NM2 - 23

GENERAL CORRESPONDENCE YEAR(S):

2007 - 2008

NEW MEXICO ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT

BILL RICHARDSON
Governor
Joanna Prukop
Cabinet Secretary

Mark E. Fesmire, P.E.
Director
Oil Conservation Division

July 18, 2007

Mr. Bill Maez
District Manager
Patina San Juan, Inc.
5802 Highway 64
Farmington, New Mexico 87401

RE: Permit Application Review for a Proposed Centralized Surface Waste Management Facility - Patina San Juan, Inc. - Sand Rock Evaporation Pond
Facility Location: NE/4 SW/4 of Section 23, Township 31 North, Range 13 West NMPM, San Juan County, New Mexico

Dear Mr. Maez:

The Oil Conservation Division (OCD) was present during the additional site investigation (drilling activities) on July 17, 2007 at the Patina San Juan, Inc.'s proposed centralized surface waste facility site for the Sand Rock Evaporation Ponds located in the NE/4, SW/4 of Section 23, Township 31 North, Range 13 West NMPM, San Juan County, New Mexico. Based upon the results of the site investigation, the application is administratively denied.

The additional drilling activities resulted in the discovery of a water-bearing zone between 55.3 feet and 57.4 feet below the ground surface; between 5626.7 feet and 5624.6 feet mean sea level (msl). The siting criteria of Paragraph (5) of Subsection A of 19.15.36.13 NMAC specifies that "no other surface waste management facility shall be located where ground water is less than 50 feet below the lowest elevation at which the operator will place oil field waste." The proposed lowest elevation of the evaporation pond design, provided in the July 12, 2007 proposed test hole boring and monitoring hole completion plan, was identified as 5664.8 feet msl. Therefore, the separation from the evaporation pond design to ground water is 38.1 feet.

If there are any questions regarding this matter, please do not hesitate to contact Brad A. Jones at (505) 476-3487 or brad.a.jones@state.nm.us.

Sincerely,

Wayne Price
Bureau Chief

LWP/baj

cc: OCD District IV Office, Aztec

Jones, Brad A., EMNRD

From: Jones, Brad A., EMNRD
Sent: Thursday, March 06, 2008 11:57 AM
To: Price, Wayne, EMNRD
Subject: FW: Sand Rock- Revised Pond Design
Attachments: Cut-Fill_analysisRotated-CutLines.pdf

Brad A. Jones
Environmental Engineer
Environmental Bureau
NM Oil Conservation Division
1220 S. St. Francis Drive
Santa Fe, New Mexico 87505
E-mail: brad.a.jones@state.nm.us
Office: (505) 476-3487
Fax: (505) 476-3462

From: David A Simpson [mailto:zdas04@muleshoe-eng.com]
Sent: Thursday, March 06, 2008 11:43 AM
To: Jones, Brad A., EMNRD
Cc: Billie Maez; 'Eric Bikis'
Subject: RE: Sand Rock- Revised Pond Design

Brad,
The attached drawing (it should be the same one that Erik sent you) is intended to show the position of excavations relative to sea level and to the water zone we encountered in the first test hole. Rest assured that the remainder of the engineering drawings and other documentation will be developed around this modified design. Further, the design will honor the minimum elevation indicated on cut line "C" which is the bottom of the dry well for the drainage system. The reason for Erik's e-mail yesterday was to let you know that the redesign is underway and to try to get your feelings on the location of the test holes relative to the new pond location to make sure that what we were trying to do meets with your interpretation of the regulations.

In the year that this process has been ongoing, Jean Muse has transferred to another job in another location. If you want to contact someone at Noble, your best bet would be to call Billie Maez (at (505) 632-8056) he is the District Manager and can either schedule the meeting you want or send you to someone on his staff to schedule it.

David A Simpson
zdas04@muleshoe-eng.com
Phone: 505-326-2115
Cell: 505-320-7299
Fax: 505-326-1237
Web site: www.muleshoe-eng.com

From: Eric Bikis [mailto:eric@bikiswater.com]
Sent: Thursday, March 06, 2008 10:42 AM
To: Jones, Brad A., EMNRD
Cc: zdas04@muleshoe-eng.com
Subject: RE: Sand Rock- Revised Pond Design

OK Brad. I am copying David Simpson so that he is aware of OCD's request. David did the design for the proposed pond.

Thanks.

Eric Bikis

From: Jones, Brad A., EMNRD [mailto:brad.a.jones@state.nm.us]
Sent: Thursday, March 06, 2008 10:23 AM
To: Eric Bikis
Cc: Price, Wayne, EMNRD
Subject: RE: Sand Rock- Revised Pond Design

Eric,

OCD has a phone call into Jean Muse (Noble Energy) to schedule a meeting and discuss the proposed project. We are unable to determine if the proposed drawing satisfies the specific engineering and construction requirements of Section 17 of 19.15.36 NMAC. The general drawing does not provide the engineering and construction details for OCD to consider the appropriate depth or elevation to obtain in order to demonstrate the 50 ft separation. OCD recommends that the site investigative work be proponed until these issue is resolved.

If you have any questions, please contact me.

Brad

Brad A. Jones
Environmental Engineer
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1220 S. St. Francis Drive
Santa Fe, New Mexico 87505
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Office: (505) 476-3487
Fax: (505) 476-3462

From: Eric Bikis [mailto:eric@bikiswater.com]
Sent: Thursday, March 06, 2008 9:03 AM
To: Jones, Brad A., EMNRD
Subject: Sand Rock- Revised Pond Design

Hi Brad,

Noble Energy is proposing to revise the design of its Sand Rock pond. The new pond:

1. Has been rotated and compressed.
2. Is 22% smaller than the original pond (9.4 AF vs. 7.3 AF).

3. Has a drain in the center, as opposed to the end, that has an elevation of 5681 feet AMSL and is 52.3 feet above the water zone in Test Hole #1 to comply with Rule 19.15.36.13 A. 5 of the state regulations pertaining to placement of oil field waste
4. Has a vertical center berm composed of concrete to allow for additional storage.

Based on these proposed changes, are the Test Boring locations shown on the attached drawing in acceptable locations? Each well would drill to a minimum elevation of 5631 feet AMSL. If you think they should be re-located, call or e-mail to discuss. We may want to move Test Holes #2 and #4 closer to the proposed pond if access is feasible. Also, I will revise the boring plan (Table 1 and other) to reflect the new elevation target depth of 5631 feet AMSL.

I've looked at the weather and we may be able to drill the middle of next week after your OSHA class in Farmington.

Please advise.

Eric A. Bikis, P.G.
Bikis Water Consultants, LLC
555 RiverGate Lane, Suite B4-82
Durango, Co 81301
Ph: 970-385-2340
Fx: 970-385-2341
Cell: 970-769-0997

Thank you for your cooperation.

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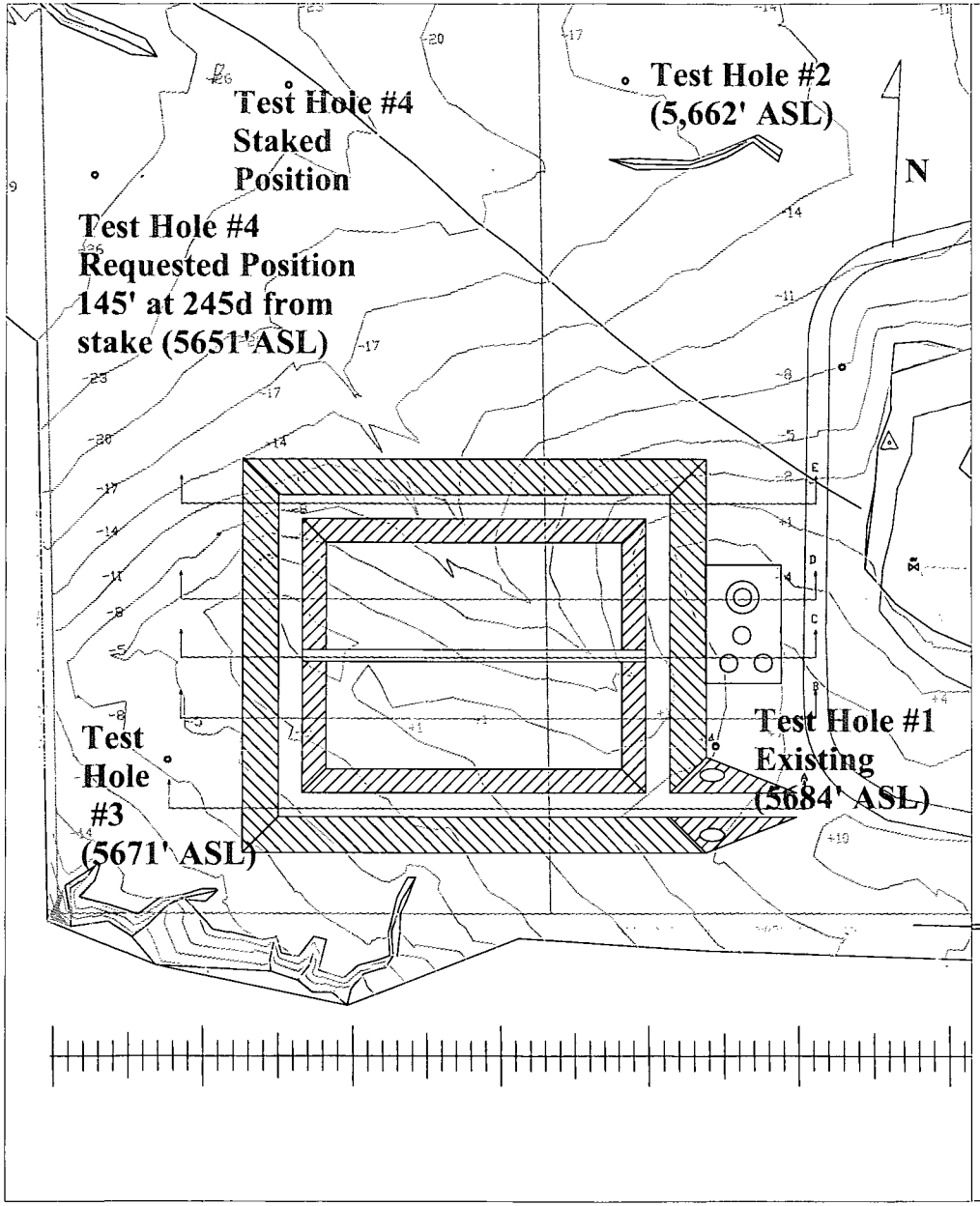
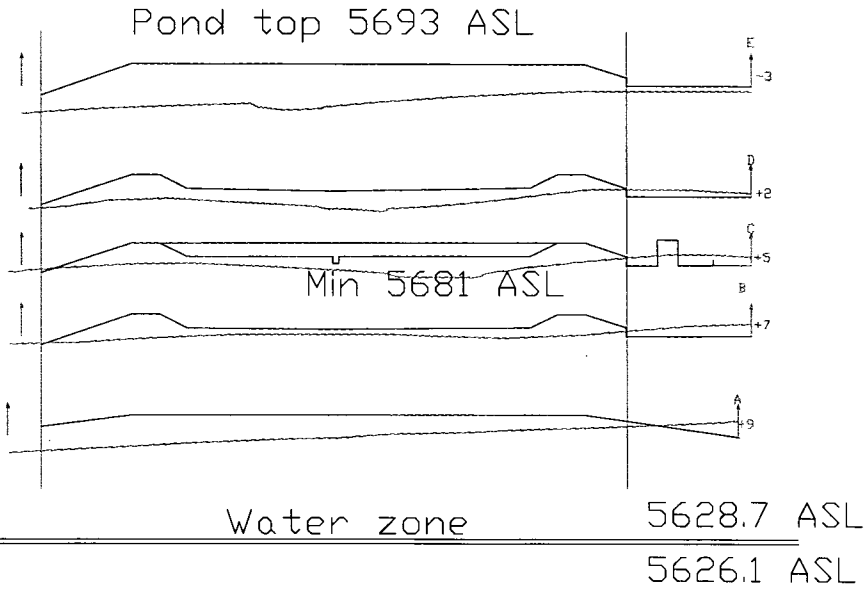

Test Hole #4
Staked
Position
Test Hole #2
(5,662' ASL)
N
Test Hole #4
Requested Position
145' at 245d from
stake (5651' ASL)
Test
Hole
#3
(5671' ASL)
Test Hole #1
Existing
(5684' ASL)


Pond top 5693 ASL
Min 5681 ASL
Water zone
5628.7 ASL
5626.1 ASL
Clearance 52.3 ft

Jones, Brad A., EMNRD

From: Eric Bikis [eric@bikiswater.com]
Sent: Thursday, March 06, 2008 9:03 AM
To: Jones, Brad A., EMNRD
Subject: Sand Rock- Revised Pond Design
Attachments: Eric A. Bikis.vcf; Revised Pond Design 03-05-08.pdf

Hi Brad,

Noble Energy is proposing to revise the design of its Sand Rock pond. The new pond:

1. Has been rotated and compressed.
2. Is 22% smaller than the original pond (9.4 AF vs. 7.3 AF).
3. Has a drain in the center, as opposed to the end, that has an elevation of 5681 feet AMSL and is 52.3 feet above the water zone in Test Hole #1 to comply with Rule 19.15.36.13 A. 5 of the state regulations pertaining to placement of oil field waste
4. Has a vertical center berm composed of concrete to allow for additional storage.

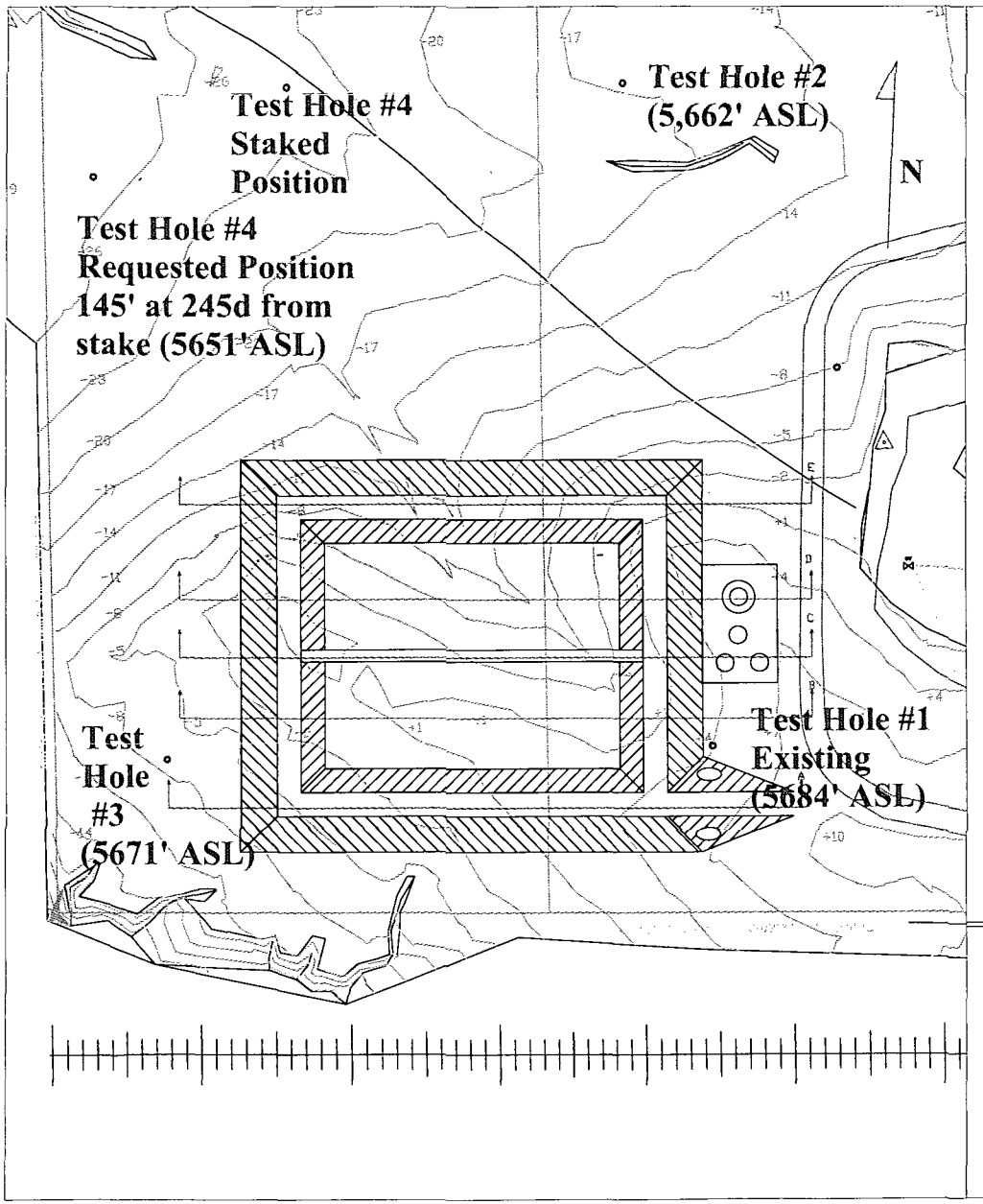
Based on these proposed changes, are the Test Boring locations shown on the attached drawing in acceptable locations? Each well would drill to a minimum elevation of 5631 feet AMSL. If you think they should be re-located, call or e-mail to discuss. We may want to move Test Holes #2 and #4 closer to the proposed pond if access is feasible. Also, I will revise the boring plan (Table 1 and other) to reflect the new elevation target depth of 5631 feet AMSL.

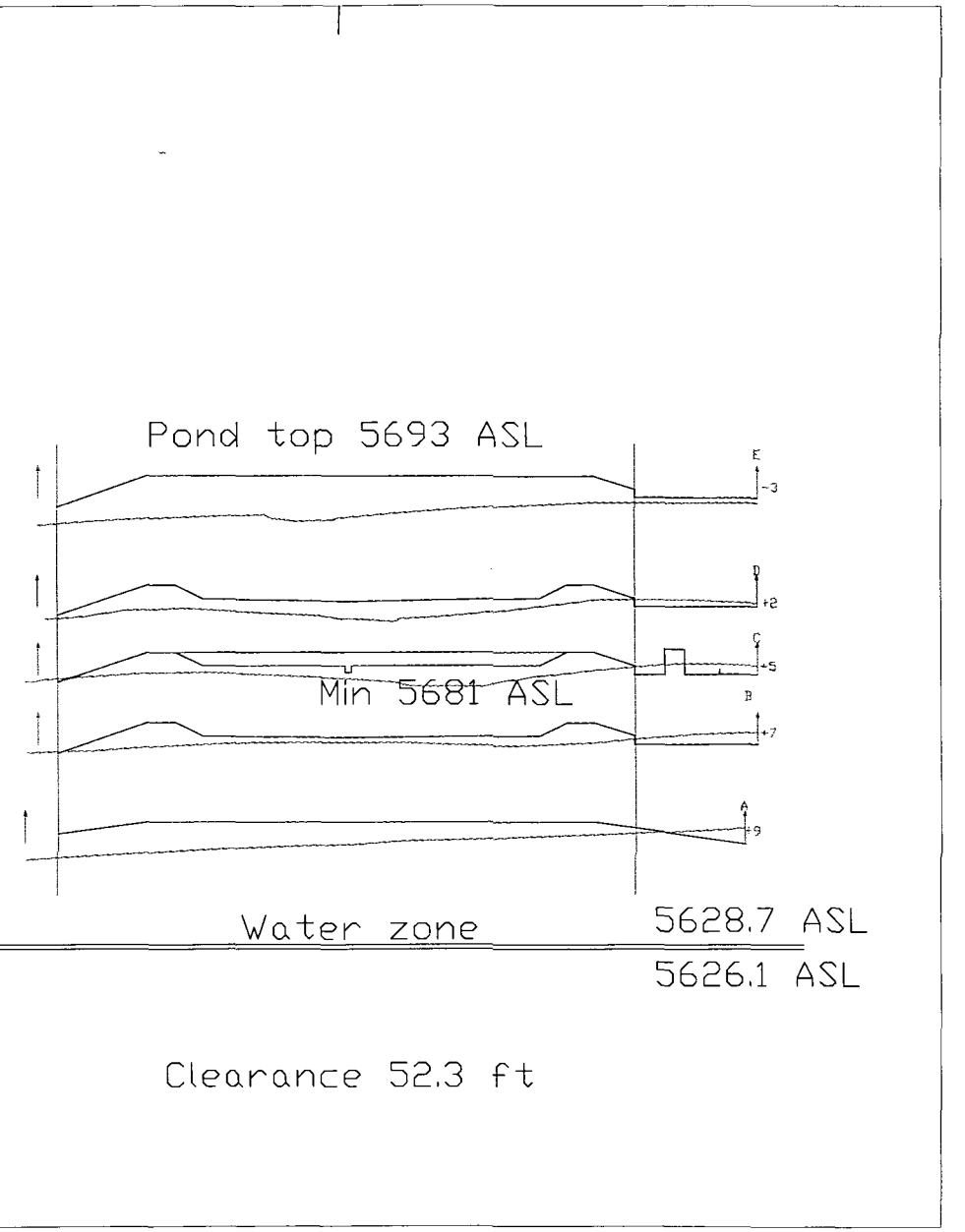
I've looked at the weather and we may be able to drill the middle of next week after your OSHA class in Farmington.

Please advise.

Eric A. Bikis, P.G.
Bikis Water Consultants, LLC
555 RiverGate Lane, Suite B4-82
Durango, Co 81301
Ph: 970-385-2340
Fx: 970-385-2341
Cell: 970-769-0997

Thank you for your cooperation.


Test Hole #4
Staked
Position
Test Hole #4
Requested Position
145' at 245d from
stake (5651' ASL)
Test Hole #2
(5,662' ASL)
N
Test
Hole
#3
(5671' ASL)
Test Hole #1
Existing
(5684' ASL)


Pond top 5693 ASL
Min 5681 ASL
Water zone
5628.7 ASL
5626.1 ASL
Clearance 52.3 ft

Jones, Brad A., EMNRD

From: Eric Bikis [eric@bikiswater.com]
Sent: Sunday, February 10, 2008 12:49 PM
To: Jones, Brad A., EMNRD
Subject: Sand Rock

Brad,
The weather has warmed. The access road may be impassable. Mo-Te will check Monday. I'll let you know.
Eric

Jones, Brad A., EMNRD

From: Jones, Brad A., EMNRD
Sent: Monday, February 18, 2008 1:08 PM
To: 'Eric Bikis'
Cc: Price, Wayne, EMNRD
Subject: RE: Sand Rock

Eric,

Thanks for the update... I'll make transportation plans for next week.

Brad

Brad A. Jones
Environmental Engineer
Environmental Bureau
NM Oil Conservation Division
1220 S. St. Francis Drive
Santa Fe, New Mexico 87505
E-mail: brad.a.jones@state.nm.us
Office: (505) 476-3487
Fax: (505) 476-3462

From: Eric Bikis [mailto:eric@bikiswater.com]
Sent: Monday, February 18, 2008 11:14 AM
To: Jones, Brad A., EMNRD
Cc: zdas04@muleshoe-eng.com
Subject: Sand Rock

Brad,

Too muddy to drill this week. We will try again next Monday.

Please reply so that I know you have received and read this e-mail.

Regards,

Eric A. Bikis, P.G.
Bikis Water Consultants, LLC
555 RiverGate Lane, Suite B4-82
Durango, Co 81301
Ph: 970-385-2340
Fx: 970-385-2341
Cell: 970-769-0997

Thank you for your cooperation.

Jones, Brad A., EMNRD

From: Jones, Brad A., EMNRD
Sent: Monday, February 25, 2008 2:46 PM
To: 'Ryan Huggins'
Subject: RE: Sandrock - postponed

Thanks for the notice... I look for an update next Monday.

Brad

Brad A. Jones
Environmental Engineer
Environmental Bureau
NM Oil Conservation Division
1220 S. St. Francis Drive
Santa Fe, New Mexico 87505
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Office: (505) 476-3487
Fax: (505) 476-3462

From: Ryan Huggins [mailto:huggins@bikiswater.com]
Sent: Monday, February 25, 2008 2:19 PM
To: Jones, Brad A., EMNRD
Subject: Sandrock - postponed

Brad:
Sorry it has taken us so long to get back to you. The Sandrock drilling will be postponed for another week (or more) in hopes that the weather will be more suitable than it is now. We will check in next week. Please reply so I know you received this email.
Thank you,
Ryan

Ryan Kathryn Huggins
Bikis Water Consultants, LLC
555 RiverGate Lane, Suite B4-82
Durango, CO 81301
Ph: 970.385.2340
Fax: 970.385.2341
Email: huggins@bikiswater.com

Jones, Brad A., EMNRD

From: Jones, Brad A., EMNRD
Sent: Monday, March 03, 2008 9:32 AM
To: 'Diana Chumney'
Subject: RE: Sandrock dr

Diana,

Thank you for the update.

Brad A. Jones
Environmental Engineer
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NM Oil Conservation Division
1220 S. St. Francis Drive
Santa Fe, New Mexico 87505
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Office: (505) 476-3487
Fax: (505) 476-3462

From: Diana Chumney [mailto:dchumney@bikiswater.com]
Sent: Monday, March 03, 2008 9:21 AM
To: Jones, Brad A., EMNRD
Cc: Ryan Huggins
Subject: Sandrock dr

Hello Mr. Jones,
Ryan Huggins will be out this week until Mar. 10, but asked me to send you an email this morning concerning Sandrock. There will be no drilling for the Sandrock project this week due to site conditions. Please contact me if you have any further questions.

Thank you,

Diana Chumney
Bikis Water Consultants, LLC
555 RiverGate Lane, Suite B4-82
Durango, CO 81301
(970) 385-2340 ph
(970)385-2341 fax
diana@bikiswater.com
www.BikisWater.com

Jones, Brad A., EMNRD

From: Jones, Brad A., EMNRD
Sent: Monday, March 03, 2008 10:04 AM
To: 'Eric Bikis'
Subject: RE: Drilling postponed (again)

Eric,

Thanks for the update. I also received an email from Diana (of your office) this morning. FYI... I'm scheduled to be in Farmington next Monday and Tuesday for some OSHA training. I should be through with the training by 1:00 or 2:00 pm, Tuesday. The current plan is to return to Santa Fe on Tuesday. If drilling looks favorable next week, try to contact me on the State cell phone 505-660-1067. I try to make arrangements, if I need to remain for the drilling. Call the cell number next Monday to provide me update, either way. Thanks.

Brad

Brad A. Jones
Environmental Engineer
Environmental Bureau
NM Oil Conservation Division
1220 S. St. Francis Drive
Santa Fe, New Mexico 87505
E-mail: brad.a.jones@state.nm.us
Office: (505) 476-3487
Fax: (505) 476-3462

From: Eric Bikis [mailto:eric@bikiswater.com]
Sent: Monday, March 03, 2008 9:52 AM
To: Jones, Brad A., EMNRD
Cc: Ryan Huggins
Subject: Drilling postponed (again)

Brad,

No Sand Rock work this week. However, the temperatures have been warmer and the wind is blowing a bit, so the soils may be dry enough soon.

Eric

Eric A. Bikis, P.G.
Bikis Water Consultants, LLC
555 RiverGate Lane, Suite B4-82
Durango, Co 81301
Ph: 970-385-2340
Fx: 970-385-2341
Cell: 970-769-0997

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Jones, Brad A., EMNRD

From: Jones, Brad A., EMNRD
Sent: Thursday, January 31, 2008 9:25 AM
To: 'Eric Bikis'
Subject: RE: Revised Test Bore and Monitoring Hole Plan 01-18-08

Eric,

Thanks for the update. I'll make plans to be there at 8 am on the 13th.

Brad

Brad A. Jones
Environmental Engineer
Environmental Bureau
NM Oil Conservation Division
1220 S. St. Francis Drive
Santa Fe, New Mexico 87505
E-mail: brad.a.jones@state.nm.us
Office: (505) 476-3487
Fax: (505) 476-3462

-----Original Message-----
From: Eric Bikis [mailto:eric@bikiswater.com]
Sent: Wednesday, January 30, 2008 8:16 PM
To: Jones, Brad A., EMNRD
Subject: RE: Revised Test Bore and Monitoring Hole Plan 01-18-08

Brad,
MO-TE has scheduled us for Wednesday and Thursday, 2/13-14/08, for the drilling. We can't predict if the access road will be passable but are hoping for the best. The plan is to meet at 8 AM at the gentlemen's club (same location we met previously).
Eric

-----Original Message-----
From: "Jones, Brad A., EMNRD" <brad.a.jones@state.nm.us>
To: "Eric Bikis" <eric@bikiswater.com>
Sent: 30-Jan-08 3:25 PM
Subject: RE: Revised Test Bore and Monitoring Hole Plan 01-18-08

Eric,

Thanks for the update. Let me know ASAP, so I can make arrangements.

Brad

Brad A. Jones
Environmental Engineer
Environmental Bureau
NM Oil Conservation Division
1220 S. St. Francis Drive
Santa Fe, New Mexico 87505
E-mail: brad.a.jones@state.nm.us <mailto:brada.jones@state.nm.us>
Office: (505) 476-3487
Fax: (505) 476-3462

From: Eric Bikis [mailto:eric@bikiswater.com]
Sent: Tuesday, January 29, 2008 10:58 AM
To: Jones, Brad A., EMNRD
Cc: zdas04@muleshoe-eng.com
Subject: RE: Revised Test Bore and Monitoring Hole Plan 01-18-08

Brad,

The driller has indicated that he will be able to drill for us that week. He is uncertain which days. I think it will take 2-3 days. I will let you know when I hear.

Eric

From: Jones, Brad A., EMNRD [mailto:brad.a.jones@state.nm.us]
Sent: Tuesday, January 22, 2008 3:29 PM
To: Ryan Huggins; Price, Wayne, EMNRD; Eric Bikis
Cc: zdas04@muleshoe-eng.com
Subject: RE: Revised Test Bore and Monitoring Hole Plan 01-18-08

Eric and Ryan,

Thanks for making the suggested revisions. Please provide me adequate notice in order to make arrangements to observe the drilling. I have set aside the week of Feb. 11 - 15, as we have tentatively discussed.

Brad

Brad A. Jones
Environmental Engineer
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E-mail: brad.a.jones@state.nm.us <mailto:brada.jones@state.nm.us>
Office: (505) 476-3487
Fax: (505) 476-3462

From: Ryan Huggins [mailto:huggins@bikiswater.com]
Sent: Monday, January 21, 2008 9:41 AM
To: Price, Wayne, EMNRD
Cc: Jones, Brad A., EMNRD; zdas04@muleshoe-eng.com
Subject: Revised Test Bore and Monitoring Hole Plan 01-18-08

Mr. Price:

Please find the attached revised (01/18/2008) plan for the proposed Sand Rock Evaporation Pond.

Thank you,

Ryan Huggins

Ryan Kathryn Huggins

Bikis Water Consultants, LLC

555 RiverGate Lane, Suite B4-82

Durango, CO 81301

Ph: 970.385.2340

Fax: 970.385.2341

Email: huggins@bikiswater.com <mailto:Huggins@bikiswater.com>

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679 East 2nd Avenue, Suite 3
Durango, Colorado 81301
Phone: 970.385.2340
Fax: 970.385.2341
www.bikiswaterconsultants.com

BIKIS
Water Consultants LLC

E-mail:eric@bikiswater.com

January 18, 2008

E-mail address: wayne.price@state.nm.us

Mr. Wayne Price
Environmental Bureau Chief
Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

Re: Test Hole Boring and Monitoring Hole Completion Plan at the Proposed Sand Rock Evaporation Pond - Phase II

Dear Mr. Price:

Bikis Water Consultants, LLC (BWC) is providing a boring plan for additional (Phase II) groundwater test holes and possible monitoring holes for the proposed Sand Rock Evaporation Pond project (Sand Rock). Sand Rock is operated by Noble Energy and is located in the NE/4, SW/4 of Section 23, Township 31 North, Range 13 West NMPM, San Juan County, New Mexico.

Test Hole #1 (TH#1) was drilled at the site on July 17, 2007. A water bearing unit was found at a depth of approximately 55.3 to 57.6 feet. The bore was completed as a monitoring well on July 19, 2007 with a screened interval from 47 to 57 feet in order to completely encompass any potentially water bearing strata encountered during drilling. Since that time, the yield of the monitoring well has been monitored and recorded. Data was initially taken on a daily basis, then weekly, and is currently collected ever two weeks (see Exhibit 1). The average daily yield of the monitoring well is approximately 58 fluid ounces per day. However, the water unit requires between one day and one week to fully recover its pressure head. Therefore, the yield is constant at 1 gallon per week and per two week bailing period.

This proposal is for three additional test holes at Sand Rock to evaluate the presence of groundwater below the pond. The three additional test holes will be utilized to determine if the free water present in TH#1 is laterally continuous and constitutes a viable water bearing unit, or if the groundwater present in TH#1 is due to an isolated, perched water unit. The three additional test holes are identified as test holes 2, 3, and 4 on Figure 1 (attached). In addition, the site has been surveyed by Trigon Sheehan to verify the precise elevations (feet above sea level) used in this monitoring design and plan.

EVAPORATION POND DESIGN ELEVATIONS

The elevations of the finished pond will be the result of considerable cutting and filling of the current site contours. This discussion aims to clarify the design elevations at the site, as reviewed and approved by the project engineer, Muleshoe Engineering. Please refer to Figure 1

(attached) and Drawings 4 and 8 of the Construction Design Details provided by Muleshoe Engineering in the application for clarification.

- The bottom of the center of both ponds is proposed to be 5,673 ft ASL.
- At the south end the drainage pipe will be in a leak-detection ditch that is one foot deep, resulting in an elevation of 5,672 ft ASL.
- The leak-detection ditch will slope 2 ft per 100 ft (2%). Therefore, after 200 ft (assuming that the ditch starts and ends 12 ft from the toe of the berm) the ditch will be 4 feet lower for an elevation of 5,668 ft ASL.
- The leak-detection ditch will then turn toward the center for 60 ft, sloping at 2 ft per 100 ft (2%) for an additional drop of 1.2 ft. The resultant elevation is 5,666.8 ft ASL.
- The dry well will be set 2 ft below the end of the leak-detection pipe for a final elevation of 5,664.8 ft ASL.

To perform an on-site analysis of the hydrogeology and meet the minimum requirements in Paragraph 5 of subsection A of Rule 19.15.36.13 NMAC, the proposed test holes must be drilled a minimum 50 feet below the lowest point in the pond design, which is the dry well below the evaporation pond. Therefore, the target depth of the proposed test holes is 5,614.8 ft ASL. (Dry Well Elevation 5,664.8 ft ASL less 50 ft equals 5,614.8 ft ASL). A conservative approach to obtain this elevation with certainty is to drill beyond this depth. Table 1 (attached) summarizes the minimum boring depths of test holes 2, 3 and 4 based on their proposed locations at Sand Rock.

BACKGROUND INFORMATION

Based on a June 18, 2007 letter to Mr. Billie Maez of Noble Energy from Mr. Wayne Price, Environmental Bureau Chief for the Oil Conservation Division (OCD) of New Mexico, BWC understands the following:

- Patina San Juan, Inc (currently doing business as Noble Energy) applied to the OCD for a centralized evaporation surface waste facility permit at Sand Rock on April 6, 2007. After reviewing the permit application, your office indicated that the OCD is considering administratively denying the application. According to your review, insufficient data was provided to characterize the hydrogeology (as outlined in Paragraph 5 of subsection A of 19.15.36.13 NMAC). This regulation requires that "No other surface waste management facility shall be located where groundwater is less than 50 feet below the lowest elevation at which the operator will place oil field waste."
- Four bore holes were completed by Trautner GeoTech in March 2007 to investigate the hydrogeology of the area. The bore logs, which are summarized as follows, were submitted with the original Sand Rock application. Bore 1 was drilled to a depth of 50 feet at a site south of the evaporation pond. This bore encountered claystone and sandstone formation at a depth of 15 feet. This tan to white material was slightly moist at 15 feet below ground surface. An increase in moisture was reported at a depth of 30

feet. Bore 2, also completed to 50 ft, was drilled to the northeast of the evaporation pond footprint, while bores 3 and 4 (19 ft and 15 ft respectively) were within the footprint. The sand and clays encountered in Bores 2, 3 and 4 were slightly moist to moist. Bore 2 also encountered a moist clay layer below 26 ft. These bore logs are used as a basis for predicting the subsurface conditions that will be encountered during new test hole drilling.

- TH#1 was drilled on July 17, 2007 (see Figure 1 for location) to a depth of approximately 57 feet below ground surface (5624.4 ft ASL). It was determined to have a water bearing unit from 53.7 to 57.6 feet of depth, therefore drilling was halted and the bore was completed as a monitoring well to observe the nature of the unit. Data was recorded for the volume of individual bails (Exhibit 1) and cumulative yield (Exhibit 2) from the well over a period of over three months. Initially, the bore was bailed dry on a daily basis, yielding approximately ½ gallon per bailing period. Monitoring was then changed to a weekly basis, at which interval the well was first bailed dry approximately after 1¼ gallons, and then reduced to less than 1 gallon per bail period. Two months of bimonthly monitoring have shown the yield to stabilize at approximately 1 gallon per bail period, which is representative of the transmissivity of the unit. This is also demonstrated in Exhibit 2, which shows that the slope of total yield lessens during the one week and two week bailing periods. These data suggest that this unit may not constitute a significant groundwater source. Further investigations have been recommended.

- Additional test holes are proposed, as described in this plan, to further characterize the potential for groundwater at Sand Rock. It is believed these additional test holes will define the hydrogeology underneath the proposed evaporation pond. Materials will be on-site during drilling to construct a monitoring hole, if determined to be necessary.

The enclosed monitoring hole completion plan, also submitted for OCD for approval, is intended to satisfy your request for design details of the monitoring wells. Based on the above background information, BWC has developed a test hole Boring Plan and a Monitoring Hole Completion Plan for your review and approval.

TEST HOLE BORING PLAN

The following test hole boring plan (boring plan) describes methods and procedures for drilling additional test holes. This plan was developed in accordance with OCD requirements for assessing hydrogeologic conditions at Sand Rock.

1. Drill additional test holes at the locations shown on Figure 1 (attached). The test holes will be drilled by Mo-Te Drilling, Inc., a licensed driller in the state of New Mexico. Mo-Te Drilling, Inc. will utilize an air-rotary drilling technique, as requested by your office. Drilling will be scheduled after approval of this plan by the OCD.
2. The locations were selected for access and to complement the current data and findings from test hole #1.
3. Each test hole will be bored at 4-3/8 inches diameter with a 3 inch core. In order to meet or exceed the requirements in the NMAC regulation, test holes will be drilled to a depth that is a minimum of 50 feet below the bottom of the proposed evaporation pond design (5,614.8 feet ASL, which takes into account excavation and fill required to construct the

pond and the dry well located below the proposed ponds in the leak-detection trench). The minimum boring depths at each test hole is summarized in Table 1. An additional 10' is recommended to assure that the minimum requirements are met.

