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To: Steve Pullen

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Subject:

Technical Memo - Triassic Park Waste Disposal Facility

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**FINAL REPORT**  
**1999 STRATIGRAPHIC AND GROUNDWATER CHARACTERIZATION PROGRAM**  
**TRIASSIC PARK WASTE DISPOSAL FACILITY**

**DRAFT**

**1. Introduction**

At the request of the New Mexico Environmental Department, Hazardous and Radioactive Material Bureau (HRMB), on August 3-5 1999, a drilling program was conducted by Gandy Marley, Inc. (GMI) at the proposed Triassic Park Disposal Facility. This drilling further clarified the subsurface stratigraphy and groundwater conditions underlying and adjacent to the proposed site. A total of ten (10) drill holes were completed as part of this program. All drilling activities were performed in accordance with the Final Work Plan for 1999 Stratigraphic and Groundwater Characterization Program dated July 28, 1999 and conditionally approved by the HRMB on July 30, 1999. (see Attachment A) Minor modifications of the Work Plan were required during implementation of the drilling program. These were generally reviewed with the HRMB on site staff. The changes are discussed and documented in this report.

HRMB staff was onsite periodically to observe the drilling operations. Specifically, staff was on site on August 3 and August 5, 1999.

**2. Purpose**

The primary purpose of this drilling was to provide additional definition to the character of the Upper Dockum sediments and their contact with the Lower Dockum mudstones. At the same time, this drilling was to supply more information on the saturation conditions of the Upper Dockum sediments.

~~To date, all characterization drilling for the facility has been completed in the southern and central portions of the proposed site. Therefore, the HRMB has requested that additional stratigraphic characterization drilling be completed in the northern portion of the site in order to assess the character of the subsurface relative to planned operational facilities in this area. The HRMB also requested that GMI use the same drilling and evaluation techniques on this additional drilling as was used on all subsequent drilling programs.~~

Drilling completed at the site to date has encountered no saturated Upper Dockum sediments underlying the proposed site. However, saturated Upper Dockum sediments have been encountered ½ mile and one mile northeast of the proposed site. Based on this information, an inferred saturation interface is projected to be approximately fifteen hundred (1500) feet east of the site boundary. USE  
GMI USE THE 40

In order to confirm this interpretation, the HRMB requested that GMI drill and, if required, install a groundwater characterization well. The HRMB has requested that GMI drill one exploratory hole east of the proposed site in order to determine the presence (or absence) of saturation within the Upper Dockum sediments.

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3. Results of Stratigraphic Characterization Program

Drilling commenced on August 3, 1999 and continued through the morning of August 5, 1999. Nine additional stratigraphic holes were drilled in the northern portion of the proposed site (see Figure 1). Due to the sandy, inaccessible nature of the area, a Caterpillar tractor (supplied by GMI) was used to build roads into each location. This equipment was also used throughout the drilling program to pull equipment into and out of each drill hole location.

Key Drilling of Roswell, New Mexico performed the work using a Portadrill, air rotary rig. The driller used a 6 3/4-inch drill bit and collected drill cuttings at 5-foot intervals. These cuttings were logged by a registered, professional geologist and a geophysical log was run on each drill hole. Geophysical logs were prepared by Southwest Geophysical Services, Inc., of Farmington, New Mexico. Each drill hole was plugged with a cement and bentonite grout by Arkins Environmental of Roswell, New Mexico. A trim line was used and all holes were plugged from the "bottom up". The stratigraphic logs are presented in Attachment B and the geophysical logs for these holes are also presented in Attachment B.

Trace ←

Table 1 presents a summary of this 1999 stratigraphic drilling:

Hole No.	Depth	Depth to Contact	Depth of Lower Dockum penetrated
PB-39	120 ft	96 ft	24ft
PB-40	90 ft	68 ft	22 ft
PB-41	75 ft	55 ft	20 ft
PB-42	90 ft	62 ft	28 ft
PB-43	100 ft	74 ft	26 ft
PB-44	110 ft	78 ft	32 ft
PB-45	120 ft	100 ft	20 ft
PB-46	120 ft	89 ft	31 ft
PB-47	130 ft	108 ft	22 ft

(1) Contact between upper and lower Dockum, based on visual logging of cuttings and geophysical log.

