482307

Total Volume Pumped In Gallons 2073800

Figure #32

Giant Refining Co. Bloomfield Refinery
Quarterly Net Tank
Volume Change

Third Quarter, 1991

Tank Number	Beginning Volume	Ending Volume	Net Change
102	13735	16763	3028
106	8010	8010	0
21	351419	218449	-132970
22	294448	331759	37311
27	182470	182470	0
32	88634	88634	0
34	87541	87541	0
35	0	0	0
37	138051	138051	0
Total Net Volume Change			-92631

Figure #33

GIANT REFINING BLOOMFIELD REFINERY
MONTHLY POTENTIOMETRIC SURFACE

MONTH/YEAR: July, 1991

WELL #	WELLHEAD ELEVATION IN FEET	DEPTH TO WATER IN FEET	DEPTH TO PRODUCT IN FEET	PRODUCT THICKNESS IN FEET	ADJUSTED WSEL* IN FEET
GRW-1	5394.30	61.51	61.51	0.00	5332.79
GRW-2	5391.28	48.80	48.75	0.05	5342.52
GRW-3	5388.77	54.75	54.75	0.00	5334.02
GRW-4	5390.02	49.75	49.75	0.00	5340.27
GRW-5	5390.56	44.10	44.10	0.00	5346.46
GRW-6	5390.81	42.86	42.86	0.00	5347.95
GRW-10	5395.02	59.06	51.80	7.26	5341.77
GRW-11	5397.85	63.00	63.00	0.00	5334.85
GRW-12	5397.24	45.94	45.94	0.00	5351.30
GRW-13	5396.90	56.14	56.14	0.00	5340.76
GBR-5	5395.07	27.87	25.60	2.27	5369.02
GBR-6	5395.70	60.04	60.04	0.00	5335.66
GBR-7	5395.85	32.23	29.82	2.41	5365.55
GBR-8	5390.50	41.93	41.93	0.00	5348.57
GBR-9	5389.92	45.94	45.94	0.00	5343.98
GBR-10	5390.57	42.32	42.32	0.00	5348.25
GBR-11	5389.43	42.15	40.84	1.31	5348.33
GBR-13	5393.04	38.00	38.00	0.00	5355.04
GBR-15	5397.99	43.35	43.35	0.00	5354.64
GBR-17	5402.69	34.94	34.94	0.00	5367.75
GBR-18	5421.68	23.05	23.05	0.00	5398.63
GBR-19	5393.83	38.83	38.82	0.01	5355.01
GBR-20	5393.47	38.55	36.26	2.29	5356.75
GBR-21S	5400.65	20.47	20.36	0.11	5380.27
GBR-21D	5400.19	36.23	36.23	0.00	5363.96
GBR-22	5395.91	38.89	35.55	3.34	5359.69
GBR-23	5403.72	23.07	23.06	0.01	5380.66
GBR-24S	5396.08	28.94	27.65	1.29	5368.17
GBR-24D	5396.77	32.29	32.29	0.00	5364.48
GBR-25	5396.72	29.78	29.78	0.00	5366.94
GBR-26	5395.59	38.46	38.46	0.00	5357.13
GBR-30	5396.58	34.05	34.05	0.00	5362.53
GBR-31	5394.86	35.20	35.20	0.00	5359.66
GBR-33	5396.28	37.99	37.92	0.07	5358.35
GBR-34	5394.00	36.61	35.40	1.21	5358.36
GBR-35	5393.66	36.42	35.30	1.12	5358.14
GBR-39	5397.55	36.08	36.08	0.00	5361.47
GBR-40	5400.76	26.44	26.44	0.00	5374.32
GBR-41	5396.35	19.22	19.22	0.00	5377.13
GBR-51	5389.68	40.24	40.24	0.00	5349.44
GBR-52	5387.74	38.67	38.67	0.00	5349.07

* WSEL - WATER SURFACE ELEVATION ADJUSTED FOR PRODUCT DEPTH

Figure #34

GIANT REFINING BLOOMFIELD REFINERY
MONTHLY POTENTIOMETRIC SURFACE
MONTH/YEAR: July, 1991

WELL #	WELLHEAD ELEVATION IN FEET	DEPTH TO WATER IN FEET	DEPTH TO PRODUCT IN FEET	PRODUCT THICKNESS IN FEET	ADJUSTED WSEL* IN FEET
SHS-1	5383.54	40.92	40.90	0.02	5342.64
SHS-2	5381.66	37.15	37.15	0.00	5344.51
SHS-3	5383.33	36.08	36.08	0.00	5347.25
SHS-4	5383.62	40.98	40.98	0.00	5342.64
SHS-5	5378.36	38.10	38.10	0.00	5340.26
SHS-6	5378.17	38.24	38.24	0.00	5339.93
SHS-7	5378.77	39.15	38.60	0.55	5340.06
SHS-8	5380.25	36.06	36.05	0.01	5344.20
SHS-9	5380.79	44.18	44.18	0.00	5336.61
SHS-10	5373.80	36.64	36.64	0.00	5337.16
SHS-11	5373.17	38.00	38.00	0.00	5335.17
SHS-12	5373.94	38.59	38.59	0.00	5335.35
SHS-13	5367.81	36.36	36.36	0.00	5331.45
SHS-14	5367.07	46.50	46.50	0.00	5320.57
SHS-15	5366.21	33.50	33.50	0.00	5332.71
SHS-16	5362.58	31.26	31.26	0.00	5331.32