4. During drilling, a professional geologist will be on-site to oversee drilling activities and driller's total depth, collect information, describe the cores from the boring hole and, if necessary, supervise construction of the monitoring hole according to the proposed design (see below). The OCD will be notified of the drilling schedule. BWC understands that a representative from the OCD will be present during drilling.
5. Core samples will be taken ahead of the drill bit in order to obtain a complete undisturbed core after the first 15 feet. It is not feasible to take cores during the first 15 feet of drilling depth; however bag samples of cuttings may be taken. If necessary, a solid steel casing will be used in the hole to prevent caving and facilitate core sampling.
6. If a saturated zone is encountered, the hole will be allowed to remain open to determine the amount of free water available. Drilling may need to cease for an indeterminate amount of time (including overnight, if necessary) to allow water ample time to filter through saturated zones. This will be done to determine if the water table is limited in supply or whether the zone can yield water in an amount sufficient to be considered groundwater.
    a. If no water zones are detected from the core samples or in the test hole, the test hole will be filled and abandoned according to OCD regulations.
    b. If water is present in the test hole, the test hole will be completed as described in the following proposed monitoring hole completion plan (Figure 2).

MONITORING HOLE COMPLETION PLAN

Figure 3 (attached) is the proposed monitoring hole completion detail.

1. The test hole will be completed using 0.010-inch factory-slotted 2-inch Schedule 40 PVC casing and screen in potential water bearing zones. The approximate depth of the water bearing zones, if any, will be determined during drilling. The depth of saturated material will determine the amount of screened pipe installed in the borehole. If a confined condition is observed in the test hole, the water zone will be screened so that groundwater does not interface with other geologic units. If the test hole indicates unconfined conditions, the slotted screen interval will extend approximately 5 feet above the estimated water depth. The additional screen interval will allow for fluctuations in the water table.
2. The annular space from 2 feet below the bottom of the screen to 2 feet above the top of the screen will be filled with clean, silica sand filter pack to allow hydraulic connection through the screen of any water bearing zones.
3. A minimum 2-foot bentonite seal will be used above the sand pack.
4. The annular space above the bentonite seal will be filled with a bentonite-cement grout (2% to 8% bentonite by weight) to the ground surface and allowed to cure for at least 24 hours before installing a surface pad.

5. The top of the casing will be protected with a cap. The exposed casing will be protected by a locking shroud.

6. A 2-foot minimum radius, 4-inch minimum thickness concrete pad will be poured around the shroud. The concrete and surrounding soil shall be sloped to direct rainfall and runoff away from the shroud.

Upon completion, the monitoring hole will be bailed and observed to determine if groundwater is present in the monitoring hole. Groundwater is defined by the OCD as "...interstitial water which occurs in saturated earth material and which is capable of entering a well in sufficient amounts to be utilized as a water supply." If a perched condition is observed in the monitoring hole, it will be bailed dry. If recharge is observed in the monitoring hole after it is bailed, then groundwater likely is present and additional study may be needed.

HEALTH AND SAFETY

Drilling will be conducted by Mo-Te Drilling, Inc., who will implement their safety plan throughout the process. Before work commences, there will be an on-site safety briefing. At a minimum, all persons on site will be required to wear safety glasses, hard hats and steel toed boots for safety.

Any unsafe work conditions identified by field crew team members will be immediately reported to the drilling crew supervisor and the project team staff member. All drilling activities will be suspended if unsafe work conditions are identified. Potential unsafe conditions may include weather related conditions or equipment related conditions. Any suspension of work activities due to unsafe work conditions will be reported to Noble Energy staff as soon as possible after cessation of drilling activities.

The boring plan and monitoring hole completion plan was prepared to address Paragraph 5 of subsection A of Rule 19.15.36.13 NMAC. If you find this methodology acceptable, please so indicate by signing on the approval line below.

Sincerely,

Bikis Water Consultants, LLC

By _____
Eric Bikis, P.G.
Project Manager

Approved,

OCD Environmental Bureau

By _____
Wayne Price, Environmental Bureau Chief
Oil Conservation District of New Mexico

Attachments: Figure 1. Sand Rock Location Map: Groundwater Test Hole Locations
Figure 2. Example Log and Proposed Monitoring Hole Completion Detail
Table 1. Proposed Test Hole Depths
Exhibit 1. Bailed Volume per Sample
Exhibit 2. Cumulative Yield: Monitoring Well One

cc: David A. Simpson, MuleShoe Engineering
Billie Maez, Noble Energy
Brad Jones, OCD

P:\Project Files\073-07 Sand Rock\Blue Dot- Phase 2 Boring Plan\Test Hole and Monitoring Hole Plan 01-18-08.doc

5802 US Hwy 64
Farmington, NM 87401

Tel: 505.632.8056
Fax: 505.632.3031
www.nobleenergyinc.com

Operations Department

RECEIVED
2008 AUG 20 PM 12 12

August 18, 2008

Wayne Price
Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Subject: Sand Rock Evaporation Pond Monitor Wells

Dear Sir:

Acting on your advice, Noble Energy has decided to drill the three additional monitoring wells to determine site suitability. These wells will be drilled per the approved drilling plan (attached for your reference). Expected minor modifications to the pond design to prevent penetrating the secondary liner will raise the lowest point in the pond some amount above the current estimate of 5667 ft ASL so the plan to drill 5605 ft ASL will provide at least a 12 ft cushion below the required 50 ft.

The drilling is scheduled to begin Tuesday morning, September 16, 2008 and continue for three days. If you want to send an NMOCD representative, Noble and Mo-Te personnel plan to meet at 8:00 am in Flora Vista and caravan to the site.

Noble's expectation is that when we have demonstrated that the site meets the regulatory requirements we will submit a new application with some minor changes to the elevations of some components of the pond. To minimize future confusion, please move any previous technical documentation to archives—the entire package will be re-submitted if the site can be shown to meet the site requirements.

Billie Maez
Production Manager—Noble Energy Inc.

cc: List Attached

Attachment: Drilling Plan

August 14, 2008
Carbon Copy List

Erik Bikis
Bikis Water Consultants, LLC
555 River Gate Lane
Suite B4-82
Durango, CO 81301

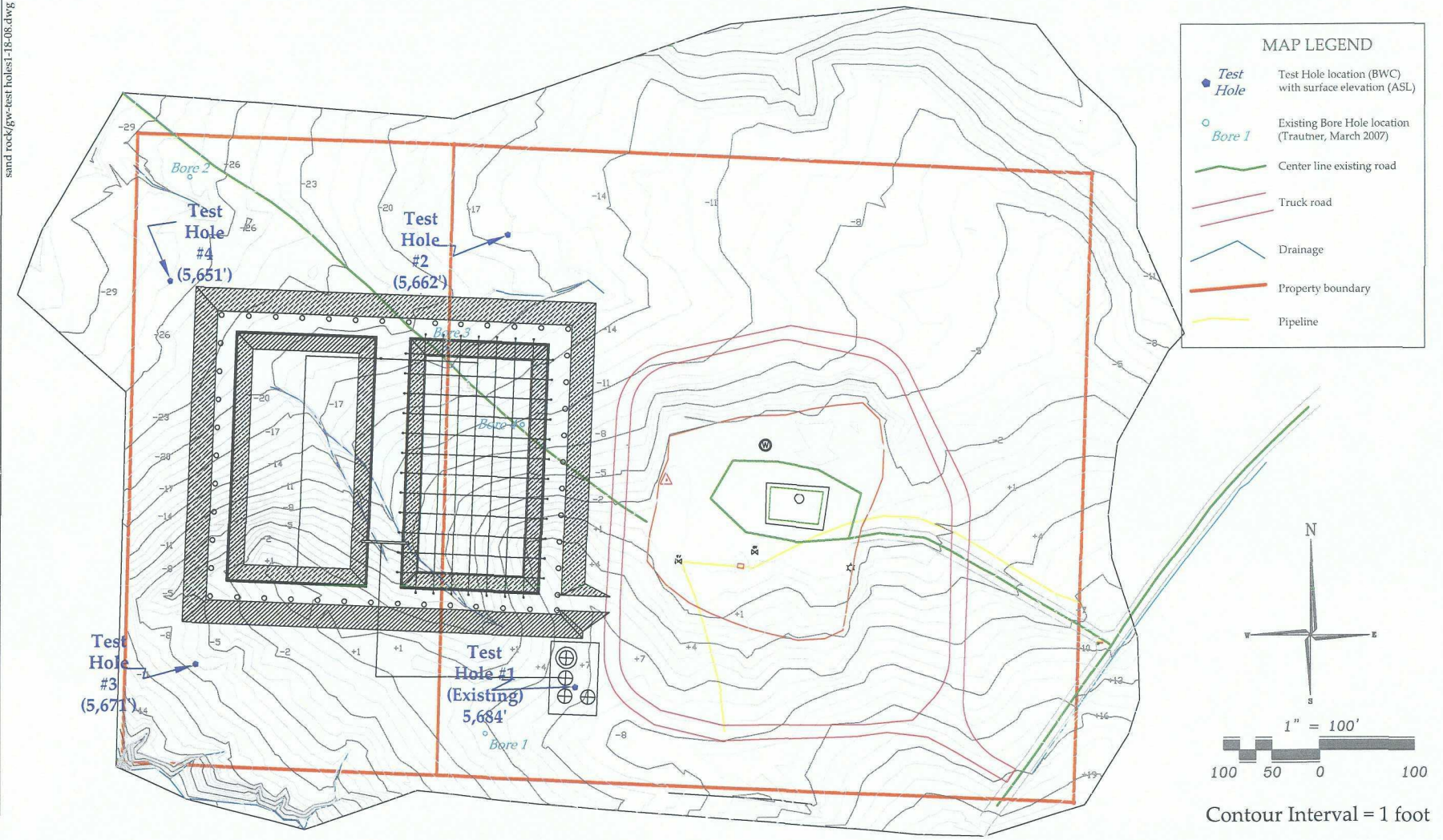
Tom Hnasko
Hinkle, Hensley, Shanor & Martin, LLP
P.O. Box 2068
Santa Fe, NM 87504

Brad Jones
New Mexico Oil Conservation Division
1220 S. St. Frances Drive
Santa Fe, NM 87505

Gail MacQuesten
New Mexico Oil Conservation Division
1220 S. St. Frances Drive
Santa Fe, NM 87505

David Simpson
MuleShoe Engineering
P.O. Box 637
Flora Vista, NM 87415

sand rock/gw-test holes1-18-08.dwg



555 RiverGate Lane, Suite B4-82
Durango, CO 81301
(970) 385-2340 ph (970) 385-2341 fx
www.BikisWater.com

Notes:
1. Date of Plan : January 18, 2008
2. Base mapping provided by Muleshoe Engineering. The "0" reference for contours equals 5,678 ft ASL. The bottom of the proposed design equals 5,664.8 ft ASL.
3. Evaporation pond footprint is proposed location.

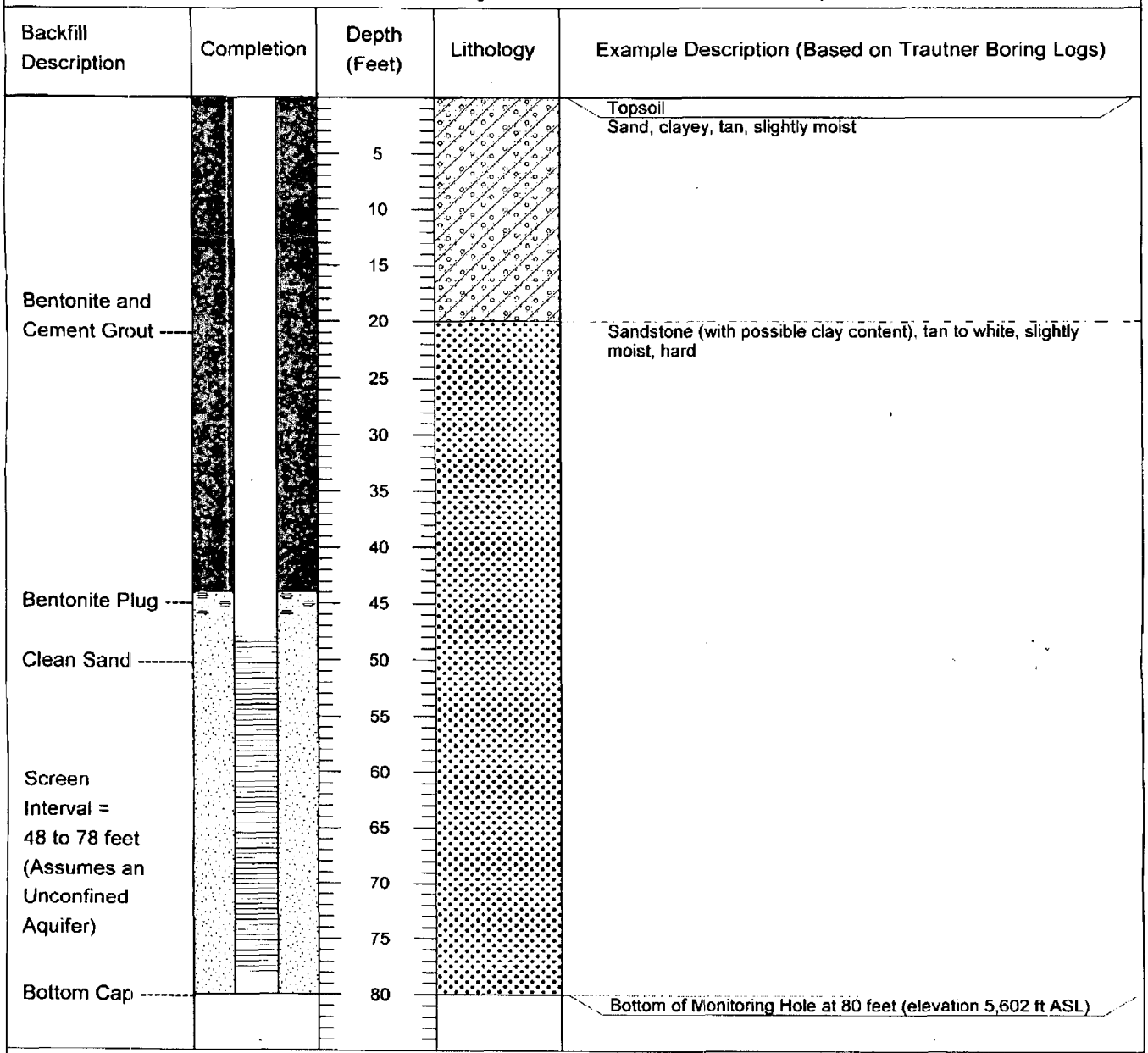
Sand Rock Evaporation Pond
Location Map
Groundwater Test Hole Locations

FIGURE 1

Figure 2. Example Log and Monitoring Hole Completion Detail

Bikis Water Consultants, LLC

Ground Elevation: 5,682 ft Boring Dia: 4 3/8 inches Total Depth: 80 ft



Completion Notes:

If moist zones are encountered during drilling of Test Hole One, drilling will cease to allow ample time for water to filter through. If moist zones are persistent and appear to be producing water, then a monitoring hole (similar to Figure 2) will be constructed. The total depth proposed in this example conservatively exceeds depths 50 feet below the bottom of the evaporation ponds design.

Site:

Sand Rock Evaporation Pond
(Example Log - Not Yet Constructed)

Project No.: 073-07-01 Date: July 12, 2007

Table 1
Proposed Test Hole Depths
Sand Rock Evaporation Pond

Name	Relative Elevation (ft) (1)	Ground Elevation (ft ASL) (2)	Target Depth (ft ASL) (3)	Approximate Boring Depth (ft) (4)
Test Hole 1 (existing)	6	5,684	5,605	79
Test Hole 2	-16	5,662	5,605	57
Test Hole 3	-7	5,671	5,605	66
Test Hole 4	-27	5,651	5,605	46

Notes:

1) The relative elevations are based on the "0" reference contour on Figure 1; equals 5,678'
2) Based on mapping provided by MuleShoe Engineering.
3) Target Bore Depth on the site based on minimum of 50 feet below the bottom design elevation of the Sand Rock Evaporation Pond plus 10 feet of buffer. Equals 5,604.8 ft ASL
4) Equals Column (2) - Column (3)

Exhibit 1. Bailed Volume per Sample
Sand Rock Monitor Well 1

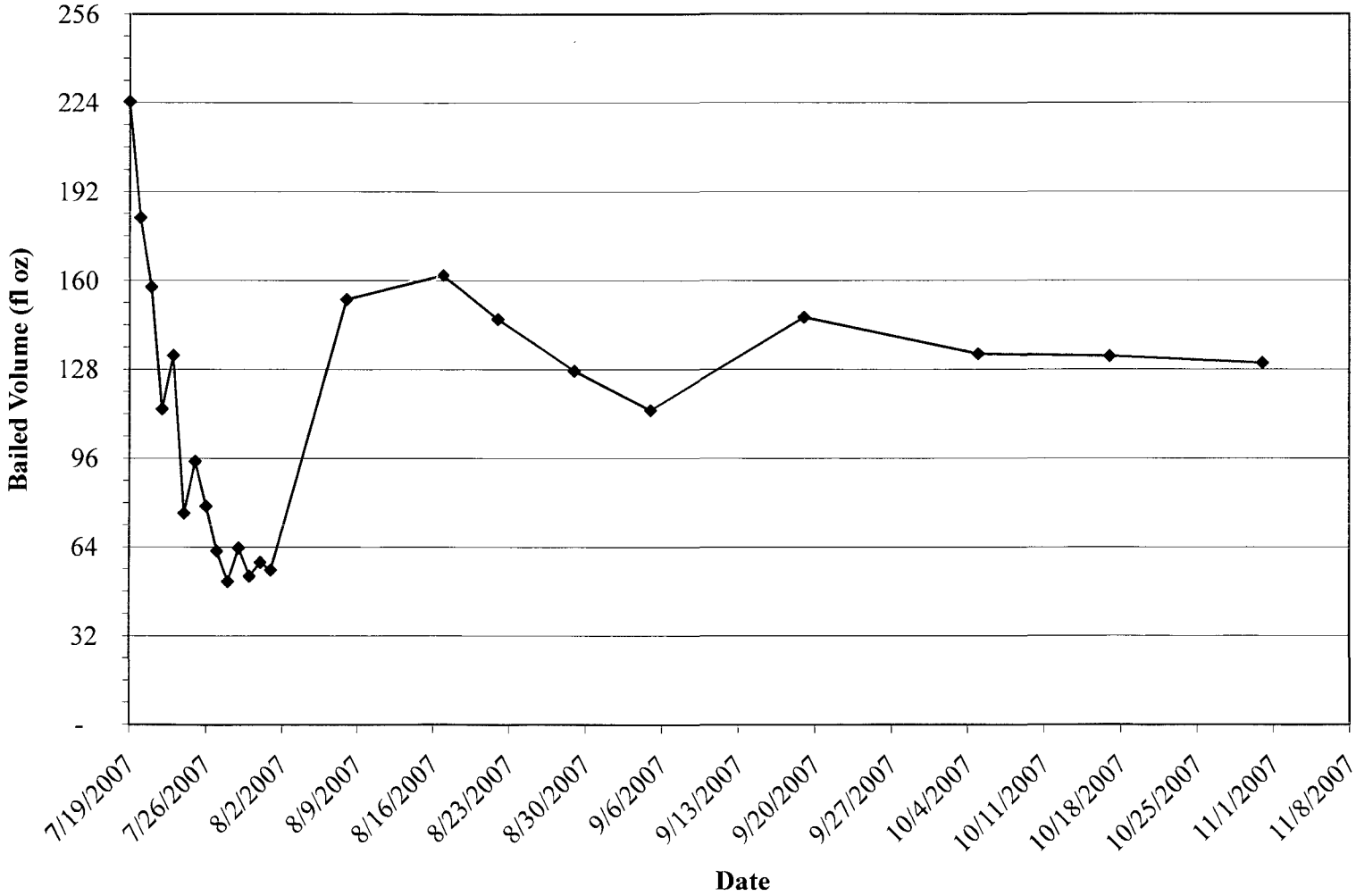
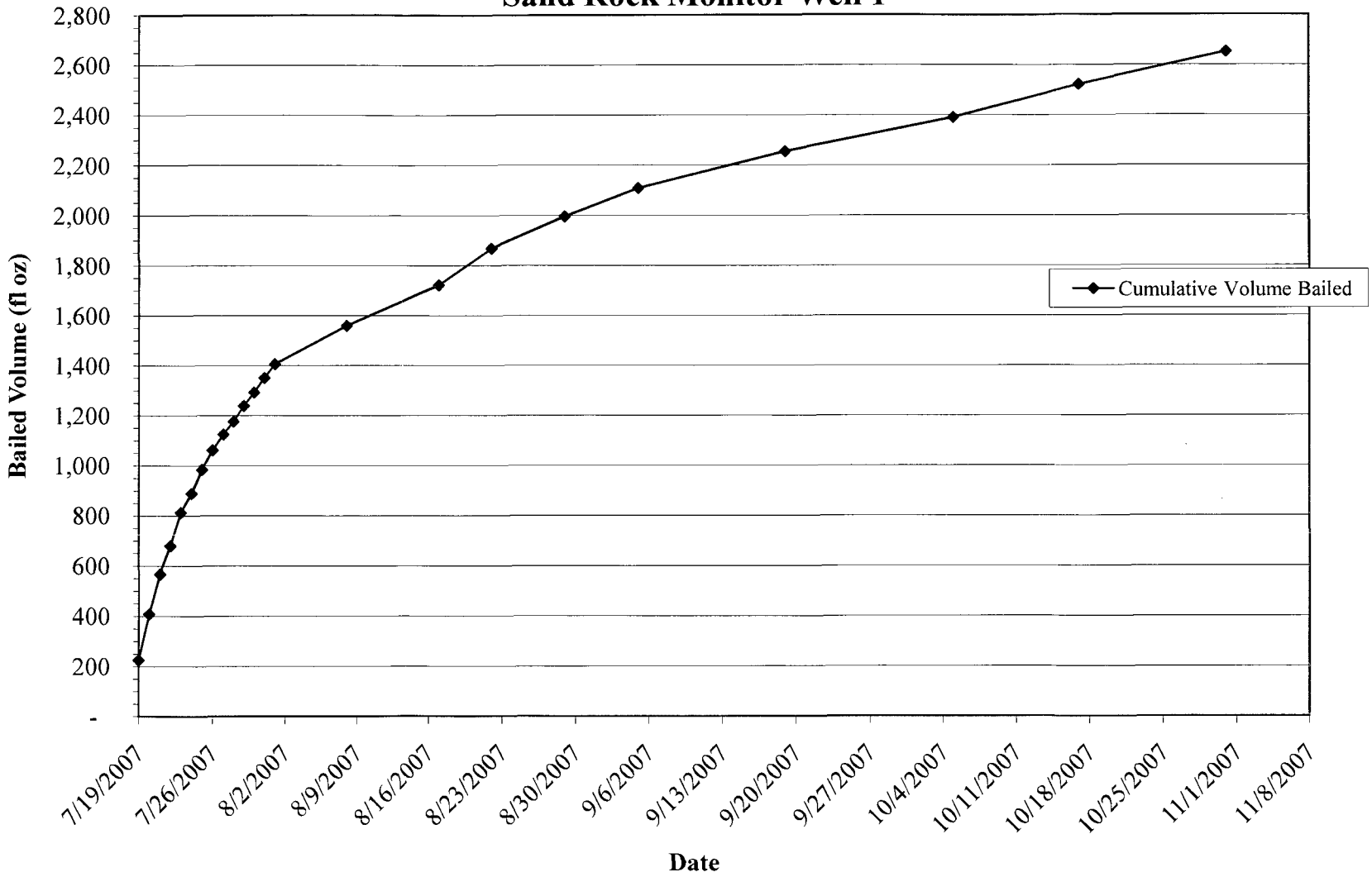


Exhibit 2. Cumulative Yield: Sand Rock Monitor Well 1



Jones, Brad A., EMNRD

From: Eric Bikis [eric@bikiswater.com]
Sent: Tuesday, November 20, 2007 1:15 PM
To: Jones, Brad A., EMNRD
Cc: zdas04@muleshoe-eng.com
Subject: Sand Rock Water Quality
Attachments: Eric A. Bikis.vcf

Brad,

Following up on our conversation today, I wanted to report that the TDS for water bailed from Monitoring Well #1 was less than 1000 mg/L, which is classified as fresh water in New Mexico.

PLEASE NOTE NEW MAILING ADDRESS BELOW.
ALSO, CLICK ON ATTACHED VCARD AND SAVE.

Eric A. Bikis, P.G.
Bikis Water Consultants, LLC
555 RiverGate Lane, Suite B4-82
Durango, Co 81301
Ph: 970-385-2340
Fx: 970-385-2341
Cell: 970-769-0997

Jones, Brad A., EMNRD

From: Ryan Huggins [huggins@bikiswater.com]
Sent: Monday, January 21, 2008 9:41 AM
To: Price, Wayne, EMNRD
Cc: Jones, Brad A., EMNRD; zdas04@muleshoe-eng.com
Subject: Revised Test Bore and Monitoring Hole Plan 01-18-08
Attachments: Test Hole and Monitoring Hole Plan package 01-18-08.pdf

Mr. Price:
Please find the attached revised (01/18/2008) plan for the proposed Sand Rock Evaporation Pond.
Thank you,

Ryan Huggins

Ryan Kathryn Huggins
Bikis Water Consultants, LLC
555 RiverGate Lane, Suite B4-82
Durango, CO 81301
Ph: 970.385.2340
Fax: 970.385.2341
Email: huggins@bikiswater.com

679 East 2nd Avenue, Suite 3
Durango, Colorado 81301
Phone: 970.385.2340
Fax: 970.385.2341
www.bikiswaterconsultants.com

BIKIS
Water Consultants LLC

E-mail:eric@bikiswater.com

January 18, 2008

E-mail address: wayne.price@state.nm.us

Mr. Wayne Price
Environmental Bureau Chief
Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

Re: Test Hole Boring and Monitoring Hole Completion Plan at the Proposed Sand Rock Evaporation Pond - Phase II

Dear Mr. Price:

Bikis Water Consultants, LLC (BWC) is providing a boring plan for additional (Phase II) groundwater test holes and possible monitoring holes for the proposed Sand Rock Evaporation Pond project (Sand Rock). Sand Rock is operated by Noble Energy and is located in the NE/4, SW/4 of Section 23, Township 31 North, Range 13 West NMPM, San Juan County, New Mexico.

Test Hole #1 (TH#1) was drilled at the site on July 17, 2007. A water bearing unit was found at a depth of approximately 55.3 to 57.6 feet. The bore was completed as a monitoring well on July 19, 2007 with a screened interval from 47 to 57 feet in order to completely encompass any potentially water bearing strata encountered during drilling. Since that time, the yield of the monitoring well has been monitored and recorded. Data was initially taken on a daily basis, then weekly, and is currently collected ever two weeks (see Exhibit 1). The average daily yield of the monitoring well is approximately 58 fluid ounces per day. However, the water unit requires between one day and one week to fully recover its pressure head. Therefore, the yield is constant at 1 gallon per week and per two week bailing period.

This proposal is for three additional test holes at Sand Rock to evaluate the presence of groundwater below the pond. The three additional test holes will be utilized to determine if the free water present in TH#1 is laterally continuous and constitutes a viable water bearing unit, or if the groundwater present in TH#1 is due to an isolated, perched water unit. The three additional test holes are identified as test holes 2, 3, and 4 on Figure 1 (attached). In addition, the site has been surveyed by Trigon Sheehan to verify the precise elevations (feet above sea level) used in this monitoring design and plan.

EVAPORATION POND DESIGN ELEVATIONS

The elevations of the finished pond will be the result of considerable cutting and filling of the current site contours. This discussion aims to clarify the design elevations at the site, as reviewed and approved by the project engineer, Muleshoe Engineering. Please refer to Figure 1

(attached) and Drawings 4 and 8 of the Construction Design Details provided by Muleshoe Engineering in the application for clarification.

- The bottom of the center of both ponds is proposed to be 5,673 ft ASL.
- At the south end the drainage pipe will be in a leak-detection ditch that is one foot deep, resulting in an elevation of 5,672 ft ASL.
- The leak-detection ditch will slope 2 ft per 100 ft (2%). Therefore, after 200 ft (assuming that the ditch starts and ends 12 ft from the toe of the berm) the ditch will be 4 feet lower for an elevation of 5,668 ft ASL.
- The leak-detection ditch will then turn toward the center for 60 ft, sloping at 2 ft per 100 ft (2%) for an additional drop of 1.2 ft. The resultant elevation is 5,666.8 ft ASL.
- The dry well will be set 2 ft below the end of the leak-detection pipe for a final elevation of 5,664.8 ft ASL.

To perform an on-site analysis of the hydrogeology and meet the minimum requirements in Paragraph 5 of subsection A of Rule 19.15.36.13 NMAC, the proposed test holes must be drilled a minimum 50 feet below the lowest point in the pond design, which is the dry well below the evaporation pond. Therefore, the target depth of the proposed test holes is 5,614.8 ft ASL. (Dry Well Elevation 5,664.8 ft ASL less 50 ft equals 5,614.8 ft ASL). A conservative approach to obtain this elevation with certainty is to drill beyond this depth. Table 1 (attached) summarizes the minimum boring depths of test holes 2, 3 and 4 based on their proposed locations at Sand Rock.

BACKGROUND INFORMATION

Based on a June 18, 2007 letter to Mr. Billie Maez of Noble Energy from Mr. Wayne Price, Environmental Bureau Chief for the Oil Conservation Division (OCD) of New Mexico, BWC understands the following:

- Patina San Juan, Inc (currently doing business as Noble Energy) applied to the OCD for a centralized evaporation surface waste facility permit at Sand Rock on April 6, 2007. After reviewing the permit application, your office indicated that the OCD is considering administratively denying the application. According to your review, insufficient data was provided to characterize the hydrogeology (as outlined in Paragraph 5 of subsection A of 19.15.36.13 NMAC). This regulation requires that "No other surface waste management facility shall be located where groundwater is less than 50 feet below the lowest elevation at which the operator will place oil field waste."
- Four bore holes were completed by Trautner GeoTech in March 2007 to investigate the hydrogeology of the area. The bore logs, which are summarized as follows, were submitted with the original Sand Rock application. Bore 1 was drilled to a depth of 50 feet at a site south of the evaporation pond. This bore encountered claystone and sandstone formation at a depth of 15 feet. This tan to white material was slightly moist at 15 feet below ground surface. An increase in moisture was reported at a depth of 30

feet. Bore 2, also completed to 50 ft, was drilled to the northeast of the evaporation pond footprint, while bores 3 and 4 (19 ft and 15 ft respectively) were within the footprint. The sand and clays encountered in Bores 2, 3 and 4 were slightly moist to moist. Bore 2 also encountered a moist clay layer below 26 ft. These bore logs are used as a basis for predicting the subsurface conditions that will be encountered during new test hole drilling.

- TH#1 was drilled on July 17, 2007 (see Figure 1 for location) to a depth of approximately 57 feet below ground surface (5624.4 ft ASL). It was determined to have a water bearing unit from 53.7 to 57.6 feet of depth, therefore drilling was halted and the bore was completed as a monitoring well to observe the nature of the unit. Data was recorded for the volume of individual bails (Exhibit 1) and cumulative yield (Exhibit 2) from the well over a period of over three months. Initially, the bore was bailed dry on a daily basis, yielding approximately ½ gallon per bailing period. Monitoring was then changed to a weekly basis, at which interval the well was first bailed dry approximately after 1¼ gallons, and then reduced to less than 1 gallon per bail period. Two months of bimonthly monitoring have shown the yield to stabilize at approximately 1 gallon per bail period, which is representative of the transmissivity of the unit. This is also demonstrated in Exhibit 2, which shows that the slope of total yield lessens during the one week and two week bailing periods. These data suggest that this unit may not constitute a significant groundwater source. Further investigations have been recommended.

- Additional test holes are proposed, as described in this plan, to further characterize the potential for groundwater at Sand Rock. It is believed these additional test holes will define the hydrogeology underneath the proposed evaporation pond. Materials will be on-site during drilling to construct a monitoring hole, if determined to be necessary.

The enclosed monitoring hole completion plan, also submitted for OCD for approval, is intended to satisfy your request for design details of the monitoring wells. Based on the above background information, BWC has developed a test hole Boring Plan and a Monitoring Hole Completion Plan for your review and approval.

TEST HOLE BORING PLAN

The following test hole boring plan (boring plan) describes methods and procedures for drilling additional test holes. This plan was developed in accordance with OCD requirements for assessing hydrogeologic conditions at Sand Rock.

1. Drill additional test holes at the locations shown on Figure 1 (attached). The test holes will be drilled by Mo-Te Drilling, Inc., a licensed driller in the state of New Mexico. Mo-Te Drilling, Inc. will utilize an air-rotary drilling technique, as requested by your office. Drilling will be scheduled after approval of this plan by the OCD.
2. The locations were selected for access and to complement the current data and findings from test hole #1.
3. Each test hole will be bored at 4-3/8 inches diameter with a 3 inch core. In order to meet or exceed the requirements in the NMAC regulation, test holes will be drilled to a depth that is a minimum of 50 feet below the bottom of the proposed evaporation pond design (5,614.8 feet ASL, which takes into account excavation and fill required to construct the

pond and the dry well located below the proposed ponds in the leak-detection trench). The minimum boring depths at each test hole is summarized in Table 1. An additional 10' is recommended to assure that the minimum requirements are met.

4. During drilling, a professional geologist will be on-site to oversee drilling activities and driller's total depth, collect information, describe the cores from the boring hole and, if necessary, supervise construction of the monitoring hole according to the proposed design (see below). The OCD will be notified of the drilling schedule. BWC understands that a representative from the OCD will be present during drilling.
5. Core samples will be taken ahead of the drill bit in order to obtain a complete undisturbed core after the first 15 feet. It is not feasible to take cores during the first 15 feet of drilling depth; however bag samples of cuttings may be taken. If necessary, a solid steel casing will be used in the hole to prevent caving and facilitate core sampling.
6. If a saturated zone is encountered, the hole will be allowed to remain open to determine the amount of free water available. Drilling may need to cease for an indeterminate amount of time (including overnight, if necessary) to allow water ample time to filter through saturated zones. This will be done to determine if the water table is limited in supply or whether the zone can yield water in an amount sufficient to be considered groundwater.
    a. If no water zones are detected from the core samples or in the test hole, the test hole will be filled and abandoned according to OCD regulations.
    b. If water is present in the test hole, the test hole will be completed as described in the following proposed monitoring hole completion plan (Figure 2).

MONITORING HOLE COMPLETION PLAN

Figure 3 (attached) is the proposed monitoring hole completion detail.

1. The test hole will be completed using 0.010-inch factory-slotted 2-inch Schedule 40 PVC casing and screen in potential water bearing zones. The approximate depth of the water bearing zones, if any, will be determined during drilling. The depth of saturated material will determine the amount of screened pipe installed in the borehole. If a confined condition is observed in the test hole, the water zone will be screened so that groundwater does not interface with other geologic units. If the test hole indicates unconfined conditions, the slotted screen interval will extend approximately 5 feet above the estimated water depth. The additional screen interval will allow for fluctuations in the water table.
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Any unsafe work conditions identified by field crew team members will be immediately reported to the drilling crew supervisor and the project team staff member. All drilling activities will be suspended if unsafe work conditions are identified. Potential unsafe conditions may include weather related conditions or equipment related conditions. Any suspension of work activities due to unsafe work conditions will be reported to Noble Energy staff as soon as possible after cessation of drilling activities.

The boring plan and monitoring hole completion plan was prepared to address Paragraph 5 of subsection A of Rule 19.15.36.13 NMAC. If you find this methodology acceptable, please so indicate by signing on the approval line below.

Sincerely,

Bikis Water Consultants, LLC

By _____
Eric Bikis, P.G.
Project Manager

Approved,

OCD Environmental Bureau

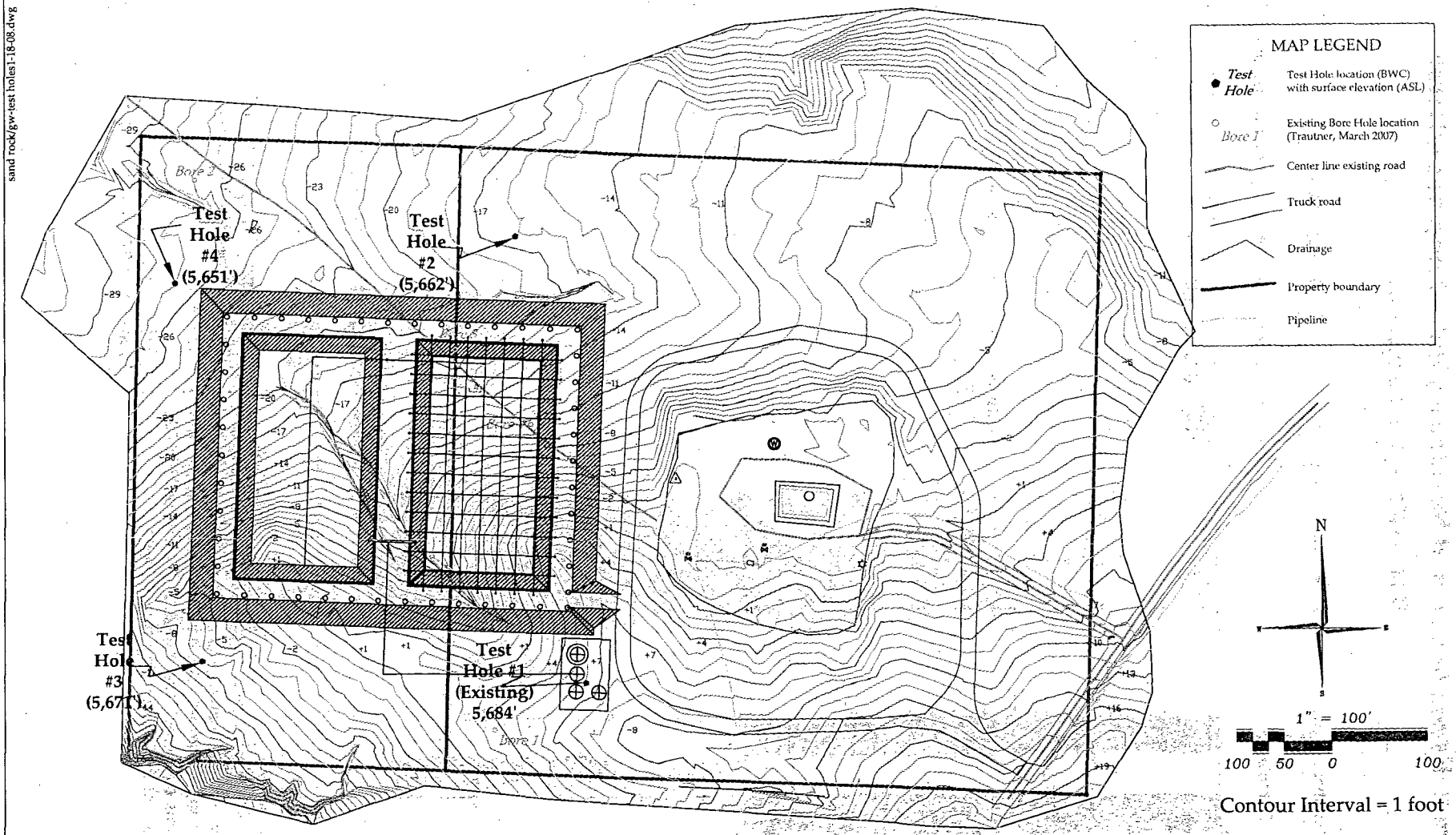
By _____
Wayne Price, Environmental Bureau Chief
Oil Conservation District of New Mexico

Attachments:
Figure 1. Sand Rock Location Map: Groundwater Test Hole Locations
Figure 2. Example Log and Proposed Monitoring Hole Completion Detail
Table 1. Proposed Test Hole Depths
Exhibit 1. Bailed Volume per Sample
Exhibit 2. Cumulative Yield: Monitoring Well One

cc: David A. Simpson, MuleShoe Engineering
Billie Maez, Noble Energy
Brad Jones, OCD

P:\Project Files\073-07 Sand Rock\Blue Dot- Phase 2 Boring Plan\Test Hole and Monitoring Hole Plan 01-18-08.doc

sand rock/gw-test holes1-18-08.dwg



BIKIS Water Consultants LLC
555 RiverGate Lane, Suite B4-82
Durango, CO 81301
(970) 385-2340 ph (970) 385-2341 fx
www.BikisWater.com

Notes:
1. Date of Plan : January 18, 2008
2. Base mapping provided by Muleshoe Engineering. The "0" reference for contours equals 5,678 ft ASL. The bottom of the proposed design equals 5,664.8 ft ASL.
3. Evaporation pond footprint is proposed location.