- Map this  
 - present in map  
 - "Wiley" in the  
 - position surface  
 - of the contact.  
 - used location  
 - of more precise  
 - lines.  
 - in all locations  
 - in the present  
 - approximately  
 - meters above  
 - the top

The nine stratigraphic holes drilled as part of this study are shown in Figure 1. To provide a complete picture of the drilling completed at the site, the historic holes also shown. The northernmost drill hole is PB-39, which is located at the section corner for Sections 7, 8, 17 and 18; T11S; R31E. In order to fit the three north-south drill holes (PB-39, PB-46 and PB-47) within the site boundary, the north-south dimension of the drill hole grid was slightly compressed. This resulted in a drill hole spacing of approximately 900 feet between the lines of east-west drill holes. The spacing between holes along the east-west lines is still 1000 feet.

AS PREVIOUS DRILL HOLES.

was this different than.

The same suite of geophysical logs (thermal neutron, gamma and caliper) was run on the 1999 drill holes. It should be noted that the 6 3/4-inch hole has some effect on the thermal neutron count rates. The character of the logs remains the same, although due to neutron flux, the actual count rate has increased. For example, with a 4 3/4-inch drill hole, the thermal neutron count rates for the Upper Dockum siltstones averaged approximately 3200 counts per second. With a 6 3/4-inch hole, this same lithology is averaging approximately 4200 counts per second.

As a matter of practice, the probe operator for Southwest Geophysical, Inc. on this program would "power-up" the down-hole geophysical equipment while the probe was resting at the bottom of the hole. It would remain on the bottom of the hole for approximately two minutes while he was readying all the instrumentation for the logging of the hole. The thermal neutron (which is located at the bottom of the probe unit) was picking up counts during this two-minute period. This resulted in a false high count rate at the bottom of each hole. This was particularly apparent in those holes that experienced some "caving in" of the loose surface sands. The probe operator suggested that the first two feet of the thermal neutron log be disregarded and to mark the logs accordingly.

In the past drilling, there has been some natural radioactivity observed scattered within the Upper Dockum sediments that was consistent with past movement and precipitation of uranium-bearing solutions. Geologically, this is not unusual, as this unit is equivalent to the Chinle Formation which hosts many uranium deposits in the Colorado Plateau region. The 1999 drilling encountered more concentrated occurrences of this natural radioactivity, particularly holes PB-43, PB-45, PB-46 and PB-47, where the gamma log had to be rerun in order to record maximum counts. These radioactive anomalies may be of "geologic interest" but will have no impact on the proposed operation (6)

All holes penetrated the entire existing Upper Dockum section and were bottomed in the Lower Dockum mudstones. Accordingly, the contact between these two units was identified in both cuttings and geophysical logs. The Work Plan stated that approximately thirty (30) feet of Lower Dockum mudstones would be displayed at the bottom of each drill hole. An average of 25 feet of mudstone was displayed at the bottom of the 1999 drill holes. The driller was using 15-foot lengths of drill pipe, and if at least 20 feet of Lower Dockum mudstones were apparent in the drill cuttings, the field decision was made not to make the driller add another length of drill pipe.

No groundwater was encountered within the Upper Dockum or Lower Dockum sediments in the 1999 drilling. Drill hole PB-39, however, was filled with surface water from a nearby gravel pit. This gravel pit, located approximately 120 feet from the drill hole, was terminated in the clay of the Upper Dockum. As a result, the pit filled with water due to the heavy precipitation in the area this year. This surface water was estimated to be infiltrating into the hole through the alluvial deposits at a depth of fifteen feet. In order to confirm that this water was from surface water, the following steps were taken to resolve the source of the water:

