June 13, 2011

Arco Federal Battery
Southwest Royalties
T17S, R30E, Section 17, Unit K

Surface Remedy

R.T. Hicks Consultants, Ltd.
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June 13, 2011

US Bureau of Land Management
Terry Gregston
Jim Amos
620 E. Green Street
Carlsbad, NM 88220

Re: Surface Remedy for Arco Federal Battery, Southwest Royalties
T17S, R30E, Section 17, Unit K

Ms. Gregston and Mr. Amos,

Thank you both for meeting with us on the above-referenced project. The surface remedy developed by putting all of our heads together is simple and straight-forward. Below is the step-by-step protocol, which we believe is consistent with our agreements at the meeting.

I. Pre-Construction
   a. Stake location of burial trench for one-call before June 15
   b. Stake location of proposed excavation footprint, which is based upon the "likely extent of impact" shown in Figure 1
   c. Call BLM after staking to allow for inspection
   d. Conduct one-call on June 15

II. Proposed Construction June 20-24
   a. Remove caliche from road "turn out" and place on west side of lease road to allow for excavation/removal of part of lease road within excavation footprint
   b. Stockpile any residual caliche from turn out
   c. Remove the 0.5-foot layer of caliche from excavation footprint to a stockpile
   d. Excavate the burial trench to accommodate 30,000 cubic feet of compacted salt impacted soil (see Figure 2). The trench will be about 12-feet deep, 100 feet long and about 26 feet wide. One end of the trench will have a steep ramp to provide an escape route for any small wildlife.
   e. Excavation of the burial trench will create two stockpiles
      i. sandy loam on the northeast side of the trench and
      ii. caliche on the south side of the trench
   f. Fence the trench for safety when construction ceases each day
   g. Excavate and remove to the trench the top 1-foot of the footprint while testing the soil (titration) to determine the horizontal extent of impacted soil.
   h. Repeat excavation and field sampling at 2 and 4 feet below grade within the original 1-foot excavation. There should be about 30,000 cubic feet of impacted soil (>1,500 mg/kg) removed from the excavation footprint (see Figure 2) and placed in the Burial Trench. Hard caliche will not be excavated from the footprint; although in most locations the caliche horizon is below 4-feet deep (see Figure 3).
   i. Call BLM about 24 hours before excavation of footprint is complete.

j. Collect four samples from edges of excavation for submission to the laboratory to demonstrate capture of horizontal extent of salt-impaired soil.
k. Place about 1-foot of caliche gravel from the burial trench stockpile over the caliche surface exposed in the excavation footprint (see Figure 3). Placing clean gravel above the impacted caliche can create a capillary break, minimizing any upward migration of salt.
l. Place the clean sandy-loam from the burial trench stockpile into the footprint excavation – mixing in organic material (e.g. rotted hay). If more soil is required to fill the excavation footprint to natural grade, find some nearby dunes with mesquite and **no oak**, and take that topsoil – mesquite roots and all – and place it in the excavation.
m. Put a liner over the impacted soil in the burial trench then cover the liner with at least 4-feet of soil – mix in organic matter if practical.
n. Install perimeter fence to prevent intrusion by grazers.

III. Post construction
a. Seed the excavation footprint, burial trench footprint and other areas disturbed by installation of the remedy with BLM-recommended mixture
b. Pray for rain
c. Monitor re-vegetation
d. Kill any mesquite that grows within the fence

We have reserved the days of June 21-24 to install the remedy. Thanks again for your help in moving this project forward.

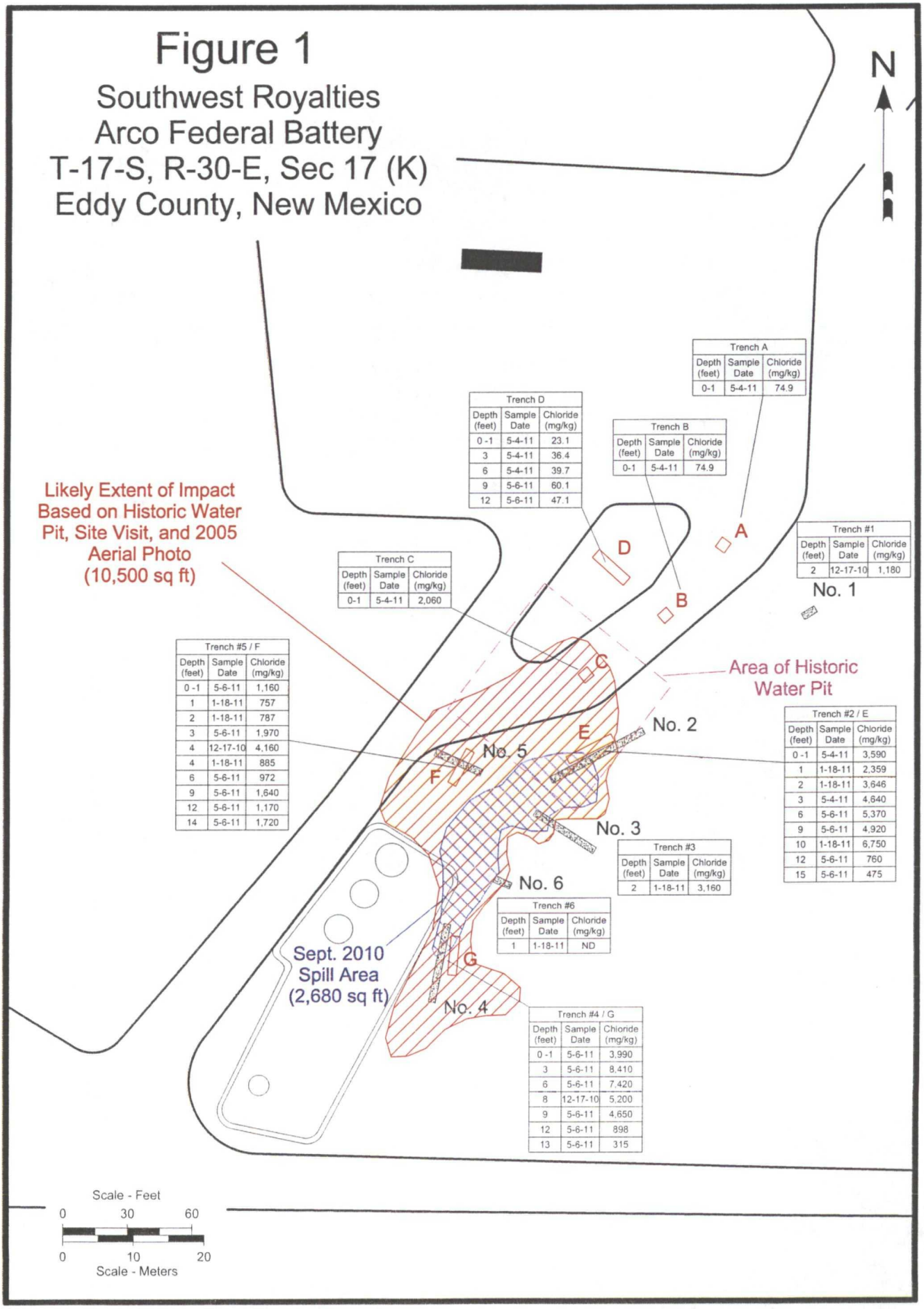
Sincerely,

Randall Hicks
Principal

Copy: Luis Gonzales, SW Royalties
Mike Bratcher, NMOCD District 2

Figure 1

Southwest Royalties
Arco Federal Battery
T-17-S, R-30-E, Sec 17 (K)
Eddy County, New Mexico



Trench A

Depth (feet)	Sample Date	Chloride (mg/kg)
0-1	5-4-11	74.9

Trench B

Depth (feet)	Sample Date	Chloride (mg/kg)
0-1	5-4-11	74.9

Trench C

Depth (feet)	Sample Date	Chloride (mg/kg)
0-1	5-4-11	2,060

Trench D

Depth (feet)	Sample Date	Chloride (mg/kg)
0 -1	5-4-11	23.1
3	5-4-11	36.4
6	5-4-11	39.7
9	5-6-11	60.1
12	5-6-11	47.1

Trench #1

Depth (feet)	Sample Date	Chloride (mg/kg)
2	12-17-10	1,180

Trench #2 / E

Depth (feet)	Sample Date	Chloride (mg/kg)
0 -1	5-4-11	3,590
1	1-18-11	2,359
2	1-18-11	3,646
3	5-4-11	4,640
6	5-6-11	5,370
9	5-6-11	4,920
10	1-18-11	6,750
12	5-6-11	760
15	5-6-11	475

Trench #3

Depth (feet)	Sample Date	Chloride (mg/kg)
2	1-18-11	3,160

Trench #4 / G

Depth (feet)	Sample Date	Chloride (mg/kg)
0 -1	5-6-11	3,990
3	5-6-11	8,410
6	5-6-11	7,420
8	12-17-10	5,200
9	5-6-11	4,650
12	5-6-11	898
13	5-6-11	315

Trench #5 / F

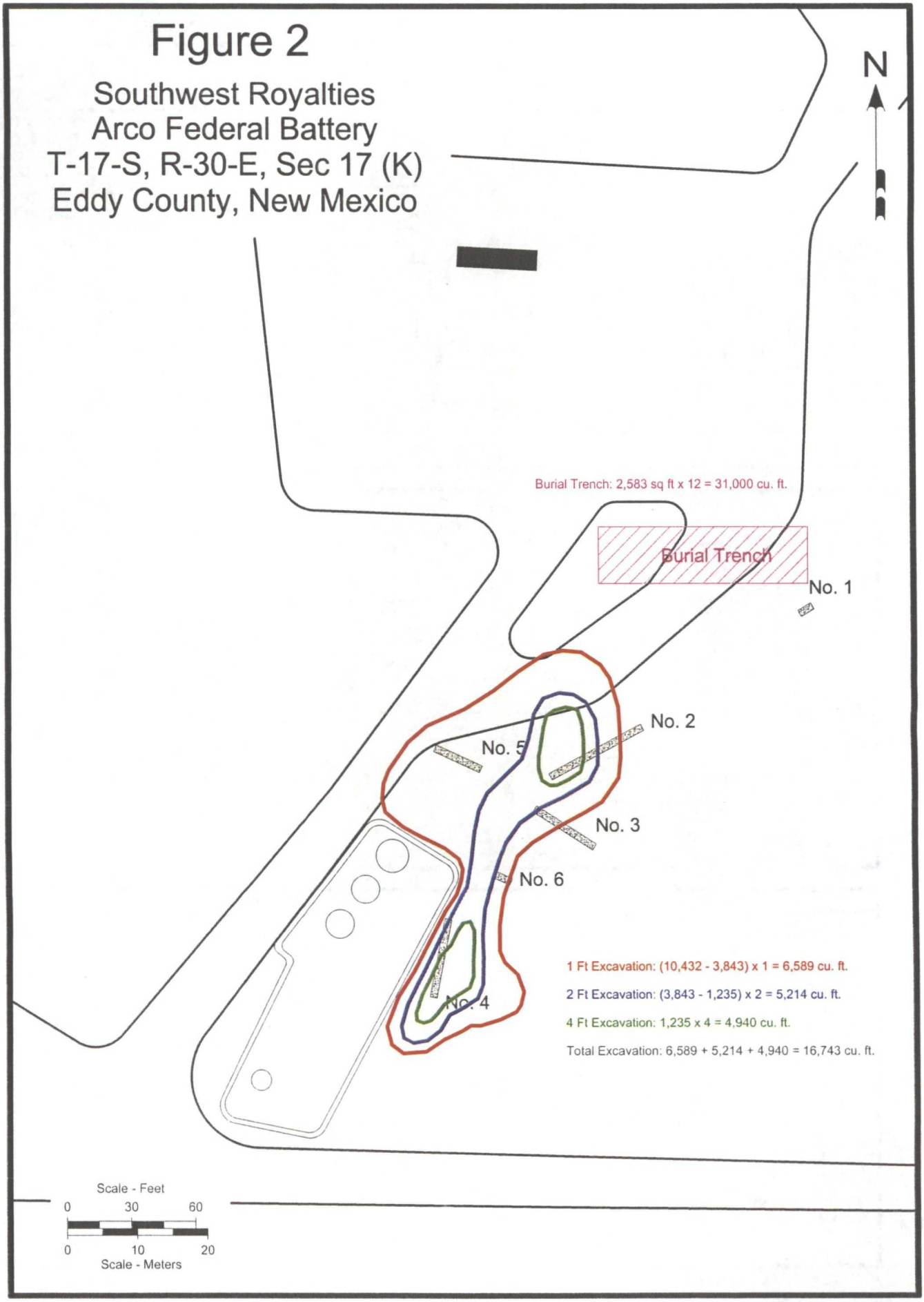
Depth (feet)	Sample Date	Chloride (mg/kg)
0 -1	5-6-11	1,160
1	1-18-11	757
2	1-18-11	787
3	5-6-11	1,970
4	12-17-10	4,160
4	1-18-11	885
6	5-6-11	972
9	5-6-11	1,640
12	5-6-11	1,170
14	5-6-11	1,720

Trench #6

Depth (feet)	Sample Date	Chloride (mg/kg)
1	1-18-11	ND

Figure 2

Southwest Royalties
Arco Federal Battery
T-17-S, R-30-E, Sec 17 (K)
Eddy County, New Mexico



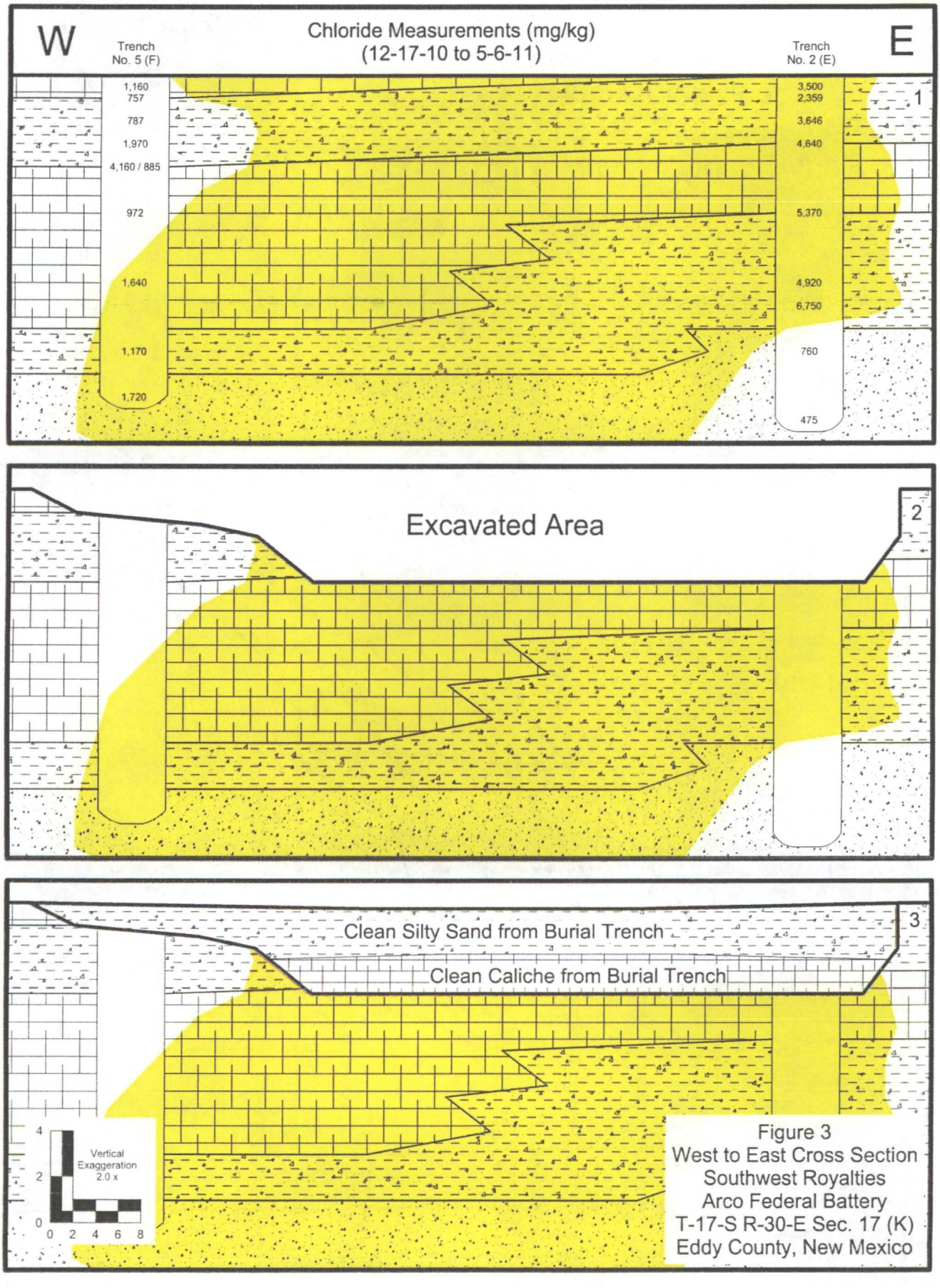


Figure 3
West to East Cross Section
Southwest Royalties
Arco Federal Battery
T-17-S R-30-E Sec. 17 (K)
Eddy County, New Mexico

Attachment 1
Site Characterization Results

R.T. Hicks Consultants, Ltd.
901 Rio Grande Blvd. NW, Suite F-142
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Attachment 1: May 2001 Sampling at Southwest Royalties Arco Federal Tank Battery

On May 4, 2011 a backhoe was utilized the recover soil samples from three shallow trenches. The three shallow trenches (A, B, and C on Figure 1) were excavated to a depth of 1.0 foot in order to sample the caliche road base in the turn-out road northeast of the Arco Federal Tank Battery. An attempt was made to install Trench D and E, but the backhoe could not penetrate below six feet due to an equipment failure. After sampling, all of the trenches were backfilled and the project was postponed.