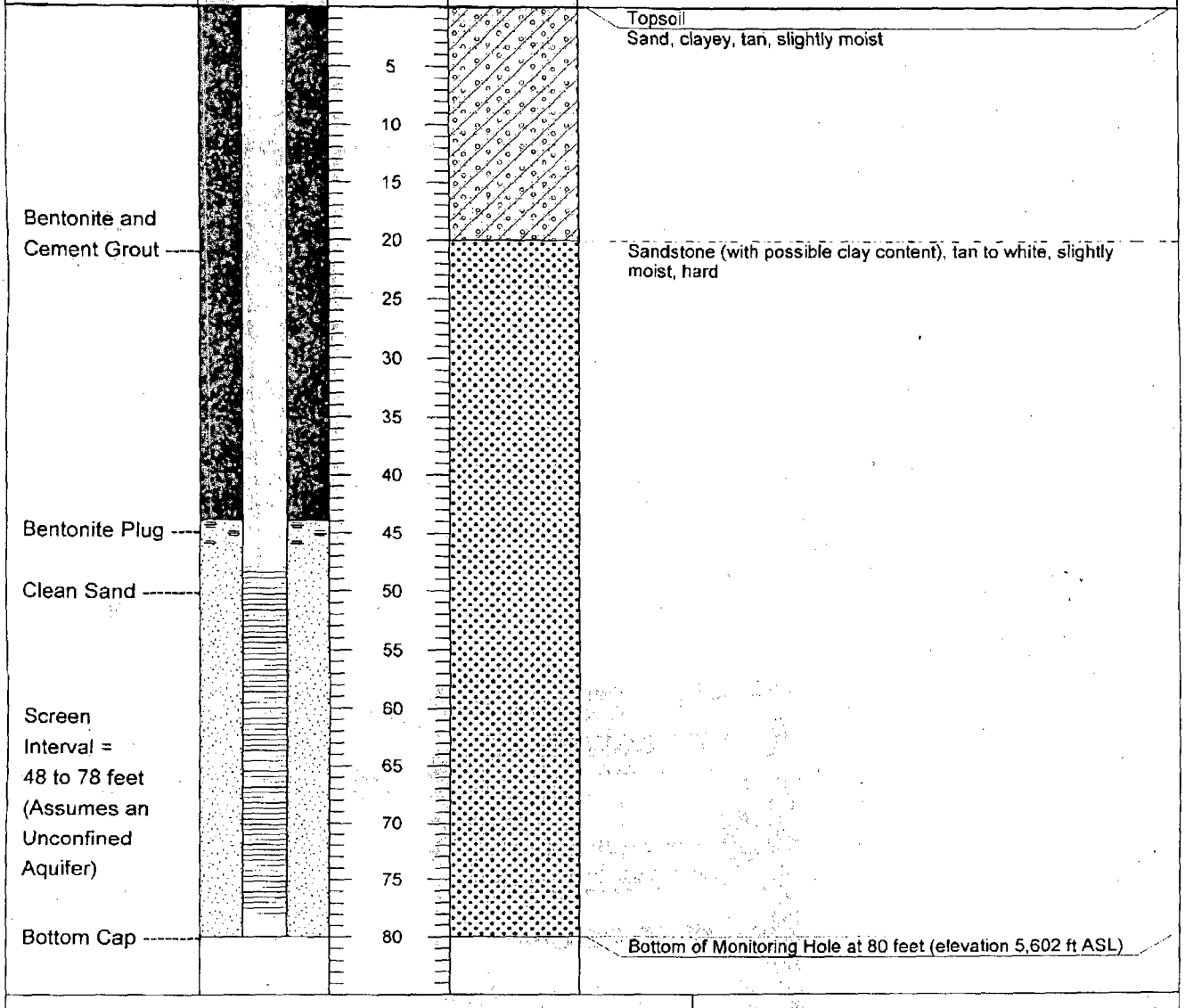
Sand Rock Evaporation Pond Location Map Groundwater Test Hole Locations

FIGURE 1

Figure 2. Example Log and Monitoring Hole Completion Detail

Bikis Water Consultants, LLC

Ground Elevation: 5,682 ft Boring Dia: 4 3/8 inches Total Depth: 80 ft



Completion Notes:

If moist zones are encountered during drilling of Test Hole One, drilling will cease to allow ample time for water to filter through. If moist zones are persistent and appear to be producing water, then a monitoring hole (similar to Figure 2) will be constructed. The total depth proposed in this example conservatively exceeds depths 50 feet below the bottom of the evaporation ponds design.

Site:

Sand Rock Evaporation Pond
(Example Log - Not Yet Constructed)

Project No.: 073-07-01 Date: July 12, 2007

Table 1
Proposed Test Hole Depths
Sand Rock Evaporation Pond

Name	Relative Elevation (ft) (1)	Ground Elevation (ft ASL) (2)	Target Depth (ft ASL) (3)	Approximate Boring Depth (ft) (4)
Test Hole 1 (existing)	6	5,684	5,605	79
Test Hole 2	-16	5,662	5,605	57
Test Hole 3	-7	5,671	5,605	66
Test Hole 4	-27	5,651	5,605	46

Notes:

1) The relative elevations are based on the "0" reference contour on Figure 1; equals 5,678'
2) Based on mapping provided by MuleShoe Engineering.
3) Target Bore Depth on the site based on minimum of 50 feet below the bottom design elevation of the Sand Rock Evaporation Pond plus 10 feet of buffer. Equals 5,604.8 ft ASL
4) Equals Column (2) - Column (3)

Exhibit 1. Bailed Volume per Sample
Sand Rock Monitor Well 1

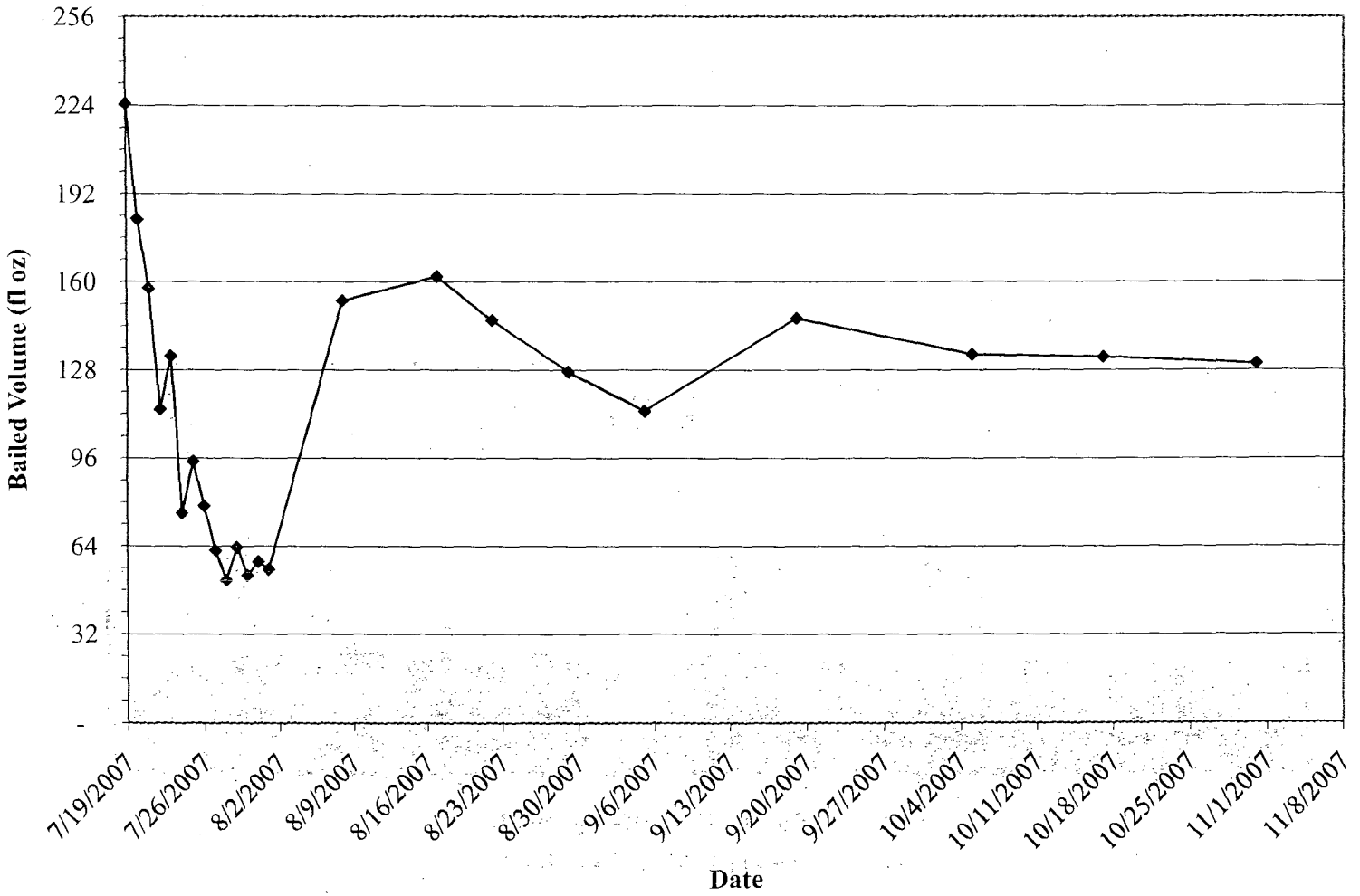
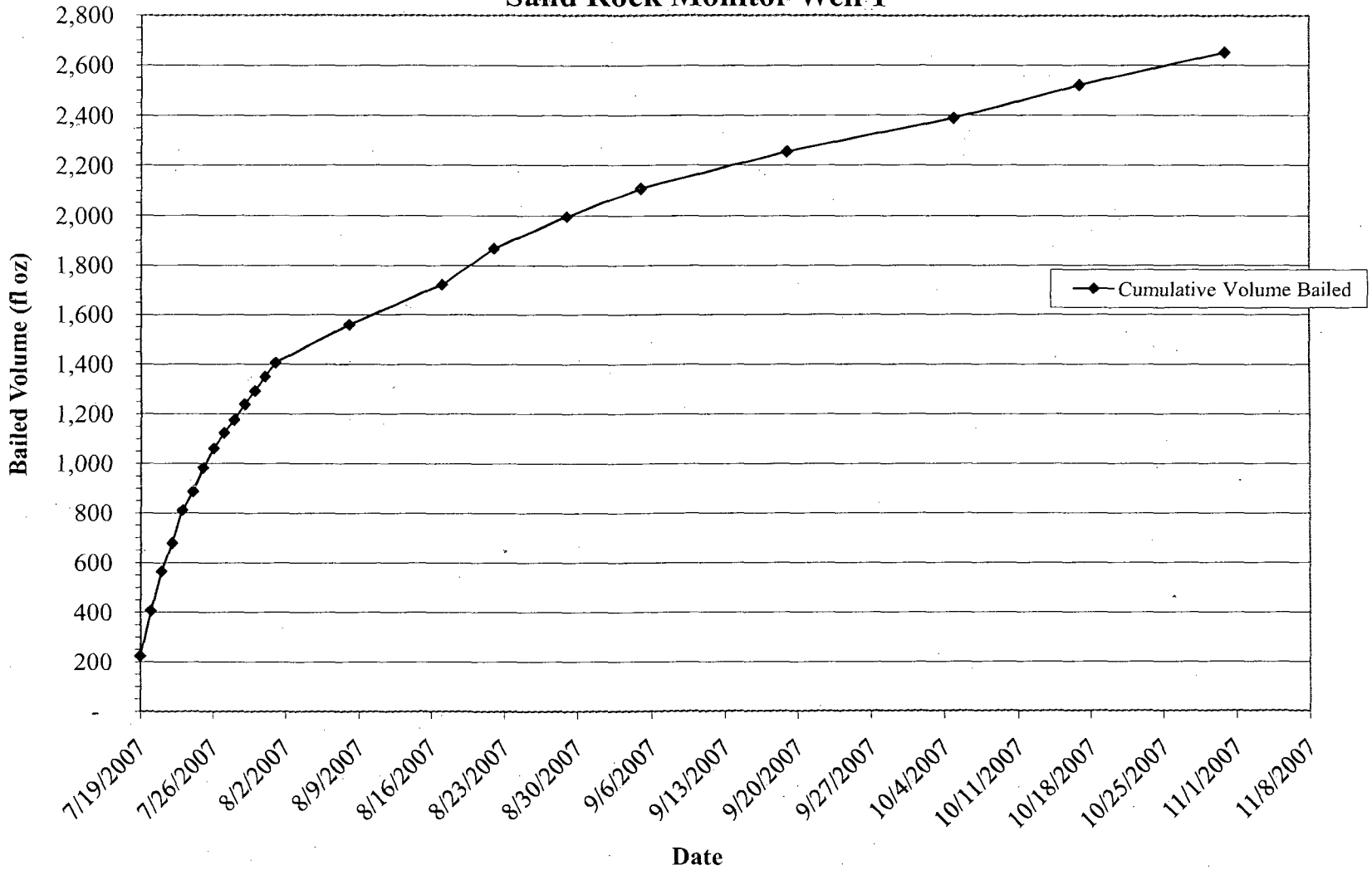


Exhibit 2. Cumulative Yield: Sand Rock Monitor Well 1



Jones, Brad A., EMNRD

From: Ryan Huggins [huggins@bikiswater.com]
Sent: Tuesday, November 13, 2007 8:50 AM
To: Price, Wayne, EMNRD
Cc: bmaez@nobleenergyinc.com; Jones, Brad A., EMNRD
Subject: Sand Rock Test Hole and Monitoring Hole Plan
Attachments: Test Hole and Monitoring Hole Plan package 11-13.pdf

Gentlemen:
I apologize. The document is attached here.
Thank you

Ryan

Ryan Kathryn Huggins
Bikis Water Consultants, LLC
555 RiverGate Lane, Suite B4-82
Durango, CO 81301
Ph: 970.385.2340
Fax: 970.385.2341
Email: huggins@bikiswater.com

679 East 2nd Avenue, Suite 3
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www.bikiswaterconsultants.com

BIKIS
Water Consultants LLC

E-mail:eric@bikiswater.com

November 13, 2007

E-mail address: wayne.price@state.nm.us

Mr. Wayne Price
Environmental Bureau Chief
Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

Re: Test Hole Boring and Monitoring Hole Completion Plan at the Proposed Sand Rock Evaporation Pond - Phase II

Dear Mr. Price:

Bikis Water Consultants, LLC (BWC) is providing a boring plan for additional (Phase II) groundwater test holes and possible monitoring holes for the proposed Sand Rock Evaporation Pond project (Sand Rock). Sand Rock is operated by Noble Energy and is located in the NE/4, SW/4 of Section 23, Township 31 North, Range 13 West NMPM, San Juan County, New Mexico.

Test Hole #1 (TH#1) was drilled at the site on July 17, 2007. A water bearing unit was found at a depth of approximately 55.3 to 57.6 feet. The bore was completed as a monitoring well on July 19, 2007 with a screened interval from 47 to 57 feet in order to completely encompass any potentially water bearing strata encountered during drilling. Since that time, the yield of the monitoring well has been monitored and recorded. Data was initially taken on a daily basis, then weekly, and is currently collected ever two weeks (see Exhibit 1). The average daily yield of the monitoring well is approximately 58 fluid ounces per day. However, the water unit requires between one day and one week to fully recover its pressure head. Therefore, the yield is constant at 1 gallon per week and per two week bailing period.

This proposal is for three additional test holes at Sand Rock to evaluate the presence of groundwater below the pond. The three additional test holes will be utilized to determine if the free water present in TH#1 is laterally continuous and constitutes a viable water bearing unit, or if the groundwater present in TH#1 is due to an isolated, perched water unit. The three additional test holes are identified as test holes 2, 3, and 4 on Figure 1 (attached). There is also a proposed alternate location in case one of the sites is not accessible. In addition, the site has been surveyed by Trigon Sheehan to verify the precise elevations (feet above sea level) used in this monitoring design and plan.

EVAPORATION POND DESIGN ELEVATIONS

The elevations of the finished pond will be the result of considerable cutting and filling of the current site contours. This discussion aims to clarify the design elevations at the site, as reviewed and approved by the project engineer, Muleshoe Engineering. Please refer to Figure 1

(attached) and Drawings 4 and 8 of the Construction Design Details provided by Muleshoe Engineering in the application for clarification.

- The bottom of the center of both ponds is proposed to be 5,673 ft ASL.
- At the south end the drainage pipe will be in a leak-detection ditch that is one foot deep, resulting in an elevation of 5,672 ft ASL.
- The leak-detection ditch will slope 2 ft per 100 ft (2%). Therefore, after 200 ft (assuming that the ditch starts and ends 12 ft from the toe of the berm) the ditch will be 4 feet lower for an elevation of 5,668 ft ASL.
- The leak-detection ditch will then turn toward the center for 60 ft, sloping at 2 ft per 100 ft (2%) for an additional drop of 1.2 ft. The resultant elevation is 5,666.8 ft ASL.
- The dry well will be set 2 ft below the end of the leak-detection pipe for a final elevation of 5,664.8 ft ASL.

To perform an on-site analysis of the hydrogeology and meet the minimum requirements in Paragraph 5 of subsection A of Rule 19.15.36.13 NMAC, the proposed test holes must be drilled a minimum 50 feet below the lowest point in the pond design, which is the dry well below the evaporation pond. Therefore, the target depth of the proposed test holes is 5,614.8 ft ASL. (Dry Well Elevation 5,664.8 ft ASL less 50 ft equals 5,614.8 ft ASL). A conservative approach to obtain this elevation with certainty is to drill beyond this depth. Table 1 (attached) summarizes the minimum boring depths of test holes 2 through 5 based on their proposed locations at Sand Rock.

BACKGROUND INFORMATION

Based on a June 18, 2007 letter to Mr. Billie Maez of Noble Energy from Mr. Wayne Price, Environmental Bureau Chief for the Oil Conservation Division (OCD) of New Mexico, BWC understands the following:

- Patina San Juan, Inc (currently doing business as Noble Energy) applied to the OCD for a centralized evaporation surface waste facility permit at Sand Rock on April 6, 2007. After reviewing the permit application, your office indicated that the OCD is considering administratively denying the application. According to your review, insufficient data was provided to characterize the hydrogeology (as outlined in Paragraph 5 of subsection A of 19.15.36.13 NMAC). This regulation requires that "No other surface waste management facility shall be located where groundwater is less than 50 feet below the lowest elevation at which the operator will place oil field waste."
- Four bore holes were completed by Trautner GeoTech in March 2007 to investigate the hydrogeology of the area. The bore logs, which are summarized as follows, were submitted with the original Sand Rock application. Bore 1 was drilled to a depth of 50 feet at a site south of the evaporation pond. This bore encountered claystone and sandstone formation at a depth of 15 feet. This tan to white material was slightly moist at 15 feet below ground surface. An increase in moisture was reported at a depth of 30

feet. Bore 2, also completed to 50 ft, was drilled to the northeast of the evaporation pond footprint, while bores 3 and 4 (19 ft and 15 ft respectively) were within the footprint. The sand and clays encountered in Bores 2, 3 and 4 were slightly moist to moist. Bore 2 also encountered a moist clay layer below 26 ft. These bore logs are used as a basis for predicting the subsurface conditions that will be encountered during new test hole drilling.

- TH#1 was drilled on July 17, 2007 (see Figure 1 for location) to a depth of approximately 57 feet below ground surface (5624.4 ft ASL). It was determined to have a water bearing unit from 53.7 to 57.6 feet of depth, therefore drilling was halted and the bore was completed as a monitoring well to observe the nature of the unit. Data was recorded for the volume of individual bails (Exhibit 1) and cumulative yield (Exhibit 2) from the well over a period of over three months. Initially, the bore was bailed dry on a daily basis, yielding approximately ½ gallon per bailing period. Monitoring was then changed to a weekly basis, at which interval the well was first bailed dry approximately after 1¼ gallons, and then reduced to less than 1 gallon per bail period. Two months of bimonthly monitoring have shown the yield to stabilize at approximately 1 gallon per bail period, which is representative of the transmissivity of the unit. This is also demonstrated in Exhibit 2, which shows that the slope of total yield lessens during the one week and two week bailing periods. These data suggest that this unit may not constitute a significant groundwater source. Further investigations have been recommended.

- Additional test holes are proposed, as described in this plan, to further characterize the potential for groundwater at Sand Rock. It is believed these additional test holes will define the hydrogeology underneath the proposed evaporation pond. Materials will be on-site during drilling to construct a monitoring hole, if determined to be necessary.

The enclosed monitoring hole completion plan, also submitted for OCD for approval, is intended to satisfy your request for design details of the monitoring wells. Based on the above background information, BWC has developed a test hole Boring Plan and a Monitoring Hole Completion Plan for your review and approval.

TEST HOLE BORING PLAN

The following test hole boring plan (boring plan) describes methods and procedures for drilling additional test holes. This plan was developed in accordance with OCD requirements for assessing hydrogeologic conditions at Sand Rock.

1. Drill additional test holes at the locations shown on Figure 1 (attached). The test holes will be drilled by Mo-Te Drilling, Inc., a licensed driller in the state of New Mexico. Mo-Te Drilling, Inc. will utilize an air-rotary drilling technique, as requested by your office. Drilling will be scheduled after approval of this plan by the OCD.
2. The locations were selected for access and to complement the current data and findings from test hole #1.
3. Each test hole will be bored at 4-3/8 inches diameter with a 3 inch core. In order to meet or exceed the requirements in the NMAC regulation, test holes will be drilled to a depth that is a minimum of 50 feet below the bottom of the proposed evaporation pond design (5,614.8 feet ASL, which takes into account excavation and fill required to construct the

pond and the dry well located below the proposed ponds in the leak-detection trench). The minimum boring depths at each test hole is summarized in Table 1. An additional 10' is recommended to assure that the minimum requirements are met.

4. During drilling, a professional geologist will be on-site to oversee drilling activities and driller's total depth, collect information, describe the cores from the boring hole and, if necessary, supervise construction of the monitoring hole according to the proposed design (see below). The OCD will be notified of the drilling schedule. BWC understands that a representative from the OCD will be present during drilling.
5. Core samples will be taken ahead of the drill bit in order to obtain a complete undisturbed core after the first 15 feet. It is not feasible to take cores during the first 15 feet of drilling depth; however bag samples of cuttings may be taken. If necessary, a solid steel casing will be used in the hole to prevent caving and facilitate core sampling.
6. If a saturated zone is encountered, the hole will be allowed to remain open to determine the amount of free water available. Drilling may need to cease for an indeterminate amount of time (including overnight, if necessary) to allow water ample time to filter through saturated zones. This will be done to determine if the water table is limited in supply or whether the zone can yield water in an amount sufficient to be considered groundwater.
    a. If no water zones are detected from the core samples or in the test hole, the test hole will be filled and abandoned according to OCD regulations.
    b. If water is present in the test hole, the test hole will be completed as described in the following proposed monitoring hole completion plan (Figure 2).

MONITORING HOLE COMPLETION PLAN

Figure 3 (attached) is the proposed monitoring hole completion detail.

1. The test hole will be completed using 0.010-inch factory-slotted 2-inch Schedule 40 PVC casing and screen in potential water bearing zones. The approximate depth of the water bearing zones, if any, will be determined during drilling. The depth of saturated material will determine the amount of screened pipe installed in the borehole. If a confined condition is observed in the test hole, the water zone will be screened so that groundwater does not interface with other geologic units. If the test hole indicates unconfined conditions, the slotted screen interval will extend approximately 5 feet above the estimated water depth. The additional screen interval will allow for fluctuations in the water table.
2. The annular space from 2 feet below the bottom of the screen to 2 feet above the top of the screen will be filled with clean, silica sand filter pack to allow hydraulic connection through the screen of any water bearing zones.
3. A minimum 2-foot bentonite seal will be used above the sand pack.
4. The annular space above the bentonite seal will be filled with a bentonite-cement grout (2% to 8% bentonite by weight) to the ground surface and allowed to cure for at least 24 hours before installing a surface pad.

5. The top of the casing will be protected with a cap. The exposed casing will be protected by a locking shroud.

6. A 2-foot minimum radius, 4-inch minimum thickness concrete pad will be poured around the shroud. The concrete and surrounding soil shall be sloped to direct rainfall and runoff away from the shroud.

Upon completion, the monitoring hole will be bailed and observed to determine if groundwater is present in the monitoring hole. Groundwater is defined by the OCD as "...interstitial water which occurs in saturated earth material and which is capable of entering a well in sufficient amounts to be utilized as a water supply." If a perched condition is observed in the monitoring hole, it will be bailed dry. If recharge is observed in the monitoring hole after it is bailed, then groundwater likely is present and additional study may be needed.

HEALTH AND SAFETY

Drilling will be conducted by Mo-Te Drilling, Inc., who will implement their safety plan throughout the process. Before work commences, there will be an on-site safety briefing. At a minimum, all persons on site will be required to wear safety glasses, hard hats and steel toed boots for safety.

Any unsafe work conditions identified by field crew team members will be immediately reported to the drilling crew supervisor and the project team staff member. All drilling activities will be suspended if unsafe work conditions are identified. Potential unsafe conditions may include weather related conditions or equipment related conditions. Any suspension of work activities due to unsafe work conditions will be reported to Noble Energy staff as soon as possible after cessation of drilling activities.

The boring plan and monitoring hole completion plan was prepared to address Paragraph 5 of subsection A of Rule 19.15.36.13 NMAC. If you find this methodology acceptable, please so indicate by signing on the approval line below.

Sincerely,

Bikis Water Consultants, LLC

By _____
Eric Bikis, P.G.
Project Manager

Approved,

OCD Environmental Bureau

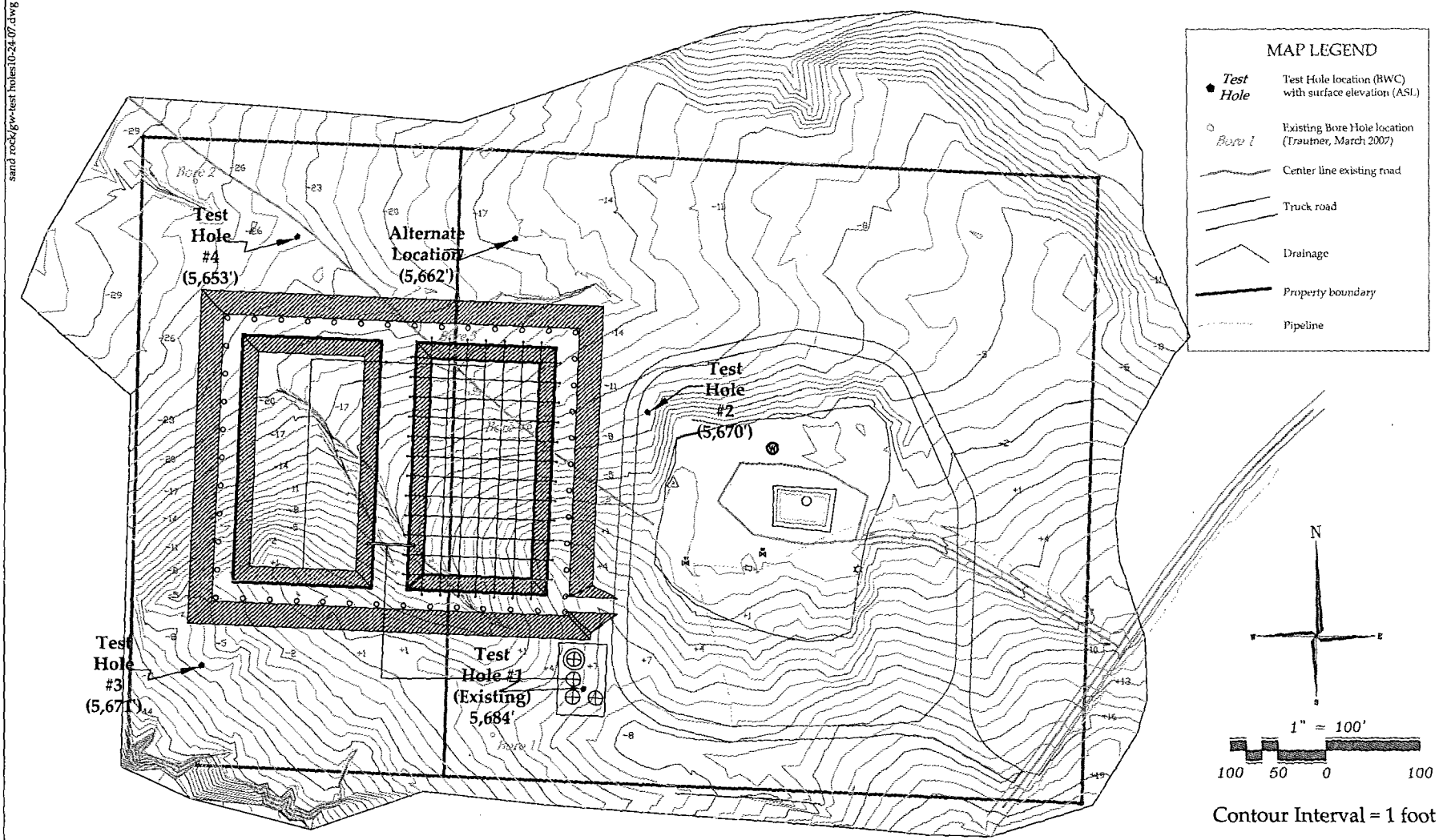
By _____
Wayne Price, Environmental Bureau Chief
Oil Conservation District of New Mexico

Attachments: Figure 1. Sand Rock Location Map: Groundwater Test Hole Locations
Figure 2. Example Log and Proposed Monitoring Hole Completion Detail
Table 1. Proposed Test Hole Depths
Exhibit 1. Bailed Volume per Sample
Exhibit 2. Cumulative Yield: Monitoring Well One

cc: David A. Simpson, MuleShoe Engineering
Billie Maez, Noble Energy
Brad Jones, OCD

P:\Project Files\073-07 Sand Rock\Blue Dot - October\Test Hole and Monitoring Hole Plan 11-13.doc

sand rock/gw-test holes10-24-07.dwg



555 RiverGate Lane, Suite B4-82
Durango, CO 81301
(970) 385-2340 ph (970) 385-2341 fx
www.BikisWater.com

Notes:
1. Date of Plan : October 24, 2007
2. Base mapping provided by Muleshoe Engineering. The "0" reference for contours equals 5,678 ft ASL. The bottom of the proposed design equals 5,664.8 ft ASL.
3. Evaporation pond footprint is proposed location.

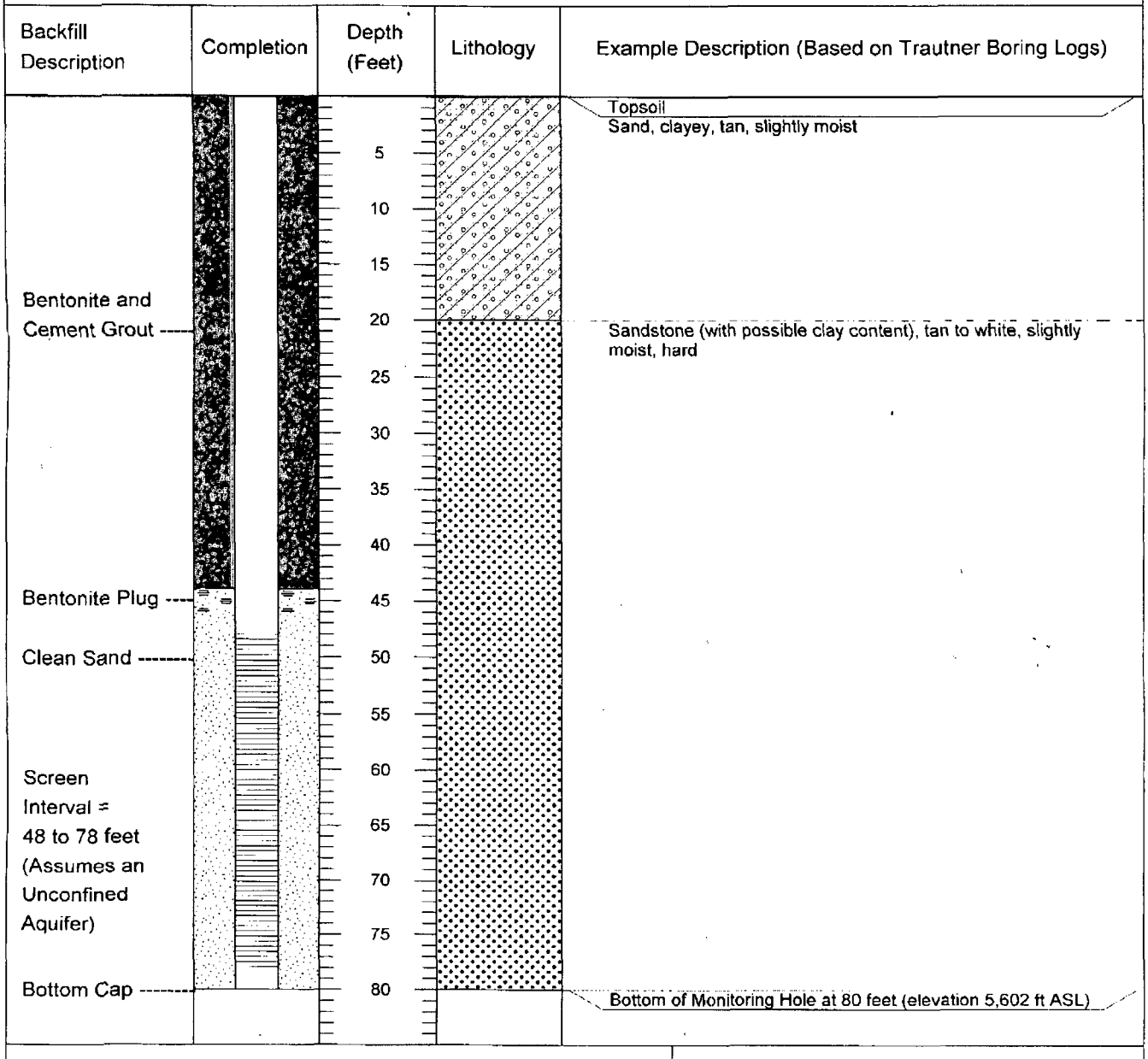
Sand Rock Evaporation Pond Location Map Groundwater Test Hole Locations

FIGURE 1

Figure 2. Example Log and Monitoring Hole Completion Detail

Bikis Water Consultants, LLC

Ground Elevation: 5,682 ft Boring Dia: 4 3/8 inches Total Depth: 80 ft



Completion Notes:

If moist zones are encountered during drilling of Test Hole One, drilling will cease to allow ample time for water to filter through. If moist zones are persistent and appear to be producing water, then a monitoring hole (similar to Figure 2) will be constructed. The total depth proposed in this example conservatively exceeds depths 50 feet below the bottom of the evaporation ponds design.

Site:

Sand Rock Evaporation Pond
(Example Log - Not Yet Constructed)

Project No.: 073-07-01 Date: July 12, 2007

Table 1
Proposed Test Hole Depths
Sand Rock Evaporation Pond

Name	Relative Elevation (ft) (1)	Ground Elevation (ft ASL) (2)	Target Depth (ft ASL) (3)	Approximate Boring Depth (ft) (4)
Test Hole 2	-8	5,670	5,605	65
Test Hole 3	-7	5,671	5,605	66
Test Hole 4	-24	5,653	5,605	48
Alternate Location	-17	5,662	5,605	57

Notes:

1) The relative elevations are based on the "0" reference contour on Figure 1; equals 5,678'

2) Based on mapping provided by MuleShoe Engineering.