- locate on map.*
1. ~~The hole~~ <sup>PB-39</sup> was completed at approximately 10:00 AM, 08/03/99. There was fifteen feet of surface alluvium at the top of the hole. *to the depth of \_\_\_\_\_*
  2. On exiting the drill hole, the driller observed the bottom two lengths of drill pipe (30 ft) were wet (water in the hole at a depth of 90 feet). *HAS*
  3. The geophysical logging truck arrived on the site the next day and a log was obtained at approximately 9:30 AM, 08/04/99. The depth of the water was 64 feet. It ~~has~~ raised 26 feet since the time it was drilled. (If the source of water were the Upper Dockum, it would have had an unexpected artesian head).
  4. A second measurement was taken at 12:20 PM, 08/04/99 and the water level had risen to a depth of 32 feet.
  5. A third water measurement was taken at 3:20 PM, 08/04/99 and the water level had risen to a depth of 22 feet.
  6. The HRMB was called and it was suggested that a 30-foot deep offset hole be drilled. This offset hole would penetrate the 15-foot thick alluvium sequence and bottom in a 15-foot sequence of mudstone. If this offset filled with water, it would be evidence of surface water movement in these sediments. The HRMB agreed.
  7. At approximately 5:00 PM, 08/04/99 a 30-foot deep offset hole to PB-39 was drilled. This hole was drilled 20 feet east of PB-39, between it and the gravel pit. The bit got stuck in the hole in the top 15 feet of drilling and water was observed on the drill pipe.

8. At 8:00 AM, 08/05/99 water levels were measured in both PB-39 and the offset hole. The water had now dropped to a depth of 47 feet in PB-39 and it stood at 12 feet in the offset hole.
9. The water level in the gravel pit (120 feet from the hole) was noticeably lower. Moss that had been floating on top of the water was now draped over approximately five feet of mud.
10. During the day, two other water levels were taken on the holes. Water levels remained at 47 feet (PB-39) and 12 feet (offset hole).
11. With the concurrence of the HRMB representative, both holes were plugged the afternoon of 08/05/99.

- Aug 216 water levels taken?  
- 10/10/99 350

#### 4. Results of Groundwater Characterization Program

The groundwater characterization program consisted of the drilling of one drill hole (PB-48) on the afternoon of August 5, 1999, east of the proposed site in an attempt to locate saturation within the Upper Dockum sediments. This drill hole was located 1000 feet north and 2000 feet east of drill hole PB-38, approximately  $\frac{3}{4}$  of a mile from the proposed Phase I Landfill (see Figure 2). According to the Work Plan, had this hole encountered groundwater, it was to have been cased as a potential downgradient monitoring well.

Key Drilling completed this hole, using a 6 $\frac{3}{4}$ -inch drill bit. Prior to drilling, the bottom 50 feet of drill pipe was steam cleaned and a vegetable-based lubricant was used during the drilling operations. The contact between the Upper Dockum and Lower Dockum sediments was encountered at a depth of 165 feet. The hole was completed to a depth of 210 feet. There was no saturation observed in the drill cuttings or on the geophysical log. Stratigraphic and geophysical logs for this hole are presented in Appendix C.

Atkins Environmental was on stand-by to complete the drill hole as a monitor well, if necessary. The morning of August 6, 1999, Atkins plugged this drill hole in the same manner in which they had plugged all stratigraphic holes. Prior to plugging, an electronic water finder was run down the hole and no saturation was encountered.

#### 5. Summary

1999 stratigraphic drilling results demonstrated that the subsurface stratigraphy underlying the proposed site is both continuous with and predictable from previous drilling results. There were no unexplainable features within the depositional environment. In all cases, the depth of the contact between the Upper Dockum and the Lower Dockum sediments was encountered where it was estimated to be. There was no groundwater within these sediments.

The groundwater characterization drilling demonstrated that there is even less groundwater in the vicinity of the site than originally thought. The limited saturation encountered one mile northeast of the site in the Upper Dockum now appears to be an isolated occurrence of perched groundwater. Upper Dockum sediments underlying the site and extending  $\frac{3}{4}$  mile downgradient have been examined by over 40 drill holes and found to be unsaturated.