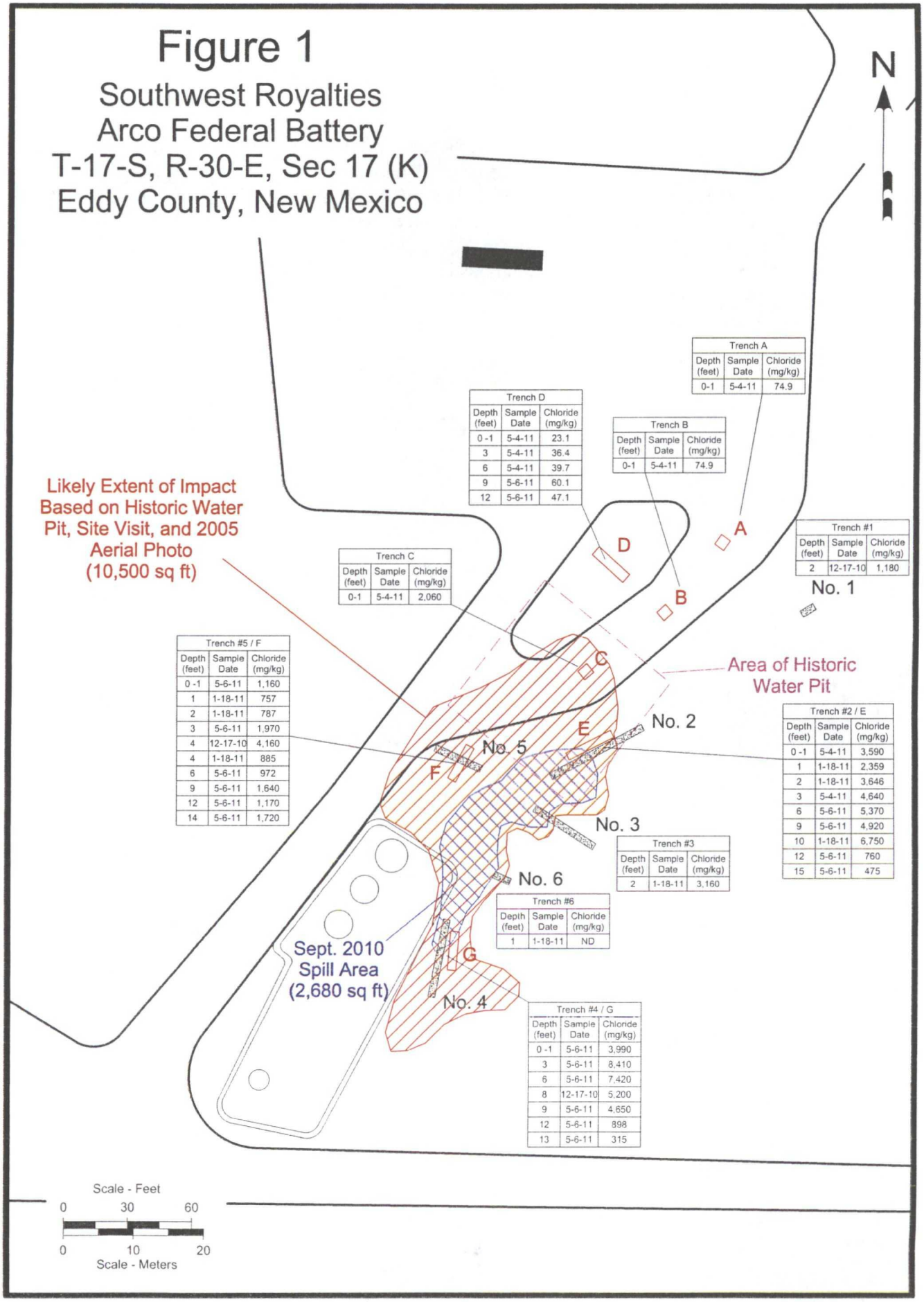
On May 6, 2001 a different backhoe was used to complete the excavations. The four deep trenches (D, E, F, and G) were excavated to depths of 12 to 15 feet, depending on the hardness of the soil encountered, in order to verify historic sampling results and establish a chloride concentration profile. All sampling of trenches was completed.

All 0- to 1-foot samples were recovered by the field technician once the surface was broken by the backhoe. The deeper samples were recovered from the backhoe bucket. Prior the sampling at each depth the excavation was cleared of all loose soil and cave-in. The backhoe bucket was then carefully operated to recover material from the precise interval selected for sampling. Each sample was described lithologically, sealed in a laboratory provided 4-ounce jar, chilled to approximately 40° F, and transported to the Xenco Laboratory in Odessa, Texas. Laboratory analysis was performed to determine the concentrations of chloride using method E300. In addition, BTEX concentrations from the samples recovered in Trench D were measured using EPA method 8021B. As in previous sampling events, no detectable hydrocarbons were observed.

The results of the chloride analysis from the May 2011 sampling event appear to confirm the horizontal extent of the affected area (approximately 10,000 ft^2) based previous samples (see Figure 1 and Table 1) and our examination of historic aerial photographs described in a separate attachment. The vertical extent of the chloride-impacted soil (>500 mg/kg) is variable. In the area of Trench F and much of the area outlined in Figure 1 as "Area of Historic Water Pit", we believe the vertical extent of salt impact is deeper than 20 feet. The impact may be as much as 60-feet, which is the approximate depth of the "red beds" at the site. This conclusion is based upon the historic evidence and our experience with similar produced water pits in the Vacuum Oil Field. Exterior to the area impacted by this historic produced water disposal pit, the vertical extent is limited to depths of less than 13 to 15 feet.

Figure 1

Southwest Royalties
Arco Federal Battery
T-17-S, R-30-E, Sec 17 (K)
Eddy County, New Mexico



Trench A

Depth (feet)	Sample Date	Chloride (mg/kg)
0-1	5-4-11	74.9

Trench D

Depth (feet)	Sample Date	Chloride (mg/kg)
0 -1	5-4-11	23.1
3	5-4-11	36.4
6	5-4-11	39.7
9	5-6-11	60.1
12	5-6-11	47.1

Trench B

Depth (feet)	Sample Date	Chloride (mg/kg)
0-1	5-4-11	74.9

Trench #1

Depth (feet)	Sample Date	Chloride (mg/kg)
2	12-17-10	1,180

Trench C

Depth (feet)	Sample Date	Chloride (mg/kg)
0-1	5-4-11	2,060

Trench #5 / F

Depth (feet)	Sample Date	Chloride (mg/kg)
0 -1	5-6-11	1,160
1	1-18-11	757
2	1-18-11	787
3	5-6-11	1,970
4	12-17-10	4,160
4	1-18-11	885
6	5-6-11	972
9	5-6-11	1,640
12	5-6-11	1,170
14	5-6-11	1,720

Trench #2 / E

Depth (feet)	Sample Date	Chloride (mg/kg)
0 -1	5-4-11	3,590
1	1-18-11	2,359
2	1-18-11	3,646
3	5-4-11	4,640
6	5-6-11	5,370
9	5-6-11	4,920
10	1-18-11	6,750
12	5-6-11	760
15	5-6-11	475

Trench #3

Depth (feet)	Sample Date	Chloride (mg/kg)
2	1-18-11	3,160

Trench #6

Depth (feet)	Sample Date	Chloride (mg/kg)
1	1-18-11	ND

Trench #4 / G

Depth (feet)	Sample Date	Chloride (mg/kg)
0 -1	5-6-11	3,990
3	5-6-11	8,410
6	5-6-11	7,420
8	12-17-10	5,200
9	5-6-11	4,650
12	5-6-11	898
13	5-6-11	315

Table 1
Arco Federal Tank Battery
Laboratory Data - Soil Samples

Sample Trench	Location in Trench	Depth (feet)	Sample Date	Titrate Cl (mg/kg)	Chloride (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)	BTEX (mg/kg)	GRO (mg/kg)	DRO (mg/kg)
Trench #1	Center	2	12/17/10	--	1,180	<0.05	<0.05	<0.05	<0.15	<0.3	<10	<10
Trench #2	South	10	12/17/10	--	5,920	<0.05	<0.05	<0.05	<0.15	<0.3	<10	<10
	South	2	1/18/11	2,162	2,505	--	--	--	--	--	--	--
	South	10	1/18/11	7,499	6,750	--	--	--	--	--	--	--
	Center	1	1/18/11	2,041	2,359	--	--	--	--	--	--	--
	Center	2	1/18/11	3,182	3,646	--	--	--	--	--	--	--
Trench #3	Center	2	12/17/10	--	240	<0.05	<0.05	<0.05	<0.15	<0.3	<10	<10
	East	2	1/18/11	2,731	3,162	--	--	--	--	--	--	--
Trench #4	North	8	12/17/10	--	5,200	<0.05	<0.05	<0.05	<0.15	<0.3	<10	<10
	North	3	1/18/11	2,563	2,973	--	--	--	--	--	--	--
	North	8	1/18/11	1,938	2,240	--	--	--	--	--	--	--
Trench #5	Center	4	12/17/10	--	4,160	<0.05	<0.05	<0.05	<0.15	<0.3	<10	<10
	Center	1	1/18/11	825	757	--	--	--	--	--	--	--
	Center	2	1/18/11	776	689	--	--	--	--	--	--	--
	Center	3	1/18/11	1,278	1,381	--	--	--	--	--	--	--
	Center	4	1/18/11	916	885	--	--	--	--	--	--	--
	East	2	1/18/11	846	787	--	--	--	--	--	--	--
Trench #6	Center	1	1/18/11	125	0	--	--	--	--	--	--	--
Trench A	Center	0-1	5/4/11	--	74.9	--	--	--	--	--	--	--
Trench B	Center	0-1	5/4/11	--	74.9	--	--	--	--	--	--	--
Trench C	Center	0-1	5/4/11	--	2,060	--	--	--	--	--	--	--
Trench D	Center	0-1	5/4/11	--	23.1	<0.0010	<0.0020	<0.0010	<0.0010	<0.0010	--	--
	Center	3	5/4/11	--	36.4	<0.0011	<0.0022	<0.0011	<0.0011	<0.0011	--	--
	Center	6	5/4/11	--	39.7	<0.001	<0.0021	<0.0010	<0.0010	<0.0010	--	--
	Center	9	5/6/11	--	60.1	<0.0011	<0.0021	<0.0011	<0.0011	<0.0011	--	--
	Center	12	5/6/11	--	47.1	<0.0011	<0.0021	<0.0011	<0.0011	<0.0011	--	--
Trench E	Center	0-1	5/4/11	--	3,590	--	--	--	--	--	--	--
	Center	3	5/4/11	--	4,640	--	--	--	--	--	--	--
	Center	6	5/6/11	--	5,370	--	--	--	--	--	--	--
	Center	9	5/6/11	--	4,920	--	--	--	--	--	--	--
	Center	12	5/6/11	--	760	--	--	--	--	--	--	--
	Center	15	5/6/11	--	475	--	--	--	--	--	--	--
Trench F	Center	0-1	5/6/11	--	1,160	--	--	--	--	--	--	--
	Center	3	5/6/11	--	1,970	--	--	--	--	--	--	--
	Center	6	5/6/11	--	972	--	--	--	--	--	--	--
	Center	9	5/6/11	--	1,640	--	--	--	--	--	--	--
	Center	12	5/6/11	--	1,170	--	--	--	--	--	--	--
	Center	14	5/6/11	--	1,720	--	--	--	--	--	--	--
Trench G	Center	0-1	5/6/11	--	3,990	--	--	--	--	--	--	--
	Center	3	5/6/11	--	8,410	--	--	--	--	--	--	--
	Center	6	5/6/11	--	7,420	--	--	--	--	--	--	--
	Center	9	5/6/11	--	4,650	--	--	--	--	--	--	--
	Center	12	5/6/11	--	898	--	--	--	--	--	--	--
	Center	13	5/6/11	--	315	--	--	--	--	--	--	--

Red text values indicate concentrations calculated from field titration results.

Attachment 2
Ground Water Characterization

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901 Rio Grande Blvd NW ▲ Suite F-142 ▲ Albuquerque, NM 87104 ▲ 505.266.5004 ▲ Fax: 505.266-0745

February 2, 2011

Mr. Mike Bratcher
NMOCD Artesia District 2
Artesia, New Mexico
Via E-Mail

RE: Southwest Royalties Arco Federal Battery
T17S, R30E, Section 17, Unit K

Dear Mike:

This letter explains the technical and regulatory rationale to support our conclusion that reporting under Part 29 of NMOCD Rules is not required for a release at the above-referenced facility as the release at the site was less than five barrels and historic activities are not detrimental to ground water at the site. Please contact me if you have any questions relating to this communication. NMOCD will be kept apprised of the proposed surface restoration work planned to meet the mandates of the BLM.

Regulatory Requirements

The applicable language from the Rules is presented below:

> **19.15.29.7 DEFINITIONS:**
> **A.** "Major release" means:...
> **B.** "Minor release" means an unauthorized release of a volume, greater than five barrels but not more than 25 barrels; or greater than 50 MCF but less than 500 MCF of gases.
>
> **19.15.29.8 RELEASE NOTIFICATION:**
> **A.** The person operating or controlling either the release or the location of the release shall notify the division of unauthorized release occurring during the drilling, producing, storing, disposing, injecting, transporting, servicing or processing of oil, gases, produced water, condensate or oil field waste including regulated NORM, or other oil field related chemicals, contaminants or mixture of the chemicals or contaminants, in accordance with the requirements of 19.15.29 NMAC.
> **B.** The person operating or controlling either the release or the location of the release shall notify the division in accordance with 19.15.29 NMAC with respect to a release from a facility of oil or other water contaminant, in such quantity as may with reasonable probability be detrimental to water or exceed the standards in Subsections A and B or C of 19.15.30.9 NMAC.

Arco Federal Battery Release Characteristics

On or about September 30, 2010, a release of less than 5 barrels occurred at the tank battery due to an overflow of the water tank. This release was not reported to NMOCD because a release of less than 5 barrels does not meet the threshold criteria of a minor release as defined above.

Samples show that the footprint of the 2-4 barrel produced water spill overlies one or more historic spills (see attached description). With respect to historic releases, an operator controlling a location must notify NMOCD if the release is "in such quantity as may with

reasonable probability be detrimental to water or exceed the standards in Subsections A and B or C of 19.15.30.9 NMAC." The attached description of the environmental setting of the site permits a conclusion that the historic releases do not meet the criteria for notification under NMOCD Rules.

Path Forward

Currently, we are evaluating laboratory reports that will allow us to develop an appropriate remedy to restore the ground surface to the requirements of the owner's representative, the BLM. This surface remedy will require addressing the asphaltic material found in the shallow subsurface. We have come to understand that NMOCD is not creating files for surface restoration projects of historic/legacy release sites provided that ground water is not threatened by the proposed actions.

NMOCD may disagree with our interpretation of the Rules or the technical information submitted in this letter or in subsequent submissions to the BLM. If NMOCD requires creation of a regulatory file, please let us know your regulatory and technical rationale for such a request. We do not want to create unnecessary work for NMOCD, BLM or our client if neither the Rules nor common sense support opening a file for this matter. We thank you in advance.

Sincerely,
R.T. Hicks Consultants, Ltd.