3) Target Bore Depth on the site based on minimum of 50 feet below the bottom design elevation of the Sand Rock Evaporation Pond plus 10 feet of buffer. Equals 5,604.8 ft ASL

4) Equals Column (2) - Column (3)

Exhibit 1. Bailed Volume per Sample
Sand Rock Monitor Well 1

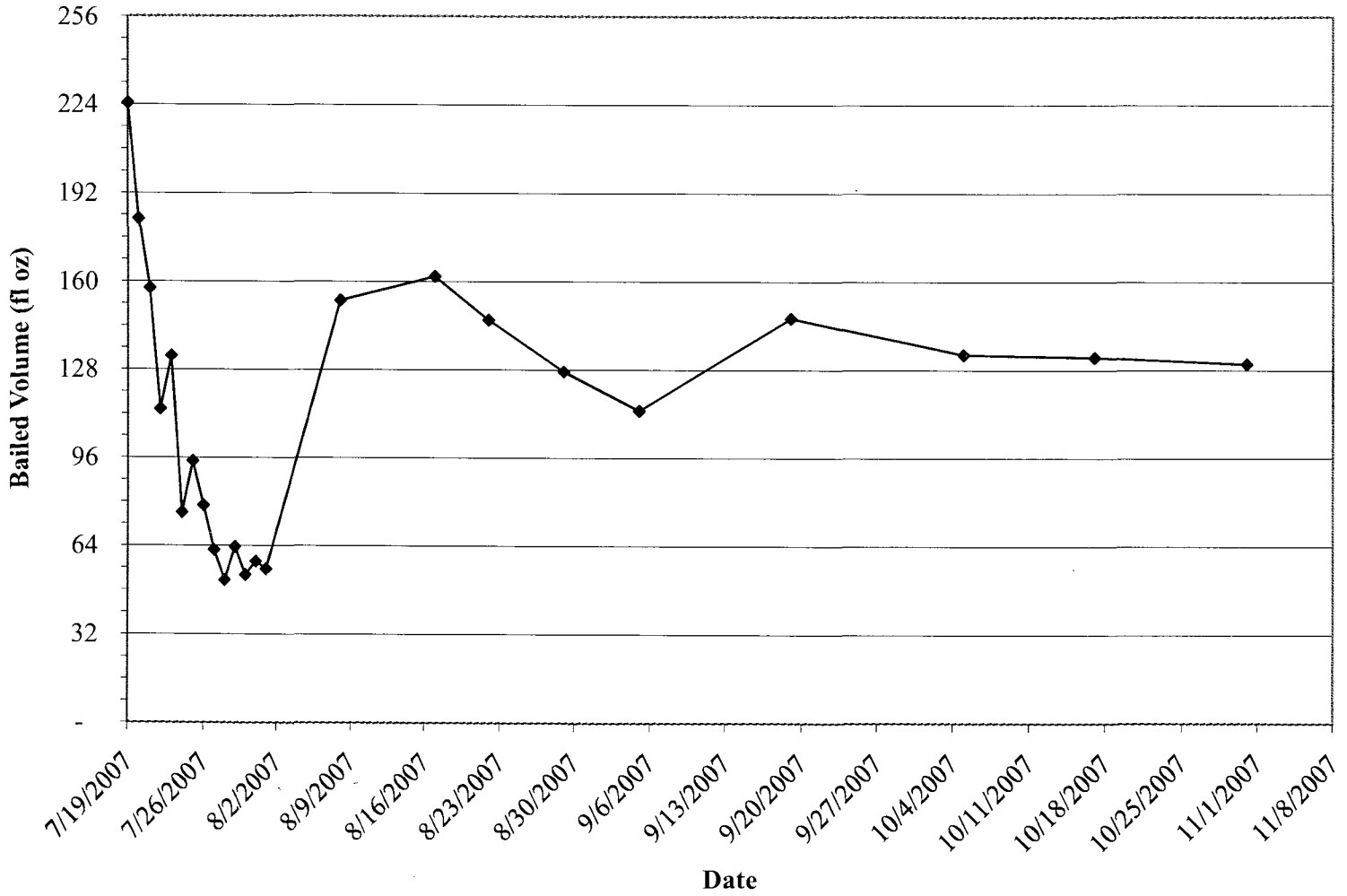
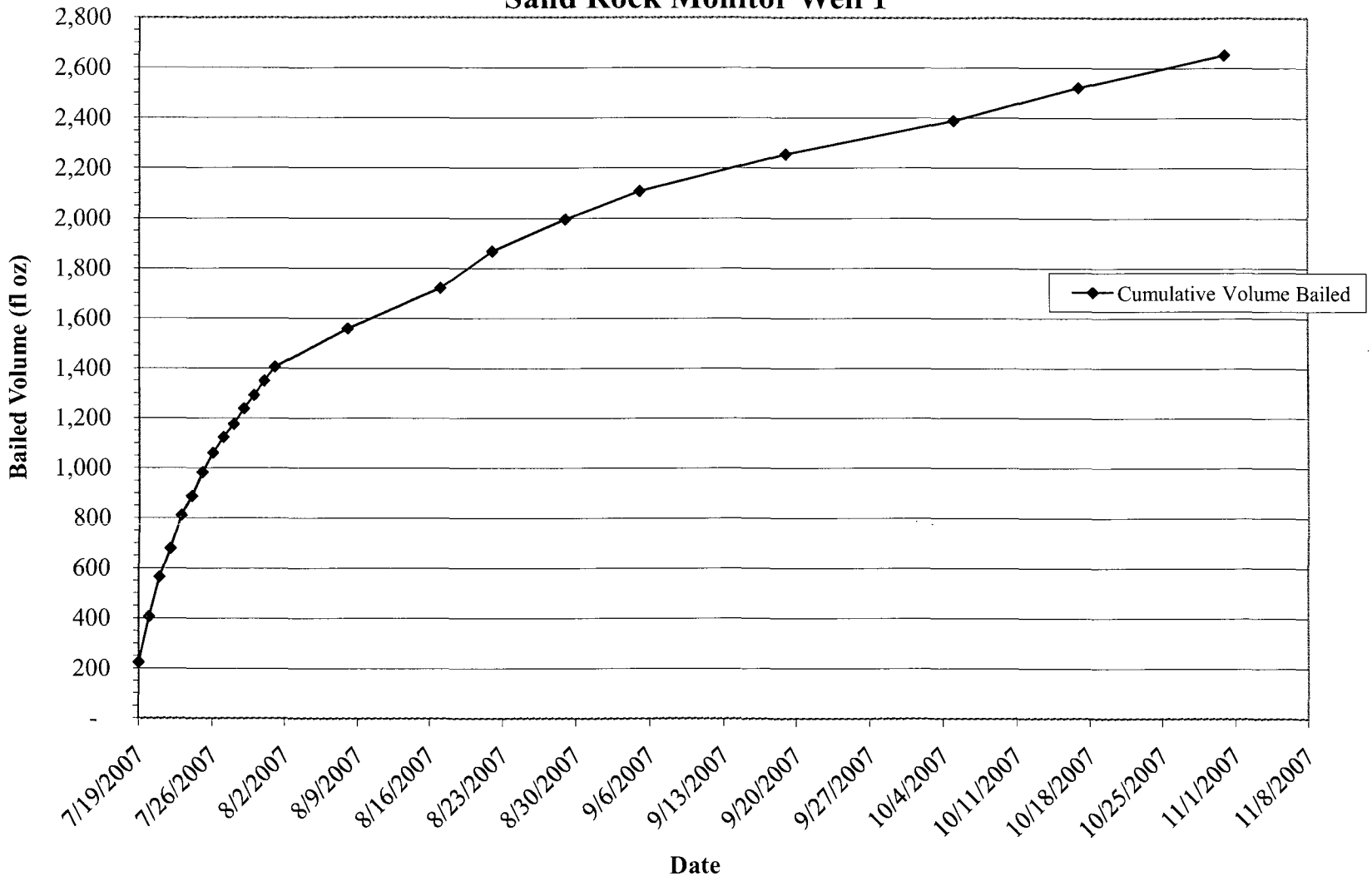


Exhibit 2. Cumulative Yield: Sand Rock Monitor Well 1



Jones, Brad A., EMNRD

From: Ryan Huggins [huggins@bikiswater.com]
Sent: Tuesday, November 13, 2007 8:47 AM
To: Price, Wayne, EMNRD
Cc: bmaez@nobleenergyinc.com; Jones, Brad A., EMNRD
Subject: Sand Rock Test Hole and Monitoring Hole Plan

Gentlemen:
Please find the attached documents detailing the ongoing monitoring and proposed additional bores at the proposed Sand Rock Evaporation Pond.
Thank you for your review

Ryan

Ryan Kathryn Huggins
Bikis Water Consultants, LLC
555 RiverGate Lane, Suite B4-82
Durango, CO 81301
Ph: 970.385.2340
Fax: 970.385.2341
Email: huggins@bikiswater.com

Jones, Brad A., EMNRD

From: Ryan Unterreiner [ryan@bikiswater.com]
Sent: Monday, July 16, 2007 3:32 PM
To: 'Eric A. Bikis'
Cc: Jones, Brad A., EMNRD
Subject: Sand Rock Evaporation Pond Test Hole Drilling
Attachments: Ryan Unterreiner (ryan@bikiswater.com).vcf

There's a little hang-up with the driller so David Simpson has arranged to meet with the driller on Tuesday at 9am in Flora Vista outside of the "Foxtails" Bar. He thought that everyone could rendezvous at Foxtails and head up to the site together.

David Simpson cell number is 505-320-7199.

Eric Bikis cell number is 970-769-0997.

Brad Jones cell number is 505-795-1222.

Brandon Powell cell number is 505-320-0200, OCD District, Aztec, NM (number to reach Brad Jones in case his number does not work)

Ryan Unterreiner
Bikis Water Consultants, LLC
679 East 2nd Avenue, Unit 3
Durango, CO 81301
(970) 385-2340 ph 385-2341 fx
ryan@bikiswater.com

Jones, Brad A., EMNRD

From: Ryan Unterreiner [ryan@bikiswater.com]
Sent: Thursday, July 12, 2007 4:28 PM
To: Jones, Brad A., EMNRD
Cc: 'Eric'
Subject: FW: Drilling Schedule
Attachments: SandRockMap.pdf

Brad,
Please refer to the attached pdf for directions to the site. David Simpson also provides a brief description below. Thanks for you assistance with the Plan.
Safe travels,
Ryan

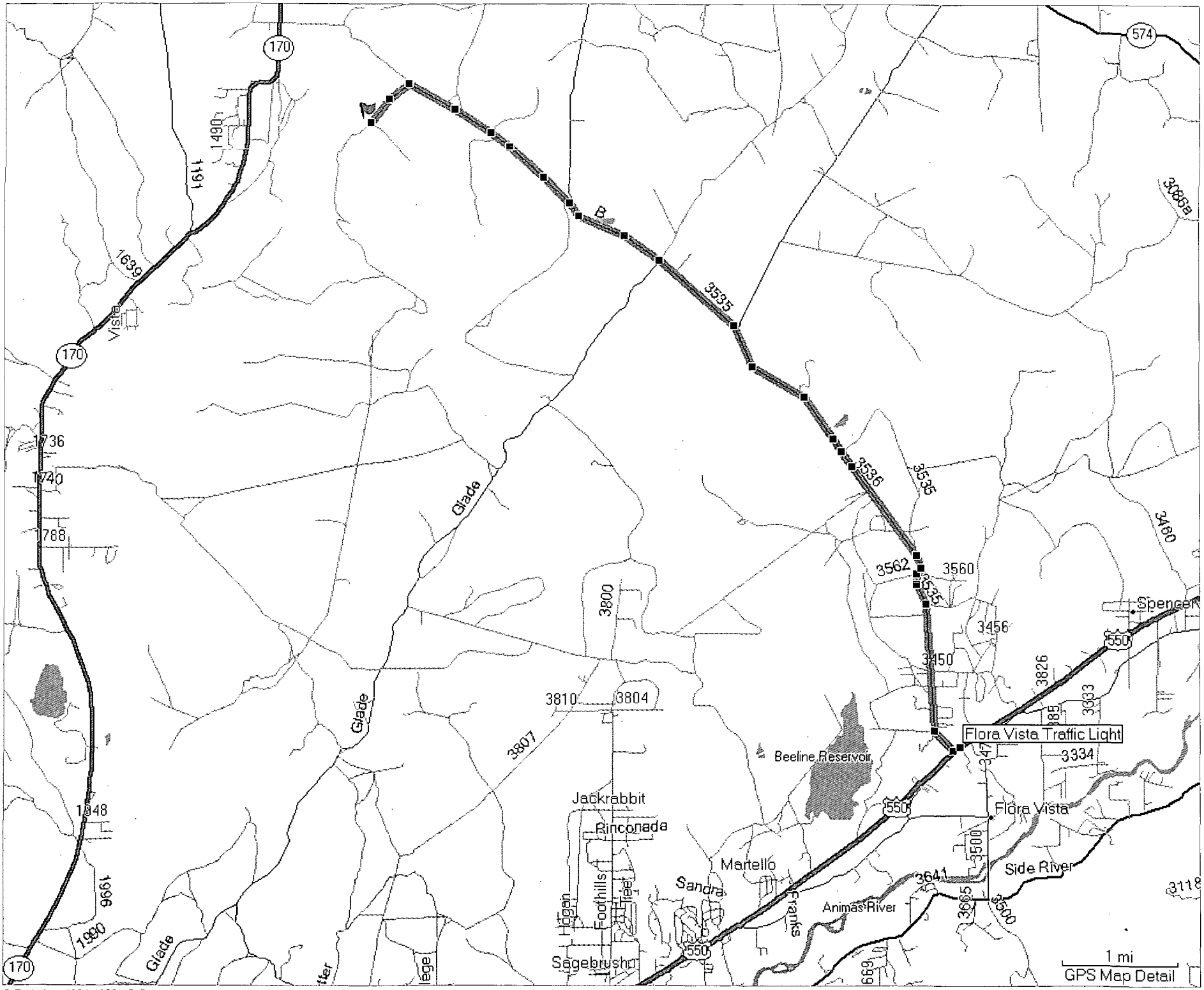
Ryan Unterreiner
Bikis Water Consultants, LLC
679 East 2nd Avenue, Unit 3
Durango, CO 81301
(970) 385-2340 ph 385-2341 fx
ryan@bikiswater.com

From: David A Simpson [mailto:zdas04@muleshoe-eng.com]
Sent: Thursday, July 12, 2007 4:02 PM
To: ryan@bikiswater.com
Subject: RE: Drilling Schedule

A map is attached. It starts at the only traffic light in Flora Vista and goes generally west of north for 8.3 miles. The map shows the road forking very near the site, but the northwest branch of the fork is disused. The road conditions are not great, but any vehicle with adequate ground clearance should have no problem.

The plan is to start rigging up around 8:00.

David A Simpson
zdas04@muleshoe-eng.com
Phone: 505-326-2115
Cell: 505-320-7299
Fax: 505-326-1237
Web site: www.muleshoe-eng.com



Jones, Brad A., EMNRD

From: Jones, Brad A., EMNRD
Sent: Thursday, July 12, 2007 3:46 PM
To: 'ryan@bikiswater.com'; Price, Wayne, EMNRD
Cc: 'David A Simpson'; 'Eric'; bmaez@nobleenergyinc.com
Subject: RE: REVISED - Boring and Monitoring Hole Plan for the Proposed Sand Rock Evaporation Ponds, Patina San Juan, Inc.

The Oil Conservation Division (OCD) has reviewed the attached document and determined that the proposal is adequate to proceed with the site investigation. It should be understood that if a monitoring well is constructed, it shall be bailed until fully developed. Please provide directions and maps to the proposed site and a confirmed start time and date for the drilling activities. The OCD appreciates the efforts of Bikis in resolving the elevation issues regarding the proposed site. If you have any questions regarding this matter, please do not hesitate to contact me.

Brad

Brad A. Jones
Environmental Engineer
Environmental Bureau
NM Oil Conservation Division
1220 S. St. Francis Drive
Santa Fe, New Mexico 87505
E-mail: brad.a.jones@state.nm.us
Office: (505) 476-3487
Fax: (505) 476-3462

From: Ryan Unterreiner [mailto:ryan@bikiswater.com]
Sent: Thursday, July 12, 2007 3:10 PM
To: Price, Wayne, EMNRD
Cc: 'David A Simpson'; 'Eric'; Jones, Brad A., EMNRD; bmaez@nobleenergyinc.com
Subject: REVISED - Boring and Monitoring Hole Plan for the Proposed Sand Rock Evaporation Ponds, Patina San Juan, Inc.

Wayne,
Please find the enclosed REVISED Boring and Monitoring Hole Plan for the subject project. Thanks for your review.

Regards,
Ryan Unterreiner

Ryan Unterreiner
Bikis Water Consultants, LLC
679 East 2nd Avenue, Unit 3
Durango, CO 81301
(970) 385-2340 ph 385-2341 fx
ryan@bikiswater.com

herein. If you have received this message in error, please advise the sender immediately by reply e-mail and delete this message.

Thank you for your cooperation.

Jones, Brad A., EMNRD

From: Ryan Unterreiner [ryan@bikiswater.com]
Sent: Thursday, July 12, 2007 3:10 PM
To: Price, Wayne, EMNRD
Cc: 'David A Simpson'; 'Eric'; Jones, Brad A., EMNRD; bmaez@nobleenergyinc.com
Subject: REVISED - Boring and Monitoring Hole Plan for the Proposed Sand Rock Evaporation Ponds, Patina San Juan, Inc.
Attachments: Test Hole and Monitoring Hole Plan 7-12pckg.pdf

Wayne,
Please find the enclosed REVISED Boring and Monitoring Hole Plan for the subject project. Thanks for your review.

Regards,
Ryan Unterreiner

Ryan Unterreiner
Bikis Water Consultants, LLC
679 East 2nd Avenue, Unit 3
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BIKIS
Water Consultants LLC

E-mail:eric@bikiswater.com

July 12, 2007

E-mail address: wayne.price@state.nm.us

Mr. Wayne Price
Environmental Bureau Chief
Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

Re: Proposed Test Hole Boring and Monitoring Hole Completion Plan

Dear Mr. Price:

As requested, Bikis Water Consultants, LLC (BWC) is providing a boring plan for a groundwater test hole and possible monitoring hole completion design for the proposed Sand Rock Evaporation Pond project (Sand Rock). Sand Rock is operated by Patina San Juan, Inc. and is located in the NE/4, SW/4 of Section 23; Township 31 North, Range 13 West NMPM, San Juan County, New Mexico.

BWC understands that the elevations that have been provided to your office in the original application require immediate clarification. Therefore, BWC reviewed the original survey file from Tom Ellison, a professional licensed surveyor in New Mexico. The findings from this review have resulted in a downward shift in elevations (35 feet) at the site from the "zero" elevation originally indicated by BWC in the June 29, 2007 draft test hole boring and monitoring hole completion plan. The accurate "zero" elevation in Figure 1 is 5,678 feet above sea level (ASL). As a result, the pond design elevations and suggested depth of the proposed test hole were adjusted to reflect actual site elevations. A discussion of these changes is included below. A universal adjustment has been made across the site to reflect the elevations described below.

EVAPORATION POND DESIGN ELEVATIONS

The elevations of the finished pond will be the result of considerable cutting and filling of the current site contours. This discussion aims to clarify the design elevations at the site, as reviewed and approved by the project engineer, Muleshoe Engineering. Please refer to Figure 1 (attached) and Drawings 4 and 8 of the Construction Design Details provided by Muleshoe Engineering in the application for clarification.

- The bottom of the center of both ponds is proposed to be 5,673 ft ASL.
- At the south end the drainage pipe will be in a ditch that is one foot deep, resulting in an elevation of 5,672 ft ASL.

- The leak-detection ditch will slope 2 ft per 100 ft (2%). Therefore, after 200 ft (assuming that the ditch starts and ends 12 ft from the toe of the berm) the ditch will be 4 feet lower for an elevation of 5,668 ft ASL.

- The leak-detection ditch will then turn toward the center for 60 ft, sloping at 2 ft per 100 ft (2%) for an additional drop of 1.2 ft. The resultant elevation is 5,666.8 ft ASL.

- The dry well will be set two ft below the end of the leak-detection pipe for a final elevation of 5,664.8 ft ASL.

To perform an on-site analysis of the hydrogeology and meet the minimum requirements in Paragraph 5 of subsection A of Rule 19.15.36.13 NMAC, the proposed test hole must be drilled a minimum 50 feet below the lowest point in the pond design, which is the dry well. Therefore, the target depth of the proposed test hole is 5,614.8 ft ASL. (Dry Well Elevation 5,664.8 ft ASL less 50 ft equals 5,614.8 ft ASL). A conservative approach to obtain this elevation with certainty is to drill beyond this depth.

BACKGROUND INFORMATION

Based on a June 18, 2007 letter to Mr. Bill Maez of Patina San Juan, Inc. from Mr. Wayne Price, Environmental Bureau Chief for the Oil Conservation Division (OCD) of New Mexico, BWC understands the following:

- Patina San Juan, Inc applied to the OCD for a centralized evaporation surface waste facility permit at Sand Rock on April 6, 2007. After reviewing the permit application, your office indicated that the OCD is considering administratively denying the application. According to your review, insufficient data was provided to characterize the hydrogeology (as outlined in Paragraph 5 of subsection A of 19.15.36.13 NMAC). This regulation requires that "No other surface waste management facility shall be located where groundwater is less than 50 feet below the lowest elevation at which the operator will place oil field waste."

- The enclosed boring plan, submitted for OCD approval, is intended to satisfy the requirements under this regulation. Specifically this plan aims to determine if groundwater is present within 50 feet of the bottom of the evaporation pond design. The proposed location for Test Hole One (TH#1) is adjacent to and upgradient of the proposed evaporation pond. It is believed this location will be effective at evaluating the hydrogeology underneath the proposed evaporation pond. If the hydrogeologic conditions cannot be fully characterized by TH#1, additional borings may be needed.

- Four bore holes were completed by Trautner GeoTech in March 2007 to investigate the hydrogeology of the area. The bore logs, which are summarized as follows, were submitted with the original Sand Rock application. Bore 1 was drilled to a depth of 50 feet at a site south of the evaporation pond. This bore encountered claystone and sandstone formation at a depth of 15 feet. This tan to white material was slightly moist at 15 feet below ground surface. An increase in moisture was reported at a depth of 30 feet. Bore 2, also completed to 50 ft, was drilled to the northeast of the evaporation pond footprint, while bores 3 and 4 (19 ft and 15 ft respectively) were within the footprint. The

sand and clays encountered in Bores 2, 3 and 4 were slightly moist to moist. Bore 2 also encountered a moist clay layer below 26 ft. These bore logs are used as a basis for predicting the subsurface conditions that will be encountered during new test hole drilling.

- The enclosed monitoring hole completion plan, also submitted for OCD for approval, is intended to satisfy your request for design details of the monitoring well. Materials will be on-site during drilling to construct a monitoring hole, if determined to be necessary.

Based on the above background information, BWC has developed a Test Hole Boring Plan and a Monitoring Hole Completion Plan for your review and approval.

TEST HOLE BORING PLAN

The following Test Hole Boring Plan (boring plan) describes methods and procedures for drilling TH#1. This plan was developed in accordance with OCD requirements for assessing hydrogeologic conditions at Sand Rock.

1. Drill a test hole (TH#1) at the location shown on Figure 1 (attached). TH#1 will be drilled by Mo-Te Drilling, Inc., a licensed driller in the state of New Mexico. Mo-Te Drilling, Inc. will utilize an air-rotary drilling technique, as requested by your office. Drilling is scheduled for July 17, 2007.
2. TH#1 will be located adjacent to the proposed evaporation pond. The location of TH#1 was selected for access and because it is in a protected location, as well as to complement the subsurface investigation previously performed by Trautner GeoTech in March 2007.
3. TH#1 will be bored at 4 $^{3/8}$ inches diameter with a 3 inch core. In order to meet or exceed the requirements in the NMAC regulation, TH#1 will be drilled to a depth that is a minimum of 50 feet below the bottom of the proposed evaporation pond design (5,614.8 feet ASL, which takes into account excavation and fill required to construct the pond and the dry well located below the proposed ponds in the leak-detection trench). Therefore, the boring depth at TH#1 (Surface elevation = 5,682 feet ASL) must be a minimum 67.2 feet below ground level. BWC proposes to drill to elevation 5,602 ft ASL, or 80 feet below the proposed surface elevation of TH#1. This total depth will provide 12.8 feet of flexibility (based on the 50 foot depth OCD requirement) in case any adjustments to the design or TH#1 location is needed in the future.
4. During drilling, a professional geologist will be on-site to oversee drilling activities and driller's total depth, collect information, describe the cores from the boring hole and, if necessary, supervise construction of the monitoring hole according to the proposed design (see below). The OCD has been notified of the drilling schedule. BWC understands that a representative from the OCD will be present during drilling.
5. Core samples will be taken ahead of the drill bit in order to obtain a complete undisturbed core after the first 15 feet. It is not feasible to take cores during the first 15 feet of drilling depth; however bag samples of cuttings may be taken. If necessary, a solid steel casing will be used in the hole to prevent caving and facilitate core sampling.
6. If a saturated zone is encountered, the hole will be allowed to remain open to determine the amount of free water available. Drilling may need to cease for an indeterminate

amount of time (including overnight, if necessary) to allow water ample time to filter through saturated zones. This will be done to determine if the water table is limited in supply or whether the zone can yield water in an amount sufficient to be considered groundwater.

a. If no water zones are detected from the core samples or in the test hole, the test hole will be filled and abandoned according to OCD regulations.

b. If water is present in the test hole, the test hole will be completed as described in the following proposed monitoring hole completion plan (Figure 2).

MONITORING HOLE COMPLETION PLAN

Figure 2 (attached) is the proposed monitoring hole completion detail.

1. The test hole will be completed using 0.010-inch factory-slotted 2-inch Schedule 40 PVC casing and screen in potential water bearing zones. The approximate depth of the water bearing zones, if any, will be determined during drilling. The depth of saturated material will determine the amount of screened pipe installed in the borehole. If a confined condition is observed in the test hole, the water zone will be screened so that groundwater does not interface with other geologic units. If the test hole indicates unconfined conditions, the slotted screen interval will extend approximately 5 feet above the estimated water depth. The additional screen interval will allow for fluctuations in the water table.
2. The annular space from 2 feet below the bottom of the screen to 2 feet above the top of the screen will be filled with clean, silica sand filter pack to allow hydraulic connection through the screen of any water bearing zones.
3. A minimum 2-foot bentonite seal will be used above the sand pack.
4. The annular space above the bentonite seal will be filled with a bentonite-cement grout (2% to 8% bentonite by weight) to the ground surface and allowed to cure for at least 24 hours before installing a surface pad.
5. The top of the casing will be protected with a cap. The exposed casing will be protected by a locking shroud.
6. A 2-foot minimum radius, 4-inch minimum thickness concrete pad will be poured around the shroud. The concrete and surrounding soil shall be sloped to direct rainfall and runoff away from the shroud.

Upon completion, the monitoring hole will be bailed and observed to determine if groundwater is present in the monitoring hole. Groundwater is defined by the OCD as "...interstitial water which occurs in saturated earth material and which is capable of entering a well in sufficient amounts to be utilized as a water supply." If a perched condition is observed in the monitoring hole, it will be bailed dry. If recharge is observed in the monitoring hole after it is bailed, then groundwater likely is present and additional study may be needed.

Additional test holes will determine if the free water present in TH#1 is laterally continuous and constitutes a viable water bearing unit, or if it the groundwater present in TH#1 is due to an isolated, perched water unit.

HEALTH AND SAFETY

Drilling will be conducted by Mo-Te Drilling, Inc., who will implement their safety plan throughout the process. Before work commences, there will be an on-site safety briefing. At a minimum, all persons on site will be required to wear safety glasses, hard hats and steel toed boots for safety.

Any unsafe work conditions identified by field crew team members will be immediately reported to the drilling crew supervisor and the project team staff member. All drilling activities will be suspended if unsafe work conditions are identified. Potential unsafe conditions may include weather related conditions or equipment related conditions. Any suspension of work activities due to unsafe work conditions will be reported to Patina San Juan, Inc. staff as soon as possible after cessation of drilling activities.

The boring plan and monitoring hole completion plan was prepared to address Paragraph 5 of subsection A of Rule 19.15.36.13 NMAC. If you find this methodology acceptable, please so indicate by signing on the approval line below.

Sincerely,

Bikis Water Consultants, LLC

By _____
Eric Bikis, P.G.
Project Manager

Approved,

OCD Environmental Bureau

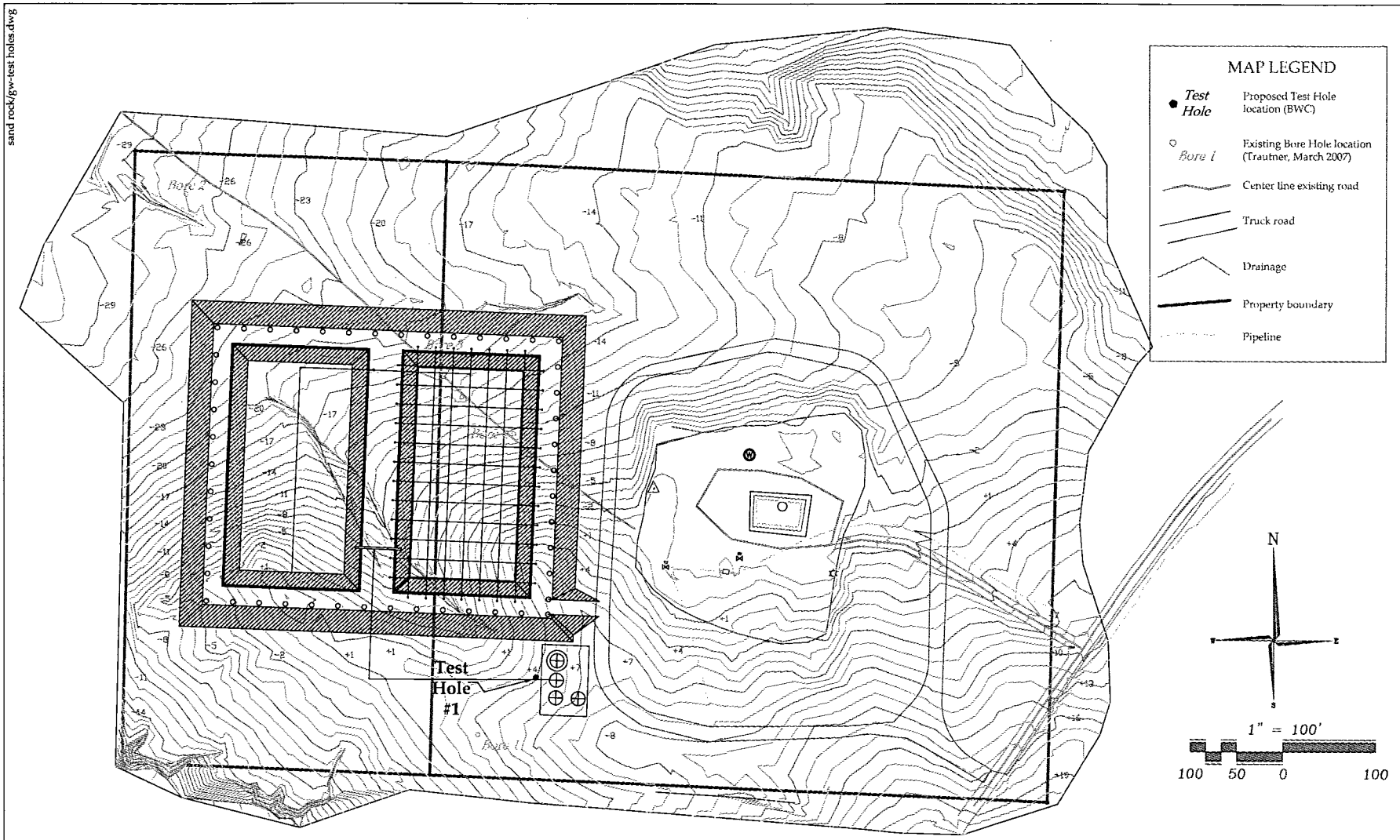
By _____
Wayne Price, Environmental Bureau Chief
Oil Conservation District of New Mexico

Attachments: Figure 1. Sand Rock Location Map: Groundwater Test Hole 1
Figure 2. Example Log and Proposed Monitoring Hole Completion Detail

cc: David A. Simpson, MuleShoe Engineering
Bill Maez, Patina San Juan, Inc
Brad Jones, OCD

P:\Project Files\073-07 Sand Rock\Blue Dot\Test Hole and Monitoring Hole Plan 7-12.doc

sand rock/gw-test holes.dwg



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Durango, CO 81301
(970) 385-2340 ph (970) 385-2341 fx
www.BikisWater.com

Notes:
1. Date of Plan : July 12, 2007
2. Base mapping provided by Muleshoe Engineering. The "0" reference for contours equals 5,678 ft ASL. The bottom of the proposed design equals 5,664.8 ft ASL.
3. Groundwater test hole # 1 proposed by BWC. Approximate elevation equals 5,682 ft ASL.
4. Bores 1 through 4 by Trautner Geotech. Bore 1 = 5,682 ft ASL. Bore 2 = 5,651 ft ASL. Bore 3 = 5,660 ft ASL. Bore 4 = 5,668 ft ASL.

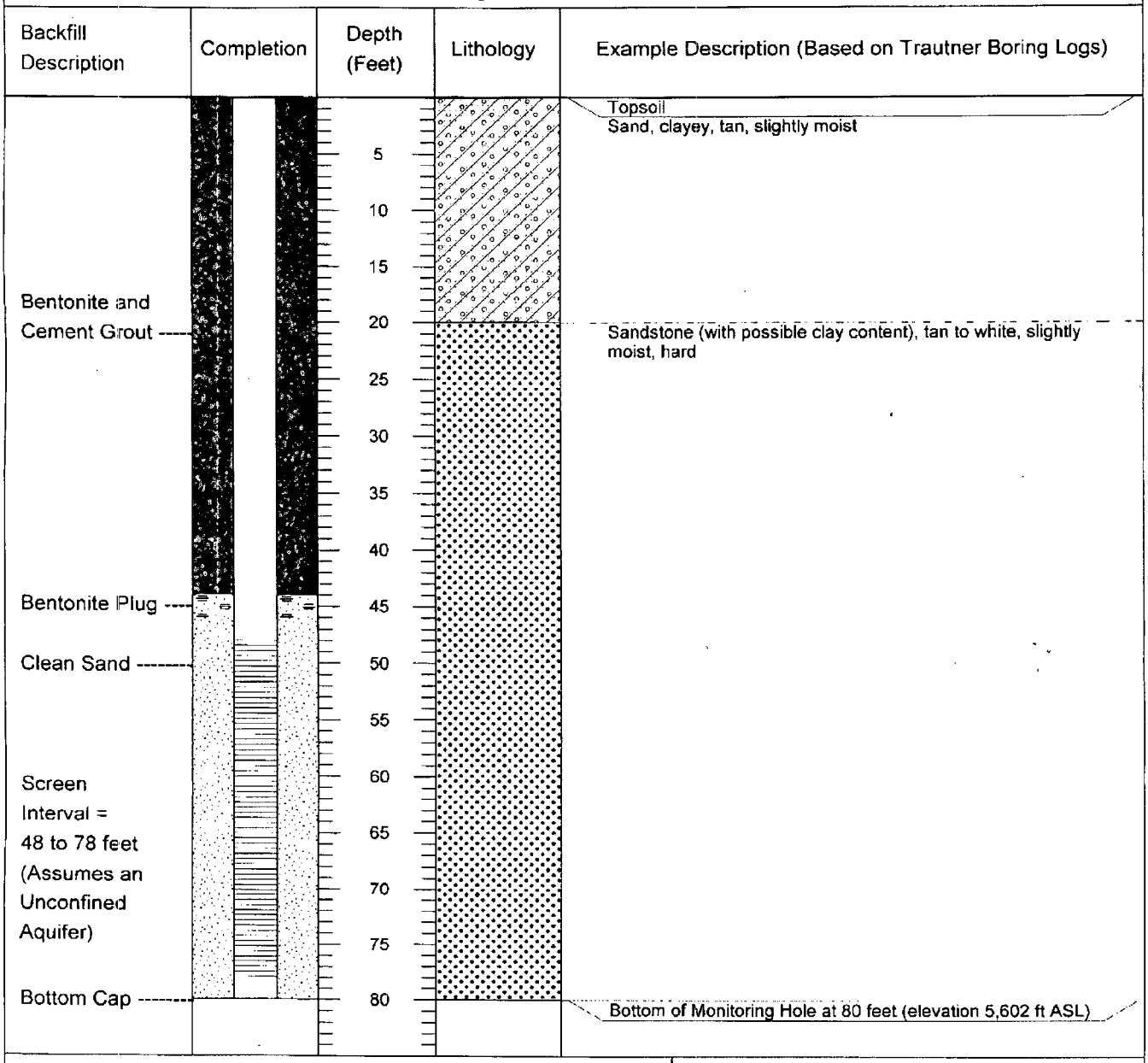
Sand Rock Location Map
Groundwater Test Hole 1

FIGURE 1

Figure 2. Example Log and Monitoring Hole Completion Detail

Bikis Water Consultants, LLC

Ground Elevation: 5,682 ft Boring Dia: 4 3/8 inches Total Depth: 80 ft



Completion Notes:

If moist zones are encountered during drilling of Test Hole One, drilling will cease to allow ample time for water to filter through. If moist zones are persistent and appear to be producing water, then a monitoring hole (similar to Figure 2) will be constructed. The total depth proposed in this example conservatively exceeds depths 50 feet below the bottom of the evaporation ponds design.

Site:

Sand Rock Evaporation Pond
(Example Log - Not Yet Constructed)

Project No.: 073-07-01 Date: July 12, 2007

Jones, Brad A., EMNRD

From: Ryan Unterreiner [ryan@bikiswater.com]
Sent: Thursday, July 12, 2007 1:47 PM
To: Price, Wayne, EMNRD
Cc: 'David A Simpson'; 'Eric'; Jones, Brad A., EMNRD; bmaez@nobleenergyinc.com
Subject: Boring and Monitoring Hole Plan for the Proposed Sand Rock Evaporation Ponds, Patina San Juan, Inc.
Attachments: Ryan Unterreiner (ryan@bikiswater.com).vcf; Test Hole and Monitoring Hole Plan 7-12pckg.pdf

Wayne,
Attached is the boring and monitoring hole plan proposed by BWC to characterize the hydrogeology at the proposed Sand Rock Evaporation Ponds operated by Patina San Juan, Inc. The boring and monitoring hole plan is offered in support of the application for the construction of the Surface Waste Facility known as the Sand Rock Evaporation Pond. If you have any questions about the plan please do not hesitate to call me or Eric Bikis, P.G. at the number below.
Regards,
Ryan Unterreiner

Ryan Unterreiner
Bikis Water Consultants, LLC
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Durango, CO 81301
(970) 385-2340 ph 385-2341 fx
ryan@bikiswater.com

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www.bikiswaterconsultants.com

BIKIS
Water Consultants LLC

E-mail:eric@bikiswater.com

July 12, 2007

E-mail address: wayne.price@state.nm.us

Mr. Wayne Price
Environmental Bureau Chief
Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

Re: Proposed Test Hole Boring and Monitoring Hole Completion Plan

Dear Mr. Price:

As requested, Bikis Water Consultants, LLC (BWC) is providing a boring plan for a groundwater test hole and possible monitoring hole completion design for the proposed Sand Rock Evaporation Pond project (Sand Rock). Sand Rock is operated by Patina San Juan, Inc. and is located in the NE/4, SW/4 of Section 23, Township 31 North, Range 13 West NMPM, San Juan County, New Mexico.

BWC understands that the elevations that have been provided to your office in the original application require immediate clarification. Therefore, BWC reviewed the original survey file from Tom Ellison, a professional licensed surveyor in New Mexico. The findings from this review have resulted in a downward shift in elevations (35 feet) at the site from the "zero" elevation originally indicated by BWC in the June 29, 2007 draft test hole boring and monitoring hole completion plan. The accurate "zero" elevation in Figure 1 is 5,678 feet above sea level (ASL). As a result, the pond design elevations and suggested depth of the proposed test hole were adjusted to reflect actual site elevations. A discussion of these changes is included below. A universal adjustment has been made across the site to reflect the elevations described below.

EVAPORATION POND DESIGN ELEVATIONS

The elevations of the finished pond will be the result of considerable cutting and filling of the current site contours. This discussion aims to clarify the design elevations at the site, as reviewed and approved by the project engineer, Muleshoe Engineering. Please refer to Figure 1 (attached) and Drawings 4 and 8 of the Construction Design Details provided by Muleshoe Engineering in the application for clarification.

- The bottom of the center of both ponds is proposed to be 5,673 ft ASL.
- At the south end the drainage pipe will be in a ditch that is one foot deep, resulting in an elevation of 5,672 ft ASL.

- The leak-detection ditch will slope 2 ft per 100 ft (2%). Therefore, after 200 ft (assuming that the ditch starts and ends 12 ft from the toe of the berm) the ditch will be 4 feet lower for an elevation of 5,668 ft ASL.

- The leak-detection ditch will then turn toward the center for 60 ft, sloping at 2 ft per 100 ft (2%) for an additional drop of 1.2 ft. The resultant elevation is 5,666.8 ft ASL.

- The dry well will be set two ft below the end of the leak-detection pipe for a final elevation of 5,664.8 ft ASL.

To perform an on-site analysis of the hydrogeology and meet the minimum requirements in Paragraph 5 of subsection A of Rule 19.15.36.13 NMAC, the proposed test hole must be drilled a minimum 50 feet below the lowest point in the pond design, which is the dry well. Therefore, the target depth of the proposed test hole is 5,614.8 ft ASL. (Dry Well Elevation 5,664.8 ft ASL less 50 ft equals 5,614.8 ft ASL). A conservative approach to obtain this elevation with certainty is to drill beyond this depth.