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**ATTACHMENT A  
HRMB CONDITIONAL APPROVAL LETTER  
DATED JULY 30, 1999**

*where is work plan.*



**GARY E. JOHNSON**  
GOVERNOR

**State of New Mexico**  
**ENVIRONMENT DEPARTMENT**  
*Hazardous & Radioactive Materials Bureau*  
2044 Gallatin Street  
P.O. Box 26110  
Santa Fe, New Mexico 87502  
(505) 827-1337  
Fax (505) 827-1544



**PETER MAGGIORIS**  
SECRETARY

**DRAFT**

July 30, 1999

Mr. Dale Gandy  
Gandy Marley, Inc.  
Post Office Box 827  
1109 East Broadway  
Taos, New Mexico 88267

**RE: Conditional Approval for Work Plan for Stratigraphic and Groundwater Characterization Program, Proposed Triassic Park Waste Disposal Facility, Chaves County, New Mexico.**

Dear Mr. Gandy:

The New Mexico Environment Department (NMED) Hazardous and Radioactive Materials Bureau (HRMB) has completed its review of the Gandy Marley, Inc. "Work Plan for 1999 Stratigraphic and Groundwater Characterization Program" dated July 28, 1999. NMED approves the work plan with the following conditions:

1. Page 5, Section 2.5, Paragraph 1. Add the following sentence at the end of the paragraph, "Each borehole will be checked for the presence of groundwater prior to abandonment".
2. Page 9 Section 3.7.1 line 9. "Samples will be collected for metals analysis...." Change to "Samples will be collected for dissolved metals analyses..."
3. Page 9 Section 3.7.1 line 10. Add the following sentence "Groundwater samples also will be collected for total metals analyses."
4. Page A-6, Section 3.4, Paragraph 7, Line 8. "Centralizers will be attached immediately above the well screen and at 20-foot intervals...." Change to "Centralizers will be attached at the base of and immediately above the well screen and at 50-foot

**DRAFT**

Dale Gandy  
July 30, 1999  
Page 2 of 2

Please call Mr. Steve Pullen of this office at (505) 827-1561 if you have questions with regarding the conditions for approval listed above.