Randall Hicks
Principal

Copy: Terry Gladston, Bureau of Land Management, Carlsbad District
Luis Gonzalez, Southwest Royalties

Attachment – Description of Environmental Setting at Arco Federal Battery

Arco Federal Battery Location

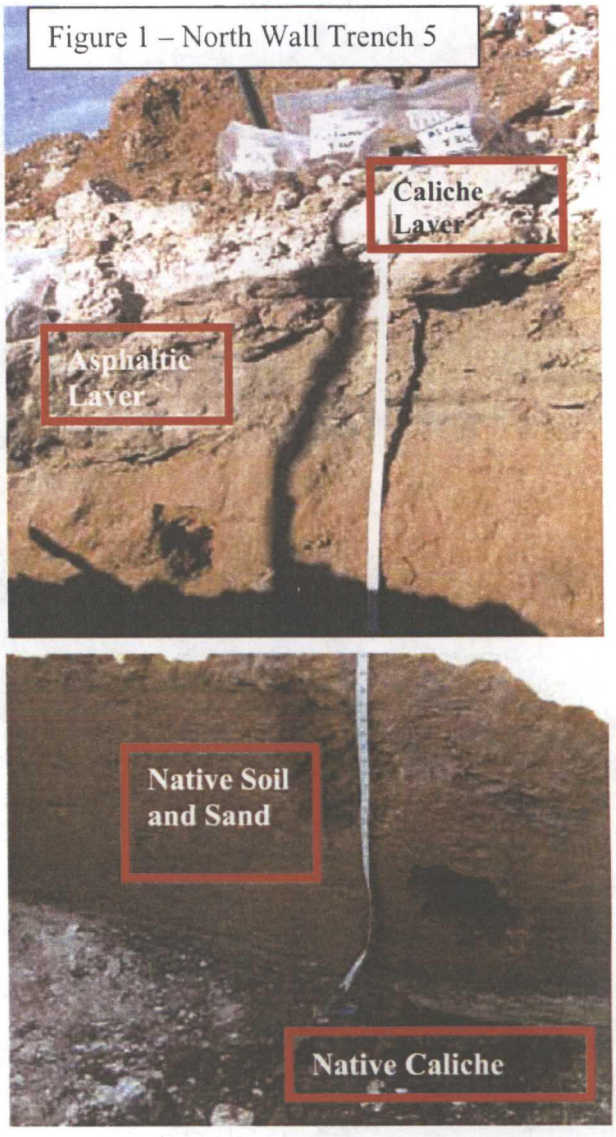
Plates 1 and 2 show the location of the Arco Federal Battery relative to Loco Hills, New Mexico. The site is located in T17S, R30E, Section 17, Unit K (N 32.832642, W 103.995653).

Also shown on Plate 2 are the Loco Hills Water Disposal Facility and the Marbob Boring B-1, which are discussed in this submission.

Release Characteristics

On or about September 30, 2010, a transfer pump plugged, causing the northern water tank to overflow. Less than 5 barrels of produced water flowed over the tank battery berm on the ground to create the footprint shown on Plate 3. The pumper estimated that more than 2 barrels but less than 5 barrels flowed from the tank to the northeast. The footprint of the September release is about 2,680 square feet; our interpretation is based upon communication with the pumper and others familiar with the release. A 4-barrel release would cover a 2,680 square foot area with about 0.13 inches of fluid. Given the slope of the area and the nature of the hard-packed (asphaltic) subsurface, a release of less than five barrels agrees with the footprint shown on Plate 3. Plate 3 shows an area of stressed vegetation that is larger than the foot print of the September 2010 release.

Figure 1 – North Wall Trench 5



In response to concerns raised by BLM (the surface owner), a contractor for Southwest Royalties excavated six sampling trenches. A representative of the BLM witnessed the excavation work as did a representative of Southwest Royalties. Figure 1 presents the north wall of Trench 5, which was not within the footprint of the 2010 release. From the bottom of the trench to the surface we observed:

- A thin exposure of underlying caliche
- 3-4 feet of loamy sand with three sample locations shown (two in shadow)
- About 12-inches of asphaltic hydrocarbons mixed with sand and caliche
- 5 to 12 inches of surface caliche gravel

The presence of an asphaltic layer beneath the surface caliche layer documents the existence of an older release in this area, which is probably the cause of the stressed vegetation observed in the field. Plate 4 is a high resolution recent aerial photograph that shows the footprint of stressed vegetation used to develop the outline of the historic spill shown in Plate 3.

History of Activity

Appendix A shows that the first oil well drilled in Unit K, Section 17 T17S R30E was Arco Federal #1, which commenced production in 1972. Appendix A also provides documentation that NMOCD issued an order allowing the Loco Hills Water Disposal facility to accept additional produced water in 1982. Information from NMOCD Online also shows that Southwest Royalties took over operation of the Arco Federal #1 well in 1990.

Although NMOCD prohibited unlined produced water disposal pits in many areas of Eddy County in 1967 (NMOCD Order R-3221), the order provided for several exemptions from this mandate, including a provision allowing disposal of up to 16 barrels/day of produced water into unlined pits. A subsequent NMOCD Order in 1988 (R-3221-D) refined the exception process. The 1982 NMOCD Order in Appendix A granted the Loco Hills Disposal Facility approval for disposal into unlined pits.

Plate 5 shows a series of historic aerial photographs of the Arco Battery location. Careful examination of the photograph from 1978 shows a very dark circular spot north of the tank battery location. The dark circle is likely the historic salt water disposal pit. The 1983 and 1986 photographs show neither stressed vegetation north of the battery nor the dark spot observed in the 1978 photograph.

Using the historic aerial photographs, the sequence of NMOCD Orders relating to produced water disposal pits, and the permitting history of the Loco Hills Disposal Facility, we constructed the following operational history of the Arco Federal Tank Battery:

- The battery was constructed after 1971 and before 1978 – probably in 1972, when the Arco Federal #1 began production.
- Produced water from the battery flowed north to a produced water disposal pit shown in Figure 2.
- The size of the disposal pit area is defined by the square area of no vegetation surrounding the dark spot on the 1978 photograph.
- The pit area was probably fenced to prevent access to livestock.
- In the early 1980s, perhaps in 1982 when Loco Hills Water Disposal was allowed to accept additional produced water, produced water from the Arco Federal tank battery flowed to the Disposal Facility and the disposal pit was closed and covered with caliche.
- Much of the area of the former disposal pit has not re-vegetated, probably due to the low permeability of the asphaltic layer associated with this past disposal

practice, the presence of the caliche used to cover the former pit and possibly due to relatively high salinity of the shallow subsurface.

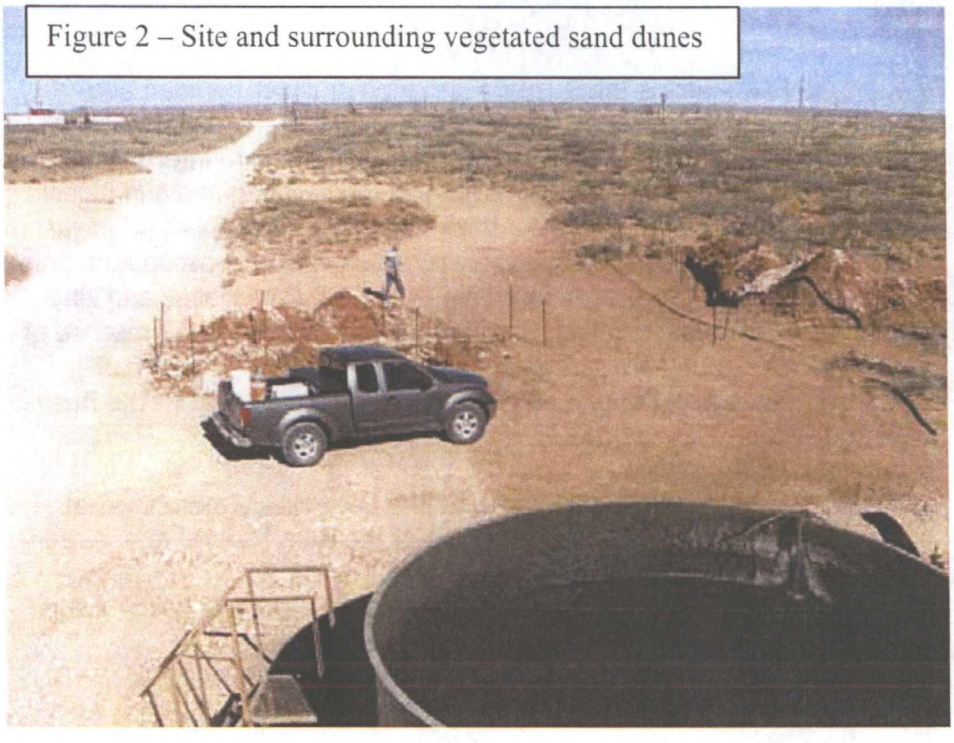
Plate 6 shows the outline of our interpretation of the area of the former produced water disposal pit (1972-1983) associated with the Arco Federal battery (dashed pink line).

Environmental Setting

Site Soils

The surface soils surrounding the caliche pit consist of Bernino Complex (see Plate 7 and Appendix C). At the spill location, the soil is most similar to the Parajito, which is an inter dune setting composed of well drained loamy sand underlain by a sandy loam. Figure 2 presents the site with small dunes typical of those visible in the background.

Figure 2 – Site and surrounding vegetated sand dunes



Beneath the surface soil is a relatively thick zone of caliche. Trench #2 was excavated to a depth of about 10 feet and exposes about 5-feet of the underlying caliche.

Site Geology

Underlying the caliche at a depth of approximately 10 feet below ground surface is the Santa Rosa Formation of late Triassic age. The Santa Rosa Formation is the lower member of the Dockum Group and consists principally of interbedded shale, sand, sandstone, and a basal conglomerate (Richey et al, 1985). The rock is somewhat silty and ranges in color from light gray and yellowish gray through light brown to reddish brown. The lithologic log from a monitor well boring at the proposed Marbob Surface

Waste Management facility (Appendix B) about 1 mile south-southeast of the site shows the lithology of this unit.

At the Marbob Boring, beneath the Santa Rosa Sandstone is the Dewey Lake (Red Bed) Formation of upper Permian age. The Dewey Lake consists of reddish-brown siltstone and mudstone with thin interbeds of fine- to medium-grained sandstone. Much of the reddish-brown rock is irregularly bleached greenish-gray in spotty and lenticular masses. Platy fragments of fibrous white selenite, presumably derived from selenite veinlets, are common in the lower portion of the unit. Their presence attests to the absence of circulating ground water since the deposition date of the selenite by vein-forming processes (Hendrickson and Jones, 1952). The boring log shows that the Dewey Lake Formation lies between 155 to 245 feet below ground surface at the boring location. The Dewey Lake Formation is difficult to distinguish from the overlying Dockum Group and some geologists might disagree with our interpretation that the Dewey Lake is present in the area.

Beneath the Dewey Lake Formation is the Rustler Formation of lower Permian age, which is estimated to be approximately 245 feet below ground surface at the Marbob boring. The Rustler consists of anhydrite (or gypsum) and siltstone with interbeds of dolomite and clayey silt. The bulk of the gypsum occurs immediately above and below beds of dolomite and clayey silt where it forms a thick rind along the upper and lower sides of anhydrite beds. The clayey silt is structureless, essentially unconsolidated, and free of cement; it is considered to be dissolution residue derived from clayey and silty halite. Formation thinness in conjunction with the absence of halite and the presence of gypsum is related to the removal by dissolution of soluble constituents [NaCl, $CaSO_4$, and possibly $CaMg(C0_3)_2$] by circulating ground water. Maximum thickness of the Rustler Formation is about 500 feet.

A review of the Surface Waste Management Permit for the Loco Hills Water Disposal Company site provide geological data about 1 mile east of the Arco Federal tank battery. As shown in Appendix D, the Santa Rosa Formation is about 4 feet below the surface and the Rustler/Santa Rosa contact is mapped at a depth of 238-288 feet below grade. The presence of the Dewey Lake Formation is not reported in the file.

The tectonic structure of the Loco Hills area is dominated by the Artesia-Vacuum Arch, which is shown in Plate 8 (http://geoinfo.nmt.edu/publications). The blue square in Plate 8 is Township 18 S, Range 30E and the Arco Federal battery is in Section 17, which is near the center of the township.

Ground water Characteristics

The Dockum aquifer comprises all water-yielding units (e.g. thin, discontinuous sandstones) within the Dockum Group. The Santa Rosa Formation, which is the most productive part of the Dockum aquifer, is present in the eastern third (10-20 miles) of Eddy County. However the monitoring wells at the Loco Hills Water Disposal site and the well located 1 mile south-southwest of the Arco Federal battery demonstrate that the Santa Rosa Sandstone and the overlying rocks do not contain "ground water" as defined by New Mexico Rules. At the Loco Hills Water Disposal facility, the wells

completed in the Santa Rosa are "dry". The monitoring well associated with the Marbob boring B-1 produces only 5-10 gallons per day.

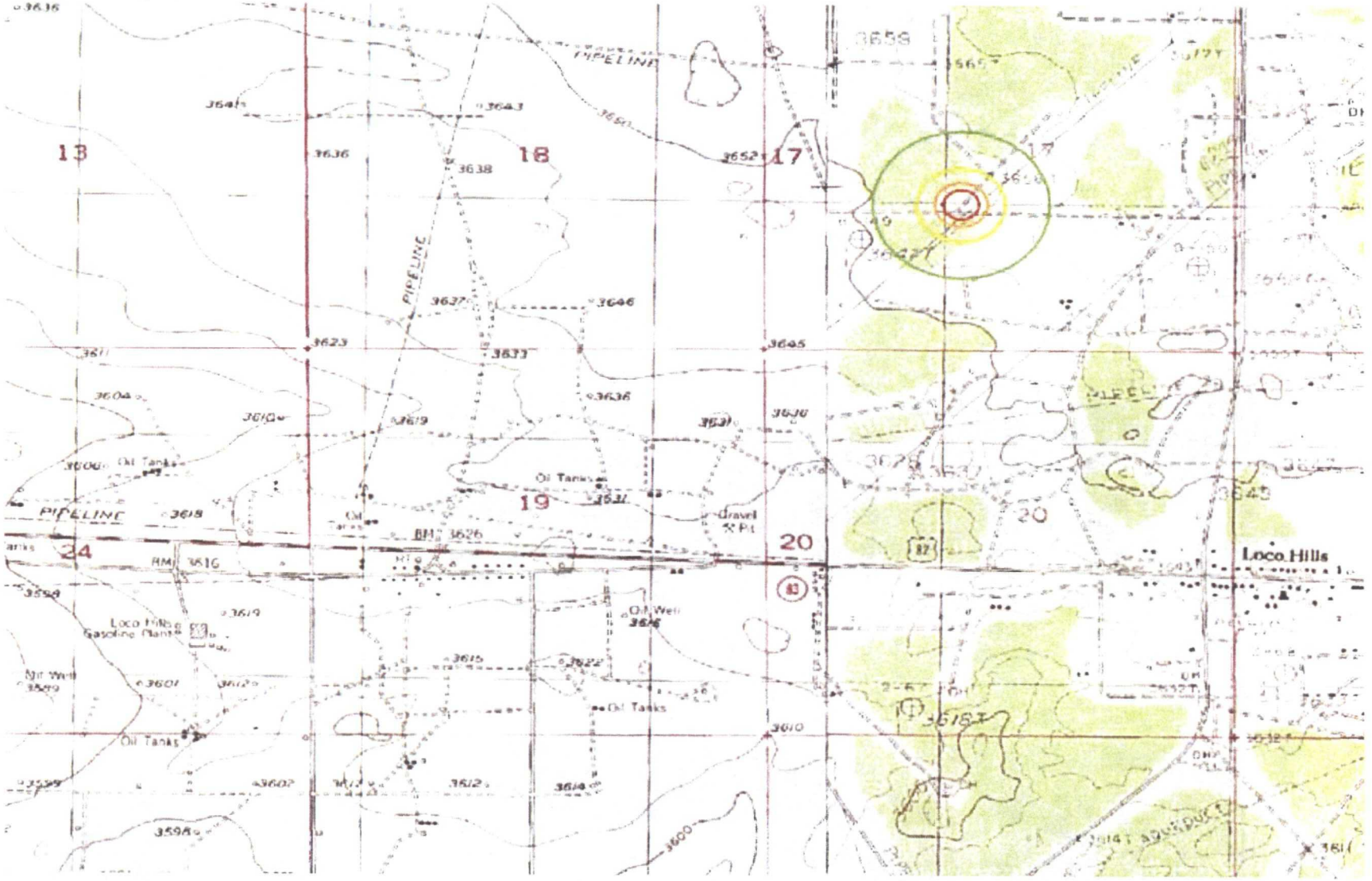
The Rustler aquifer consists of water-yielding rocks from the Culebra and Magenta dolomite members of the Rustler Formation. The Rustler aquifer is confined by the overlying Permian Dewey Lake Formation. The dissolved solids concentration of the water is extremely variable and ranges from 2,000 to over 300,000 mg/L, with the principal ions being calcium and sulfate. The water is not suitable for human consumption, but is sometimes used for irrigation, livestock watering, and oilfield water-flooding operations.

We measured a depth to ground water at a cathodic protection well located about 2,500 feet west of the proposed Marbob Surface Waste Management facility. This well is 260 feet deep and completed in the Rustler Formation. The depth to ground water is 205 feet below land surface. Depth to ground water is approximately 260 feet below land surface at the proposed Marbob facility. At the Loco Hills Water Disposal facility, wells completed in the Santa Rosa and Rustler are dry (see Appendix D).