BACKGROUND INFORMATION

Based on a June 18, 2007 letter to Mr. Bill Maez of Patina San Juan, Inc. from Mr. Wayne Price, Environmental Bureau Chief for the Oil Conservation Division (OCD) of New Mexico, BWC understands the following:

- Patina San Juan, Inc applied to the OCD for a centralized evaporation surface waste facility permit at Sand Rock on April 6, 2007. After reviewing the permit application, your office indicated that the OCD is considering administratively denying the application. According to your review, insufficient data was provided to characterize the hydrogeology (as outlined in Paragraph 5 of subsection A of 19.15.36.13 NMAC). This regulation requires that "No other surface waste management facility shall be located where groundwater is less than 50 feet below the lowest elevation at which the operator will place oil field waste."

- The enclosed boring plan, submitted for OCD approval, is intended to satisfy the requirements under this regulation. Specifically this plan aims to determine if groundwater is present within 50 feet of the bottom of the evaporation pond design. The proposed location for Test Hole One (TH#1) is adjacent to and upgradient of the proposed evaporation pond. It is believed this location will be effective at evaluating the hydrogeology underneath the proposed evaporation pond. If the hydrogeologic conditions cannot be fully characterized by TH#1, additional borings may be needed.

- Four bore holes were completed by Trautner GeoTech in March 2007 to investigate the hydrogeology of the area. The bore logs, which are summarized as follows, were submitted with the original Sand Rock application. Bore 1 was drilled to a depth of 50 feet at a site south of the evaporation pond. This bore encountered claystone and sandstone formation at a depth of 15 feet. This tan to white material was slightly moist at 15 feet below ground surface. An increase in moisture was reported at a depth of 30 feet. Bore 2, also completed to 50 ft, was drilled to the northeast of the evaporation pond footprint, while bores 3 and 4 (19 ft and 15 ft respectively) were within the footprint. The

sand and clays encountered in Bores 2, 3 and 4 were slightly moist to moist. Bore 2 also encountered a moist clay layer below 26 ft. These bore logs are used as a basis for predicting the subsurface conditions that will be encountered during new test hole drilling.

- The enclosed monitoring hole completion plan, also submitted for OCD for approval, is intended to satisfy your request for design details of the monitoring well. Materials will be on-site during drilling to construct a monitoring hole, if determined to be necessary.

Based on the above background information, BWC has developed a Test Hole Boring Plan and a Monitoring Hole Completion Plan for your review and approval.

TEST HOLE BORING PLAN

The following Test Hole Boring Plan (boring plan) describes methods and procedures for drilling TH#1. This plan was developed in accordance with OCD requirements for assessing hydrogeologic conditions at Sand Rock.

1. Drill a test hole (TH#1) at the location shown on Figure 1 (attached). TH#1 will be drilled by Mo-Te Drilling, Inc., a licensed driller in the state of New Mexico. Mo-Te Drilling, Inc. will utilize an air-rotary drilling technique, as requested by your office. Drilling is scheduled for July 17, 2007.
2. TH#1 will be located adjacent to the proposed evaporation pond. The location of TH#1 was selected for access and because it is in a protected location, as well as to complement the subsurface investigation previously performed by Trautner GeoTech in March 2007.
3. TH#1 will be bored at 4 $^{3/8}$ inches diameter with a 3 inch core. In order to meet or exceed the requirements in the NMAC regulation, TH#1 will be drilled to a depth that is a minimum of 50 feet below the bottom of the proposed evaporation pond design (5,614.8 feet ASL, which takes into account excavation and fill required to construct the pond and the dry well located below the proposed ponds in the leak-detection trench). Therefore, the boring depth at TH#1 (Surface elevation = 5,682 feet ASL) must be a minimum 67.2 feet below ground level. BWC proposes to drill to elevation 5,602 ft ASL, or 80 feet below the proposed surface elevation of TH#1. This total depth will provide 12.8 feet of flexibility (based on the 50 foot depth OCD requirement) in case any adjustments to the design or TH#1 location is needed in the future.
4. During drilling, a professional geologist will be on-site to oversee drilling activities and driller's total depth, collect information, describe the cores from the boring hole and, if necessary, supervise construction of the monitoring hole according to the proposed design (see below). The OCD has been notified of the drilling schedule. BWC understands that a representative from the OCD will be present during drilling.
5. Core samples will be taken ahead of the drill bit in order to obtain a complete undisturbed core after the first 15 feet. It is not feasible to take cores during the first 15 feet of drilling depth; however bag samples of cuttings may be taken. If necessary, a solid steel casing will be used in the hole to prevent caving and facilitate core sampling.
6. If a saturated zone is encountered, the hole will be allowed to remain open to determine the amount of free water available. This will be done to determine if the water table is

limited in supply or whether the zone can yield water in an amount sufficient to be used as a water supply.

a. If no water zones are detected from the core samples or in the test hole, the test hole will be filled and abandoned according to OCD regulations.

b. If water is present in the test hole, the test hole will be completed as described in the following proposed monitoring hole completion plan (Figure 2).

MONITORING HOLE COMPLETION PLAN

Figure 2 (attached) is the proposed monitoring hole completion detail.

1. The test hole will be completed using 0.010-inch factory-slotted 2-inch Schedule 40 PVC casing and screen in potential water bearing zones. The approximate depth of the water bearing zones, if any, will be determined during drilling. The depth of saturated material will determine the amount of screened pipe installed in the borehole. If a confined condition is observed in the test hole, the water zone will be screened so that groundwater does not interface with other geologic units. If the test hole indicates unconfined conditions, the slotted screen interval will extend approximately 5 feet above the estimated water depth. The additional screen interval will allow for fluctuations in the water table.
2. The annular space from 2 feet below the bottom of the screen to 2 feet above the top of the screen will be filled with clean, silica sand filter pack to allow hydraulic connection through the screen of any water bearing zones.
3. The annular space immediately above the sand filter pack will be sealed with bentonite at a minimum of 2 feet above the sand pack.
4. The annular space above the bentonite seal will be filled with a bentonite-cement grout (2% to 8% bentonite by weight) to the ground surface and allowed to cure for at least 24 hours before installing a surface pad.
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6. A 2-foot minimum radius, 4-inch minimum thickness concrete pad will be poured around the shroud. The concrete and surrounding soil shall be sloped to direct rainfall and runoff away from the shroud.

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Any unsafe work conditions identified by field crew team members will be immediately reported to the drilling crew supervisor and the project team staff member. All drilling activities will be suspended if unsafe work conditions are identified. Potential unsafe conditions may include weather related conditions or equipment related conditions. Any suspension of work activities due to unsafe work conditions will be reported to Patina San Juan, Inc. staff as soon as possible after cessation of drilling activities.

The boring plan and monitoring hole completion plan was prepared to address Paragraph 5 of subsection A of Rule 19.15.36.13 NMAC. If you find this methodology acceptable, please so indicate by signing on the approval line below.

Sincerely,

Bikis Water Consultants, LLC

By _____
Eric Bikis, P.G.
Project Manager

Approved,

OCD Environmental Bureau

By _____
Wayne Price, Environmental Bureau Chief
Oil Conservation District of New Mexico

Attachments: Figure 1. Sand Rock Location Map: Groundwater Test Hole 1
Figure 2. Example Log and Proposed Monitoring Hole Completion Detail

cc: David A. Simpson, MuleShoe Engineering
Bill Maez, Patina San Juan, Inc
Brad Jones, OCD

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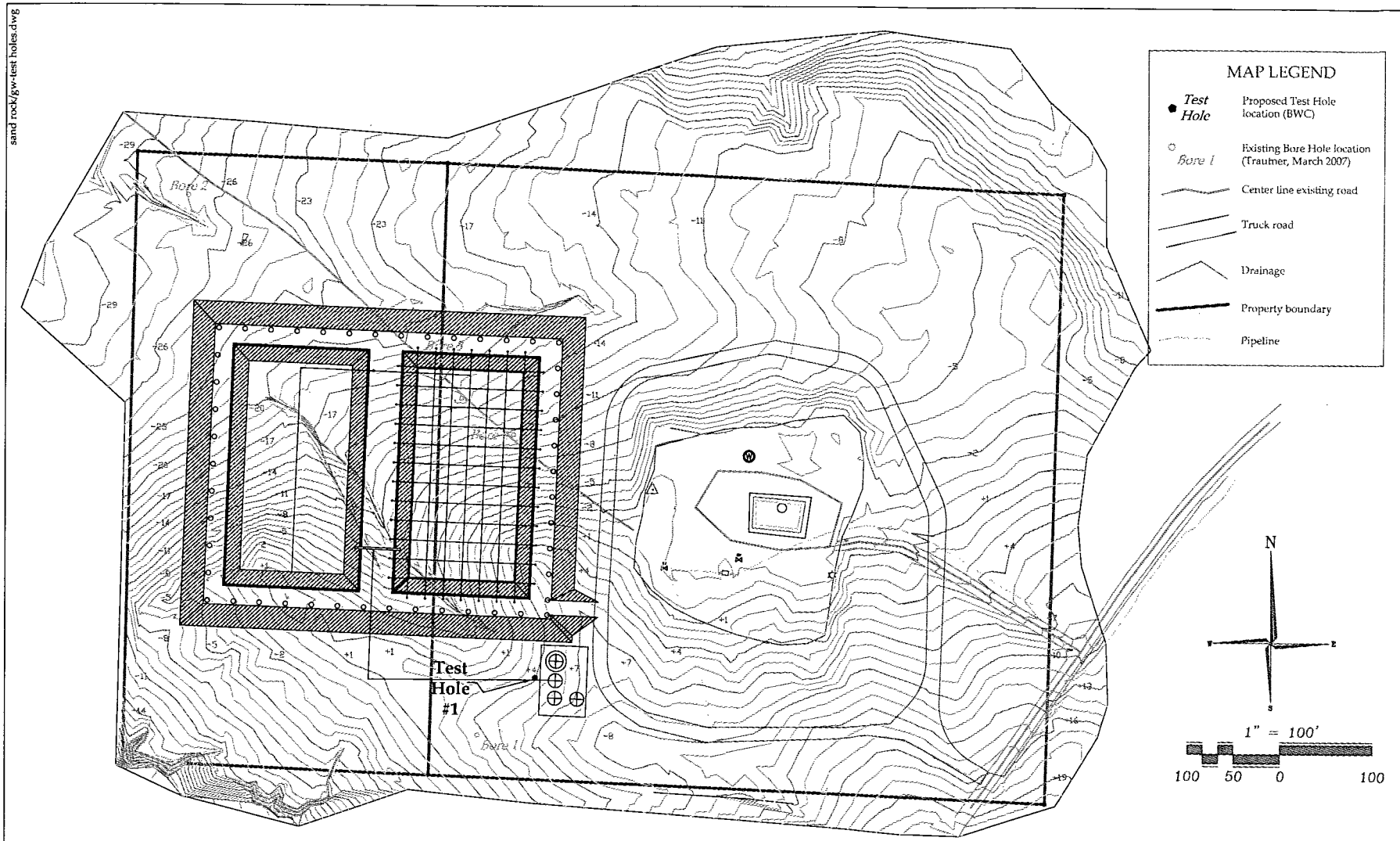
sand rock/gw-test holes.dwg



BIKIS Water Consultants LLC

679 East 2nd. Ave., Unit 3
Durango, CO 81301
(970) 385-2340 ph (970) 385-2341 fx
www.BikisWater.com

Notes:
1. Date of Plan : July 12, 2007
2. Base mapping provided by Muleshoe Engineering. The "0" reference for contours equals 5,678 ft ASL. The bottom of the proposed design equals 5,664.8 ft ASL.
3. Groundwater test hole # 1 proposed by BWC. Approximate elevation equals 5,682 ft ASL.
4. Bores 1 through 4 by Trautner Geotech. Bore 1 = 5,682 ft ASL. Bore 2 = 5,651 ft ASL. Bore 3 = 5,660 ft ASL. Bore 4 = 5,668 ft ASL.

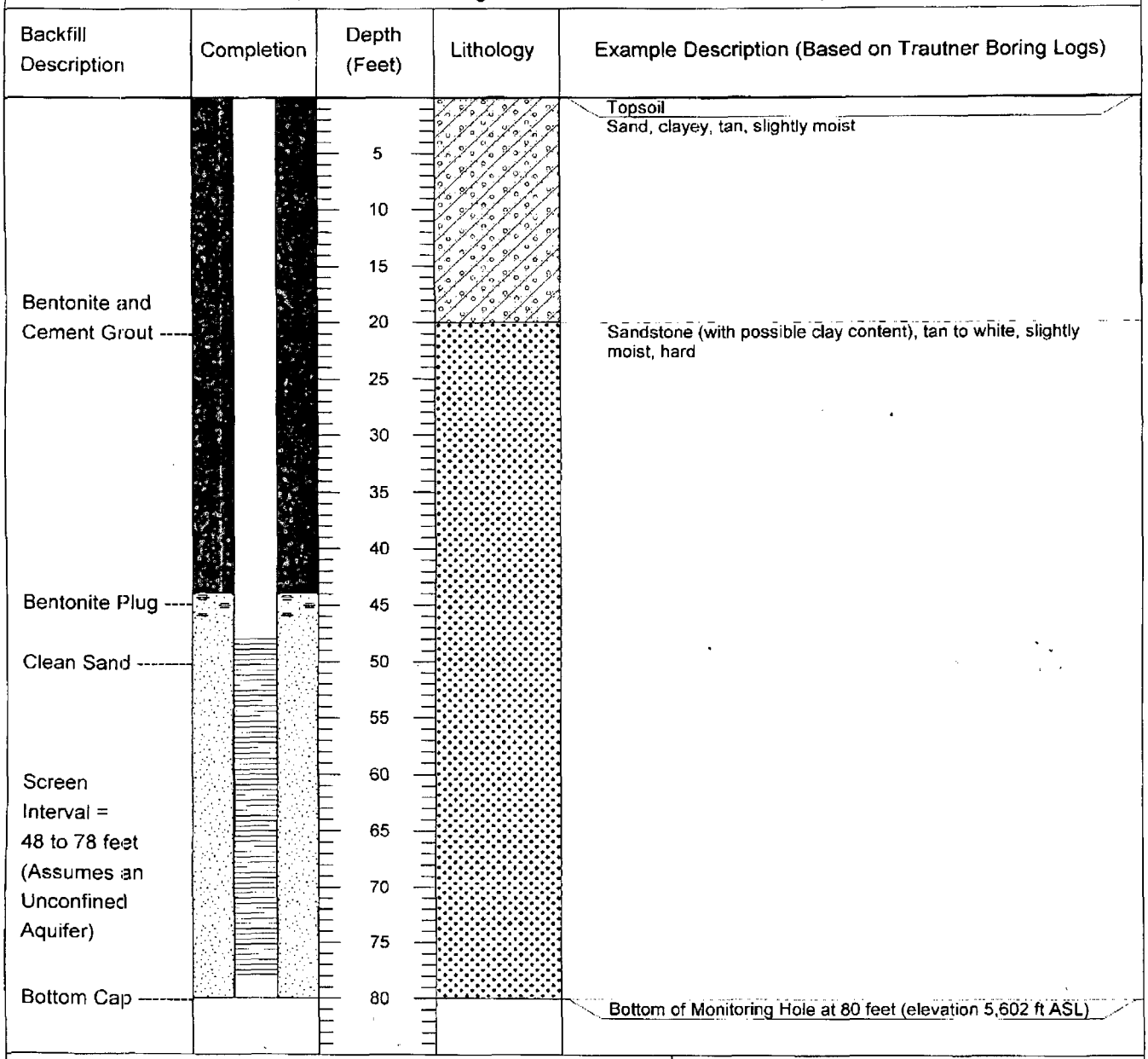
Sand Rock Location Map
Groundwater Test Hole 1

FIGURE 1

Figure 2. Example Log and Monitoring Hole Completion Detail

Bikis Water Consultants, LLC

Ground Elevation: 5,682 ft Boring Dia: 4 3/8 inches Total Depth: 80 ft



Completion Notes:

If moist zones are encountered during drilling of Test Hole One, drilling will cease to allow ample time for water to filter through. If moist zones are persistent and appear to be producing water, then a monitoring hole (similar to Figure 2) will be constructed. The total depth proposed in this example conservatively exceeds depths 50 feet below the bottom of the evaporation ponds design.

Site:

Sand Rock Evaporation Pond
(Example Log - Not Yet Constructed)

Project No.: 073-07-01 Date: July 7, 2007

Jones, Brad A., EMNRD

From: Ryan Unterreiner [ryan@bikiswater.com]
Sent: Monday, July 02, 2007 12:04 PM
To: ryan@bikiswater.com; Price, Wayne, EMNRD
Cc: David A. Simpson; Jones, Brad A., EMNRD; 'Eric Bikis'
Subject: Revision to Figure 1 for Sand Rock Evaporation Pond (Application)
Attachments: Ryan Unterreiner (ryan@bikiswater.com).vcf; Test Hole and Monitoring Hole Plan package 6-29.pdf

Wayne,
You must forgive me, but the previous plan contained an older draft map (Figure 1) that showed a (proposed) test hole location that was not practical for the facility. Please refer to the attached map (Figure 1) for the correct (proposed) location. Figure 1 is no longer in draft form in this package. Again, I apologize for the inconvenience. If you have any questions or comments on the plan please give me a call.
Regards,

Ryan Unterreiner
Bikis Water Consultants, LLC
679 East 2nd Avenue, Unit 3
Durango, CO 81301
(970) 385-2340 ph 385-2341 fx
ryan@bikiswater.com

From: Ryan Unterreiner [mailto:ryan@bikiswater.com]
Sent: Friday, June 29, 2007 2:36 PM
To: 'wayne.price@state.nm.us'
Cc: David A. Simpson (zdas04@muleshoe-eng.com); 'brad.a.jones@state.nm.us'; 'Eric Bikis'
Subject: Permit Application (Supplement) for Proposed Sand Rock Evaporation Pond - Patina San Juan, Inc.

Hi Wayne,
Attached are plans to drill a test hole and possible monitoring hole to characterize the hydrogeology below the proposed Sand Rock Evaporation Pond. These plans were prepared to address Paragraph (5) of Subsection A of 19.15.36.13 NMAC. Please review at your earliest convenience so that we may coordinate with the driller to perform the work. If you have any questions or comments regarding these plans do not hesitate to reach me or Eric Bikis, P.G. at the number below.
Regards,
Ryan

Ryan Unterreiner
Bikis Water Consultants, LLC
679 East 2nd Avenue, Unit 3
Durango, CO 81301
(970) 385-2340 ph 385-2341 fx
ryan@bikiswater.com

message.

Thank you for your cooperation.

---

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Fax: 970.385.2341
www.bikiswaterconsultants.com

BIKIS
Water Consultants LLC

E-mail:eric@bikiswater.com

June 29, 2007

E-mail address: wayne.price@state.nm.us

Mr. Wayne Price
Environmental Bureau Chief
Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

Re: Proposed Test Hole Boring and Monitoring Hole Completion Plan

Dear Mr. Price:

As requested, Bikis Water Consultants, LLC (BWC) is providing a proposed boring plan for a groundwater test hole and possible monitoring hole completion design for the proposed Sand Rock Evaporation Pond project (Sand Rock). Sand Rock is operated by Patina San Juan, Inc. and is located in the NE/4, SW/4 of Section 23, Township 31 North, Range 13 West NMPM, San Juan County, New Mexico.

BACKGROUND INFORMATION

Based on a June 18, 2007 letter to Mr. Bill Maez of Patina San Juan, Inc. from Mr. Wayne Price, Environmental Bureau Chief for the Oil Conservation Division (OCD) of New Mexico, BWC understands the following:

- Patina San Juan, Inc applied to the OCD for a centralized evaporation surface waste facility permit at Sand Rock on April 6, 2007. After reviewing the permit application, your office indicated that the OCD is considering administratively denying the application. According to your review, insufficient data was provided to characterize the hydrogeology (as outlined in Paragraph 5 of subsection A of 19.15.36.13 NMAC). This regulation requires that "No other surface waste management facility shall be located where groundwater is less than 50 feet below the lowest elevation at which the operator will place oil field waste."

- The enclosed boring plan, submitted for OCD approval, is intended to satisfy the requirements under this regulation. Specifically this plan aims to determine if groundwater is present within 50 feet of the proposed evaporation pond. The proposed location for Test Hole One (TH#1) is adjacent to and upgradient of the evaporation pond. It is believed this site will be effective at further evaluating the hydrogeology underneath the proposed evaporation pond. If the hydrogeologic conditions cannot be characterized by TH#1, additional borings may be needed.

- Four bore holes were completed by Trautner GeoTech in March 2007 to investigate the hydrogeology of the area. The bore logs, which are summarized as follows, were submitted with the original Sand Rock application. Bore 1 was drilled to a depth of 50 feet at a site south of the evaporation pond. This bore encountered claystone and sandstone formation at a depth of 15 feet. This tan to white material was slightly moist at 15 feet below ground surface. An increase in moisture was reported at a depth of 30 feet. Bore 2, also completed to 50 ft, was drilled to the northeast of the evaporation pond footprint, while bores 3 and 4 (19 ft and 15 ft respectively) were within the footprint. The sand and clays encountered in Bores 2, 3 and 4 were slightly moist to moist. Bore 2 also encountered a moist clay layer below 26 ft. These bore logs are used as a basis for predicting the subsurface conditions that will be encountered during new test hole drilling.

- The enclosed monitoring hole completion plan, also submitted for OCD for approval, is intended to satisfy your request for design details of the monitoring well. If free water is found to be present in TH#1 within 24 hours, it will be completed as a monitoring hole as described in this plan.

Based on the above background information, BWC has developed a Test Hole Boring Plan and a Monitoring Hole Completion Plan for your review and approval.

TEST HOLE BORING PLAN

The following Test Hole Boring Plan (boring plan) describes methods and procedures for drilling TH#1. This plan was developed in accordance with OCD requirements for assessing hydrogeologic conditions at Sand Rock.

1. Drill a test hole (TH#1) at the location shown on Figure 1 (attached). TH#1 will be drilled by Mo-Te Drilling, Inc., a licensed driller in the state of New Mexico. Mo-Te Drilling, Inc. will utilize an air-rotary drilling technique, as requested by your office.
2. TH#1 will be located adjacent to the proposed evaporation pond. The location of TH#1 was selected due to access and its somewhat protected location, as well as to complement the subsurface investigation previously performed by Trautner GeoTech in March 2007.
3. TH#1 will be bored at 4 $^{3/8}$ inches diameter with a 3 inch core. In order to meet or exceed the requirements in the NMAC regulation, TH#1 will be drilled to a depth that is a minimum of 50 feet below the bottom elevation of the proposed evaporation pond (5,708 feet asl, which takes into account excavation required to construct the pond). Therefore, the boring depth at TH#1 (Elevation = 5,715 feet asl) will be a minimum 57 feet below ground level. This total depth will likely provide adequate data to determine the presence or absence of groundwater below the pond.
4. During drilling, a professional geologist will be on-site to oversee drilling activities and driller's total depth, collect information, describe the cores from the boring hole and, if necessary, supervise construction of the monitoring hole according to the proposed design (see below). The OCD will be given at least 14 days notice prior to the commencement of drilling to allow an OCD representative to be present during drilling.
5. Core samples will be taken ahead of the drill bit in order to obtain a complete undisturbed core after the first 15 feet. It is not feasible to take cores during the first 15 feet of drilling

depth; however bag samples of cuttings may be taken. If necessary, a solid steel casing will be used in the hole to prevent caving and facilitate core sampling.

6. Intervals of the core sample that contain moisture will be tested for the presence of free water by leaving the bore hole open for at least 24 hours.
    a. If no water zones are detected from the core samples or in the test hole, the test hole will be filled and abandoned according to OCD regulations.
    b. If water is present in the test hole after 24 hours, the test hole will be completed as described in the following proposed monitoring hole completion plan.

MONITORING HOLE COMPLETION PLAN

The monitoring hole construction will adhere to the minimum guidelines set forth by the New Mexico Environment Department for drilled monitoring wells. Figure 2 (attached) is the proposed well construction detail.

- The test hole will be completed using 20 millimeter factory-slotted 2 inch Schedule 40 PVC screen and casing in potential water bearing zones. The approximate depth of the water bearing zones, if any, will be determined during drilling. The depth of saturated material will determine the amount of screened pipe installed in the borehole. Based on the observed saturated zone interval, the slotted screen interval will extend approximately 5 feet above the estimated water depth. The additional screen interval will allow for fluctuations in the water table.
- The annular space from 2 feet below the bottom of the screen to 2 feet above the top of the screen will be filled with clean, silica sand filter pack to allow hydraulic connection through the screen of any water bearing zones.
- The annular space immediately above the sand filter pack will be sealed with grout or hydrated bentonite pellets a minimum 2 feet above the sand pack.
- The annular space above the bentonite/cement seal will be filled with uncontaminated drill cuttings, clean sandy clay or fine grained soil to within 10 feet of the ground surface. The remaining 10 feet will be sealed with a bentonite-cement grout seal (2% to 8% bentonite by weight) and allowed to cure for at least 24 hours before installing a surface pad.
- The top of the casing will be protected with a cap. The exposed casing will be protected by a locking shroud.
- A 2-foot minimum radius, 4-inch minimum thickness concrete pad shall be poured around the shroud. The concrete and surrounding soil shall be sloped to direct rainfall and runoff away from the shroud.

Upon completion, the monitoring hole will be bailed and observed for another 24 hour period in order to determine if groundwater is present in the monitoring hole. Groundwater is defined by the OCD as "...interstitial water which occurs in saturated earth material and which is capable of entering a well in sufficient amounts to be utilized as a water supply."

If the monitoring hole indicates potential water zones, then additional test holes will be bored. Further test holes will determine if the free water present in TH#1 is laterally continuous and constitutes a viable water bearing unit, or if it the groundwater present in TH#1 is due to an isolated, perched water unit.

HEALTH AND SAFETY

Drilling will be conducted by Mo-Te Drilling, Inc., who will implement their safety plan throughout the process. Before work commences, there will be an on-site safety briefing. At a minimum, all persons on site will be required to wear safety glasses, hard hats and steel toed boots for safety.

Any unsafe work conditions identified by field crew team members will be immediately reported to the drilling crew supervisor and the project team staff member. All drilling activities will be suspended if unsafe work conditions are identified. Potential unsafe conditions may include weather related conditions or equipment related conditions. Any suspension of work activities due to unsafe work conditions will be reported to Patina San Juan, Inc. staff as soon as possible after cessation of drilling activities.

The boring plan and monitoring hole completion plan was prepared to address Paragraph 5 of subsection A of Rule 19.15.36.13 NMAC. If you find this methodology acceptable, please so indicate by signing on the approval line below.

Sincerely,

Bikis Water Consultants, LLC

By _____
Eric Bikis, P.G.
Project Manager

Approved,

OCD Environmental Bureau

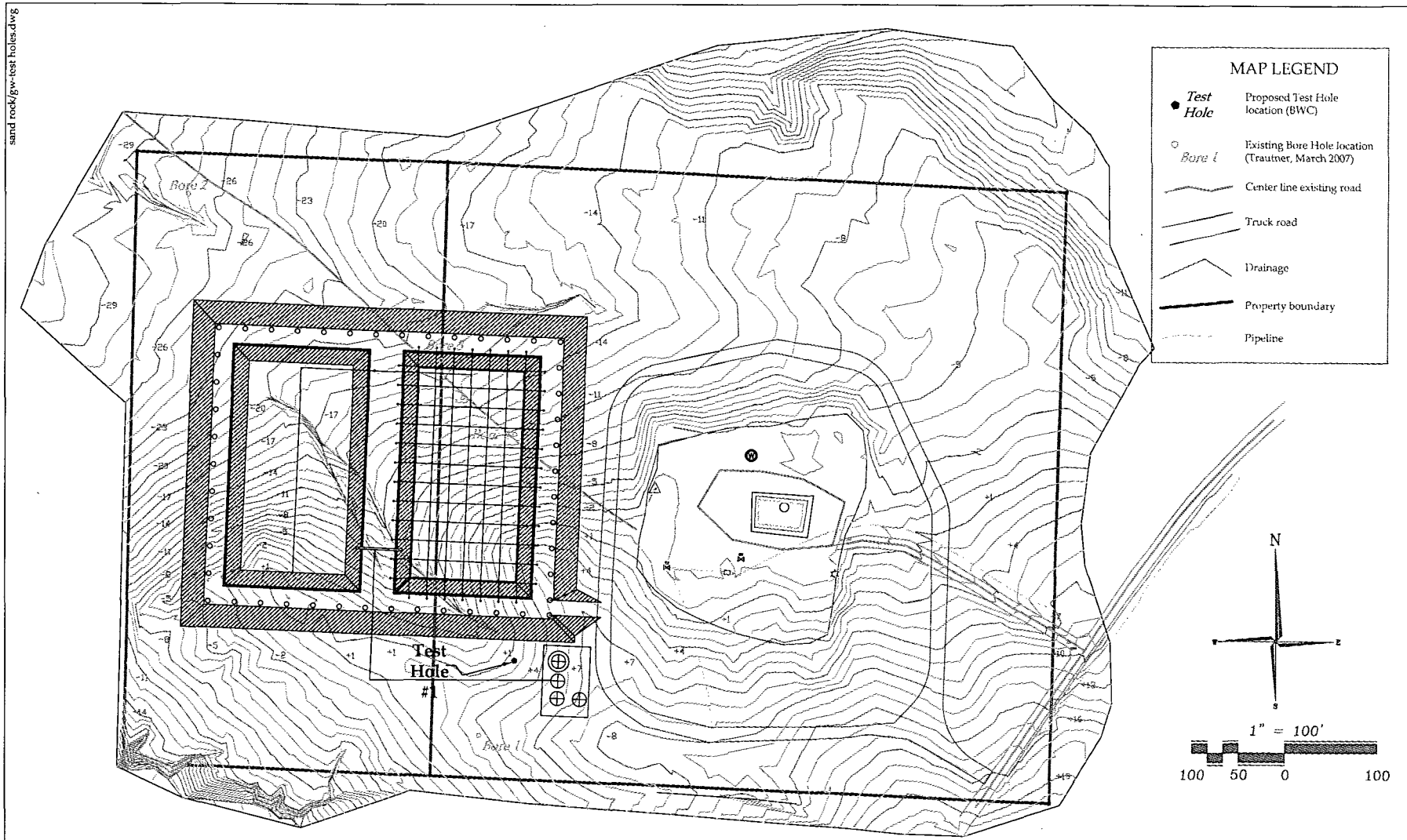
By _____
Wayne Price, Environmental Bureau Chief
Oil Conservation District of New Mexico

Attachments: Figure 1. Sand Rock Location Map: Groundwater Test Hole 1
Figure 2. Typical Log and Proposed Monitoring Hole Completion Plan

cc: David A. Simpson, MuleShoe Engineering
Bill Maez, Patina San Juan, Inc

P:\Project Files\073-07 Sand Rock\Test Hole and Monitoring Hole Plan 6-27.doc

sand rock/gw-test holes.dwg



BIKIS Water Consultants LLC

679 East 2nd. Ave., Unit 3
Durango, CO 81301
(970) 385-2340 ph (970) 385-2341 fx
www.BikisWater.com

Notes:
1. Date of Plan : June 28, 2007 (DRAFT)
2. Base mapping provided by Muleshoe Engineering. The "0" reference for contours equals 5,713 ft ASL. The proposed pond bottom equals 5,708 ft ASL.
3. Groundwater test hole # 1 by BWC. Approximate elevation equals 5,715 ft ASL.
4. Bores 1 through 4 by Trautner Geotech. Bore 1 = 5,717 ft ASL. Bore 2 = 5,686 ft ASL. Bore 3 = 5,696 ft ASL. Bore 4 = 5,702 ft ASL.

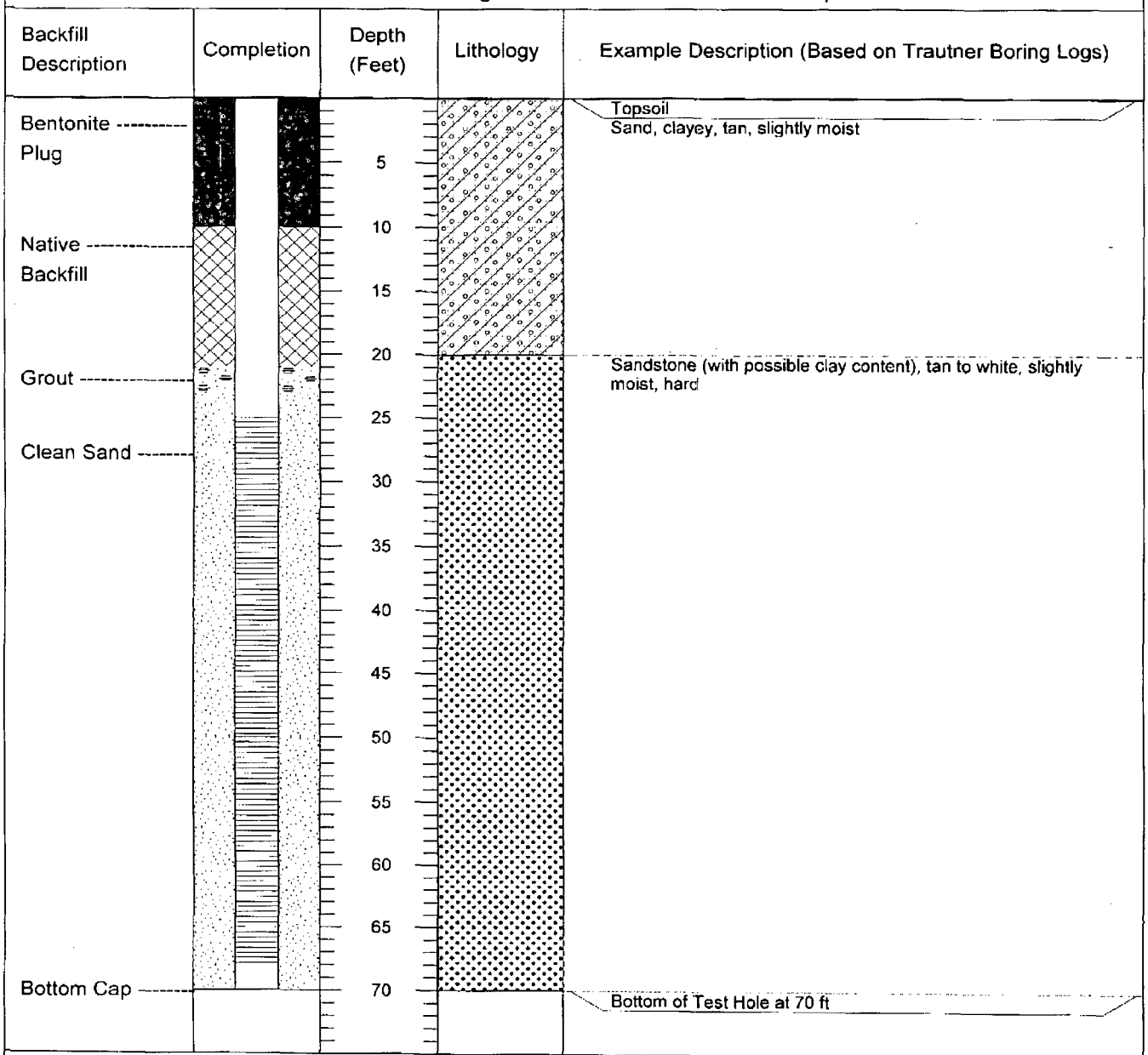
Sand Rock Location Map
Groundwater Test Hole 1

FIGURE 1

Figure 2. Typical Log and Monitoring Hole Completion Detail

Bikis Water Consultants, LLC

Ground Elevation: 5,719 ft Boring Dia: 4 3/8 inches Total Depth: 70 ft



Completion Notes:

If free water is present in Test Hole One after a 24 hour observation period, it will be completed according to this detail. Following completion, free water encountered in the monitoring hole will be bailed. After bailing, another 24 hour observation period will be allowed in order to determine if there is a consistent source of free water in the bore hole.

Site:

Sand Rock Evaporation Pond

Project No.: 073-07-01

Jones, Brad A., EMNRD

From: Ryan Unterreiner [ryan@bikiswater.com]
Sent: Friday, June 29, 2007 2:36 PM
To: Price, Wayne, EMNRD
Cc: David A. Simpson; Jones, Brad A., EMNRD; 'Eric Bikis'
Subject: Permit Application (Supplement) for Proposed Sand Rock Evaporation Pond - Patina San Juan, Inc.
Attachments: Ryan Unterreiner (ryan@bikiswater.com).vcf; Test Hole and Monitoring Hole Plan package 6-29.pdf

Hi Wayne,
Attached are plans to drill a test hole and possible monitoring hole to characterize the hydrogeology below the proposed Sand Rock Evaporation Pond. These plans were prepared to address Paragraph (5) of Subsection A of 19.15.36.13 NMAC. Please review at your earliest convenience so that we may coordinate with the driller to perform the work. If you have any questions or comments regarding these plans do not hesitate to reach me or Eric Bikis, P.G. at the number below.
Regards,
Ryan

Ryan Unterreiner
Bikis Water Consultants, LLC
679 East 2nd Avenue, Unit 3
Durango, CO 81301
(970) 385-2340 ph 385-2341 fx
ryan@bikiswater.com

679 East 2nd Avenue, Suite 3
Durango, Colorado 81301
Phone: 970.385.2340
Fax: 970.385.2341
www.bikiswaterconsultants.com

BIKIS
Water Consultants LLC

E-mail:eric@bikiswater.com

June 29, 2007

E-mail address: wayne.price@state.nm.us

Mr. Wayne Price
Environmental Bureau Chief
Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

Re: Proposed Test Hole Boring and Monitoring Hole Completion Plan

Dear Mr. Price:

As requested, Bikis Water Consultants, LLC (BWC) is providing a proposed boring plan for a groundwater test hole and possible monitoring hole completion design for the proposed Sand Rock Evaporation Pond project (Sand Rock). Sand Rock is operated by Patina San Juan, Inc. and is located in the NE/4, SW/4 of Section 23, Township 31 North, Range 13 West NMPM, San Juan County, New Mexico.

BACKGROUND INFORMATION

Based on a June 18, 2007 letter to Mr. Bill Maez of Patina San Juan, Inc. from Mr. Wayne Price, Environmental Bureau Chief for the Oil Conservation Division (OCD) of New Mexico, BWC understands the following:

- Patina San Juan, Inc applied to the OCD for a centralized evaporation surface waste facility permit at Sand Rock on April 6, 2007. After reviewing the permit application, your office indicated that the OCD is considering administratively denying the application. According to your review, insufficient data was provided to characterize the hydrogeology (as outlined in Paragraph 5 of subsection A of 19.15.36.13 NMAC). This regulation requires that "No other surface waste management facility shall be located where groundwater is less than 50 feet below the lowest elevation at which the operator will place oil field waste."

- The enclosed boring plan, submitted for OCD approval, is intended to satisfy the requirements under this regulation. Specifically this plan aims to determine if groundwater is present within 50 feet of the proposed evaporation pond. The proposed location for Test Hole One (TH#1) is adjacent to and upgradient of the evaporation pond. It is believed this site will be effective at further evaluating the hydrogeology underneath the proposed evaporation pond. If the hydrogeologic conditions cannot be characterized by TH#1, additional borings may be needed.