Sincerely,



James P. Bearzi  
Chief  
Hazardous and Radioactive Materials Bureau

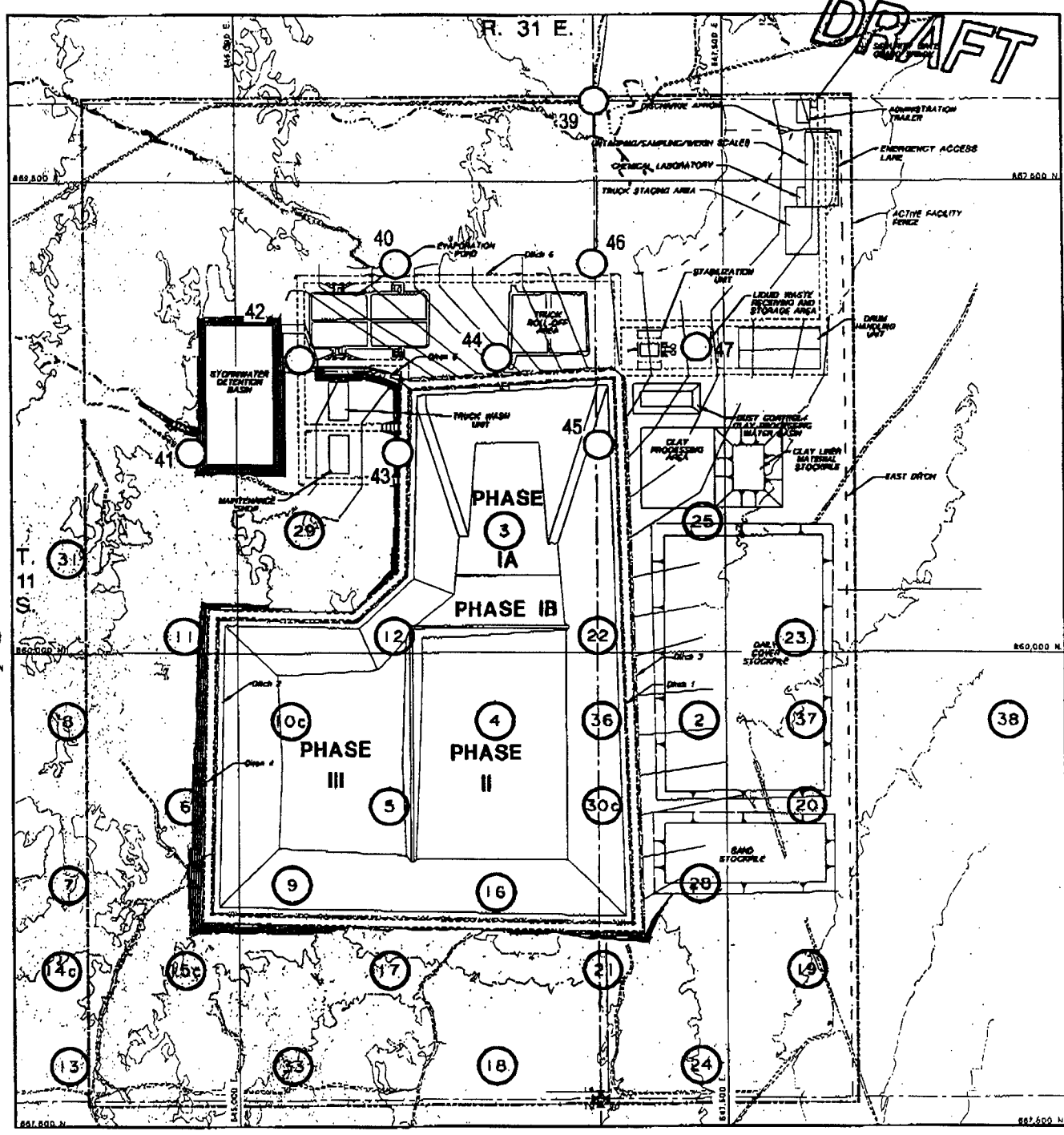
cc: Stephanie Kruse  
Steve Pullen



**DRAFT**

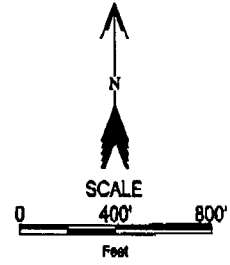
**ATTACHMENT B  
STRATIGRAPHIC CHARACTERIZATION LOGS**

**DRAFT**



**LEGEND**

- (21) LOCATION & NUMBER OF EXISTING HOLES
- 40 (●) LOCATION & NUMBER OF 1999 STRATIGRAPHIC CHARACTERIZATION HOLES



NOTE: Holes 14 & 32 Are Shown At Actual Location, But Just Fall Outside Of Mapped Area

0	Issued For Record	8/18/99	P. Corser	M. Melnick	P. Corser
REV. NO.	REVISIONS	REV. DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
PROJECT No. 174902.019900 AutoCAD FILE: P-Stratigraphic-Holes SCALE: See Scale Bar FIGURE No. 1					