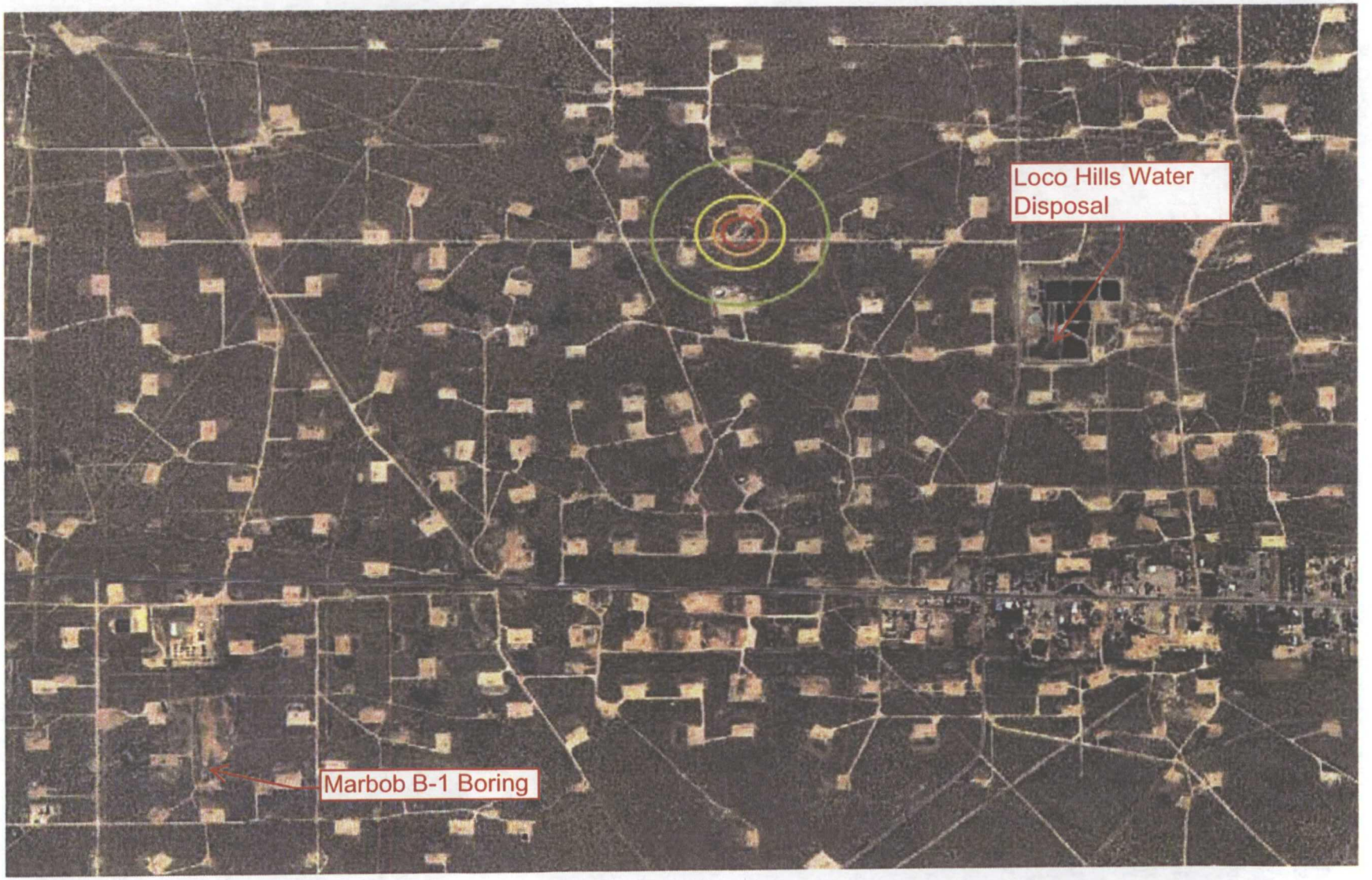
We conclude with reasonable probability that fresh ground water does not exist beneath the Arco Federal tank battery. The Artesia-Vacuum Arch has caused the Dockum Group aquifers, including the Santa Rosa Sandstone, to lie above any potentiometric surface. Although there are no nearby water quality data from the Rustler, regional data suggest that water in the Rustler would be brackish.

Surface Water Characteristics

Examination of Plate 1 and the site (see Figure 2) demonstrate that there is no watercourse or surface water within the dune field that characterizes the environs of the Arco Federal Tank Battery. Plate 9 shows identified water courses in the general area of the site. The nearest surface water body is Bear Grass Draw, about 4 miles west of the site.



Petroleum Recovery Research Center	USGS Topographic Map.	Plate: 1
	Southwest Royalties - Arco Federal Battery	Jan 23, 2011



Distance (ft): 200 300 500 1000

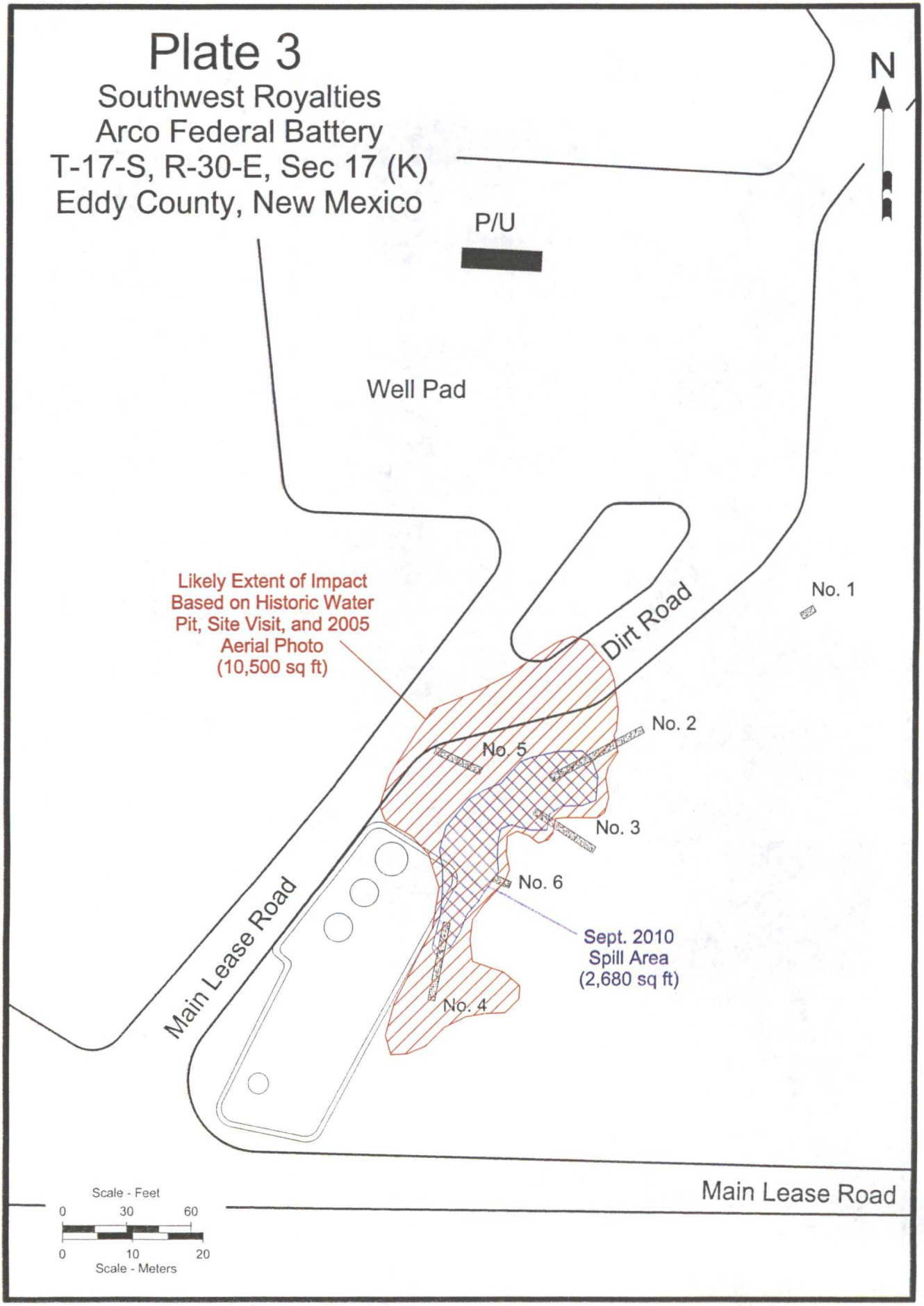
0 1000 2000ft

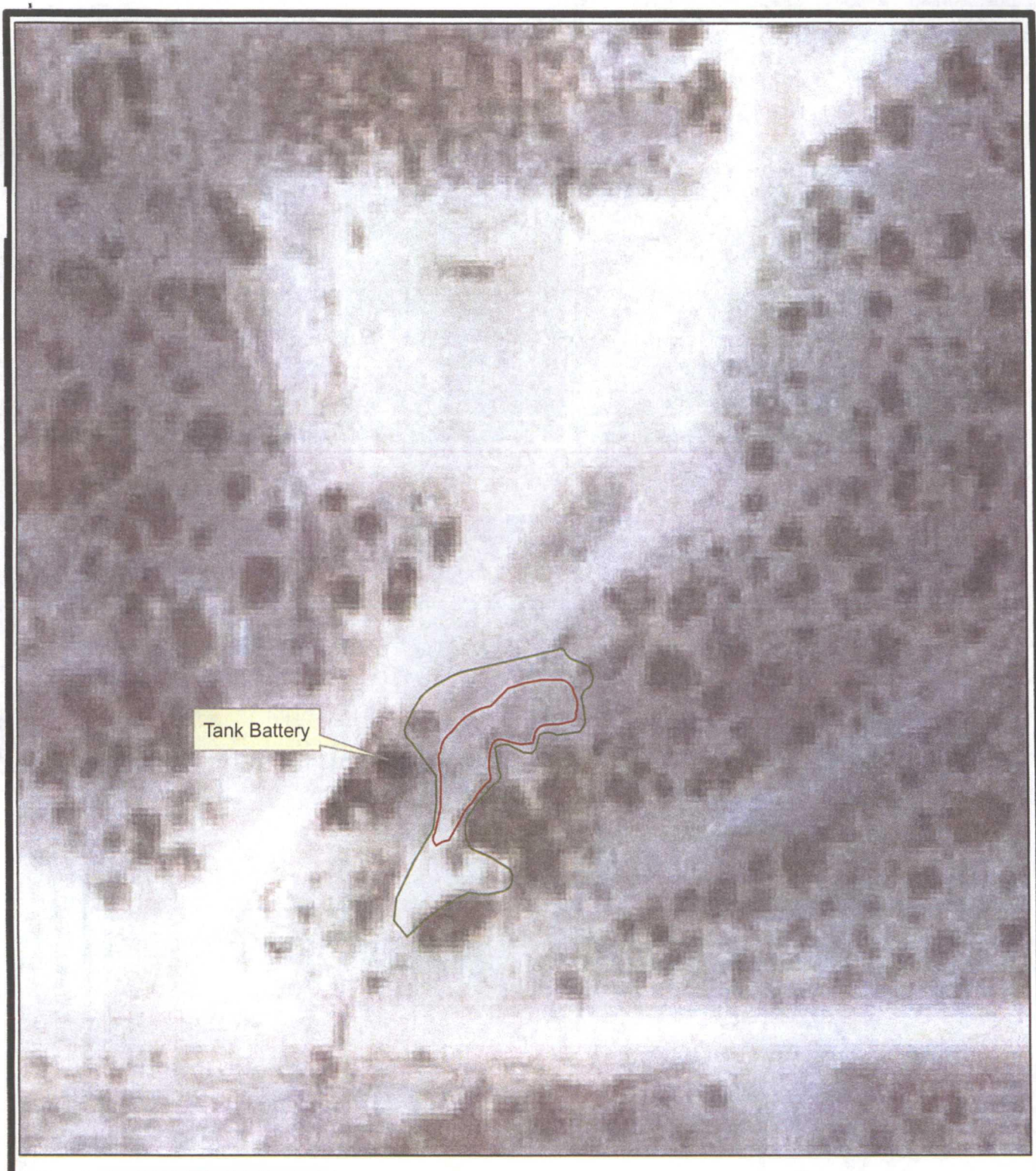
N W E S

Petroleum Recovery Research Center	Recent Aerial Photograph	Plate: 2
	Southwest Royalties - Arco Federal Battery	Jan 23, 2011

Plate 3

Southwest Royalties
Arco Federal Battery
T-17-S, R-30-E, Sec 17 (K)
Eddy County, New Mexico