* WSEL - WATER SURFACE ELEVATION ADJUSTED FOR PRODUCT DEPTH

Giant Bloomfield Refinery
Sample Matrix

LOCATION	MONTHLY	QUARTERLY	SEMI ANNUALLY	ANNUAL
Stripper Infuent	601 602 GWC	601 602 GWC	601 602 GWC	601 602 GWC
Stripper Effluent	601 602 GWC	601 602 GWC	601 602 GWC	601 602 GWC Metals PAH
GRW-3		601 602 GWC PAH	601 602 GWC PAH	601 602 GWC PAH
GRW-6		601 602 GWC PAH	601 602 GWC PAH	601 602 GWC PAH
GRW-13		601 602 GWC PAH	601 602 GWC PAH	601 602 GWC PAH
GBR-15		601 602 GWC	601 602 GWC	601 602 GWC
GBR-17		601 602 GWC	601 602 GWC	601 602 GWC PAH
GBR-24D		601 602 GWC	601 602 GWC	601 602 GWC PAH

Figure #35

Giant Bloomfield Refinery
Sample Matrix

LOCATION	MONTHLY	QUARTERLY	SEMI ANNUALLY	ANNUAL
GBR-30		601 602 GWC	601 602 GWC	601 602 GWC PAH
GBR-31		601 602 GWC	601 602 GWC	601 602 GWC PAH
SHS-3		601 602	601 602 GWC	601 602 GWC
SHS-6		601 602	601 602 GWC	601 602 GWC
SHS-10		601 602	601 602 GWC	601 602 GWC
SHS-12		601 602	601 602 GWC	601 602 GWC
SHS-13		601 602	601 602 GWC	601 602 GWC
SHS-15		601 602	601 602 GWC	601 602 GWC
SHS-16		601 602	601 602 GWC	601 602 GWC

Giant Bloomfield Refinery
Sample Matrix

LOCATION	MONTHLY	QUARTERLY	SEMI ANNUALLY	ANNUAL
SHS-7			601 602 GWC	601 602 GWC
SHS-9			601 602 GWC	601 602 GWC
SHS-11			601 602 GWC	601 602 GWC
Tank 21				601 602 GWC Metals PAH
Tank 27				601 602 GWC Metals PAH
Offsite Stream				601 602 GWC Metals PAH

Notes

All wells will have water and free product elevations determined on a monthly basis.

Wells exhibiting free product will not be sampled.

GIANT

Farmington Refinery Remediation
606 Highway 64
Post Office Box 256
Farmington, New Mexico 87499

CHAIN OF CUSTODY

Date: 4-15-91 Page 1 of 1

LABORATORY The Laboratory
ADDRESS 1212 E. Main St. Lab City, CA
TELEPHONE (333) 555-2222
SAMPLER'S SIGNATURE

REQUESTED ANALYSIS

SAMPLE NUMBER	MATRIX	LOCATION	POLYNUCLEAR AROMATICS 610/8310	HALOGENATED VOLATILES 601/8010	AROMATIC VOLATILES 602/8020	GENERAL WATER CHEMISTRY	NUMBER OF CONTAINERS
910415 0955	Water	SHS-25		✓	✓	✓	5
910415 1322	water	GRW-64	✓			✓	3

PROJECT INFORMATION

PROJECT: Refinery Remediation
PROJECT MANAGER: Paul P. Project
SHIPPING I.D. NO. Fed. Express #
SHIPPED VIA Federal Express

SAMPLE RECEIPT

TOTAL NO. OF CONTAINERS
CHAIN OF CUSTODY SEALS
REC'D GOOD CONDITION/COLD
CONFORMS TO RECORD
LABORATORY NUMBER:

SPECIAL INSTRUCTIONS OR COMMENTS
Please return original COC

1004

RELINQUISHED BY: (Signature) 1.	RELINQUISHED BY: (Signature) 2.	RELINQUISHED BY: (Signature) 3
Sally Sampler		
(Printed Name) Sally Sampler	(Printed Name)	(Printed Name)
(Company) Giant Refining	(Company)	(Company)
DATE AND TIME: 4-15-91 4:30 pm.	DATE AND TIME:	DATE AND TIME:
RECEIVED BY: (Signature) 1.	**RECEIVED BY: (Signature) 2.**	**RECEIVED BY: (Signature) 3**
		LABORATORY
(Printed Name)	(Printed Name)	(Printed Name)
(Company)	(Company)	(Company)
DATE AND TIME:	DATE AND TIME:	DATE AND TIME:

Figure #36

san juan repr Form 209-29

SECTION IV

REPAIR
AND
MAINTENANCE
MANUALS

Note: Repair and Maintenance Manuals are found in volume two of this manual.

Giant Meeting 11/22/91

Name	Co.	Phone
Monica Chapa	EPA	214-655-6730
Renee Holmes	EPA CRC	214-655-2120
KEN GOODMAN	PRC	214-754-8765
Denny Foust	OCD	505-334-6178
Bill Luthans	EPA	214-655-6730
Tim Kinney	Giant	(505) 632-3306
Bill Olson	NMOCD	(505) 827-5885
DAVID TOMKO	NMED	(505) 327-9851
Dale McDaniels	NMED	505-827-0072