- Four bore holes were completed by Trautner GeoTech in March 2007 to investigate the hydrogeology of the area. The bore logs, which are summarized as follows, were submitted with the original Sand Rock application. Bore 1 was drilled to a depth of 50 feet at a site south of the evaporation pond. This bore encountered claystone and sandstone formation at a depth of 15 feet. This tan to white material was slightly moist at 15 feet below ground surface. An increase in moisture was reported at a depth of 30 feet. Bore 2, also completed to 50 ft, was drilled to the northeast of the evaporation pond footprint, while bores 3 and 4 (19 ft and 15 ft respectively) were within the footprint. The sand and clays encountered in Bores 2, 3 and 4 were slightly moist to moist. Bore 2 also encountered a moist clay layer below 26 ft. These bore logs are used as a basis for predicting the subsurface conditions that will be encountered during new test hole drilling.

- The enclosed monitoring hole completion plan, also submitted for OCD for approval, is intended to satisfy your request for design details of the monitoring well. If free water is found to be present in TH#1 within 24 hours, it will be completed as a monitoring hole as described in this plan.

Based on the above background information, BWC has developed a Test Hole Boring Plan and a Monitoring Hole Completion Plan for your review and approval.

TEST HOLE BORING PLAN

The following Test Hole Boring Plan (boring plan) describes methods and procedures for drilling TH#1. This plan was developed in accordance with OCD requirements for assessing hydrogeologic conditions at Sand Rock.

1. Drill a test hole (TH#1) at the location shown on Figure 1 (attached). TH#1 will be drilled by Mo-Te Drilling, Inc., a licensed driller in the state of New Mexico. Mo-Te Drilling, Inc. will utilize an air-rotary drilling technique, as requested by your office.
2. TH#1 will be located adjacent to the proposed evaporation pond. The location of TH#1 was selected due to access and its somewhat protected location, as well as to complement the subsurface investigation previously performed by Trautner GeoTech in March 2007.
3. TH#1 will be bored at 4 $^{3/8}$ inches diameter with a 3 inch core. In order to meet or exceed the requirements in the NMAC regulation, TH#1 will be drilled to a depth that is a minimum of 50 feet below the bottom elevation of the proposed evaporation pond (5,708 feet asl, which takes into account excavation required to construct the pond). Therefore, the boring depth at TH#1 (Elevation = 5,715 feet asl) will be a minimum 57 feet below ground level. This total depth will likely provide adequate data to determine the presence or absence of groundwater below the pond.
4. During drilling, a professional geologist will be on-site to oversee drilling activities and driller's total depth, collect information, describe the cores from the boring hole and, if necessary, supervise construction of the monitoring hole according to the proposed design (see below). The OCD will be given at least 14 days notice prior to the commencement of drilling to allow an OCD representative to be present during drilling.
5. Core samples will be taken ahead of the drill bit in order to obtain a complete undisturbed core after the first 15 feet. It is not feasible to take cores during the first 15 feet of drilling

depth; however bag samples of cuttings may be taken. If necessary, a solid steel casing will be used in the hole to prevent caving and facilitate core sampling.

6. Intervals of the core sample that contain moisture will be tested for the presence of free water by leaving the bore hole open for at least 24 hours.
    a. If no water zones are detected from the core samples or in the test hole, the test hole will be filled and abandoned according to OCD regulations.
    b. If water is present in the test hole after 24 hours, the test hole will be completed as described in the following proposed monitoring hole completion plan.

MONITORING HOLE COMPLETION PLAN

The monitoring hole construction will adhere to the minimum guidelines set forth by the New Mexico Environment Department for drilled monitoring wells. Figure 2 (attached) is the proposed well construction detail.

- The test hole will be completed using 20 millimeter factory-slotted 2 inch Schedule 40 PVC screen and casing in potential water bearing zones. The approximate depth of the water bearing zones, if any, will be determined during drilling. The depth of saturated material will determine the amount of screened pipe installed in the borehole. Based on the observed saturated zone interval, the slotted screen interval will extend approximately 5 feet above the estimated water depth. The additional screen interval will allow for fluctuations in the water table.
- The annular space from 2 feet below the bottom of the screen to 2 feet above the top of the screen will be filled with clean, silica sand filter pack to allow hydraulic connection through the screen of any water bearing zones.
- The annular space immediately above the sand filter pack will be sealed with grout or hydrated bentonite pellets a minimum 2 feet above the sand pack.
- The annular space above the bentonite/cement seal will be filled with uncontaminated drill cuttings, clean sandy clay or fine grained soil to within 10 feet of the ground surface. The remaining 10 feet will be sealed with a bentonite-cement grout seal (2% to 8% bentonite by weight) and allowed to cure for at least 24 hours before installing a surface pad.
- The top of the casing will be protected with a cap. The exposed casing will be protected by a locking shroud.
- A 2-foot minimum radius, 4-inch minimum thickness concrete pad shall be poured around the shroud. The concrete and surrounding soil shall be sloped to direct rainfall and runoff away from the shroud.

Upon completion, the monitoring hole will be bailed and observed for another 24 hour period in order to determine if groundwater is present in the monitoring hole. Groundwater is defined by the OCD as "...interstitial water which occurs in saturated earth material and which is capable of entering a well in sufficient amounts to be utilized as a water supply."

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HEALTH AND SAFETY

Drilling will be conducted by Mo-Te Drilling, Inc., who will implement their safety plan throughout the process. Before work commences, there will be an on-site safety briefing. At a minimum, all persons on site will be required to wear safety glasses, hard hats and steel toed boots for safety.

Any unsafe work conditions identified by field crew team members will be immediately reported to the drilling crew supervisor and the project team staff member. All drilling activities will be suspended if unsafe work conditions are identified. Potential unsafe conditions may include weather related conditions or equipment related conditions. Any suspension of work activities due to unsafe work conditions will be reported to Patina San Juan, Inc. staff as soon as possible after cessation of drilling activities.

The boring plan and monitoring hole completion plan was prepared to address Paragraph 5 of subsection A of Rule 19.15.36.13 NMAC. *If you find this methodology acceptable, please so* indicate by signing on the approval line below.

Sincerely,

Bikis Water Consultants, LLC

By _____
Eric Bikis, P.G.
Project Manager

Approved,

OCD Environmental Bureau

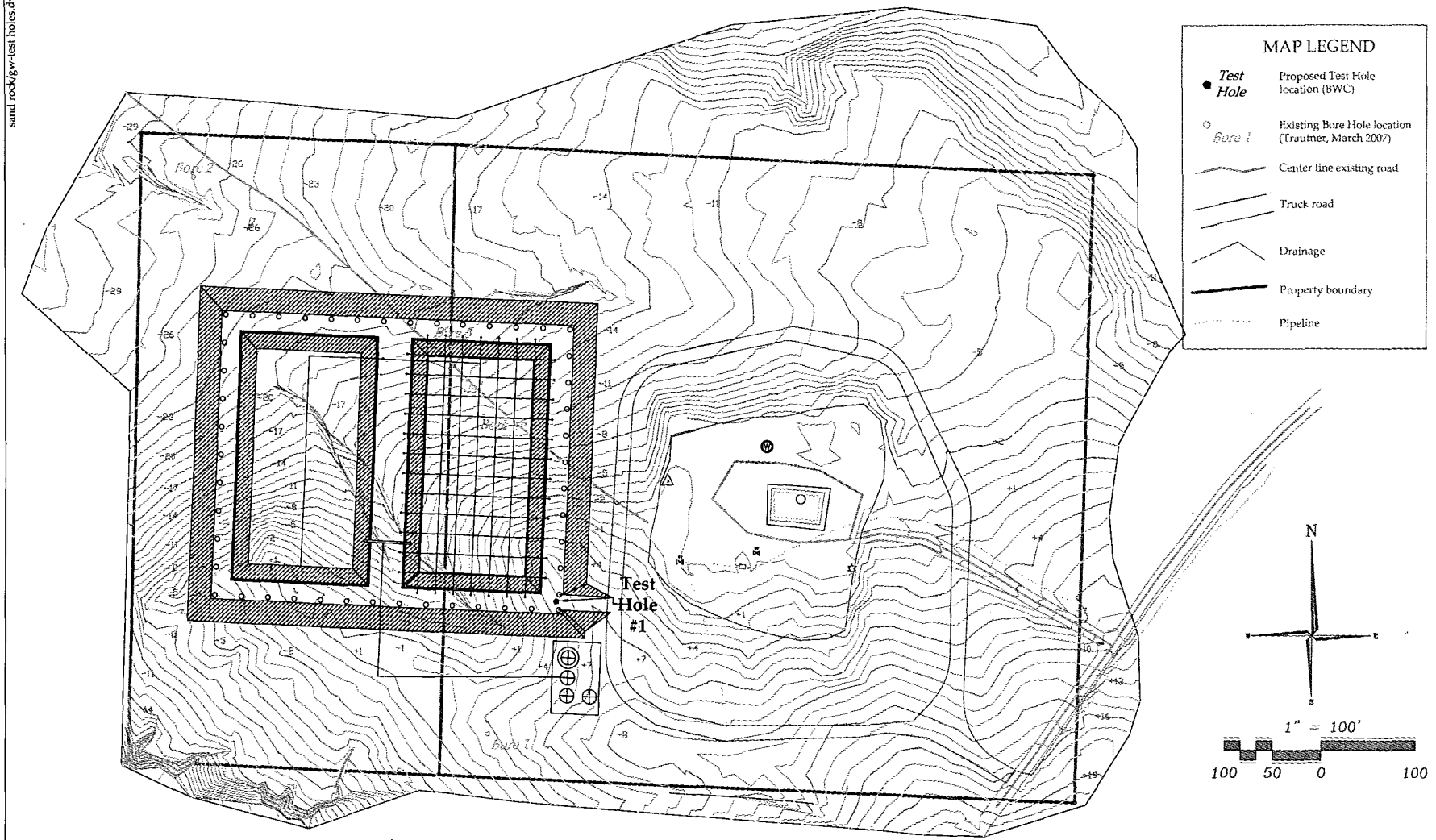
By _____
Wayne Price, Environmental Bureau Chief
Oil Conservation District of New Mexico

Attachments: Figure 1. Sand Rock Location Map: Groundwater Test Hole 1
Figure 2. Typical Log and Proposed Monitoring Hole Completion Plan

cc: David A. Simpson, MuleShoe Engineering
Bill Maez, Patina San Juan, Inc

P:\Project Files\073-07 Sand Rock\Test Hole and Monitoring Hole Plan 6-27.doc

sand rock/gw-test holes.dwg



BIKIS Water Consultants LLC

679 East 2nd. Ave., Unit 3
Durango, CO 81301
(970) 385-2340 ph (970) 385-2341 fx
www.BikisWater.com

Notes:
1. Date of Plan : June 28, 2007 (DRAFT)
2. Base mapping provided by Muleshoe Engineering. The "0" reference for contours equals 5,713 ft ASL. The proposed pond bottom equals 5,708 ft ASL.
3. Groundwater test hole # 1 by BWC. Approximate elevation equals 5,718 to 5,719 ft ASL.
4. Bores 1 through 4 by Trautner Geotech. Bore 1 = 5,717 ft ASL. Bore 2 = 5,686 ft ASL. Bore 3 = 5,696 ft ASL. Bore 4 = 5,702 ft ASL.

DRAFT – FOR REVIEW

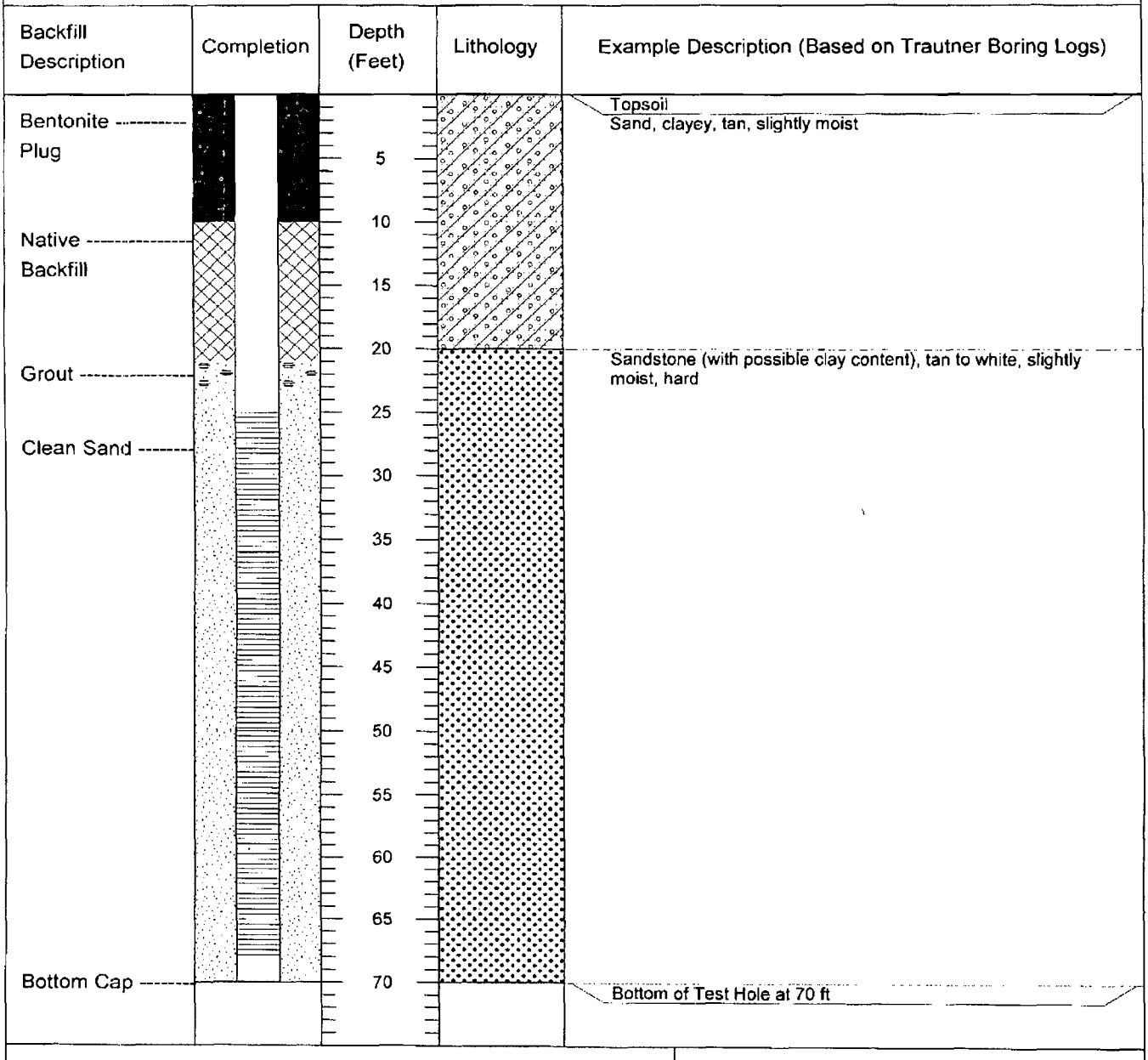
Sand Rock Location Map
Groundwater Test Hole 1

FIGURE 1

Figure 2. Typical Log and Monitoring Hole Completion Detail

Bikis Water Consultants, LLC

Ground Elevation: 5,719 ft Boring Dia: 4 3/8 inches Total Depth: 70 ft



Completion Notes:

If free water is present in Test Hole One after a 24 hour observation period, it will be completed according to this detail. Following completion, free water encountered in the monitoring hole will be bailed. After bailing, another 24 hour observation period will be allowed in order to determine if there is a consistent source of free water in the bore hole.

Site:

Sand Rock Evaporation Pond

Project No.: 073-07-01

Jones, Brad A., EMNRD

From: David A Simpson [zdas04@muleshoe-eng.com]
Sent: Wednesday, June 27, 2007 10:49 AM
To: Jones, Brad A., EMNRD
Cc: eric@bikiswater.com; Billie Maez; bovitz@nobleenergyinc.com
Subject: Sand Rock Evaporation Pond Subsurface Evaluation

Brad,
Wayne Price's June 18, 2007 letter required notice to the NMOCD prior to drilling a well to evaluate the area under the proposed Sand Rock Evaporation Pond. Eric Bikis with Bikis Water Consultants will be contacting you with a boring plan for approval. Assuming that the plan being prepared will prove to be acceptable, we have scheduled the MO-TE rig to begin the drilling and coring process at 8:00 am on Tuesday 7/17.

Please let me know if this e-mail constitutes adequate notice or if you require a paper letter.

David A Simpson

zdas04@muleshoe-eng.com
Phone: 505-326-2115
Cell: 505-320-7299
Fax: 505-326-1237
Web site: www.muleshoe-eng.com

NEW MEXICO ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT

BILL RICHARDSON
Governor
Joanna Prukop
Cabinet Secretary

Mark E. Fesmire, P.E.
Director
Oil Conservation Division

June 18, 2007

Mr. Bill Maez
District Manager
Patina San Juan, Inc.
5802 Highway 64
Farmington, New Mexico 87401

RE: Permit Application Review for a Proposed Centralized Surface Waste Management Facility - Patina San Juan, Inc. - Sand Rock Evaporation Pond
Facility Location: NE/4 SW/4 of Section 23, Township 31 North, Range 13 West NMPM, San Juan County, New Mexico

Dear Mr. Maez:

The Oil Conservation Division (OCD) has reviewed Patina San Juan, Inc.'s application for a centralized surface waste facility permit for the Sand Rock Evaporation Ponds located in the NE/4, SW/4 of Section 23, Township 31 North, Range 13 West NMPM, San Juan County, New Mexico. Based upon the information in the application, sufficient data was not provided to characterize the hydrogeology of the proposed site. Therefore, the OCD is considering to administratively deny the application.

The application demonstrates that the proposed location does not satisfy the siting criteria of Subsection A of 19.15.36.13 NMAC. The ground water elevation for water well #1 of 5606 feet (Figure 4 of Attachment C of the application) and the ground contour elevation of 5654 feet of the proposed site (Figure 5 of Attachment C of the application) demonstrates that the depth of ground water at the proposed site is approximately 48 feet below the ground surface. This does not include the excavation and construction of the evaporation ponds. Paragraph (5) of Subsection A of 19.15.36.13 NMAC states "no other surface waste management facility shall be located where ground water is less than 50 feet below the lowest elevation at which the operator will place oil field waste." The geotechnical engineering report, Attachment B of the application, did not provide the appropriate details for a proper review. The report did indicate increased moisture during the subsurface site investigation and the site assessment summary suggested that "water conditions will be encountered during the construction."

The OCD met with Mr. David Simpson of Muleshoe Engineering, who submitted the application on the behalf of Patina San Juan, Inc., on June 13, 2007 to discuss the siting criteria demonstration and issues. Based upon our conversation with Mr. Simpson, it was determined that the initial site investigation did not provide the sufficient data for a proper assessment. If Patina San Juan,

In. choose to pursue the application, the OCD recommends an additional boring or monitoring well be constructed at the proposed site in order to characterize the hydrogeology. The OCD requests that a boring plan be submitted for review and approval to ensure that all parties are in agreement of the additional site investigative work. The boring plan shall include a site map indicating the proposed boring location, the method of drilling, procedures to determine if ground water is present, and the proposed construction design details of the monitoring well.

The OCD recommends that the method of drilling be air-rotary with advanced coring. The drilling and coring shall continue until the initial water-bearing zone is encountered. Sufficient time should be allowed to pass in order to determine if enough water is present to install a monitoring well. During drilling, detailed geologic logs shall be maintained throughout the length of each well. Sufficient data must be obtained to demonstrate and characterize the hydrogeology of the site. It is required that a representative from the OCD be present when the drilling occurs. The OCD requires that sufficient notification (at least 14 days) be provided, in order for the OCD representative to make the appropriate arrangements to be present. The purpose of the additional drilling is to assist in the characterization of the site. However, if the hydrogeologic conditions cannot be determined, additional borings or monitoring wells may be needed.

The OCD anticipates the submittal of a boring plan that addresses the recommendations provided above. The plan should include the method of drilling, the plan to continuously core, the proposed construction design details of the monitoring well, if installed, procedures to determine if ground water is present, and a site map indicating the proposed boring location. The plan must be approved by the OCD prior to the implementation of any site characterization and investigative work. If Patina San Juan, Inc. chooses not to pursue the application for this location, please notify the OCD in writing.

If there are any questions regarding this matter, please do not hesitate to contact Brad A. Jones at (505) 476-3487 or brad.a.jones@state.nm.us.

Sincerely,

Wayne Price
Bureau Chief

LWP/baj

cc: OCD District IV Office, Aztec
David A. Simpson, PE, Muleshoe Engineering, Flora Vista, NM

District I
1625 N. French Dr., Hobbs, NM 88240
District II
1301 W. Grand Avenue, Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

2007 APR 8 AM 12 45

Form C-137
Revised June 10, 2003

Submit Original Plus 1
Copy to Santa Fe
1 Copy Appropriate
District Office

APPLICATION FOR WASTE MANAGEMENT FACILITY

(Refer to the OCD Guidelines for assistance in completing the application)

☐ Commercial ☒ Centralized

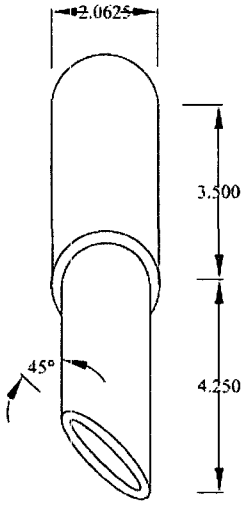
1. Type: ☒ Evaporation ☐ Injection ☐ Other
   ☐ Solids/Landfarm ☐ Treating Plant
2. Operator: Patina San Juan, Inc.
   Address: 5802 Highway 64, Farmington, NM 87401
   Contact Person: Jean Muse Phone: 505-632-8056
3. Location: NE /4 SW /4 Section 23 Township 31N Range 13W
   Submit large scale topographic map showing exact location See Attachment "K"
4. Is this a modification of an existing facility? ☐ Yes ☒ No
5. Attach the name and address of the landowner of the facility site and landowners of record within one mile of the site. See Attachment "K"
6. Attach description of the facility with a diagram indicating location of fences, pits, dikes, and tanks on the facility. See Attachment "A"
7. Attach designs prepared in accordance with Division guidelines for the construction/installation of the following: pits or ponds, leak-detection systems, aerations systems, enhanced evaporation (spray) systems, waste treating systems, security systems, and landfarm facilities. See Attachment "A"
8. Attach a contingency plan for reporting and clean-up for spills or releases. See Attachment "E"
9. Attach a routine inspection and maintenance plan to ensure permit compliance. See Attachment "D"
10. Attach a closure plan. See Attachment "F"
11. Attach geological/hydrological evidence demonstrating that disposal of oil field wastes will not adversely impact groundwater. Depth to and quality of ground water must be included. See Attachments "B" and "C"
12. Attach proof that the notice requirements of OCD Rule ~~711~~ 36 have been met. To be submitted after administrative review
13. Attach a contingency plan in the event of a release of H_2S. See Attachment "D"
14. Attach such other information as necessary to demonstrate compliance with any other OCD rules, regulations and orders. See attached documentation
15. CERTIFICATION
    I hereby certify that the information submitted with this application is true and correct to the best of my knowledge and belief.

Name: Billie Maez Title: District Manager

Signature: Billie Maez Date: 4/5/07

E-mail Address: bmaez@nobleenergyinc.com

COPY



MULESHOE ENGINEERING

David A. Simpson
P.O. Box 637
Flora Vista, NM 87415

Office: 505-326-2115
Cell: 505-320-7299
Fax: 505-326-1237

February 28. 2007

To whom it may concern,

The following information supporting Patina San Juan, Inc. application for the construction of the Surface Waste Facility to be known as the *Sand Rock Evaporation Pond* was prepared by the undersigned or under his direct supervision. Every effort has been made to ensure that all components of this design comply with applicable regulations, administrative codes, technical codes & standards, and best engineering practices.

David A. Simpson, P.E.
New Mexico License Number 16189
Expires December 31, 2007

DAS
4/5/07

New Mexico P.E. Seal

Sand Rock Evaporation Pond

Prepared for: Patina San Juan, Inc.
by David A. Simpson, P.E.
MuleShoe Engineering

Prepared: April 4, 2007

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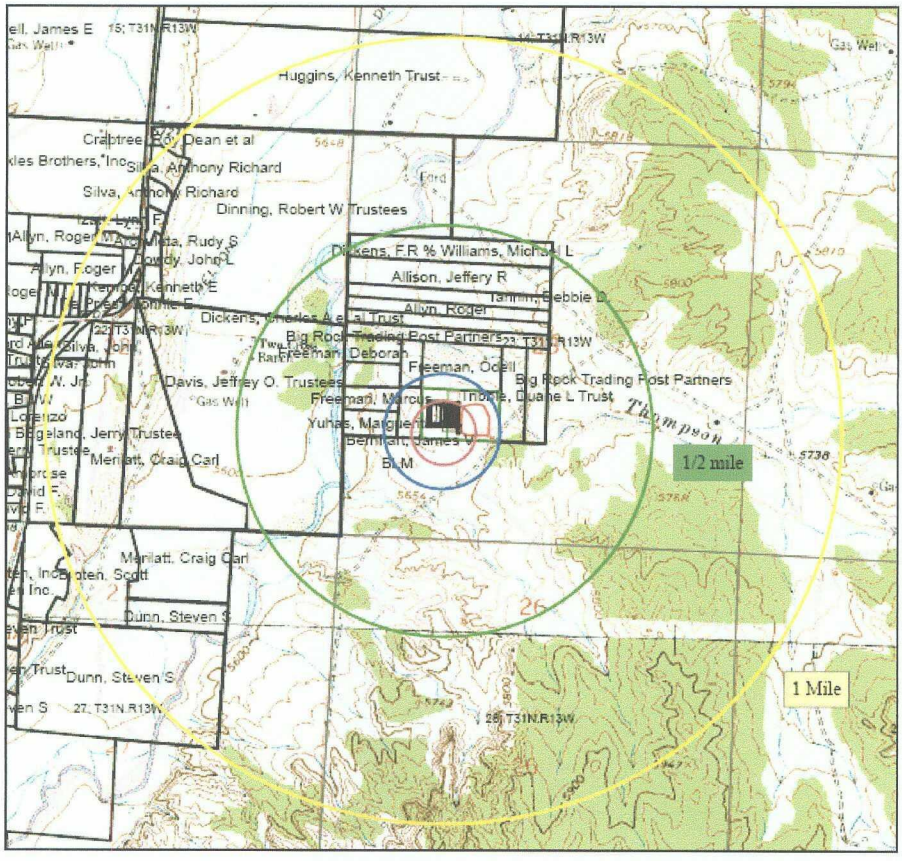
Sand Rock Evaporation Pond

I. Project Summary

The Sand Rock Evaporation Pond will sit on 15 acres of land owned by Patina San Juan, Inc. in NE SW corner of Section 23 of Township 31N Range 13W. The facility will be made up of: (1) equipment to pre-treat the incoming water to remove residual oil; (2) truck unloading area; (3) two evaporation ponds (each 112 X 224 X 8 ft deep for a total of 9.2 acre feet of empoundment); and (4) mechanical evaporators.



The site is in the center of the map above, the green line is ½ mile from the property edge and the outer line is 1 mile from the property edge.

II. Site Description

The pond system will include two ponds of similar size. The east pond will be set up for inflow and a surge volume. The west pond will be set up for accelerated evaporation.

A. Design Considerations

1. Facility Pre-treat

Approximately 80-90% of the water entering the facility will be piped in from CBM wells. Since the producing strategy of the Sand Rock

Gathering system is to use central compression to achieve very-low wellsite pressures, this water should be free of compressor oil. Also, the CBM in this area has tended to reasonably free of oil from interbedded sandstone lenses. The remaining 10-20% of the water will be trucked from conventional reservoirs and pits. These sources have a high likelihood of oil contamination.

The facility will be set-up such that all incoming water will enter through a 750 bbl heated pre-treat tank. This tank will allow the incoming water enough time at elevated temperatures to enhance the performance of the "gun barrel". The gun barrel is a modified tank specifically designed to separate oil from water. The gun barrel is also heated and is configured to allow oil to gravity feed from the top of the gun barrel into an oil tank while the water is taken from low in the gun barrel directly into the pond. Bringing all the water through these two tanks will serve to minimize the risk of contaminating the ponds with oil.

As a last protection against oil contamination, the incoming water will flow into a pipe between the two ponds. The top of this 20-inch pipe will define the minimum freeboard, and the pipe will have an adjustable knife valve on both ends (west pond normally shut, east pond normally open slightly) any oil that makes it to that point should collect on the surface of the water in the pipe. This pipe also serves as protection against liner erosion by slowing the inlet stream and discharging it into a section of the pond that is normally water-filled.

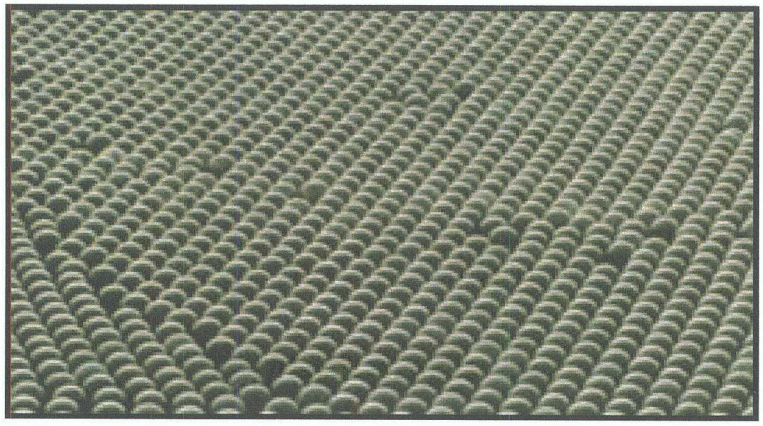
2. *Bird Protection*

The east pond will be covered with 1-1/2-inch mesh netting supported by a grid of cables such as the example below.

This system has proven to withstand snow and wind loads while effectively hiding the water surface from the view of migratory birds.

This netting provides considerable shade on the water surface and will hinder evaporation to some extent.

The west pond will be covered with pond balls. These mat-black hollow balls shield the water surface from appearing to be a water surface. They provide some insulation that will slow evaporation in the hottest part of the day, but will facilitate evaporation during marginal periods of the day by retaining heat. To minimize the impact of the shadow effect, spray-type evaporators will be required. The evaporators (see below) will cause very small droplets to be created, the droplets that don't evaporate in the air will settle onto the hot side of the pond balls to increase capacity of the evaporators.

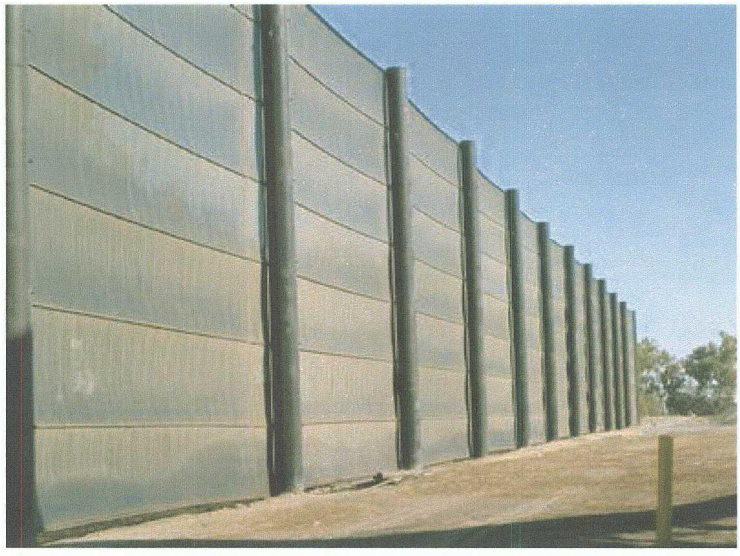


3. *Spray and overspray protection*

To overcome the shading effects of the bird netting and pond balls, spray-evaporators will be needed to keep the pond size within acceptable limits. The evaporator chosen is the SMI 420F from Snow Machines, Inc.

This tethered evaporator can be pulled to any location within the pond to minimize the risks of overspray, and since it is floating on the surface of the pond the minimum freeboard provides at least 3 ft of extra protection against the spray getting outside the pond's limits.

While the moveable nature of the evaporator and locating it on the surface of the water will go a long ways toward minimizing overspray, the last line of defense will be 20 ft tall wind walls. These walls are constructed of a post-and-cable system that has proven itself strong enough to withstand very strong winds and to significantly reduce the magnitude of wind speed across the walls. The walls in this project will look something like:



4. *Odor Control*

Most of the odors that can emanate from an evaporation pond are caused by anaerobic bacteria. A pond that has adequate oxygenation will tend to not have an offensive odor. The procedures in Attachment "D" include regular observation of pond condition. If a problem develops then the particular source of the odor will be evaluated and either treated with biocide or an air-sparging system will be employed. According to the Texas Extension Service (http://aquanic.org/publicat/usda_rac/efs/srac/370fs.pdf), about 1 hp per surface acre is enough to keep a pond healthy. The design of this pond includes a 5 hp oil-free air compressor to maintain the pond at a healthy oxygen level.

B. Design Elements

1. *Dike Protection*

Attachment "B" details the soils condition and the GeoTech design of the dike walls. Erosion protection will be provided by either a GeoTextile

Material or a skim-coat of Shot-crete. The final decision will be made when the exact contours of the berm walls are finalized.

Attachment "B" page 13 discusses the possibility that some bench drains may be required on the north end of the berm. After further discussions with Trautner GeoTech, it became clear that the problem being addressed will be solved by the 12 ½ ft. concrete-filled supports for the wind walls located every 46 ft along that berm.

2. *Liner specifications and compatibility*

The dirt surface of the pond substrate will be compacted and crumbed to remove sharp rocks that could damage the secondary liner. The bottom of the ponds will be sloped to facilitate installation of the drainage system (see below). The center of the ponds on the long axis will have a trench with a taper from a shallow depth of 6-inches from the pond bottom on the south to 4.5 ft on the north. The short axis of the ponds will also be tapered from the outer wall to the center (i.e., 2 ft/100 ft slope over 50 ft).

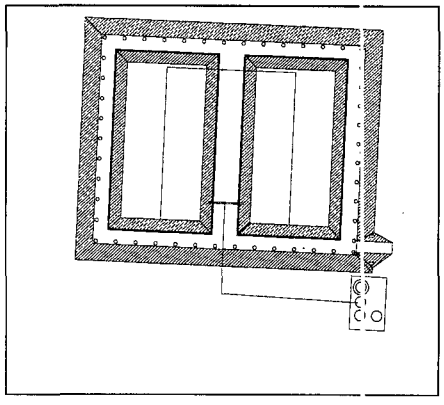
A 20-inch pipe will run from pond to pond for inflow. The pipe will be installed with its top 3 ft below the finished grade of the top of the dike. The pipe will be the terminus of the inflow line and will have head gates on both ends. In normal operation the west head gate will be shut and the east will be open 2-3 inches from the bottom to allow water to flow into the east pond. A 10-inch cross-connect pipe will be installed with its top at 5 ft below the finished top of the dike. There will head gates on one end of this pipe; the gate will be open in normal operation.

The secondary liner will be 60 mil HDPE certified by the manufacturer to meet EPA SW-846 method 9090A. Above the secondary liner will be a highly-permeable GeoTech material which is capable of facilitating lateral flow (see below).

The primary liner will be 80 mil HDPE certified by the manufacturer to meet EPA SW-846 method 9090A.

3. *Leak Detection*

The leak-detection system will look like:



The bottom of the pond will be laid out in a "V" shape with the long sides tapered to the center and a leak-detection trench tapering from south to north. The secondary liner will be laid over this shaped soil and Schedule 80 perforated PVC will be run in the trench the length of the pond and backfilled with ½ inch minus washed stone. Highly permeable GeoNet material (see Attachment "G") will be placed on top of the secondary liner. The north end of the perforated PVC pipe will transition to steel pipe that runs to a dry-well in the center of the berm. The dry-well will be a vertical piece of 12-inch steel pipe buried within the center dike. The dry-well will run to a point slightly above the finished grade of the dike and will have a removable cap. Procedures (Attachment "D") will require periodic visual inspection of the dry well. This technique allows for leak detection without the risk that a failed primary liner could ever overwhelm the dry well and cause a spill.

4. *Freeboard and overtopping protection*

   The ends of the inflow 20-inch pipe will provide a strong visual reference of the maximum fluid level (see Attachment "A").

   The pond balls in the west pond are positive protection against waves forming on that pond. The combination of the bird netting, the net-support cables, and the 20 ft tall wind fences will be adequate to prevent significant wave action in the east pond.

   These actions are expected to provide positive protection against overtopping the pond.

5. *Prevention of nuisance and hazardous odors*

   The primary cause of nuisance odors in evaporation ponds is anaerobic bacteria growing in an oxygen-deprived environment. One of the common byproducts of anaerobic bacteria is the formation of Hydrogen Sulfide (H_2S), a very dangerous poisonous gas. Risks of H_2S formation will be mitigated by:

   - Extreme aeration provided by the SMI 420F evaporators.
   - Procedures that require regular inspections of the pond by H_2S trained personnel with personal monitors. In the event that the pond develops an odor, the procedures address steps to correct the problem.
   - Procedures that require regular water samples to test for (among other things) bacteriological activity.
   - Procedures to chemically shock the pond to reverse rapid bacteriological growth.
   - The site design includes a 5 hp air compressor to provide sparging air to the ponds to rapidly correct oxygen imbalance.

6. *Climatological Factors*

   Attachment "J" contains the calculations used to size the pond surface and the design of the wind fences.

The site is at 5,060 ft elevation and can be expected to see freezing temperatures during at least 5 months out of the year, periods of 2 weeks with the temperature never rising above freezing are reasonably common.

The following actions are planned to prevent freezing temperatures from disrupting operations or creating an increased spill potential:

- All piping will be buried or it will be heat traced and insulated
- The tank loading area and the pre-treat tanks will be located within a berm that can hold 112% of the largest tank.
- The pond balls in the west pond have been shown to insulate the pond surface such that the pond can be expected to remain ice-free even in the coldest temperatures.
- Some ice may form on the east pond, but it is anticipated that being in thermal contact with the west pond will minimize the amount of ice and it is unlikely that ice formation will put the pond-liner at risk.
- During very cold weather it can be expected that a large amount of the sprayed water will turn to snow. This snow will be contained within the east pond by the lack of momentum to the spray, the height of the freeboard, and the wind walls. It has been shown in the snow-making industry that making snow from spray significantly increases evaporation, this has also been shown in several Oil & Gas experiments (one conducted in San Juan County).

It is anticipated that the design of this site is well-suited for any potential weather events and that freezing weather will enhance its operation.

7. *Waste stream description and chemical analysis*

80-90% of the water that will be processed at this facility will be CBM water from the Fruitland formation. This water (see Attachment "M" for a typical water analysis) will be piped to the site and can be expected to be nearly free of oil. The remaining water (see Attachment "M") will be trucked to the site from conventional-well pits.