Legend

Sept. 2010 Spill Area

Stressed Vegetation

N

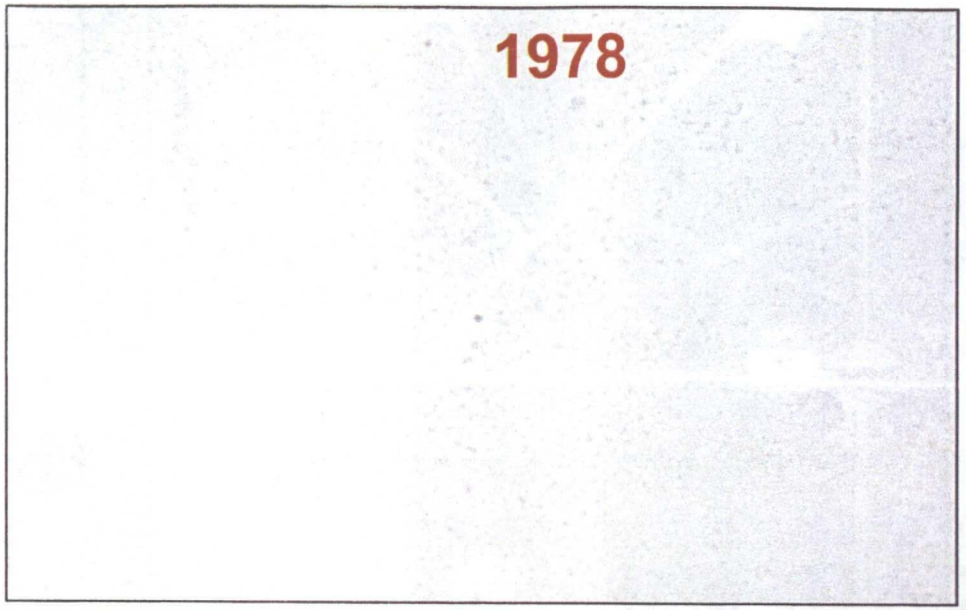
W E

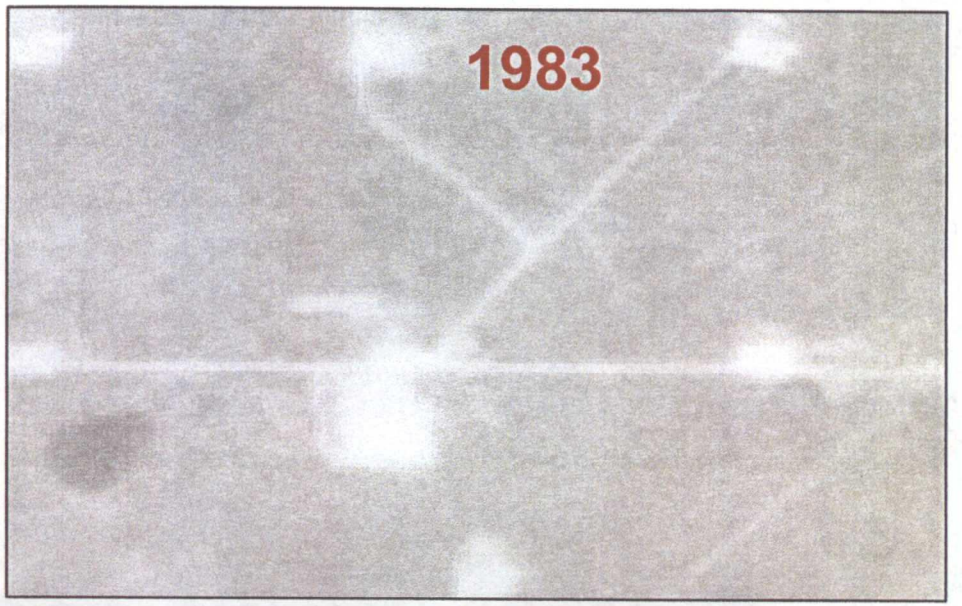
S

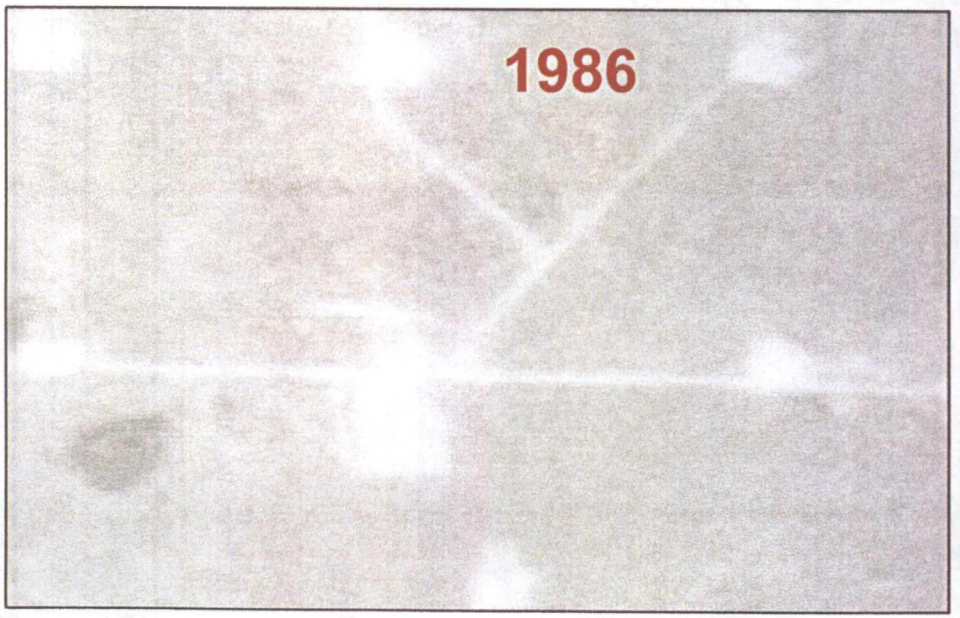
0 40 80

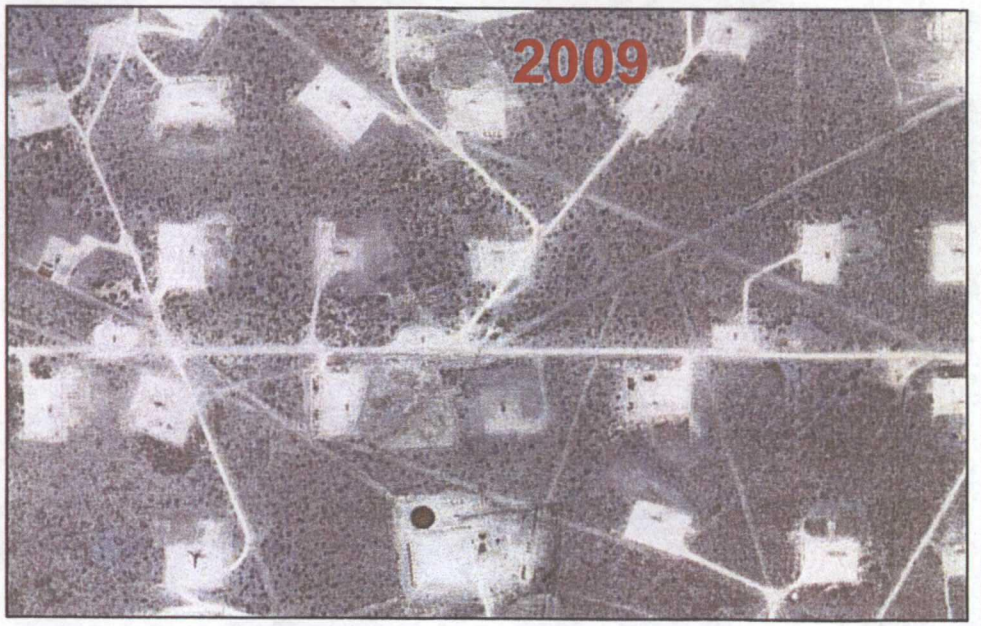
Feet

R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	2009 Aerial Showing Tank Battery and Spill Footprint	Plate 4
	SW Royalties: Arco Federal Battery	January 2011









0 400 800 Feet

R.T. Hicks Consultants, Ltd
901 Rio Grande Blvd NW Suite F-142
Albuquerque, NM 87104
Ph: 505.266.5004

Aerial Photos: 1978, 1983, 1986, & 2009

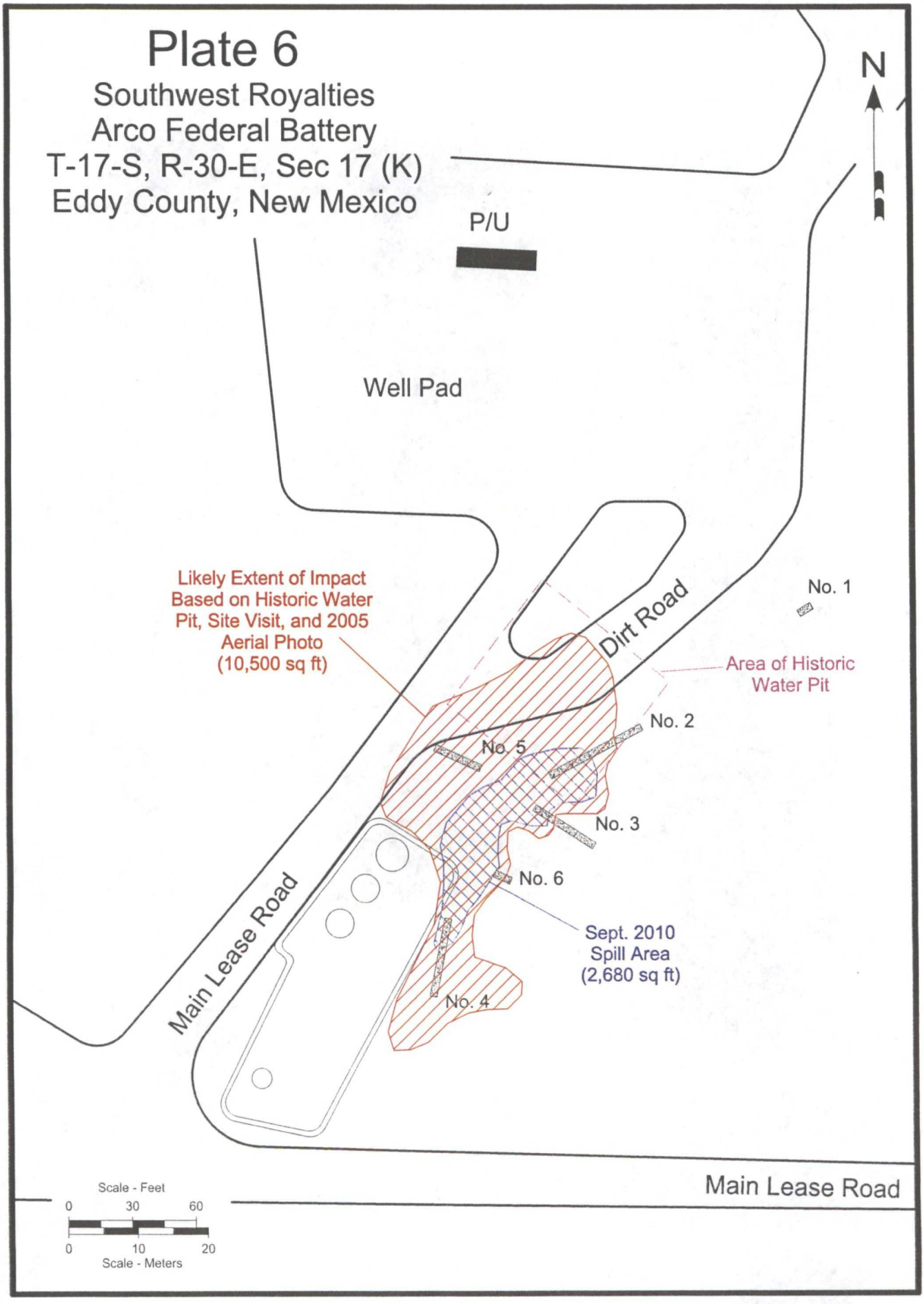
Plate 5

SW Royalties: Arco Federal Battery

January 2011

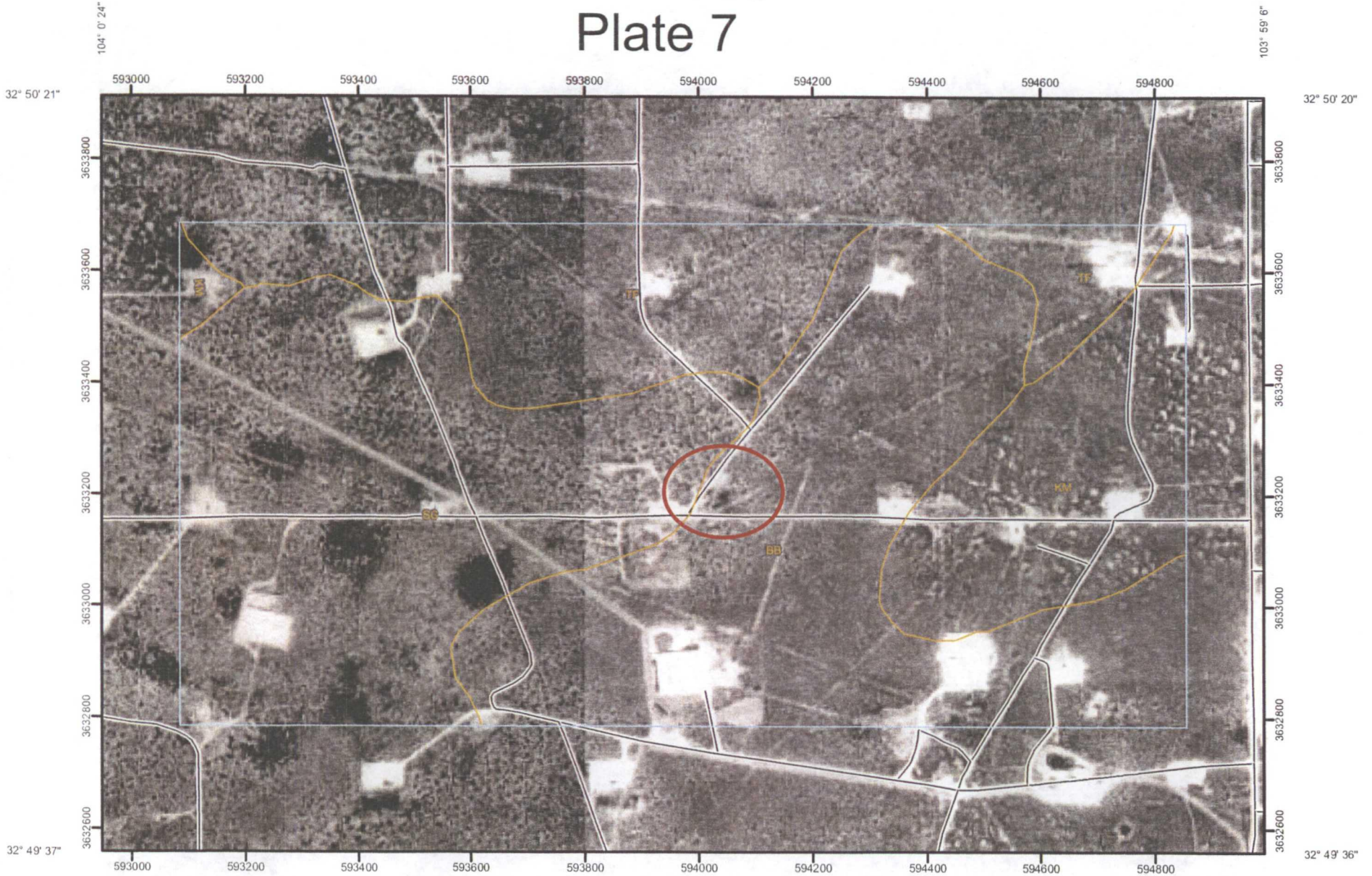
Plate 6

Southwest Royalties
Arco Federal Battery
T-17-S, R-30-E, Sec 17 (K)
Eddy County, New Mexico



Soil Map—Eddy Area, New Mexico
(Arco Federal Battery)

Plate 7



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:9,700 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 13N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Eddy Area, New Mexico
Survey Area Data: Version 9, Feb 20, 2009

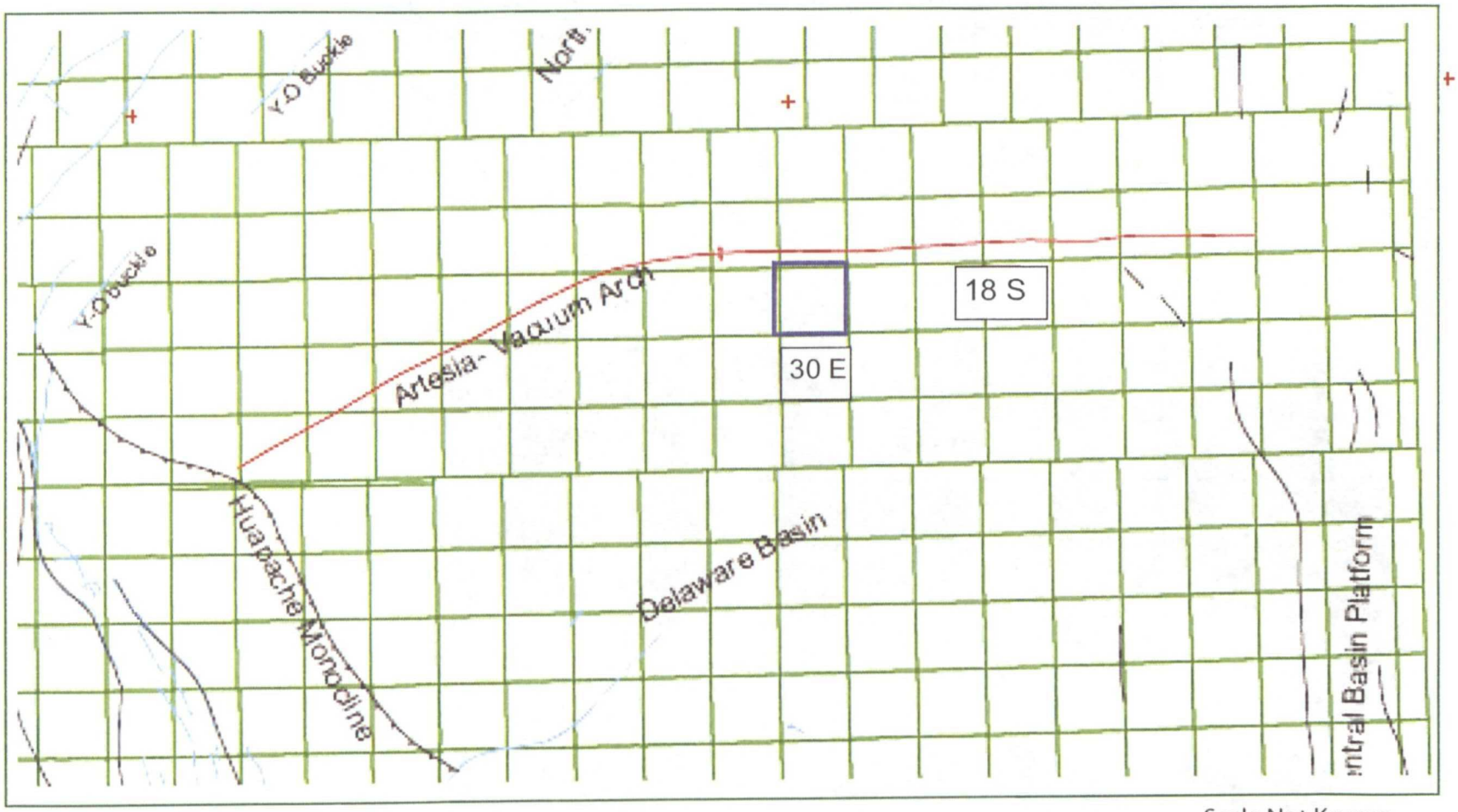
Date(s) aerial images were photographed: 11/1/1997

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Plate 7

Map Unit Legend

Eddy Area, New Mexico (NM614)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
BB	Berino complex, 0 to 3 percent slopes, eroded	135.3	34.4%
KM	Kermit-Berino fine sands, 0 to 3 percent slopes	55.9	14.2%
SG	Simona gravelly fine sandy loam, 0 to 3 percent slopes	130.8	33.2%
TF	Tonuco loamy fine sand, 0 to 3 percent slopes	71.5	18.2%
Totals for Area of Interest		**393.5**	**100.0%**