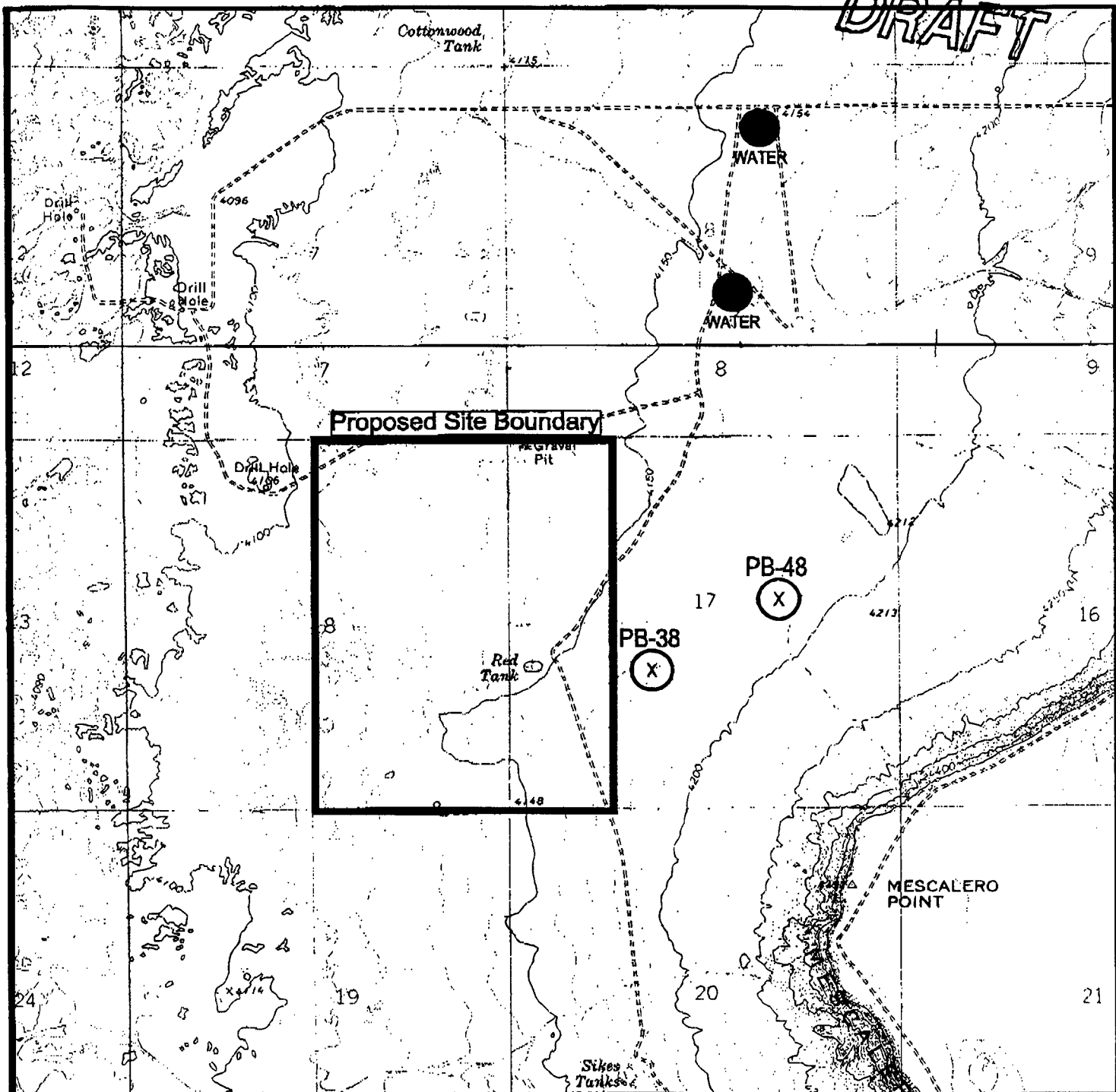


Gandy-Marley, Inc. - Triassic Park  
 1999 Characterization Program  
**LOCATION OF STRATIGRAPHIC  
 CHARACTERIZATION HOLES**

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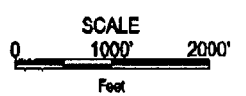
**ATTACHMENT C  
GROUND WATER CHARACTERIZATION LOG**

**DRAFT**



**LEGEND**

- EXISTING HOLES WITH GROUNDWATER
- PB-38 (X) EXISTING HOLE WITHOUT GROUNDWATER



0	Issued For Report	8/19/99	F. Corsi	M. Mathison	P. Corser
REV. NO.	REVISIONS	REV DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
PROJECT NO. 84402.02/84300			APPCAD FILE PROPOSED-L-HOLES		
SCALE: See Scale Bar		FIGURE NO. 2			

**MONTGOMERY WATSON**

**Gandy-Marley, Inc. - Triassic Park  
1999 Characterization Program**

**LOCATION OF GROUNDWATER  
CHARACTERIZATION HOLE**