All water will enter the site through an elevated, heated "Pre-Treat" tank that will serve to provide significant retention time to allow any oil entering the facility to separate. The Pre-Treat tank will gravity feed into a 400 bbl gun-barrel that is also heated. The design of the gun-barrel allows oil to flow from the top of the heated stream while water exits from very low in the tank. This combination of treatment should be nearly 100% effective at removing oil.

III. Variances from NMAC 19.15.36 Requested

The following items are described in NMAC 19.15.36 as "the division may approve". Patina is requesting that the Division review the following items.

A. Spray Equipment

The spray equipment described above in II.A.3 and Attachment "H" will be used to increase the capacity of the ponds during times of low evaporation (e.g., cloudy days, high humidity periods, etc.). Without this spray equipment it is anticipated that there will be times that significant gas volumes will be required to be shut-in due to lack of water-disposal capacity.

The alternative considered was to size the ponds for adequate evaporation during low-evaporation periods. This calculation results in each pond size being almost 3 times as large as the proposed ponds.

B. Leak Detection

Upon engineering review of the drainage system described in 19.15.36.17.B.(9), it was difficult to see how 2 ft of earthen fill between the secondary and primary liners could be installed and compacted without excessive risk of damaging the drainage system and/or the secondary liner. Even with the utmost of care, these risks do not seem trivial to Patina.

As an alternative, Patina is proposing using a GeoNet material as defined in 19.15.36.7.B.(4).(d) and Attachment "G" to this document. This material is advertised to have transmissivity of $2X10^{3}$ m^2/sec which is $2X10^{7}$ cm^2/sec or 12 orders of magnitude higher than the minimum 10^{-5} cm^2/sec required by the specifications. The transmissivity measurements were taken with 10,000 psf (69.4 psi or 161 ft of water) applied to two steel plates. With 8 ft of water the GeoNet fabric will be operating at a small fraction of its rated load.

C. Ground Water Sampling

NMAC 19.15.36.9.C.(15).(b) requires a water sample of the shallowest fresh-water aquifer underlying the facility. Wright Water Engineers (see Attachment "C") was unable to locate a fresh-water well on the east side of the La Plata River that would be representative of any ground water underlying the site. Trautner GeoTech (see Attachment "B") drilled down to 50 ft in two separate bores and encountered a claystone with high sand content that they were unable to penetrate without excessive risk of sticking their tools. Wright Water Engineers has requested a variance to NMAC 19.15.36.9.C.(15).(b) (see Attachment "C", page 4).

Sand Rock Evaporation Pond
Project Detailed Design

Prepared for Patina San Juan, Inc.
by David A. Simpson, P.E.
MuleShoe Engineering

Prepared: April 4, 2007

I. Scope and Background

This project will create the *Sand Rock Evaporation Pond* for the disposal of produced water from Patina San Juan, Inc. conventional and CBM wells.

A. Area of Investigation

The pond will be located on 15 acres owned by Patina San Juan, Inc. in NE SW Section 23, Township 31N, Range 13W in San Juan County, NM.

B. Project Description.

1. *Overall Site (Drawing 1 and 2)*

   The site will consist of:

   - Two evaporation ponds, each with a bottom measurement of 112 ft X 224 ft and nominally 8 ft deep from the toe to the top of the berm.
   - Pre-Treat facility to receive incoming fluids
   - Truck unloading area and access road

2. *Pond layout (Drawing 3, 4, 5, and 6)*

   The ponds will be laid out with the long axis roughly north-to-south. A 20 ft wind fence will be placed on top of the berm surrounding the perimeter. The west pond will be filled with Pond Balls to protect migratory birds and the east pond will have bird netting over the pond. Spray evaporation equipment will be floating in the west pond.

3. *Pre-Treat Facility (Drawing 7)*

   All water entering the facility either from the Produced Water pipeline or from water trucks will enter through an elevated 750 bbl, heated pre-treat tank. Fluids will gravity drain from the pre-treat tank to a 400 bbl Gun Barrel. Any oil in the stream will gravity flow into a 300 bbl Oil tank. The residual water will gravity-flow into the evaporation ponds through a 4-inch buried pipe.

II. Safety Plan

An analysis of the personal hazards on this project showed that the extraordinary hazards include: (1) earth movement; and (2) pipeline purging and return to service. Risk mitigation of these exceptional hazards is discussed below.

"Ordinary" hazards on this project include: (1) materials movement; (2) flash-burn hazards to eyes from welding; (3) trenching hazards; and (4) first-aid injuries. This list is not all inclusive and there are other hazards that are more task specific. The risks will be mitigated by: (1) a program of safety meetings; (2) Job Hazard Analysis; and (3) delineation and enforcement of required personal protective equipment and training.

A. Personal Protective Equipment.

All personnel working on or observing the project will have and use the following minimum safety equipment

- Hard hat. Everyone on site must wear a hard hat at all times while outside of vehicles. While welders are actually wearing a welding hood, they are exempt from the hard-hat requirement. While not welding, welders must wear a hard hat.
- "Hard toe" footwear (preferably with leather over the ankles). The toe protection need not be steel, but must meet OSHA requirements for protection.
- Safety glasses that provide protection both from impact damage (both from the front and the side) and from "flash burn" for non-welders. This burn-protection should be adequate to prevent eye damage to someone several feet away from the welder who is not required by job duties to stare at the arc.
- Eye protection for welders should be such that their eyes are safe for the duration of concentrated attention to the weld. Since this kind of protection is quite cumbersome, additional safety glasses are not required while wearing a welding hood. However, safety glasses meeting the Z.81 specification are required while not wearing a welding hood.
- While using a powered grinding wheel or a powered wire brush, the worker must be wearing a full-face shield.
- Gloves appropriate to the task being performed are required.
- When fabrications, fittings, or pipe are being moved on location by suspending them from a piece of equipment (e.g., a rubber-tired hoe) a rope or strap will be attached to the fabrication and it will be controlled by a worker on the ground to prevent damage or injury from the fabrication swinging.
- When there are overhead power lines on or near location, large signs will be placed under the power lines to alert equipment-operators to that hazard
- Fire extinguishers will be out of their racks and located near the site of any welding.
- Hearing protection will be available to all personnel at all times, and it must be worn for high-noise operations.

B. One Calls

The contractor is responsible for making *New Mexico One Call* notification for each location where digging is likely. It is also the contractor's responsibility to update the *New Mexico One Call System* to ensure that the notification does not expire. The contractor will keep a log of dates, times, and confirmation numbers for each *One Call* placed.

C. Earth Movement

This project will involve moving many tons of earth. Much of the time the berm walls exceed 5 ft above personnel working in the bottom of the pond. Risks of crushing accidents will be minimized by:

- Maintaining proper slope of the berm walls. Berm walls inside the pond will never be steeper than 2:1.
- Compacting the berm walls to 90% of Modified Proctor at no less often than 12-inch lifts.
- Contractor completing the *Daily Inspection Report* in Exhibit "C" daily.

It is felt that these steps will result in the berm walls approximating the consistency of Class "A" soil, and the slope is more shallow than the 1.5:1 maximum slope allowed in Class "C" excavations.

D. Isolation of energy for hot work

The most likely energy source on this job will either be reservoir pressure or pipeline pressure. Electrical sources should be absent, and hydraulic sources are limited to the contractor's equipment. When hot work is being done on a line connected to a pressure source, positive isolation will be required. Acceptable methods of positive isolation are:

1. *Double-block-and-bleed*

   Simply put, this method requires that two sealing surfaces with a vent between them be used to ensure that one leaking seal will not cause an unexpected introduction of pressure or explosive material. Either two valves on the system with an acceptable vent between them or a double-block-and-bleed valve may be used. If pairs of system valves are used, the vent between them must be at least 1-inch. On this project, the wellsite dogleg and the meter-run outlet can be used. The vent is on the dogleg.

2. *Skillet Blind*

   A Skillet Blind is a plate of steel sized to fit between the raised face on a raised-face flange. Skillets provide the maximum positive isolation, are not prone to accidental unauthorized operation, and you can readily see when one is installed. On the down side, it can be difficult to install a skillet blind, it is frequently not possible to find a suitable flange near the work site, and you generally have to blow the upstream piping back down to remove it.

   The skillets required on this project will be made out of mild steel plate stock (such as ASTM A 515-70 or ASTM A 516-70) at least 0.160" thick for 4-inch applications. The handle on the skillet should extend at least 6-inches from the raised face on the flange. Metal stock for the skillets will be provided by Contractor.

III. Detailed Design

A. General Specifications

The piping for this project will be built to ASME B31.8 specifications.

All piping and fittings will be specified.

Threaded fittings will be 3,000 lb class. Above-ground 2-inch and 3-inch will preferentially be threaded. Piping that is 4-inch and larger, and all below ground piping will be welded with connections flanged.

B. Construction Steps

1. *Reference height (Drawing 1 & 8)*

   Establish a reference height to correspond with elevation -2 on Drawing 1 (approx the narrow-side center of the southern berm on the east pond, cut line "D-D'" on Drawing 8). This reference height will be finished grade of the top of the berm. Where necessary, cut the grade south of the south berm to ensure that the top of the berm is at least 2 ft higher than the surrounding surface.

2. *Establish the Bottom planes of the pond (Drawing 3 & 4)*

   The corners of the pond will be 8 ft lower than the reference height, tapering to the east and west on the North-South axis toward the center of each pond at 9 ft below the reference height. These surfaces should be free of sharp rocks and compacted to 90% of a Modified Proctor Test.

3. *Install the Leak-Detection Header and Dry Well (Drawing 6)*

   The leak-detection header will be 4-inch, standard-wall steel pipe that runs from a point adjacent to and 6 ft below the toe of the center-berm into the dry well located in the center berm.

   The dry well will be a length of 12-inch steel pipe, installed vertically from 16 ft below the reference plane up to 1 ft above the reference plane. The two 4-inch drainage headers will be welded into the dry well, reinforcement is not required.

4. *Create the Berms (Drawing 5 & 6)*

   Berm walls will taper at a 2:1 angle on the inside wall and 3:1 angle on the outside wall up to the reference height. Any fill material will be compacted to 90% of Modified Proctor in 12-inch lifts. Cut material from the south end of the pond can be used for fill material.

   The 10-inch S20 cross-connect line and knife-valve will be installed level in the center berm wall with the top of the pipe 5 ft below the reference plane.

   The 20-inch S10 inflow line and knife valves will be installed level in the center berm wall with the top of the pipe 3 ft below the reference plane. A

notch will be cut out of the top of the pipe on both ends; the notch will be located 4-inches back from the pipe-end and slope 45° to the pipe end.

The 4-inch S40 inflow-line will tie into the top of the 20-inch with a weld-o-let. From the weld-o-let there will be a 12-inch stub, a 90° elbow pointing south, a 45° elbow pointing down, a length of pipe to get approximately to the centerline of the 20-inch, a second 45° elbow and straight pipe to the edge of the berm. This inflow line will be tied to the gun barrel with underground piping.

30-inch culverts will be installed vertically to protect each of the three knife valves. The culverts should extend 1 ft above the reference plane.

When the berm has been contoured to its final elevation cut a 12-inch wide anchor-trench 12-inches deep, 12-inches from the edge of the berm-top all the way around both ponds.

The southeast corner of the berm will have an 8:1 (7°) slope truck ramp onto the berm. This ramp will have a 24-inch culvert to allow drainage along the berm heal.

5. *Install the secondary liner (Drawing 4)*

[**Note:** The Aztec Office of the NMOCD must be notified 72 hours prior to installing the secondary liner]

Dig the leak-detection trench from the south end of each pond towards the north end. The trench should be the width of a narrow bucket. At the south end it should be approximately 6-inches deep. Slope the trench 2 ft per 100 ft (north end of the trench should be about 4'-9" deeper than the bottom of the pond). Ensure that the bottom of the trench is free of sharp rocks. The north end of the leak-detection trench turns toward the center berm and continues to slope to the leak-detection header.

Install the secondary liner following the manufacturer's procedures. Ensure the seal around the leak detection pipes, 10-inch cross connect pipe, and the 20-inch inflow pipe is consistent with the manufacturer's specifications. The secondary liner will contour to the bottom of the leak-detection trench and the anchor-trench and go at least 12-inches past the edge of the anchor trench.

Minimize liner seams and orient them up and down, not across a slope. Use factory seams where possible. Field seams in geosynthetic material will be thermally seamed (hot wedge) with a double track weld to create an air pocket for non-destructive air channel testing. A stabilized air pressure of 35 psi, plus or minus one percent, shall be maintained for at least five minutes. Overlap liners four to six inches before seaming, and orient seams parallel to the line of maximum slope, i.e., oriented along, not across, the slope. The operator shall minimize the number of field seams in corners and irregularly shaped areas. There shall be no horizontal seams within five feet of the slope's toe. Qualified personnel shall perform field seaming.

6. *Install leak detection pipe (Drawing 4 and 6)*

   Lay the 4-inch Schedule 80 PVC perforated pipe in the leak-detection trench with the perforations up. Use a standard 90° elbow to turn toward the center berm and tie the PVC into the steel header pipe.

   Fill the anchor trench with ½ minus washed stone, level with the top of the drainage trench.

7. *Install the GeoMat fabric (Drawing 4)*

   The GeoMat fabric covers the bottom of the pond and is not intended to ride up onto the berms, but extra material on the berm slope is not a problem.

8. *Install the primary liner (Drawing 4)*

   [**Note:** The Aztec Office of the NMOCD must be notified 72 hours prior to installing the primary liner]

   Install the primary liner following the manufacturer's procedures. Ensure the seal around the 10-inch cross connect pipe, and the 20-inch inflow pipe is consistent with the manufacturer's specifications. The primary liner will contour to the bottom of the pond and the anchor-trench and go at least 12-inches past the edge of the anchor trench.

   Minimize liner seams and orient them up and down, not across a slope. Use factory seams where possible. Field seams in geosynthetic material will be thermally seamed (hot wedge) with a double track weld to create an air pocket for non-destructive air channel testing. A stabilized air pressure of 35 psi, plus or minus one percent, shall be maintained for at least five minutes. Overlap liners four to six inches before seaming, and orient seams parallel to the line of maximum slope, i.e., oriented along, not across, the slope. The operator shall minimize the number of field seams in corners and irregularly shaped areas. There shall be no horizontal seams within five feet of the slope's toe. Qualified personnel shall perform field seaming.

   When the liner is properly stretched, anchor both liners in the anchor trench with heavy-wall 4-inch steel pipe (rejected well-casing works well). Backfill the anchor trench with roadbase.

9. *Install posts for bird netting on East Pond (Drawing 3)*

   The 82 posts for the bird netting require 18-inch diameter hole three ft deep, located in a line 3 ft from the outer edge of the anchor trench. These posts are spaced per drawing 3. The posts are set in concrete.

10. *Install posts for Wind Walls (Drawing 3)*

    The 30 posts for the wind walls are spaced per drawing 3. They require a 30-inch diameter hole, 12.5 ft deep, set in concrete.

Note: it is critical that the ¼ inch through holes on the wind-wall posts be installed perpendicular to the pond. These holes carry the eye bolts that secure the wind-wall material and must all be pointed toward the pond.

11. Move the site-inlet facilities from the Langendorf #2 SWD

The 750 bbl pre-treat tank, the base for the pre-treat tank, the 400 bbl gun barrel, and the two 300 bbl oil tanks will be removed from the Langendorf #2 SWD and relocated to the Sand Rock Evap Pond.

The tanks will require standard tank lifting and transport techniques.

The base for the 750 bbl pre-treat tank is concrete filled and weighs approximately 720,000 lbm. The base was fabricated on site from ¼ plate, approximately 20 2-inch pipes were welded to the interior to help hold shape during the concrete pour. Consequently the base and the concrete will be moved as a unit. Two tunnels at 90° from each other will be cut under the base using vacuum-excavation equipment. Straps with adequate carrying capacity will be run through the tunnels for lifting the 22 ft diameter, 8 ft tall base.

12. Set the Site-inlet facilities (Drawing 3 & 7)

- Excavate for the base of the Pre-treat tank, a circle approximately 26 ft diameter and 2 ft deep. Compact the circle to 90% of Modified Proctor. Set 12"X12" concrete "pavers" in a 22-ft diameter circle. Pavers should be located every 30° around the circumference (12 pavers required). The pavers must be set level with a consistent height within 1/8 inch.
- Set the Base and verify that the top edge is level within 1/8 inch
- Backfill against the base
- Prepare a berm 50'X75'X20" (inside measurement). This berm will be lined with 60 mil HDPE sealed against the Pre-Treat tank base
- Set the Pre-treat tank, gun barrel, and oil tanks at the same elevation as they were at the Langendorf #2 SWD
- Connect the piping

13. Set electrical utilities

Bring electrical power to a distribution point on the center berm. This distribution point will supply the two SMI 420F evaporators and the sparging compressor. At least 150A, 440V service will be required.

14. Prepare the access road

The access road will be built as laid out in Drawing 2. The road will be covered in at least 10-inches of road base, compacted to 90% of Modified Proctor.

15. Build Fencing and erosion prevention

The site will be fenced with chain link and barbed wire approximately 20 ft beyond the berm wall on all sides (up to 460' X 390' for a total

perimeter of 1,700 ft). An access gate will allow traffic up the truck ramp, this gate will normally be locked. The load line for truck unloading will be located outside of the fence.

To minimize erosion on the berm wall, the berm will be covered with a skim coat of Shotcrete.

IV. Work Plan

This project should take approximately 2 months of construction.

Exhibit "A" Drawings

Contour Lines 1 ft
Minor gradient on scale 10 ft

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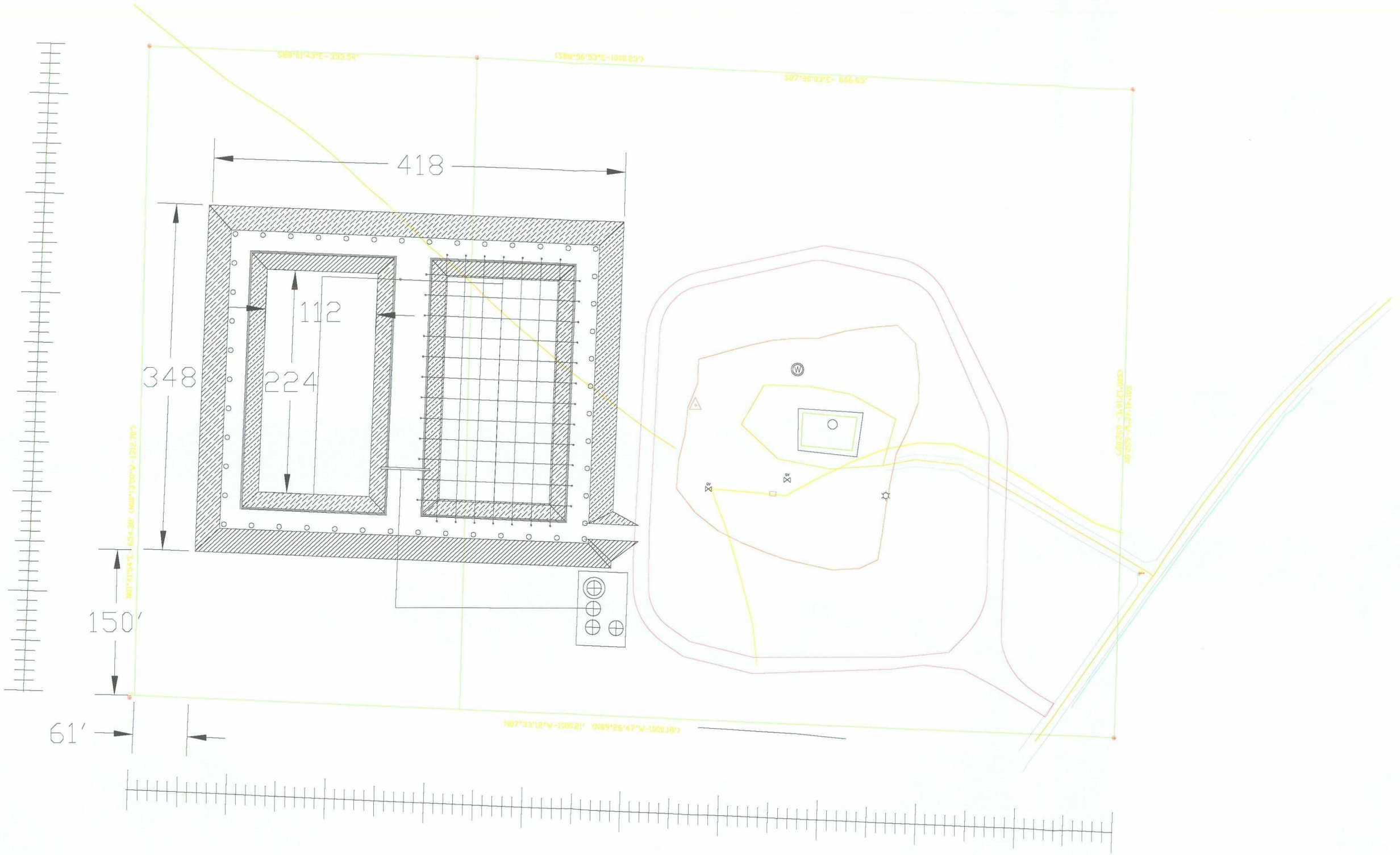
Patina San Juan, Inc

Sand Rock Evaporation Pond

Dwg No	Date:	REV
1	4-4-07	0



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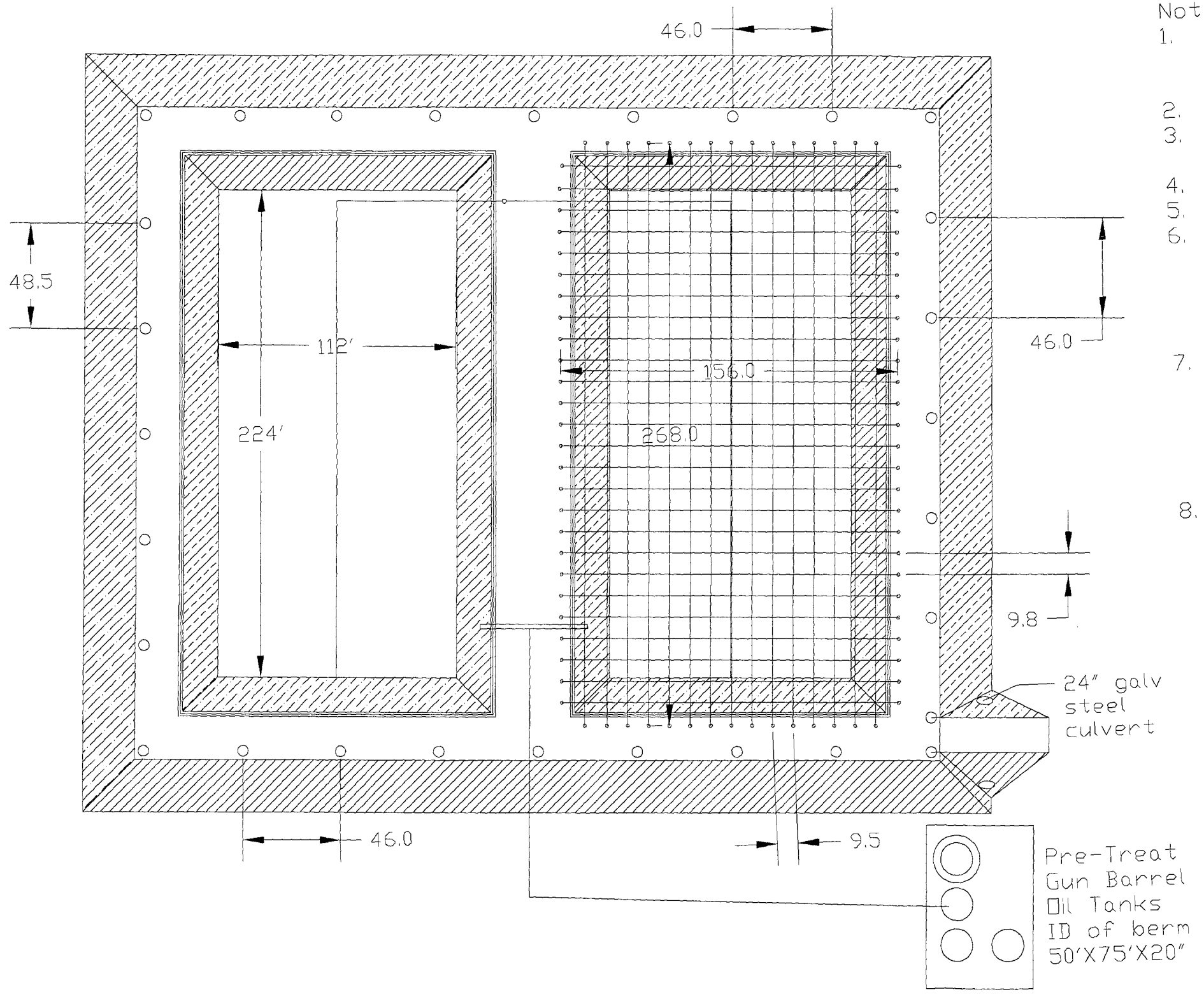
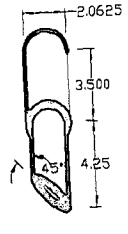
Sand Rock Evap Pond

Dwg No	Date:	REV
2	4-4-07	0



Notes:

1. Anchor trench 12" from edge, 12" deep X 12" wide around each pond. Outer dimension of each trench 146'X246'
2. GeoNet Fabric between Liners.
3. Perforated 4-inch PVC sloped 2'/100' Drain lines brought together in 12" dry well
4. Outer bank slope 3:1, inner bank 2:1
5. Pond depth at berm toe 8' to top of berm
6. Wind fence 20' tall, Post hole center 4' from outer edge, space each side per dimensions. Post holes 30-inch diameter, 12.5 ft deep, 1.7 cu yd of 2,500 psi concrete required for each post (49.3 cu yd total)
7. East Pond will have 1-½ inch mesh bird netting, support posts will require 18-inch holes, 3 ft deep, 3 ft from outer edge of anchor trench, space each side per dimensions. 0.2 cu yd of 2,500 psi concrete required for each post (16.4 cu yd total).
8. West pond will have 32,208 ft^2 of pond balls (four truck loads)



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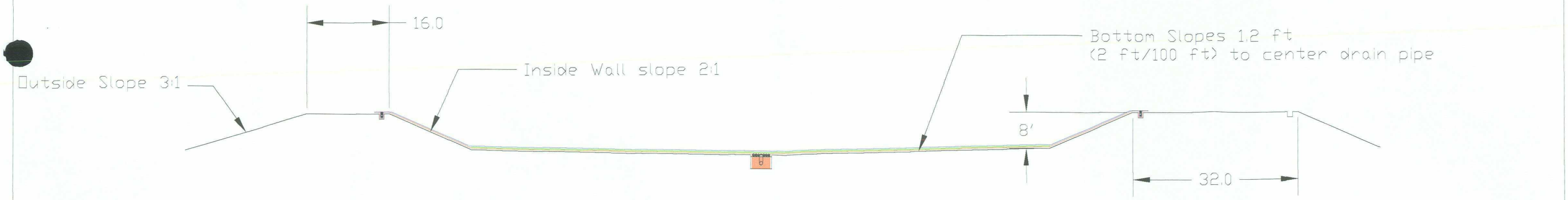
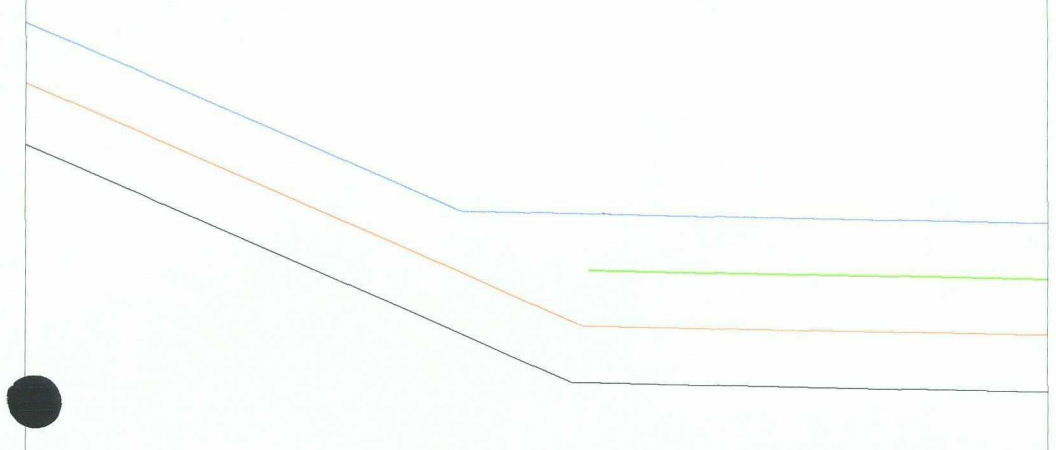
Sand Rock Evap Pond Layout

Dwg No 3 | Date: 4-4-07 | REV 0

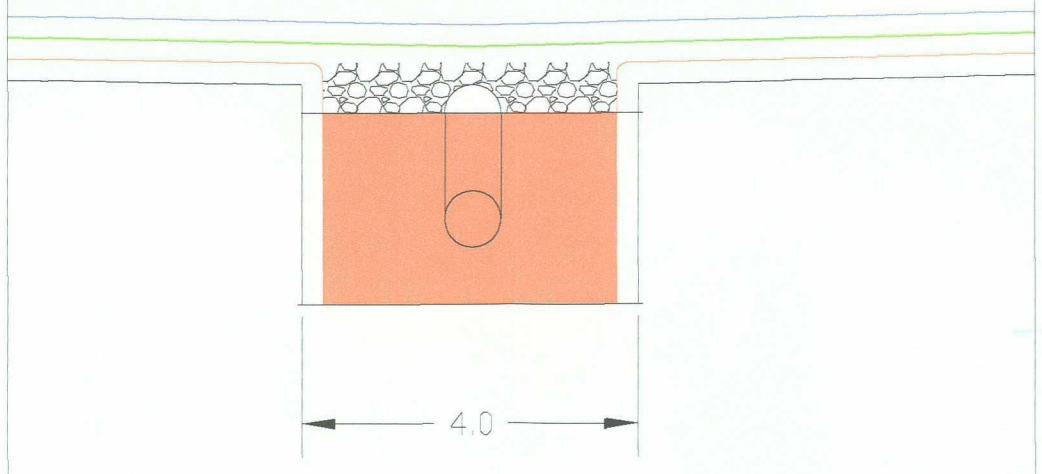


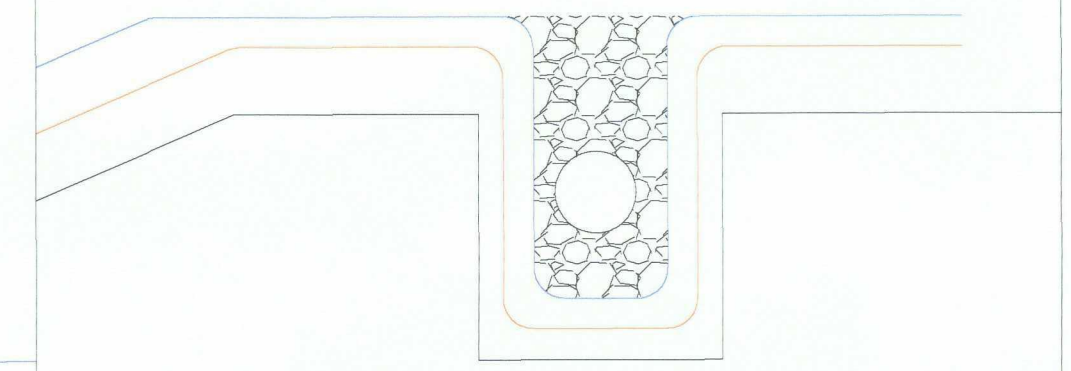


Primary and secondary liners 60 mil HDPE

GeoMat fabric only covers the bottom of the pond

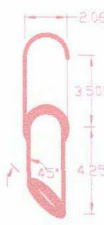
Leak-detection trench down center of long axis. On south end of trench, depth is 5" tapering to 4'-3" at north end. Install perforated S80 PVC drain pipe on top of secondary liner in trench. Fill trench flush with ½" minus washed stone





Anchor Trench, located 1' from edge of pond, trench is 1 ft wide X 1' deep

When both liners are installed, set a 4-inch heavy-wall pipe in the trench on top of the liner and backfill the anchor trench



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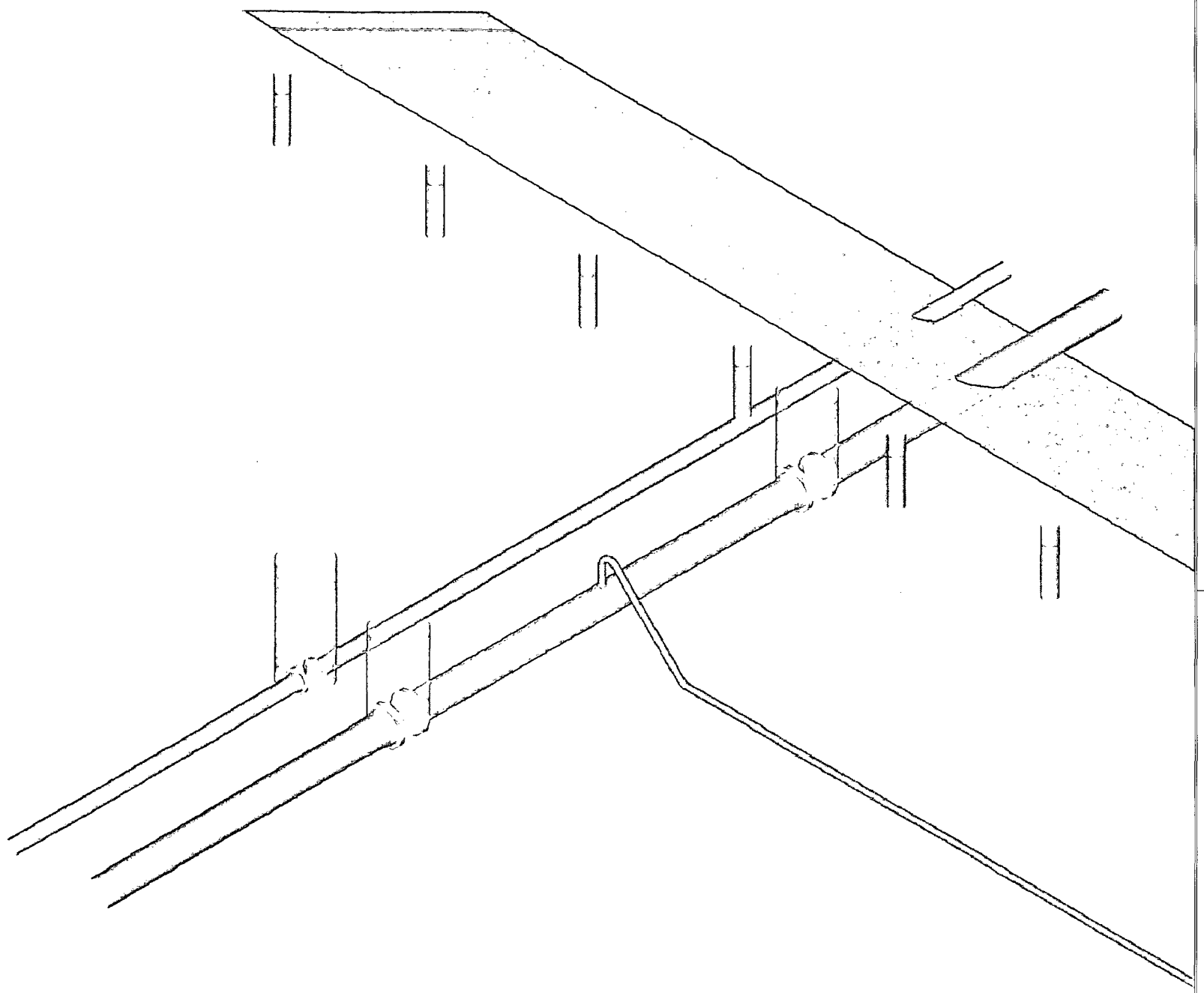
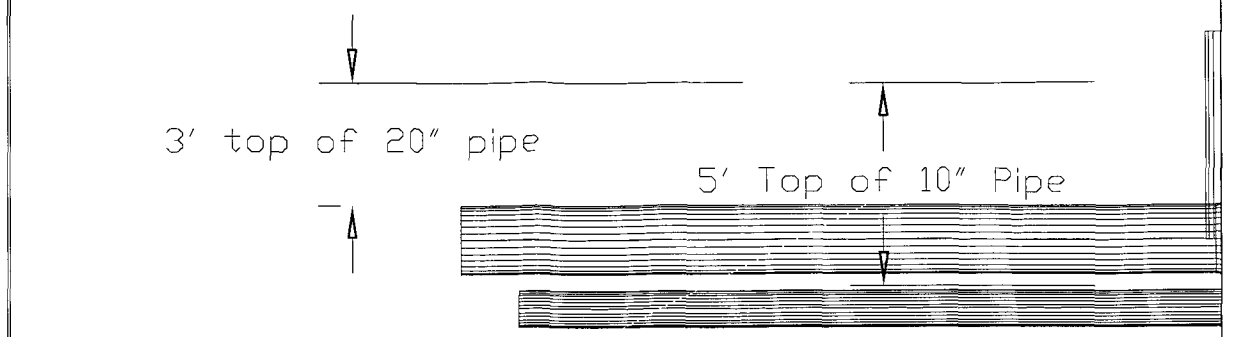
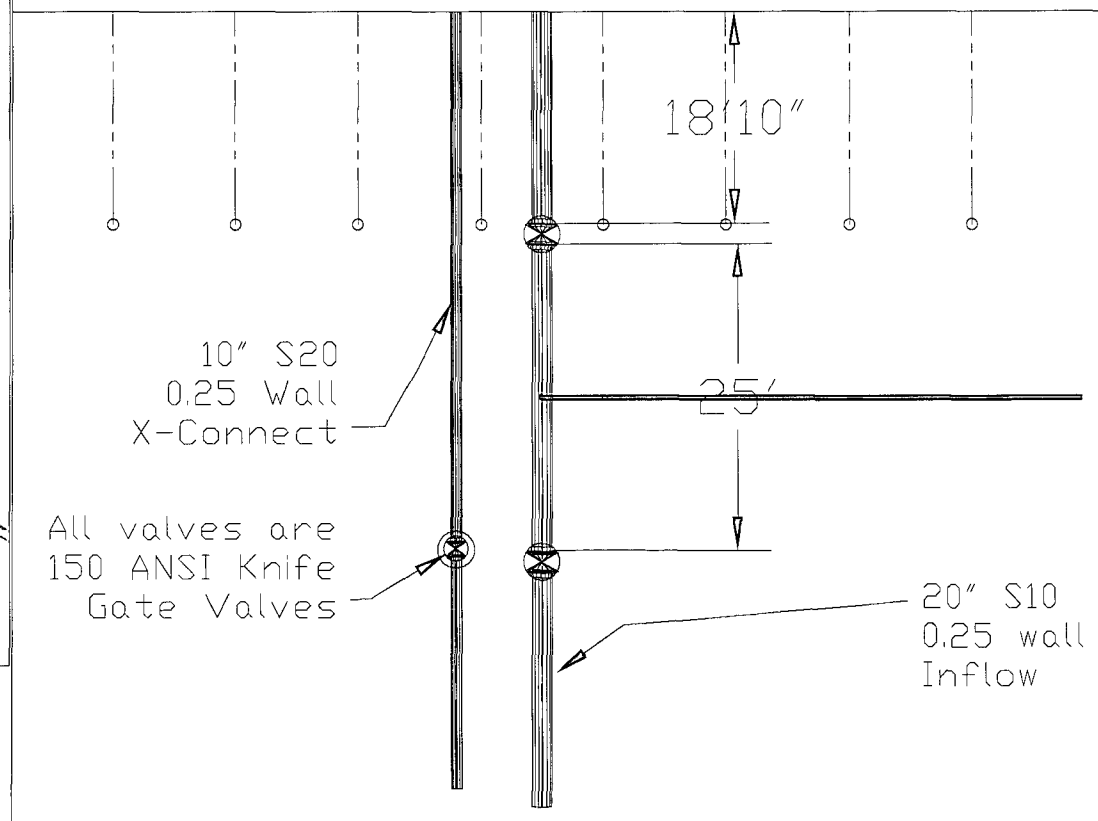
Pond Liner Details