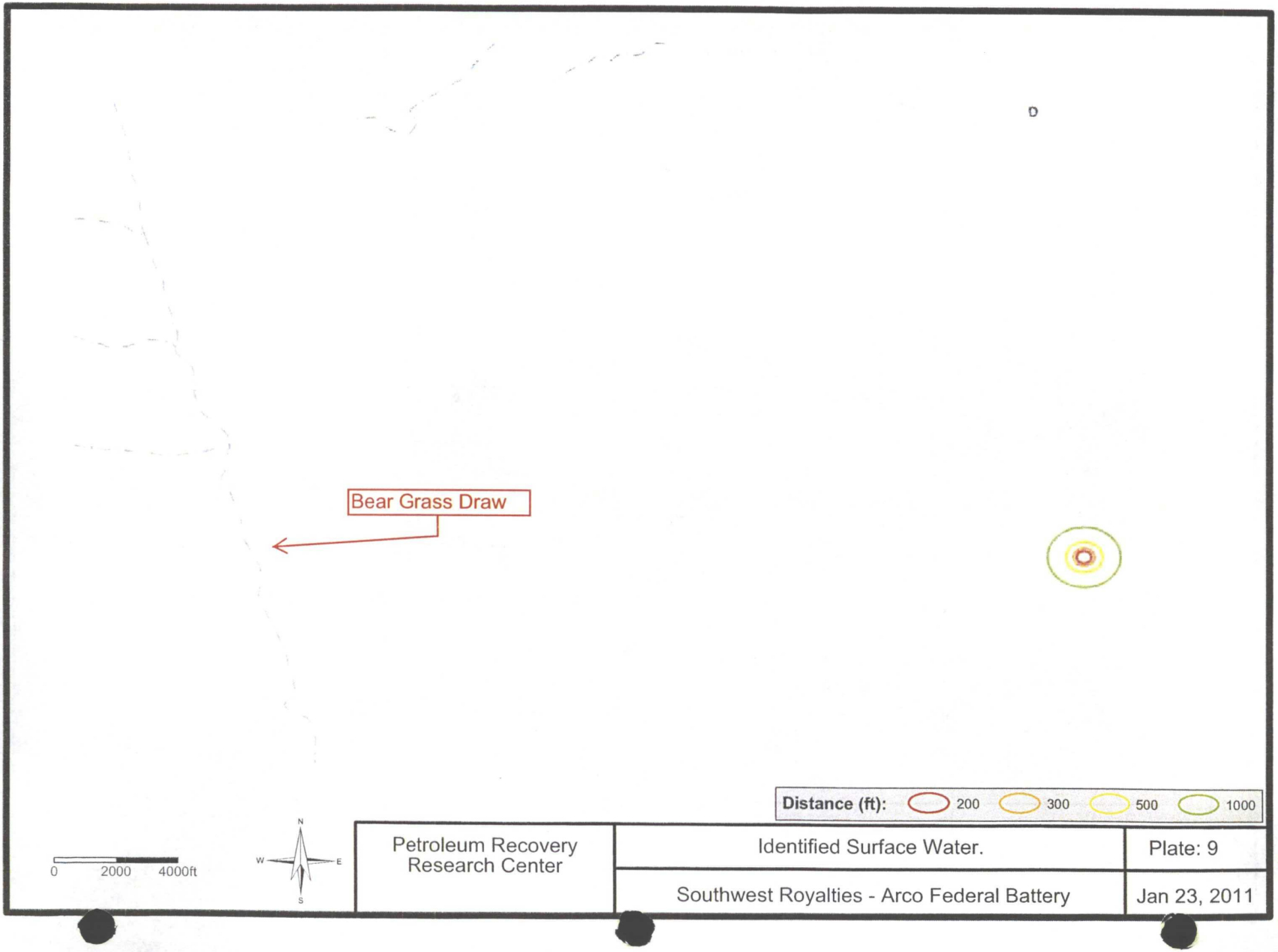
Source: http://geoinfo.nmt.edu

Scale Not Known

T 18S, R 30 E noted in blue box. Artesia-Vacuum Arch is located north of Arco Federal Battery

R.T. HICKS CONSULTANTS, LTD.
901 Rio Grande Blvd. NW Suite F-142 Albuquerque, NM 87104
505.266.5004 Fax: 505.266.0745

Tectonic Map of a Portion of Southeast New Mexico	Plate 8
Southwest Royalties - Arco Federal Battery	January 2011



Petroleum Recovery Research Center	Identified Surface Water.	Plate: 9
	Southwest Royalties - Arco Federal Battery	Jan 23, 2011

Appendix A

Historic Documents

R.T. Hicks Consultants, Ltd.
901 Rio Grande Blvd. NW, Suite F-142
Albuquerque, NM 87104

N. M. O. C. C. COPY

Copy to Ad

Form 9-331
(May 1963)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUBMIT IN TRIPLICATE* (Other instructions on reverse side)

Form approved.
Budget Bureau No. 42-R1424.

5. LEASE DESIGNATION AND SERIAL NO.: NM-074936

6. IF INDIAN, ALLOTTEE OR TRIBE NAME:

SUNDRY NOTICES AND REPORTS ON WELLS

(Do not use this form for proposals to drill or to deepen or plug back to a different reservoir. Use "APPLICATION FOR PERMIT—" for such proposals.)

1. OIL WELL [X] GAS WELL [ ] OTHER

7. UNIT AGREEMENT NAME:

2. NAME OF OPERATOR: General American Oil Company of Texas

8. FARM OR LEASE NAME: ARCO

3. ADDRESS OF OPERATOR: P. O. Box 416 Loco Hills, New Mexico 88255

9. WELL NO.: # 1

4. LOCATION OF WELL (Report location clearly and in accordance with any State requirements.* See also space 17 below.) At surface: 1980' FSL and 1980' FWL

10. FIELD AND POOL, OR WILDCAT: Grayburg-Jackson

11. SEC., T., R., M., OR BLK. AND SURVEY OR AREA: Sec. 17, T17S, R30E

14. PERMIT NO.:

15. ELEVATIONS (Show whether DF, RT, GR, etc.): 3657' G.L.

12. COUNTY OR PARISH: Eddy

13. STATE: N.M.

16. Check Appropriate Box To Indicate Nature of Notice, Report, or Other Data

NOTICE OF INTENTION TO:				SUBSEQUENT REPORT OF:			
TEST WATER SHUT-OFF	[ ]	PULL OR ALTER CASING	[ ]	WATER SHUT-OFF	[X]	REPAIRING WELL	[ ]
FRACTURE TREAT	[ ]	MULTIPLE COMPLETE	[ ]	FRACTURE TREATMENT	[X]	ALTERING CASING	[ ]
SHOOT OR ACIDIZE	[ ]	ABANDON*	[ ]	SHOOTING OR ACIDIZING	[ ]	ABANDONMENT*	[ ]
REPAIR WELL	[ ]	CHANGE PLANS	[ ]	(Other)			
(Other)			[ ]				

(NOTE: Report results of multiple completion on Well Completion or Recompletion Report and Log form.)

17. DESCRIBE PROPOSED OR COMPLETED OPERATIONS (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work. If well is directionally drilled, give subsurface locations and measured and true vertical depths for all markers and zones pertinent to this work.)*

1. Well spudded at 4:00 P.M. 4-26-72
2. Ran 527' KB of 8-5/8" 20# casing as follows:
   a. Volume of cement equalled 132 cubic ft. (100 sacks).
   b. Brand of cement was southwestern class "C" with 2% Cacl.
   c. Approximate temperature of cement slurry was 68 degrees F.
   d. Formation temperature was 86 degrees F.
   e. After standing cemented for 9 hours compressive strength was 800#. Pressure tested to 400#. Tested O.K.
   f. Drilled out cement after standing 9 hours.
3. Ran 3685' KB of 4-1/2" 9.5# casing and cemented with 450 sacks cement.
4. We perforated as follows: 2485'-2489', 2500'-2504', 2604'-2608', 2639'-2643', 2707'-2714,' 2981'-2983', 3005'-3007', 3068'-3072', 3116'-3122', 3147'-3150', 3172'-3176', 3348'-3358', 3444'-3448', 3472'-3476', 3612'-3622',
5. 3612'-3622' Frac with 30,000# sand and 30,000 gallons water.
   3444'-3476' Frac with 30,000# sand and30,000 gallons water.
   3348'-3358' Frac with 20,000# sand and 20,000 gallons water.
   3116'-3176' Acidized with 3,500 gallons
   2981'-3072' Acidized with 3,500 gallons
   2707'-2714' Frac with 20,000# sand and 20,000 gallons water.
   2604'-2643' Frac with 30,000# sand and 30,000 gallons water.
   2485'-2504' Frac with 30,000# sand and 30,000 gallons water.

RECEIVED
JUN 29 1972
O. C. C.
ARTESIA, OFFICE

RECEIVED
JUN 28 1972
U. S. GEOLOGICAL SURVEY
ARTESIA, NEW MEXICO

18. I hereby certify that the foregoing is true and correct

SIGNED M E Walter TITLE District Superintendent DATE June 27, 1972

(This space for Federal or State office use)

APPROVED BY: TITLE: DATE:

CONDITIONS OF APPROVAL, IF ANY:

APPROVED
JUN 28 1972
R. L. BEEKMAN
ACTING DISTRICT ENGINEER

*See Instructions on Reverse Side

Instructions

General: This form is designed for submitting proposals to perform certain well operations, and reports of such operations when completed, as indicated, on Federal and Indian lands pursuant to applicable Federal law and regulations, and, if approved or accepted by any State, on all lands in such State, pursuant to applicable State law and regulations. Any necessary special instructions concerning the use of this form and the number of copies to be submitted, particularly with regard to local, area, or regional procedures and practices, either are shown below or will be issued by, or may be obtained from, the local Federal and/or State office.

Item 4: If there are no applicable State requirements, locations on Federal or Indian land should be described in accordance with Federal requirements. Consult local State or Federal office for specific instructions.

Item 17: Proposals to abandon a well and subsequent reports of abandonment should include such special information as is required by local Federal and/or State offices. In addition, such proposals and reports should include reasons for the abandonment; data on any former or present productive zones, or other zones with present significant fluid contents not sealed off by cement or otherwise; depths (top and bottom) and method of placement of cement plugs; mud or other material placed below, between and above plugs; amount, size, method of parting of any casing, liner or tubing pulled and the depth to top of any left in the hole; method of closing top of well; and date well site conditioned for final inspection looking to approval of the abandonment.

U.S. GOVERNMENT PRINTING OFFICE: 1963—O-685229

847 - 485

drilled in a pattern as shown on Exhibit "A" designed to detect horizontal movement of water from said disposal area.

(15) That in the event salt water is detected in any monitor well, Case No. 7329 should be reopened within 90 days to permit applicant to appear and show cause why the authority to use said pits for water disposal should not be rescinded.

(16) That the maximum volume of produced water to be disposed of through said system should not exceed 2500 barrels per acre per month.

(17) That a freeboard of a minimum of three feet should be maintained at all times."

(5) That said Order No. R-6811-A did contain provisions limiting the maximum disposal volume to 2500 barrels per acre per month, requiring maintenance of a minimum three foot freeboard in all pits and the drilling and equiping of monitor wells.

(6) That the applicant now seeks the amendment of said Order No. R-6811-A to remove only the 2500 barrels per acre per month disposal volume limitation.

(7) That the application was opposed by a surface and ground water interest owner in the area which might be affected by the disposal operation.

(8) That the applicant presented evidence designed to demonstrate that the change in disposal volume would not significantly alter the hydrologic regime established by institution of the disposal operation nor threaten contamination of any fresh water supplies.

(9) That the protestant presented new evidence which tended to show that there were both southeast and southwest trending slopes on the interface between the Santa Rosa formation and the Rustler formation under the disposal pits.

(10) That the protestant further presented testimony tending to show that an impermeable clay barrier exists at the base of the Santa Rosa formation which would effectively stop the vertical infiltration of the disposed waters into the Rustler formation.

(11) That if the disposed water which percolates through the Santa Rosa formation from said pits cannot move into the Rustler formation, it may move laterally through the Santa Rosa formation where it may endanger fresh water supplies.

(12) That in order to verify that any water percolating from said pits ultimately enters the Rustler formation and does not move laterally within the Santa Rosa formation, the well monitoring system provided for in said Order No. R-6811-A should be expanded.

(13) That the additional monitor wells should be drilled to the Rustler formation and should be located at points approximately 250 feet north of the present monitor well No. 9 located to the east of the disposal facility, approximately 150 feet from monitor well No. 2 along a line connecting monitor well 2 and monitor well 3, and at a third location approximately midway between the present monitor holes No. 4 and 5 all as depicted on Exhibit "A" to said Order No. R-6811-A.

(14) That provided that these additional monitor wells are drilled and utilized in the same manner as the original monitor wells, no increased threat to fresh water supplies should result from lifting the 2500 barrels-per-acre disposal limitation contained in Order No. R-6811-A.

(15) That the application should be approved and the additional monitor wells should be required.

(16) That the granting of this application restricted in the manner set forth above will not cause waste, or impair correlative rights, or endanger designated fresh water supplies.

IT IS THEREFORE ORDERED:

(1) That the application of Loco Hills Water Disposal Company for an amendment of Division Order No. R-6811-A to remove the 2500 barrel per acre per month disposal limitation included in Order No. (1), thereof, is hereby approved.

PROVIDED HOWEVER, that this order shall not become effective until the applicant has drilled and completed three additional monitor wells located approximately (1) 250 feet to the North of present monitor hole No. 9, (2) 150 feet from present monitor well No. 2 along a line connecting monitor well No. 2 and 3 and (3) midway between the present monitor holes Nos. 4 and 5.

PROVIDED FURTHER, that each of said monitor wells shall be drilled to the top of the Rustler formation and that such wells

shall be cased and operated in the same manner as those monitor wells required by Order No. R-6811-A.

(2) That jurisdiction of this cause is retained for the entry of such further orders as the Division may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

OIL CONSERVATION COMMISSION

ALEX J. ARMIJO, Member

ED KELLEY, Member

JOE D. RAMEY, Member & Secretary

Appendix B

Lithologic Log from Proposed Marbob Surface Waste Management Facility

R.T. Hicks Consultants, Ltd.
901 Rio Grande Blvd. NW, Suite F-142
Albuquerque, NM 87104

Geologist: Gil Van Deventer
Driller: Eades Drilling
Drilling Method: Air/Mud Rotary
Start Date: 7/5/2005
End Date: 7/8/2005

Client: Marbob Energy Corporation
Project Name: Caliche Pit
Project Location: T17S, R30E, Section 30, Unit D
Boring ID: B-1 (255 ft)
Boring Location: SWC of caliche pit ~160 ft northwest of Burch Keely Unit #143

Depth (feet)	Description	Lithology	USCS Symbol	Sample Interval	Sample Time	Sample Type	Chloride mg/kg	Moisture Content (%)	Grain size distibution (%) Gravel	Coarse sand	Med Sand	Fine Sand	Silt	Clay
0	Sandy loam from 0' - 1' : weathered, fractured caliche		SM	0' - 1'	0945	Surface								
5	(95%) with fine sand (5%) in matrix from 1' - 6'		CAL	5' - 7'	0950	SplitSpoon			0%	3%	17%	12%	21%	47%
10	Reddish-brown silty fine to medium sand, subangular to			10'-12'	0955		64	6.1	15%	11%	14%	23%	20%	17%
15	subrounded, some clay (<5%), some MnO_2 (<1-2%)		SM	15'-17'	1005	SplitSpoon								
20	from 6' - 22'			20'-22'	1015		64	11.8	0.0%	0%	5%	21%	41%	33%
25	Reddish-brown fine sand, loose, rounded frosted quartz			25'-27'	1040		64	3.7	4%	1%	0%	36%	42%	17%
30	grains from 22' - 28'		SW	30'-32'	1055	SplitSpoon	96	11.4	2%	8%	10%	5%	6%	69%
35				35'-37'	1115		112	19.9	0%	1%	7%	11%	16%	65%
40	Reddish-brown and brownish-red clayey fine sand,			40'-42'	1145		144	14.8	0%	0%	1%	9%	25%	65%
45	subangular to subrounded, some calcite nodules near top,		SC	45'-47'	1200	SplitSpoon	96	6.5	0%	1%	0%	10%	32%	57%
50	some 1/2"-2" thick stringers of fine sand; from 28' - 50'			50'-52'	1315									
55	Reddish-brown uniform fine sand, loose, subrounded,			55'-57'	1345	SplitSpoon	64	5.3	0%	0%	0%	19%	48%	33%
60	rounded frosted quartz grains; from 50' - 65'		SW	60'-62'	1405									
65	Reddish-brown and brownish-red clayey fine sand,			65'	1430	Cuttings								
70	subangular to subrounded, some calcite nodules near top,		SC	70'-72'	1440	SplitSpoon	64	6.9	0%	0%	0%	14%	43%	43%
75	some 1/2"-2" thick stringers of fine sand; from 65' - 80'			75'	1500	Cuttings								
80														
85				85'	1550									
90				90'	1600									
95	Reddish-brown uniform fine sand, loose, subrounded,			95'	1615									
100	rounded frosted quartz grains; from 80' - 138'			100'	1635									
105				105'	1640									
110			SW	110'	1645	Cuttings	64		0%	0%	1%	22%	44%	33%
115				115'	1650									
120	Due to borehole instability of loose sands above drilling			120'	1651									
125	resumed using freshwater at 125 ft on 07/06/05			125'	1720									
130				130'	1400									
135	Reddish-brown uniform fine sand, loose, subrounded,			135'	1420									
140	rounded frosted quartz grains; from 80' - 138'			140'	1440									
145	Gravelly fine sand		SP	145'	1500	Cuttings								
150	Gravelly red clay (Base of Santa Rosa?)		GC	150'	1530	Cuttings								
155				155'	1600									
160	Red clay (Top of Dewey Lake Red Bed Formation?)			160'	0940									
165	Red clay (driller noted formation denser at this point)			165'	0945									
170	Red clay with minor fine to coarse sand (<1-2%)			170'	1000									
175				175'	1005									
180				180'	1020									
185				185'	1040									
190				190'	1050									
195				195'	1100									
200			CH	200'	1120	Cuttings	64		0%	3%	16%	10%	7%	64%
205	Red clay with			205'	1140									
210	minor fragments of fine to med-grained sandstone			210'	1200									
215				215'	1205									
220				220'	1210									
225				225'	1215									
230				230'	1225									
235				235'	1235									
240				240'	1245									
245				245'	1255									
250	Red clay with medium-grained sandstone stringers		SC	250'	1300	Cuttings	96		0%	3%	44%	7%	10%	37%
255				255'	1305									

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Marbob Energy Corp.
Lithologic Log of Boring B-1

Plate 9
July 2005

Appendix C

Explanation of Soils, Plate 7

R.T. Hicks Consultants, Ltd.
901 Rio Grande Blvd. NW, Suite F-142
Albuquerque, NM 87104

Explanation of Soils Map in Plate 7

Eddy Area, New Mexico

BB—Berino complex, 0 to 3 percent slopes, eroded

Map Unit Setting

- Elevation: 3,000 to 4,200 feet
- Mean annual precipitation: 10 to 15 inches
- Mean annual air temperature: 60 to 64 degrees F
- Frost-free period: 200 to 220 days

Map Unit Composition

- Berino and similar soils: 60 percent
- Pajarito and similar soils: 25 percent

Description of Berino

Setting

- Landform: Fan piedmonts, plains
- Landform position (three-dimensional): Riser
- Down-slope shape: Convex
- Across-slope shape: Linear
- Parent material: Mixed alluvium and/or eolian sands

Properties and qualities

- Slope: 0 to 3 percent
- Depth to restrictive feature: More than 80 inches
- Drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum content: 40 percent
- Maximum salinity: Nonsaline to very slightly saline (2.0 to 4.0 mmhos/cm)
- Sodium adsorption ratio, maximum: 1.0
- Available water capacity: Moderate (about 8.0 inches)

Interpretive groups

- Land capability (nonirrigated): 7e
- Ecological site: Loamy Sand (R042XC003NM)

Typical profile

- 0 to 17 inches: Fine sand
- 17 to 58 inches: Sandy clay loam
- 58 to 60 inches: Loamy sand

Description of Pajarito

Setting

- Landform: Interdunes, plains, dunes
- Landform position (three-dimensional): Side slope
- Down-slope shape: Linear, convex
- Across-slope shape: Linear, convex
- Parent material: Mixed alluvium and/or eolian sands

Properties and qualities

- Slope: 0 to 3 percent
- Depth to restrictive feature: More than 80 inches
- Drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum content: 40 percent
- Maximum salinity: Nonsaline (0.0 to 1.0 mmhos/cm)
- Sodium adsorption ratio, maximum: 1.0
- Available water capacity: Moderate (about 8.0 inches)

Interpretive groups

- Land capability classification (irrigated): 2e
- Land capability (nonirrigated): 7e
- Ecological site: Loamy Sand (R042XC003NM)

Typical profile

- 0 to 9 inches: Loamy fine sand
- 9 to 72 inches: Fine sandy loam

Eddy Area, New Mexico

SG—Simona gravelly fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

- Elevation: 3,000 to 4,200 feet
- Mean annual precipitation: 10 to 14 inches
- Mean annual air temperature: 60 to 64 degrees F
- Frost-free period: 210 to 220 days

Map Unit Composition

- Simona and similar soils: 95 percent

Description of Simona

Setting

- Landform: Alluvial fans, plains
- Landform position (three-dimensional): Rise
- Down-slope shape: Linear, convex
- Across-slope shape: Linear
- Parent material: Mixed alluvium and/or eolian sands

Properties and qualities

- Slope: 0 to 3 percent
- Depth to restrictive feature: 7 to 20 inches to petrocalcic
- Drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum content: 15 percent
- Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
- Sodium adsorption ratio, maximum: 1.0
- Available water capacity: Very low (about 2.1 inches)

Interpretive groups

- Land capability (nonirrigated): 7e
- Ecological site: Shallow Sandy (R042XC002NM)

Typical profile

- 0 to 19 inches: Gravelly fine sandy loam
- 19 to 23 inches: Indurated

Appendix D

Loco Hills Water Data

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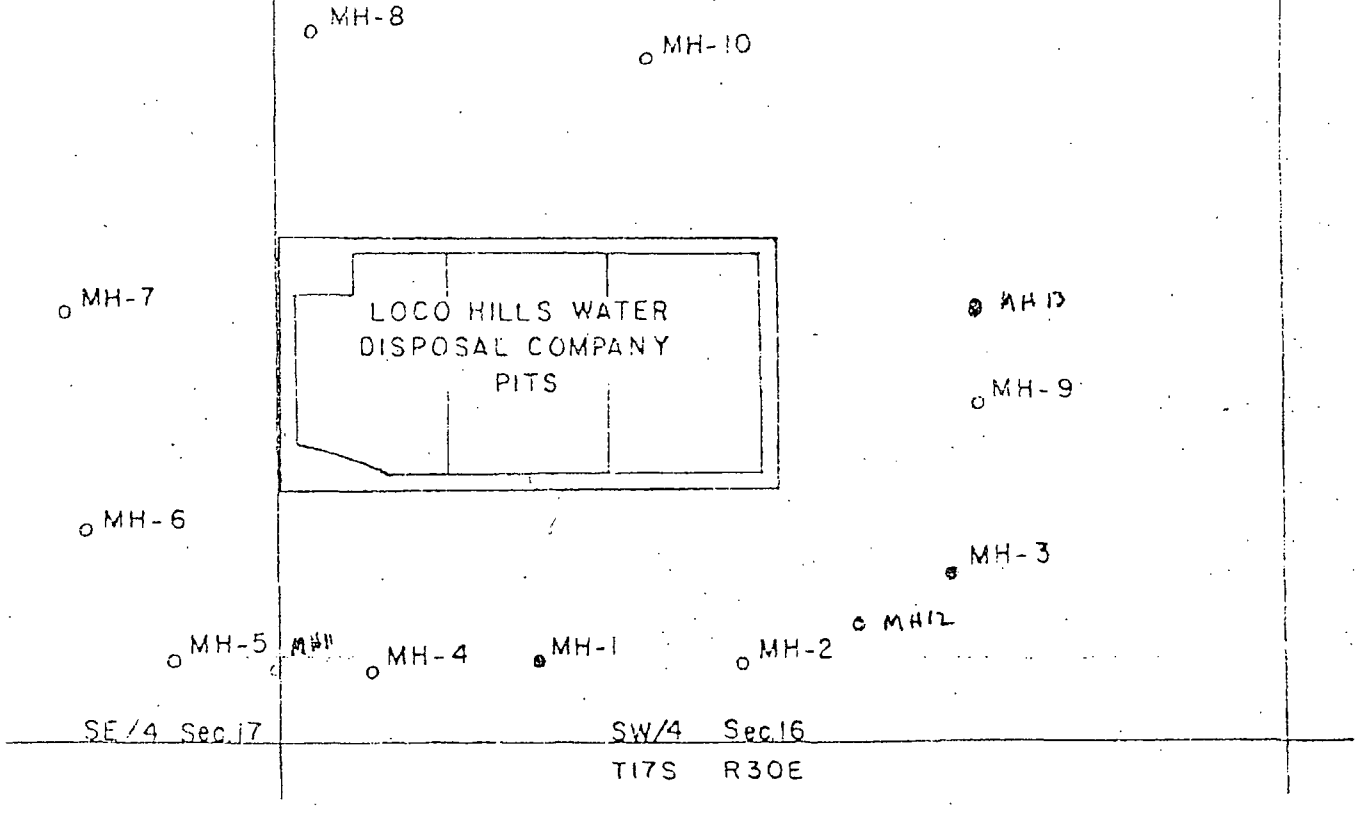
Albuquerque, NM 87104

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 7720 Exhibit No. 1
Submitted by Loco Hills
Hearing Date 11-29-82

Map from Loco Hills Water Disposal Facility NMOCD File Showing Monitor Well Locations



o 60' MONITOR HOLES
• RUSTLER DEPTH MONITOR HOLES

500 0 500 1000

N

EDDY COUNTY, NEW MEXICO
MONITOR HOLE LOCATIONS
LOCO HILLS WATER DISPOSAL CO.
9/17/82

ED L. REED & ASSOCIATES, INC
CONSULTING HYDROLOGIST
MIDLAND & CORPUS CHRISTI, TEXAS

5-25-99 Notes on Groundwater at Loco[illegible], Water Disposal

MJK

1. Ground water monitoring of the following monitoring wells must be performed quarterly and records of the date, inspector and status of the monitor well must be maintained. Annual reports must be furnished to the OCD Santa Fe office in database form and must include a graphical plot showing water level and conductivity in each well for all preceding quarters.

   MH-1, MH-2, **MH-3**, MH-4, MH-5, MH-6, MH-7, MH-8, MH-9, MH-10, **MH-11**, **MH-12** and **MH-13**

   NOTE: Monitor wells listed in plain type are completed to 60 feet below ground surface (bgs) within the Santa Rosa Formation and screened within 4 feet of the surface. Monitor wells listed in **bold** type are completed within the top of the Rustler Formation and screened from total depth to within 4 feet of the surface. The top of the Rustler Formation was encountered at depths ranging from 239 feet to 288 feet bgs. Each monitor well is cemented from 4 feet to the surface.

   The evaporation ponds were expected to leak. Waste water was expected to migrate vertically to the Rustler Formation and then follow the local and regional dip of the Rustler to the southeast and south. Waste water was not expected to migrate horizontaly with in the Santa Rosa Formation.

2. If fluid is present in the Santa Rosa Formation 60 foot monitor wells (MH-2, MH-4, MH-5, MH-6, MH-7, MH-8, MH-9 and MH-10) the fluids in the pond and monitor wells must be analized for conductivity. If the pond and monitor well fluid conductivity analyses are similar the OCD Santa Fe and appropriate District offices must be notified within 48 hours. Within 72 hours of discovery, the permittee will submit a plan to the OCD Santa Fe and appropriate District offices for review and approval that describes what procedures will be taken to investigate the lateral extent of extent of the waste water plume.

3. If fluid is present in the Rustler Formation monitor wells (MH-1, MH-3, MH-11, MH-12, and MH-13) the fluids in the pond and monitor wells must be analized for conductivity. The Pond and monitor well fluid analysis will be recorded for the annual report to be furnished to the OCD.

Description of Monitoring Well Completion, From Loco Hills Water Disposal Facility NMOCD File

12/15/2005

LOCO HILLS WATER DISPOSAL, CO.

9:05 AM

RECEIVED
DEC 19 2005
OIL CONSERVATION DIVISION

NM-1-004

ANNUAL REPORT
QUARTERLY MONITORING
WELL SAMPLING

QUARTER		WATER LEVEL	CONDUCTIVITY
1ST QTR	03/01/05		
	JAN	ALL WELL DRY	
	FEB	ALL WELL DRY	
	MAR	ALLWELL DRY	

QUARTER		WATER LEVEL	CONDUCTIVITY
2ND QTR	06/01/05		
	APR	ALL WELL DRY	
	MAY	ALL WELL DRY	
	JUN	ALL WELL DRY	

QUARTER		WATER LEVEL	CONDUCTIVITY
3RD QTR	09/01/05		
	JUL	ALL WELL DRY	
	AUG	ALL WELL DRY	
	SEP	ALL WELL DRY	

QUARTER		WATER LEVEL	CONDUCTIVITY
4TH QTR	12/01/05		
	OCT	ALL WELL DRY	
	NOV	ALLWELL DRY	
	DEC	ALL WELL DRY	

From Loco Hills Water Disposal Facility NMOCD File Showing Monitor Wells Are Dry

Attachment 3
Net Environmental Benefit Analysis

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Attachment 3: Net Environmental Benefit Analysis

Explanation of Scoring

The alternatives considered for a semi-quantitative Net Environmental Benefit Analysis (NEBA) for surface restoration at the SW Royalties Arco Federal Tank Battery are:

A. Dig and haul all impacted soil with chloride >1,000 ppm to a maximum depth of 5-feet, import clean fill and amendments.
B. Dig and haul hot spots (>2,000 ppm chloride, maximum depth 3-feet), import clean fill and blend to <1,000 ppm chloride.
C. Dig up hot spots (>2,000 ppm chloride, maximum depth 3-feet) and dispose of impacted soil in on-site trench, import fill (from trench) and blend to <1,000 ppm.
D. Dig up hot spots and dispose of impacted soil in on-site trench, import some soil from trench, create depression for water collection, use water plus "straw" to restore native soil.
E. Dig and haul hot spots, install liner "shingles" 4' below ground surface, import fill for area above liner and blend.
F. Remove surface caliche, rip and disc site, add amendments.

NEBA methodologies are described by several authors, including:

- Efroymson and others (2003, esd.ornl.gov/programs/ecorisk/documents/NEBA-petrol-s-report-RE.pdf)
- Robertson (2006, *www.freshwaterspills.net/neba/neba.ppt*)
- ASTM (2006, http://www.astm.org/Standards/F2532.htm)
- Kealy and others (2001, www.iosc.org/papers/01338.pdf)

For the Arco Federal Battery site, we elected to modify the NEBA method described by Robertson (2006) and ASTM (2006). Because the site comprises less than 1-acre, the use of Habitat Equivalency Metrics, as presented by Kealy and others (2001) is not appropriate. While Robertson uses a color-coded ranking system (green, yellow, red) that allows the user of the NEBA to visually discern which response action provides a more favorable outcome, we used a numerical ranking system where a score of 3 provides the greatest benefit (or least harm), and a ranking of 1 provides the least benefit.

Each criterion has two multiplying factors: one that considers the importance to stakeholders and a second that considers the importance of the criteria to the site-specific environmental setting. In theory, the site-specific environmental setting would be established by good data. In practice, one stakeholder may conclude that site data demonstrate the absence of a water table aquifer beneath the site. According to that stakeholder, ground water quality cannot be impaired and a site multiplication factor of zero is appropriate. Another stakeholder may conclude that data do not demonstrate with a reasonable degree of scientific certainty that a water table aquifer is absent. This second stakeholder may assign a site multiplication factor of 2. Consensus, which is critical to the NEBA process, could create a final site multiplication factor of 0.5, 1 or zero – depending upon which stakeholder is most convincing to the group.

The stakeholder multiplication factor considers the importance of the criteria to the stakeholder. A stakeholder with a surface grazing lease may have sufficient water supplied by a pipeline or nearby source and protecting ground water quality beneath the site may not be important. To this surface leaseholder, forage for livestock may be the most important criteria and assigned a multiplication factor of 3 while protection of ground water would be assigned a factor of 1. Consensus may create a simple average of the various stakeholder scores.

The score and the two multiplication factors are used to calculate a weighted value for each remedy. This weighted value = (Site Multiplication Factor*Score) + (Stakeholder Multiplication Factor * Score).

At this time, the stakeholder multiplication factor is essentially a placeholder as we need additional input from the BLM, adjacent landowners and surface users. Most publications that describe the NEBA process emphasize that success requires a consensus among stakeholders. This DRAFT report is the first step in creating a consensus between all stakeholders. After review of this DRAFT by BLM, we would anticipate a review by surface and subsurface lessees, nearby landowners and possibly the NMOCD.

Ground Water

Data demonstrate that ground water is not present at the site (see Hicks Consultants letter to NMOCD, 2-2-11). Therefore, the multiplication factor for site conditions and stakeholders is zero and scoring is not warranted.

Surface Water

A surface water body (a playa or an arroyo that may hold water for several days) is not present in the area. This condition creates a multiplication factor for surface water of zero for both the site and stakeholders.

Air Quality

Dust generation

Our evaluation suggests that the footprint of the historic release(s) covers slightly less than 10,500 square feet. Data suggest that soil with a chloride concentration greater than 1,000 ppm exists to a depth of 4-8 feet beneath this footprint. Under Remedy A, we estimate that dust generation would occur due to the excavation of the site to an average depth of 5-feet, generating a total of 2,528 cubic yards of soil. The transport of 126 belly-dump trucks over about 1-mile of dirt road toward the landfill would generate additional dust. We assigned a score of 1 for Remedy A. For the purposes of this evaluation, we estimate that excavation and removal of "hot spots" (>2,000 ppm chloride) to a depth of about 4-feet will generate about 1,463 cubic yards of soil requiring transport (Remedies B and E), thus, Remedies B and E will generate about 40% less dust than Remedy A. Remedies C and D call for excavation to 4-feet and generate the same 1,463 cubic yards of soil but avoids transport along the dirt road through on-site trench burial thus creating slightly less dust than Remedies B or E. Because Remedies B, C, D, and E generate about the same volume of dust, all receive a score of 2. Remedy F will require some removal of asphaltic soil and caliche prior to ripping/discing and adding

amendments of straw (to increase soil permeability) and water (to flush chloride below the root zone). As a result, Remedy F will generate the least dust, and we assigned a score of 3 to Remedy F.

Assigned Values for Dust Generation

Remedy	Score	Site Multiplication Factor	Stakeholder Multiplication Factor	Weighted Value, Dust Generation
A	1	1	1	2
B	2			4
C	2			4
D	2			4
E	2			4
F	3			6

During the next 1-5 years, which is the timeframe anticipated to achieve a successful remedy at the Arco Federal Battery site, oil and gas operations in the area will create a significant amount of dust. The incremental contribution of any of the remedies is very small in comparison to the dust generated by other activities and natural processes. We assigned a stakeholder multiplication factor of 1.

In addition to addressing soil impacted by salt, all of the remedies call for the removal of about 4,000 square feet of caliche associated with the unused dirt road loop shown in Figure 1. We anticipate this caliche will be suitable for re-use at nearby roads or well locations and any dust generation created by the removal of caliche at the spill site is offset by the lack of dust created by a need to mine caliche elsewhere and transport it to a nearby location.

The footprint of the release is relatively small and the distance to pavement from the site is less than 1 mile; dust creation by any proposed remedy is relatively small. Therefore, we assigned a site multiplication factor of 1.

Exhaust Generation

The 65-mile haul distance to a landfill creates a relatively large exhaust impact to Remedy A so we assigned it a score of 1. Remedies B and E call for less transport and receive a score of 2. Remedies C and D generate about the same exhaust at the site due to excavation but not the exhaust caused by transport to a landfill. Remedy F requires earthworking equipment to condition the soil and will probably generate about the same mass of air pollution from engine exhaust as Remedies C and D. Remedies C, D and F received a score of 3.

Assigned Values for Exhaust Generation

Remedy	Score	Site Multiplication Factor	Stakeholder Multiplication Factor	Weighted Value, Exhaust Generation
A	1	1	2	3
B	2			6
C	3			9
D	3			9
E	2			6
F	3			9

From a stakeholder perspective, air pollution and generation of greenhouse gas appears more important than dust generation at this site; creating a stakeholder multiplication factor of 2. The site multiplication factor is 1 for many of the same reasons discussed above for dust generation. The widespread use of closed loop/haul-off drilling in this area creates a large volume of exhaust that dwarfs any contribution from any remedy discussed herein.

Habitat Restoration

Native Vegetation

Over the long-term, reducing the disturbance footprint and transforming the area to natural vegetation (habitat and forage) is important and received a site multiplication factor of 3. With respect to the stakeholder importance, we assigned this criteria a multiplication factor of 3 – we believe all stakeholders desire restoration of the site to as close as practical to the pre-disturbance condition.

Remedies A and E are the most robust and have worked well at other sites. Therefore, these remedies are ranked higher than all others for this criterion. Because Remedy F relies upon natural precipitation plus some irrigation to flush the salt from the sandy soil, some maintenance and time are required for this remedy to succeed. In other areas where the soil contains more clay than this site, the addition of amendments to reduce salinity has failed. We assigned the lowest score for Remedy F, primarily due to the uncertainty of success. Remedies B, C, and D have a good chance of creating re-vegetation and we assigned a score of 2 for these remedies.

Assigned Values for Native Vegetation

Remedy	Score	Site Multiplication Factor	Stakeholder Multiplication Factor	Weighted Value, Native Vegetation
A	3	3	3	18
B	2			12
C	2			12
D	2			12
E	3			18
F	1			6

Restore Original Landforms

The landforms in undisturbed areas appear are small dunes. Hall and Goble (2006, http://redrockgeological.com/pdf/2006_mescalero_sands.pdf) describe these dunes as coppice dunes that formed in the region after 1880 due to the northern expansion of Torrey Mesquite (see page 305 of the referenced publication). One can argue that the presence of mesquite and the coppice dunes is influenced by ranching and farming in the area. Replacement of dunes at this site is not considered a priority. In fact, one can argue that a remedy that removes mesquite and the accompanying dues creates an environmental benefit.

Remedies A-E call for borrowing topsoil from adjacent areas – which will cause mesquite/dune removal. Therefore all these remedies receive a score of 3. Remedy F calls for the creation of a small depression to capture precipitation during soil flushing/restoration but does not require removal of topsoil/mesquite from adjacent areas. Remedy F receives a score of 2. All remedies will foster the growth of native grass rather than mesquite and help return the area to "pre-Columbian" conditions.

Assigned Values for Restore Original Landforms

Remedy	Score	Site Multiplication Factor	Stakeholder Multiplication Factor	Assigned Value, Restore Original Landforms
A	3	1	1	6
B	3			6
C	3			6
D	3			6
E	3			6
F	2			4

As described by Hall and Goble, the area of dune formation is enormous relative to the small area of the Arco Federal Battery impact. The site ranking multiplication factor is 1 as a result. Pending input from stakeholders about the importance of restoring the area to pre-1880 conditions, we assigned a stakeholder multiplication factor of 1.

Connectivity

Within the highly developed area of Loco Hills, creating large habitat corridors and/or a landscape with reasonable "connectivity" is very difficult in the short term. At the site, however, oil and gas development to the northwest and northeast is minimal and native landscape and relatively dense vegetation is present. Restoring the small area of the release footprint plus the "illegal" caliche road turn-out minimizes the habitat fragmentation between the northeast and northwest areas of undeveloped land to the width of the lease road – therefore we assigned a site multiplication factor of 2. Pending stakeholder input, we assigned a stakeholder multiplication factor of 2. As oil and gas activity in the area shuts down in 20-30 years, connectivity will become more important to stakeholders than today.

All remedies are ranked the same for this criterion because this scoring assumes that all remedies will be equally successful in restoring natural vegetation and soil in which animals can burrow. All of the remedies received a score of 2, a site multiplication factor of 2, a stakeholder multiplication factor of 2 and a weighted value for connectivity of 8.

Wildlife

The small area of the historic spill is not a critical habitat for wildlife and restoration of this small area will have little impact on wildlife, given the existing oil and gas development in the area. We assigned a site multiplication factor of 1 and a stakeholder multiplication factor of 1. By assuming that all remedies will succeed, all of the remedies are ranked equal 2 for the protection of wildlife, all receive a weighted value of 4.

Social Costs and Benefits

Allocation of Regulatory Review Time

As indicated above, Remedy F requires the most on-going maintenance and monitoring and will require more oversight than other remedies. Therefore this remedy receives the lowest score, 2. Although Remedies A and E are the most robust and Remedies B, C and D are familiar to the agencies – all of these remedies require some on-going monitoring and oversight by the agencies. These five remedies receive a score of 3.

Assigned Values for Regulatory Review

Remedy	Score	Site Multiplication Factor	Stakeholder Multiplication Factor	Assigned Value, Regulatory Review Time
A	3	1	1	6
B	3			6
C	3			6
D	3			6
E	3			6
F	2			4

We assigned a multiplication factor of 1 for the site and a multiplication factor of 1 for stakeholder input because the small size of the impact.

Forage for Livestock and Multiple Use Access

The area of the historic spill footprint is small. During re-vegetation, the area may be fenced to prevent grazing and silt fences may be employed to minimize erosion. After 2 years, we believe vegetation can be re-established under all remedies. Therefore the site and stakeholder multiplication factors are both 1 and all remedies received the same score of 2, for a total value for forage of 4 for each remedy.

Impact on Resources

All of the remedies use fresh water for dust suppression during excavation. At the landfill, we assume that produced water or brine is employed for dust suppression. Remedy F relies upon the addition of a relatively small volume fresh water after large precipitation events to flush the salt below the root zone. However, Remedy F also calls

for the creation of a small depression to capture and hold precipitation, which may be considered a benefit. Because the amount of added water to enhance salt flushing is small, Remedy F receives the same score as all the other remedies, 2. Water is precious in the area of Loco Hills and we assigned a site multiplication factor of 3. Because stakeholders are accustomed to scarce water and the water used and/or saved by the remedies is small, the stakeholder multiplication factor is 1.

Assigned Values for Impact on Water Resources

Remedy	Score	Site Multiplication Factor	Stakeholder Multiplication Factor	Assigned Value, Impact on Water Resources
A	2	3	1	8
B	2			8
C	2			8
D	2			8
E	2			8
F	2			8

The impact of each remedy to the environmental budget of the operator is also considered in this analysis, with a site multiplication factor of 3. This high multiplication factor is a function of the value of the land relative to the cost of the remedies. If, instead the impacted 1/3 acre were in suburban Dallas, the value of the land could be much more than the cost of any remedy and the site multiplication factor would be 1. With respect to the stakeholder multiplication factor, cost is generally not considered as a factor by government agencies – except for the evaluation of remedies under CERCLA. For the oil and gas operators who are also stakeholders, cost is very important. Nevertheless, we assigned a stakeholder multiplication factor of 1 because the requirements of a surface owner generally trump the wishes of a lessee. If a low-cost remedy can be successful and provide a high environmental benefit, the operator will be more willing to employ the low-cost remedy at other sites where environmental conditions warrant. Remedy A is the most expensive and receives the lowest score. Remedy F is the least expensive and receives a score of 3.

Assigned Values for Impact on Cost

Remedy	Score	Site Multiplication Factor	Stakeholder Multiplication Factor	Assigned Value, Impact on Cost
A	1	3	1	4
B	1			4
C	2			8
D	2			8
E	2			8
F	3			12

Evaluation of cost in ranking environmental responses is not unique. Kealy and others (2001) consider cost in their NEBA analysis. Natural Resource Damage Assessments

determine the monetary value of environmental impacts. Habitat Equivalency Analysis is used to determine how much land a responsible party may purchase to offset the loss of habitat (ecological service). For a price of $35,000 (the lowest cost remedy) we believe the operator could purchase ten times the area of impact (i.e. 3 acres) at a location of nearby "sensitive habitat" selected by the current surface owner.

	Remedy A	Remedies B & E	Remedies C, D	Remedy F
Sq. ft.footprint of release(s)	10,500	10,500	10,500	10,500
Percent of footprint excavated	100%	40%	40%	30%
Ft. deep of 1000 ppm Cl	5	3	3	1
Total cubic feet of impact	52,500	31,500	31,500	10,500
ft3/yrd3	27	28	29	30
Total cubic yards of impacted soil	1,944	1,125	1,086	350
Expansion factor for soil	1.3	1.3	1.3	1.3
Cubic yards for transport	2,528	1,463	1,412	455
Yards/truck	20	21	0	0
Number of truckloads to landfill	126	70	0	0
Approx. cost/yrd excavation (remove and import soil)	$ 45.00	$ 45.00	$ 45.00	$ 45.00
Approx cost/yrd haul to landfill	$ 30.00	$ 30.00	$ -	$ -
Consulting and Analytical	$ 10,000.00	$ 15,000.00	$ 15,000.00	$ 20,000.00
Total Cost	**$ 173,333.33**	**$ 109,500.00**	**$ 63,879.31**	**$ 35,750.00**

Human Safety

All remedies require on-site earthwork and some vehicular transport. The safety threat posed by transport is greater than on-site earthwork as this element can involve the public. Remedy A requires the greatest amount of on-site earthwork and vehicular transport (waste to the landfill), we assigned it a score of 1. Remedies B and E require less earthwork and transport than Remedy A, and receive a score of 2. For Remedies C, D and F, the only vehicular transport involves moving equipment to and from the site. These three remedies involve about the same amount of on-site earthwork as B and E. A score of 3 was given to Remedies C, D and F. Human safety should be the most important factor; a multiplication factor of 3 is assigned for the site and stakeholders.

Assigned Values for Human Safety

Remedy	Score	Site Multiplication Factor	Stakeholder Multiplication Factor	Assigned Value, Human Safety
A	1	3	3	6
B	2			12
C	3			18
D	3			18
E	2			12
F	3			18

Summary

Table 3 presents the scoring of all remedies based upon the analysis presented above, listed from highest scoring to lowest. Remedy A and B are ranked relatively low and Remedies C, D and E rank highest.

Remedy	Total Score of all Weighted Values
C	87
D	87
E	84
F	83
B	74
A	69

This scoring represents the opinion of one professional and provides a starting point for creating a final NEBA, which is a collaborative effort between various stakeholders.

Attachment 4
Regulatory Compliance Opinion

R.T. Hicks Consultants, Ltd.
901 Rio Grande Blvd. NW, Suite F-142
Albuquerque, NM 87104

R. T. HICKS CONSULTANTS, LTD.

901 Rio Grande Blvd NW ▲ Suite F-142 ▲ Albuquerque, NM 87104 ▲ 505.266.5004 ▲ Fax: 505.266-0745

March 1, 2011

Mr. Mike Bratcher
NMOCD Artesia District 2
Artesia, New Mexico
Via E-Mail

RE: Southwest Royalties Arco Federal Battery

Mike,

I need some input regarding the applicability of the Surface Waste Management Rules to possible corrective actions at the Arco Federal Battery in Loco Hills. To me, the Rules are clear and any remediation we propose for this historic release or the non-reportable release of last year is not subject to the mandates of the Surface Waste Rules. I present my logic below. Hicks Consultants does not wish to recommend any action that is contrary to the Rules. Let me know what you think. Specifically we need to know if we are misinterpreting NMOCD Rules. *Will you require notification or some kind of permitting in a case where BLM approves of on-site burial of salty dirt and/or asphaltic soil?*

According to the NMOCD Rules, a "Surface Waste Management Facility" is not "a remediation conducted in accordance with a division-approved abatement plan pursuant to 19.15.30 NMAC, a corrective action pursuant to 19.15.29 NMAC or a corrective action of a non-reportable release". The definition of a Surface Waste Management Facility in the rules is reproduced below (emphasis mine).

19.15.2.7. R.

(11) "Surface waste management facility" means a facility that receives oil field waste for collection, disposal, evaporation, remediation, reclamation, treatment or storage except:
(a) a facility that utilizes underground injection wells subject to division regulation pursuant to the federal Safe Drinking Water Act, and does not manage oil field wastes on the ground in pits, ponds, below-grade tanks or land application units;
(b) a facility permitted pursuant to the New Mexico environmental improvement board rules or WQCC rules;
(c) a temporary pit as defined in 19.15.17 NMAC;
(d) a below-grade tank or pit that receives oil field waste from a single well, permitted pursuant to 19.15.37 NMAC, regardless of the capacity or volume of oil field waste received;
(e) a facility located at an oil and gas production facility and used for temporary storage of oil field waste generated on-site from normal operations, if the facility does not pose a threat to fresh water, public health, safety or the environment;
(f) a remediation conducted in accordance with a division-approved abatement plan pursuant to 19.15.30 NMAC, a corrective action pursuant to 19.15.29 NMAC or a corrective action of a non-reportable release;
(g) a facility operating pursuant to a division emergency order;

(h) a site or facility where the operator is conducting emergency response operations to abate an immediate threat to fresh water, public health, safety or the environment or as the division has specifically directed or approved; or
(i) a facility that receives only exempt oil field waste, receives less than 50 barrels of liquid water per day (averaged over a 30-day period), has a capacity to hold 500 barrels of liquids or less and is permitted pursuant to 19.15.17 NMAC.

At the Arco Federal Battery, we may propose corrective actions to mitigate the impacts of the past disposal of "oil field waste" in a produced water disposal pit and the effects of a non-reportable release. The definition of oil field waste is presented below:

19.15.2.7.O.
(3) "Oil field waste" means waste generated in conjunction with the exploration for, drilling for, production of, refining of, processing of, gathering of or transportation of oil, gas or carbon dioxide; waste generated from oil field service company operations; and waste generated from oil field remediation or abatement activity regardless of the date of release. Oil field waste does not include waste not generally associated with oil and gas industry operations such as tires, appliances or ordinary garbage or refuse unless generated at a division-regulated facility, and does not include sewage, regardless of the source.

The objective of the Surface Waste Management Rules is presented below from NMOCD Rules:

19.15.36.6 OBJECTIVE: To regulate the disposal of oil field waste and the construction, operation and closure of surface waste management facilities.

Except for the section on small landfills, all of the sections of the Surface Waste Management Rule address various aspects of Surface Waste Management Facilities. For example, 19.15.36.13 describes requirements for siting and operational requirements applicable to all permitted surface waste management facilities. There are sections of the Rule that specifically address landfills, landfarms, small landfarms, and evaporation ponds. As stated above, except for the section on small landfarms, these sections all apply to Surface Waste Management Facilities. Note the following from the section on Landfills:

19.15.36.14 SPECIFIC REQUIREMENTS APPLICABLE TO LANDFILLS:
A. General operating requirements.
(1) The operator shall confine the landfill's working face to the smallest practical area ...
(8) When the operator has filled a landfill cell, the operator shall close it pursuant to the conditions contained in the surface waste management facility permit and the requirements of Paragraph (2) ...
B. Ground water monitoring program. If fresh ground water exists at a site... the ground water monitoring system shall consist of a sufficient number of wells... to yield ground water from the uppermost aquifer that:
(1) represent the quality of background ground water that leakage from a landfill has not affected; and
(2) represent the quality of ground water passing beneath and down gradient of the surface waste management facility.

We could find nothing in Part 36 of NMOCD Rules that applies to a remediation effort addressing the historic release or the non reportable release at the Arco Federal Battery. We will keep you fully informed of all our proposals to the surface owner (BLM), and would appreciate hearing from you if you disagree with our conclusion that possible on-site burial for a corrective action does not fall under NMOCD Surface Waste Facility regulations.

Sincerely,
R.T. Hicks Consultants, Ltd.

Randall Hicks
Principal

Copy: Luis Gonzalez, Southwest Royalties