Dwg No	Date:	REV
4	4-4-07	0







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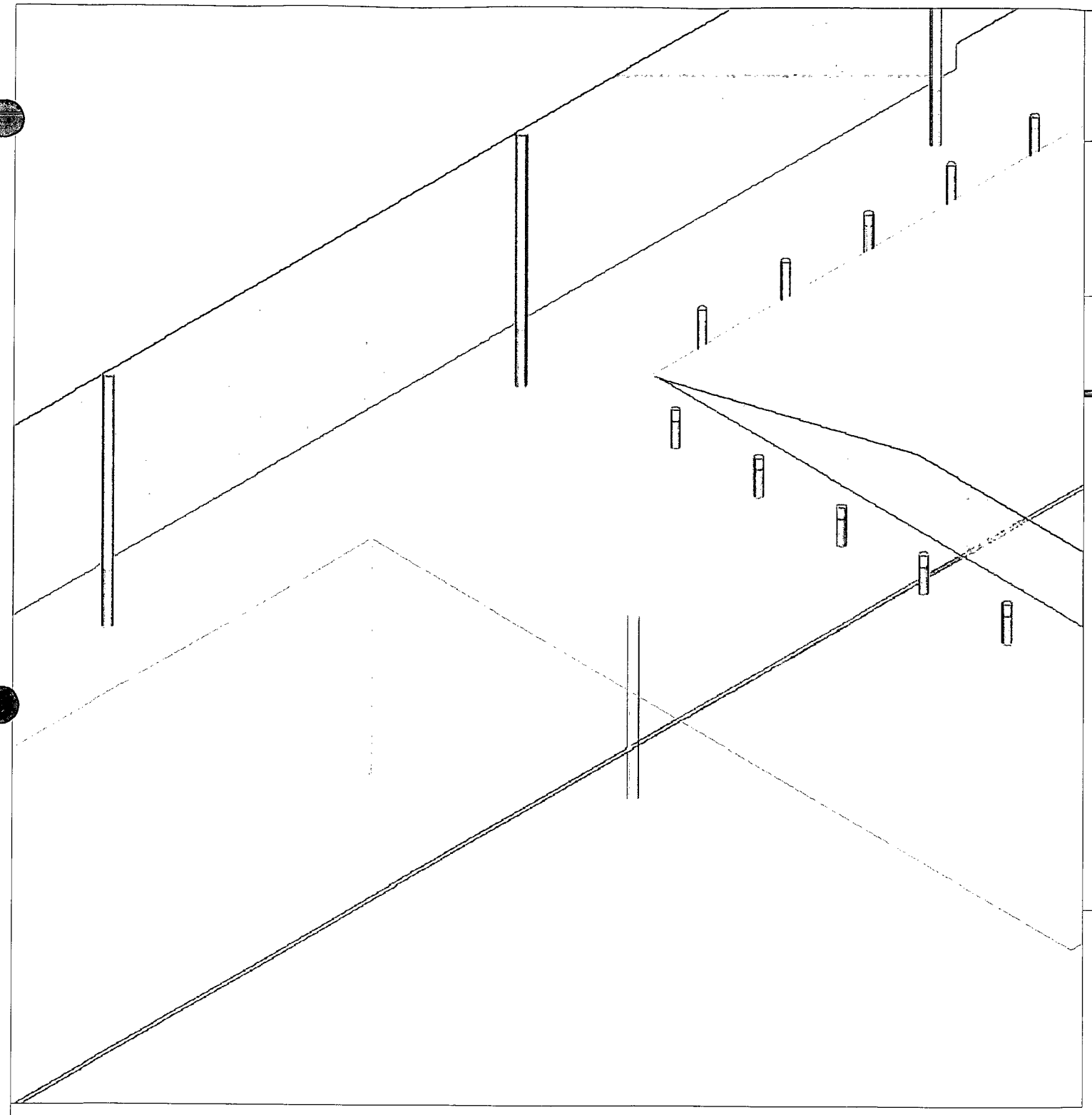
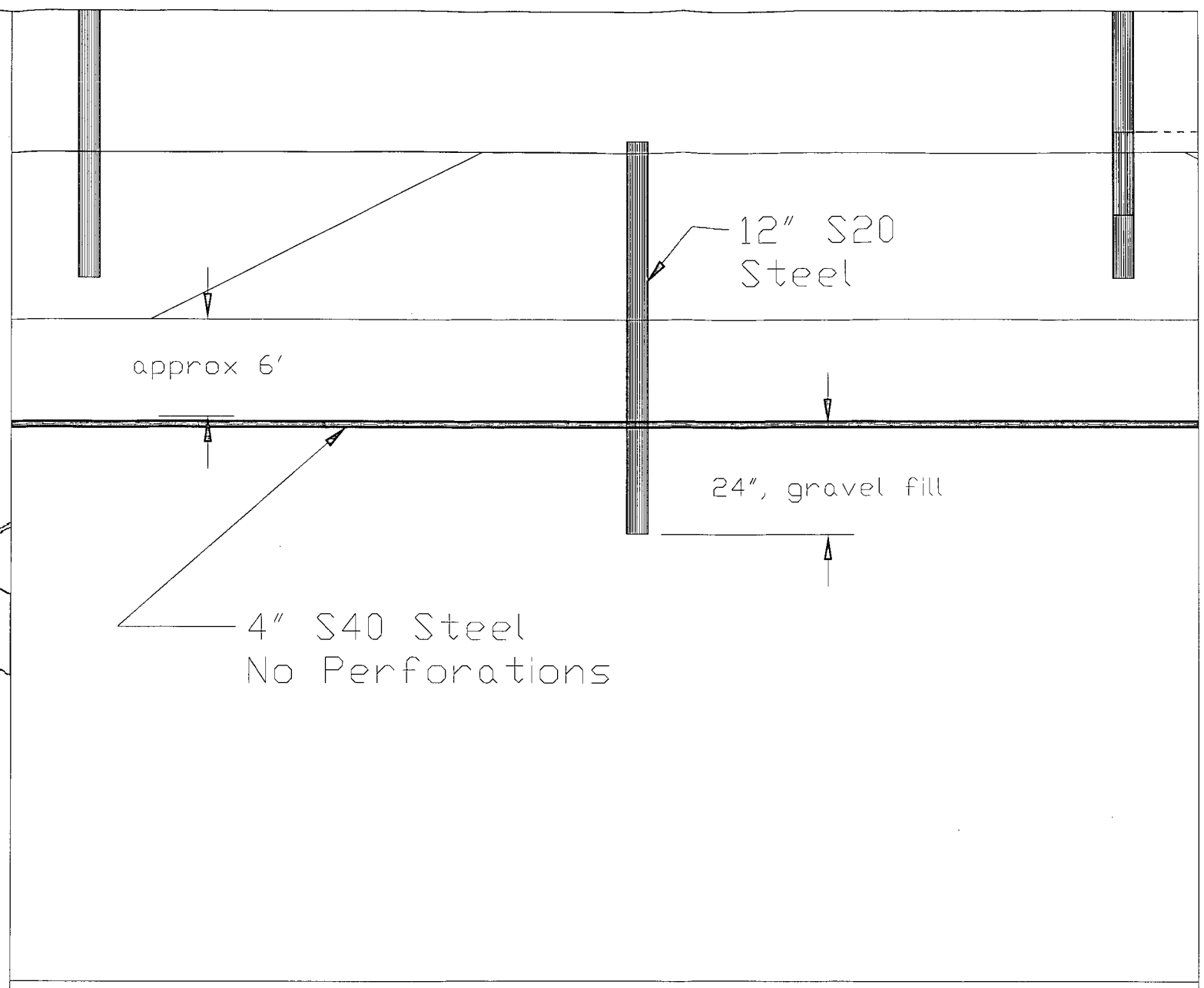
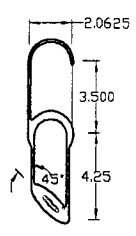
Inflow and cross Connect Pipe

Dwg No	Date:	REV
5	4-4-07	0







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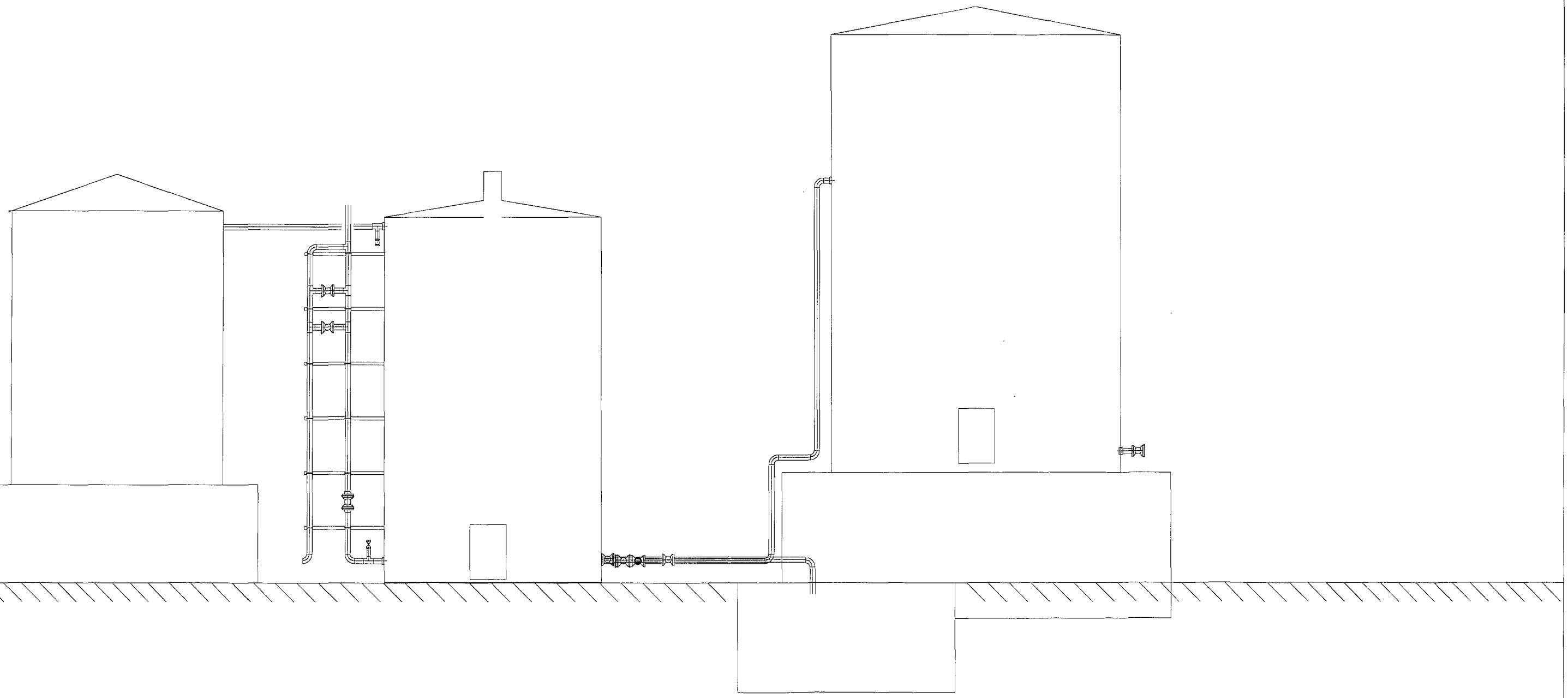
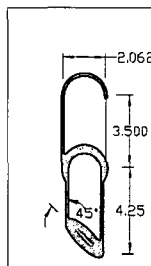
Drain System Dry Well

Dwg No	Date:	REV
6	4-4-07	0





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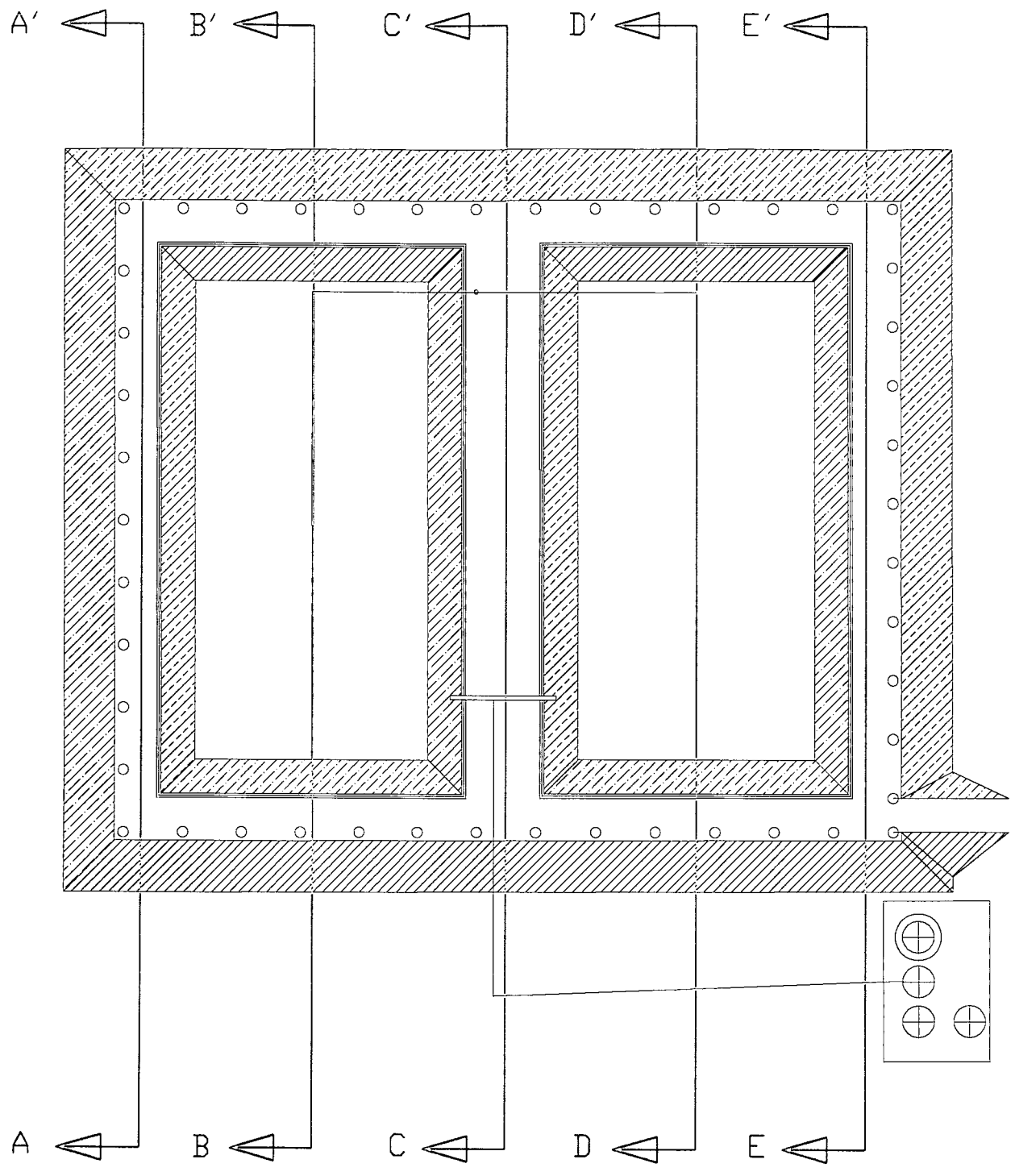
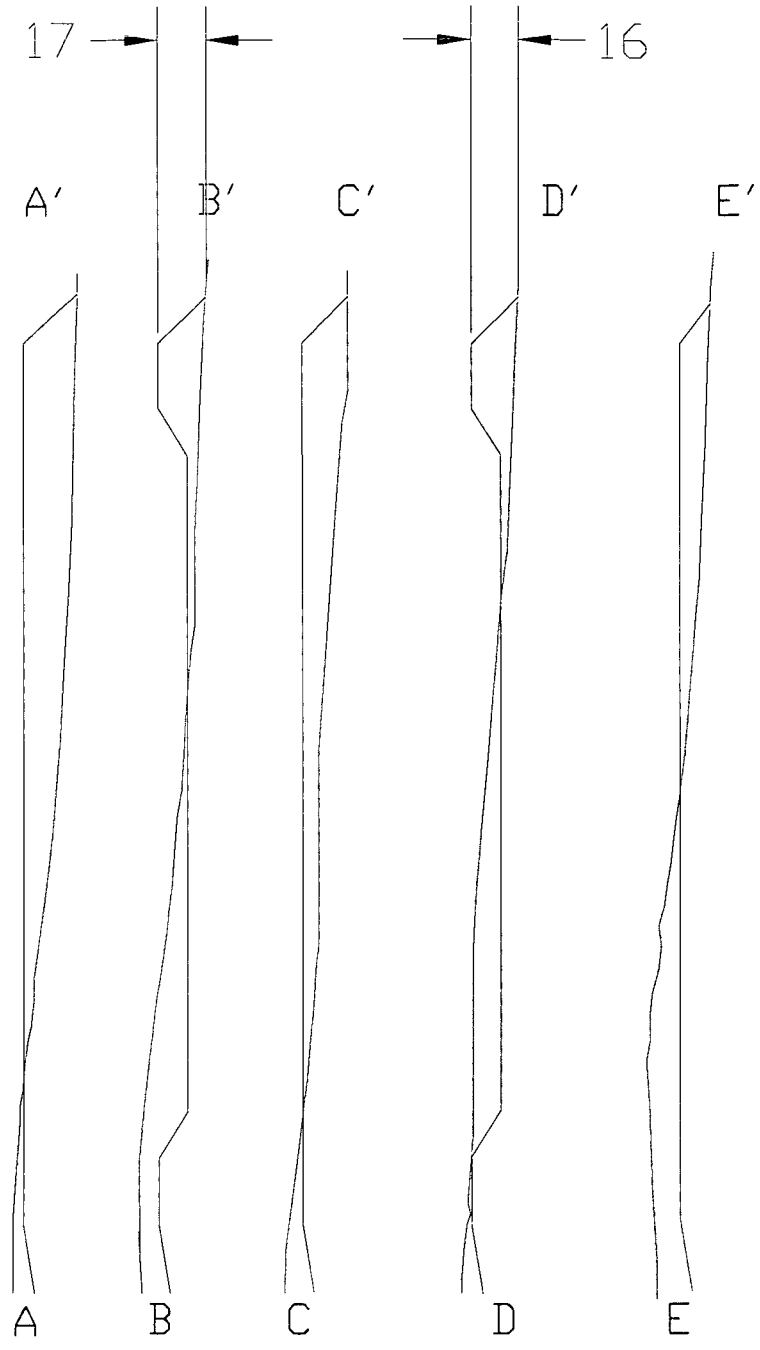
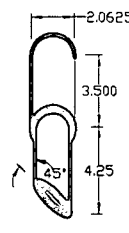
Pre-Treat Layout

Dwg No	Date:	REV
7	4-4-07	0





	CutVol (yd^3)	Fill Vol (yd^3)	Net Fill (Cut)
A-A'	269	4,115	3,845
B-B'	7,321	4,202	(3,119)
C-C'	299	2,521	2,222
D-D'	6,669	3,608	(3,061)
E-E'	1,845	1,336	(509)
	16,403	15,782	(621)



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Cut and Fill Plan

Dwg No 8 | Date: 4-4-07 | REV 0

Exhibit "B" Daily Inspection Report

Excavation Daily Inspection Report
(to be completed daily and kept on site)

Date/time: _____ Location: _____

Depth of highest walls: _____

Soil Type (circle one): Stable Rock A B C Other: _____

Slope Ratio (H:V): _____ (if less than 2:1, explain in comments)

Utilities Located: Yes / No

Barricades and traffic control: _____

Water removal required?: Yes / No

Confined Space permit required? Yes / No

Spoil piles at least 2 ft back from edge? Yes / No

Comments: _____

_____

Competent Person Signature: _____

Competent Person Printed Name: _____

Attachment "B" GeoTech Engineering Report

TRAUTNER GEOTECH
A DIVISION OF TRIGON GEBG

GEOTECHNICAL ENGINEERING

RECOMMENDATIONS
For

SAND ROCK EVAPORATION POND

PROJECT SITE

Prepared For
Muleshoe Engineering
Mr. David Simpson
Project Number: 50924GE
March 28, 2007

GEOTECHNICAL ENGINEERING, MATERIAL TESTING AND ENGINEERING GEOLOGY
214 BODO DRIVE • DURANGO, CO 81303 • 970/259-5095 • FAX 970/382-2515

PN: 50924GE
March 27, 2007

PN: 50924GE
March 27, 2007

1.0 REPORT INTRODUCTION

This report presents our geotechnical engineering recommendations for the Sand Rock Evaporation Pond Project. This report was requested by Mr. David Simpson, P.E., Mule Shoe Engineering. The field study was completed on March 13, 2007. The laboratory study was completed on March 27, 2007.

Geotechnical engineering is a discipline which provides insight into natural conditions and site characteristics such as; subsurface soil and water conditions, soil strength, swell (expansion) potential, consolidation (settlement) potential, and often slope stability considerations. Typically the information provided by the geotechnical engineer is utilized by many people including the project owner, architect or designer, structural engineer, civil engineer, the project builder and others. The information is used to help develop a design and subsequently implement construction strategies that are appropriate for the subsurface soil and water conditions, and slope stability considerations. It is important that the geotechnical engineer be consulted throughout the design and construction process to verify the implementation of the geotechnical engineering recommendations provided in this report. Generally the recommendations and technical aspects of this report are intended for design and construction personnel who are familiar construction concepts and techniques, and understand the terminology presented below. We should be contacted if any questions or comments arise as a result of the information presented below.

Sections 1.0 and 2.0 provide an introduction and an establishment of our scope of service. Sections 3.0 through 8.0 of this report present our geotechnical engineering field and laboratory studies (Sections 3.0 and 4.0) followed by our recommendations found in Section 5.0.

Section 6.0 provides a brief discussion of construction sequencing and strategies which may influence the geotechnical engineering characteristics of the site. The discussion and construction recommendations presented in Section 6.0 are intended to help develop site soil conditions that are consistent with the geotechnical engineering recommendations presented previously in the report. The construction considerations section is not intended to address all of the construction planning and needs for the project site, but is intended to provide an overview to aid the owner, design team, and contractor in understanding some construction concepts that may influence some of the geotechnical engineering aspects of the site and proposed development.

The data used to generate our recommendations are presented throughout this report and in the attached figures.

1.1 *Scope of Project*

We understand that the proposed project will consist of constructing a earthen berm evaporation pond that is lined with an impermeable geotextile membrane. We understand that overall dimensions of the pond structure will be approximately 450 feet by 350 feet, and will include two (2) pond cells. The bottom of the pond cells will be approximately eight (8) feet below the top elevation of the exterior berms and the berms that divide the cells.

2.0 GEOTECHNICAL ENGINIEERING STUDY

This section of this report presents the results of our field and laboratory study and our geotechnical engineering recommendations based on the data obtained.

Our services include a geotechnical engineering study of the subsurface soil and water conditions for development of this site for the proposed industrial use.

2.1 *Geotechnical Engineering Study Scope of Service*

The outline of our study which was delineated in our proposal for services and the order of presentation of the information presented in this report is presented in this report is presented below.

Field Study

- We advanced four (4) test borings at the project within and adjacent to the areas we understand are planned for construction of the proposed pond structure.
- Select driven sleeve and bulk soil samples were obtained from the test borings and returned to our laboratory for testing.

Laboratory Study

- The laboratory testing and analysis of the samples obtained included:
  - Moisture content and dry density,
  - Estimates of soil strength based on laboratory testing to help establish a basis for development of soil bearing capacity and lateral earth pressure values.

- Swell/consolidation tests to help assess the expansion and consolidation potential of the proposed embankment materials and the embankment foundation support soils on this site to help estimate the settlement of the embankment and the foundation support soil,
- Plastic and liquid limit tests to determine the Plasticity Index of the soil, and,
- Sieve analysis tests

Geotechnical Engineering Recommendations

- This report addresses the geotechnical engineering aspects of the site and provides recommendations including;

Geotechnical Engineering Section(s)

- Subsurface soil and water conditions that may influence the project design and construction considerations
- Geotechnical engineering design parameters including;

  - ✓ Soil bearing capacity values and recommended for the proposed lined earthen embankment dike structures,
  - ✓ Stability analysis of the proposed embankment dike configurations, and,
  - ✓ Post construction settlement values of the embankment dike structures.

Construction Consideration Section

- Fill placement considerations including cursory comments regarding site preparation and grubbing operations,
- Considerations for excavation cut slopes,
- Natural soil preparation considerations for use as backfill on the site,
- Compaction recommendations for various types of backfill proposed at the site, and,
- Cursory exterior grading considerations

- This report provides design parameters, but does not provide foundation design or design of structure components. The project architect, designer, structural engineer or builder may be contacted to provide a design based on the information presented in this report.

- Our subsurface exploration, laboratory study and engineering analysis do not address environmental or geologic hazard issues

3.0 FIELD STUDY

3.1 *Project location*

The proposed legal description for the evaporation pond structure is designated as; NE quarter of the SW quarter of Section 23, Township 31 North , Range 13 West, N.M.P.M. The structure in located in San Juan County, north of Farmington, New Mexico.

3.2 *Site Description and Geomorphology*

The ground surface at the project site generally slopes down to the northwest with an inclination of approximately ten to one (10:1, horizontal to vertical) or flatter. Broad crested shallow ridge features are located in the southern portion of the proposed pond location. Steeper slopes exist off the flanks of the ridge features with inclinations as steep as approximately five to one (5:1, h:v).

The subsurface soil and rock material encountered in the area generally consists of a mixture of sand and clay soil material overlying the underlying bedrock formational material. Soil depths overlying the formational material tend to be highly variable due to the different historical erosional patterns and topographic character of the site. The sand and clay soil material encountered in the area may exhibit a low to moderate swell potential. The shale and claystone beds found within the formational material may exhibit a relatively high swell potential when wetted.

3.3 *Subsurface Soil and Water Conditions*

We advanced four (4) test borings in the vicinity of the proposed pond structure. The location of the test borings relatively to the proposed pond layout is shown on Figure 1. The logs of the soils encountered in our test borings are presented in Appendix A.

Test borings One and Two were advanced to a depth of fifty (50) feet below the grounds surface primarily to verify that the subsurface free water elevation was not encountered within this depth. We did not encountered subsurface free water in these test borings. In addition, we obtained soils samples in these borings for subsequent laboratory testing.

- Test Boring One was advanced south of the proposed southeast corner of the pond structure at the crest of a ridge feature. We encountered a relatively shallow soil mantle consisting of a clayey sand material from the ground surface to a depth of five (5) feet below the ground surface where we encountered the underlying formational material. The formational material encountered consist of interbedded layers of sandstone and claystone material to the bottom of the test borings at fifty (50) feet below the ground surface.

- Test Boring Two was advanced north of the proposed northwest corner of the pond structure. The test boring was advanced at an elevation below the proposed pond bottom elevation. We encountered clayey sand material from the ground surface to a depth of twenty-six (26) feet below the ground surface. We encountered clay soil material with sand at a depth of twenty-six (26) feet below the ground surface to the bottom of the test boring at fifty (50) feet below the ground surface. We encountered an increase in moisture content in the bottom ten (10) feet of the test boring. We did not encounter subsurface free water in the test boring.

Test Borings Three and Four were advanced in the northwest area of the proposed pond. In Test Boring Three we encountered slightly clayey sand material from the ground surface to the bottom of boring at nineteen (19) feet below the ground surface. In Test Boring Four we encountered slightly clayey sand material from the ground surface to a depth of ten (10) feet below the ground surface where we encountered sandstone formational material. Test Boring Four was advanced to a depth of fifteen (15) feet below the ground surface.

The logs of the subsurface conditions presented in Appendix A and described above are based on our interpretation of the subsurface conditions exposed in the test holes at the time of our field work. Subsurface soil and water conditions are often variable across relatively short distances. It is likely that variable subsurface soil and water conditions will be encountered during construction.

4.0 LABORATORY STUDY

The laboratory study included tests to estimate the strength, swell and consolidation potential of the soils tested. We performed the following tests on select samples obtained from the test borings.

Moisture content and dry density: the moisture content and in-situ dry density of some of the soil samples were assessed in general accordance with ASTM D2216

Atterberg Limits; the plastic limit, liquid limit and plasticity index of some of the soil samples was determined in general accordance with ASTM D4318

Swell-Consolidation Tests; the one dimensional swell-consolidation potential of some of the soil samples obtained was determined in general accordance with ASTM D2435. The soil sample tested is exposed to varying loads and usually the addition of water. The one-dimensional swell-consolidation response of the soil sample to the loads and/or water is represented graphically on Figures 4.1 and 4.2.

A synopsis of some of our laboratory data for some of the samples tested is tabulated below.

Sample Designation	Moisture Content (percent)	Dry Density (PCF)	Swell Pressure (PSF)	Swell Potential (% under 100 psf load)
TB 2 @ 9 feet	6.4	102.3	550	0.3
TB-4 @ 4 feet	3.3	106.8	No water added	--

5.0 POND EMBANKMENT BERM RECOMMENDATIONS

We understand that the proposed pond berms will be constructed from earthen fill material and will be lined with a water impervious liner on the interior of the ponds. We anticipate that the berms will range in height from approximately eight (8) to twenty (20) feet in height. The interior slope inclination is proposed to be two to one (2:1, h:v) and will have an elevation relief of approximately eight (8) feet. The exterior embankment slope inclination is proposed to be three to one (3:1, h:v) and will have an elevation relief ranging from approximately eight (8) to twenty (20) feet.

5.1 Stability Analysis of Pond Embankment

We performed a cursory analysis of the slope stability conditions for the proposed pond slopes at the project site. Our analysis included an assessment of the stability of both the exterior proposed three to one (3:1, h:v) slopes and the interior proposed two to one (2:1, h:v) slopes. We performed our analysis for both the unfilled pond condition and filled liquid pond condition. We performed our analysis on a hypothetical maximum embankment height of twenty (20) feet. this should theoretically represent the least stable embankment configuration for the proposed pond. We utilized an angle of internal friction of thirty (30) degrees and a cohesion of fifty (50) pounds per square foot in our analysis. These values are based on laboratory testing performed on the native clayey sand material encountered in our test borings.

Our study included observations of the topography and geomorphology of the project site and adjacent areas. Slope cross sections of critical portions of the site were prepared based on proposed slope inclinations and slope heights given to us by Mr. David Simpson, P.E., Mule Shoe Engineering.

There are numerous methods and techniques available for slope stability analysis. Most methods include an evaluation of;

- the strength of the soil materials within the slope,
- anisotropies within the slope materials, such as formational material bedding planes, and anomalous soil contacts,
- the subsurface water and soil moisture conditions, and,
- the pre-construction and post-construction geometry of the slope areas where development and construction is proposed.

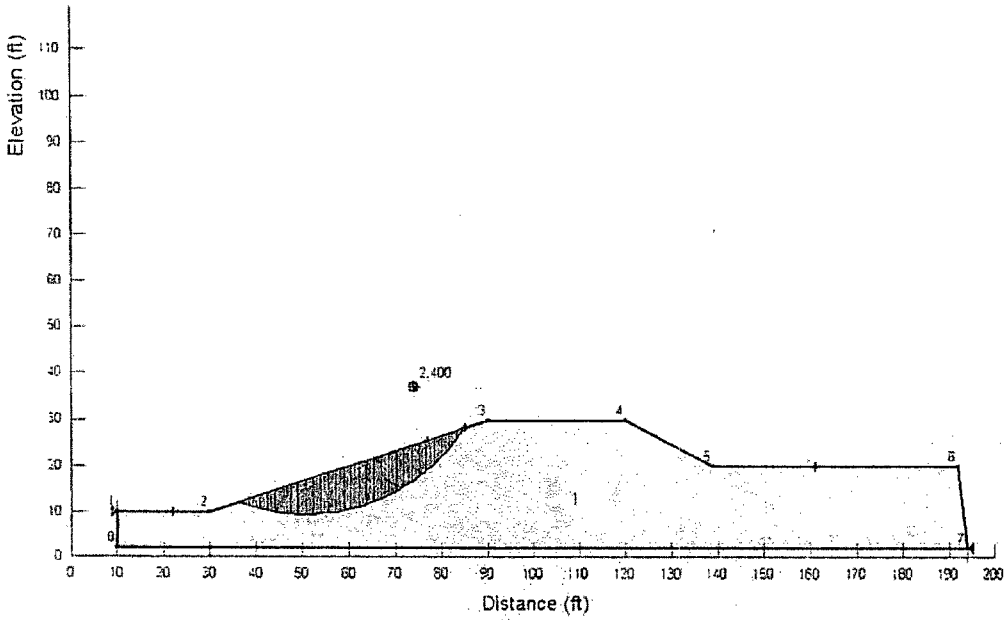
The data developed during the analysis is condensed and used to estimate the forces within a soil mass that tend to drive movement and the forces that tend to resist movement. The ratio of resisting forces to driving forces is often referred to as the "theoretical slope factor of safety" (FOS) which is a somewhat misleading term to describe this ratio. The ratio is not a true factor of safety, but is a useful mathematical characterization of the forces within a soil mass and the associated stability condition of the slope being analyzed.

A ratio of less than one (1) indicates that the driving forces within a soil mass are greater than the resisting forces; therefore movement of the slope is occurring. A ratio of one (1) indicates that the driving forces are equal to the resisting forces, which indicates that movement within the soil can be triggered by only slight increases in the driving forces or slight reductions in the resisting forces. A ratio of greater than one (1) is an indication that the driving forces are less than the resisting forces and the slope is not moving. Since there are numerous variables and incongruities within most soil masses, a slope is generally not considered as stable until the ratio is 1.5 or greater.

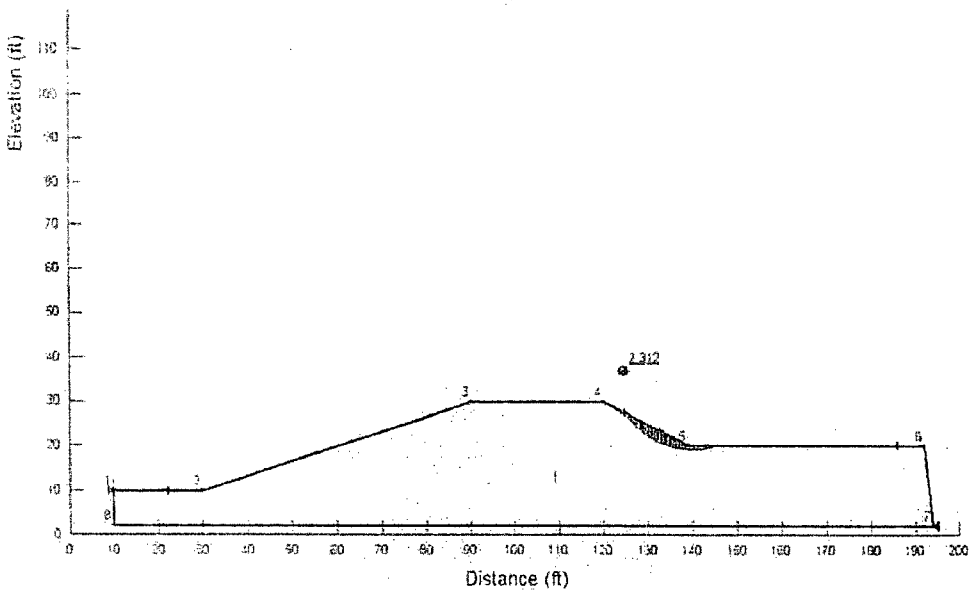
We used SLOPE-W slope stability software to evaluate the stability of computer modeled slope cross sections of select portions of this site. We primarily used the Modified Bishop's Method of slices to analyze the computer modeled slopes. We further evaluated the stability of the slopes on this site using infinite slope stability analysis techniques. The Modified Bishop's Method of Slices evaluates both the resisting and driving forces within slices of the sloped soil mass along a theoretical semi-circular failure plane. The semicircular failure plane with the lowest theoretical factor of safety is labeled the critical circle.

We analyzed the theoretical stability of the proposed three to one (3:1,h:v) exterior and two to one (2:1, h:v) interior slopes for a slope height of twenty (20) feet. The unfilled condition of the pond is simulated in these analyses shown below.

3:1,H:V Unfilled Pond Condition; Exterior Slopes



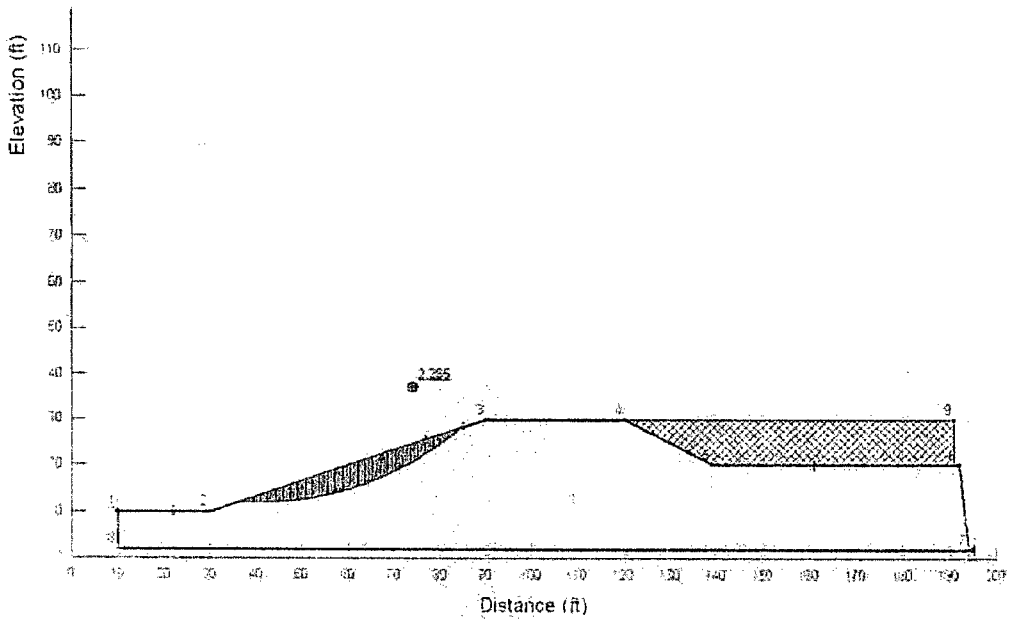
2:1. H:V Unfilled Pond Condition; Interior Slopes



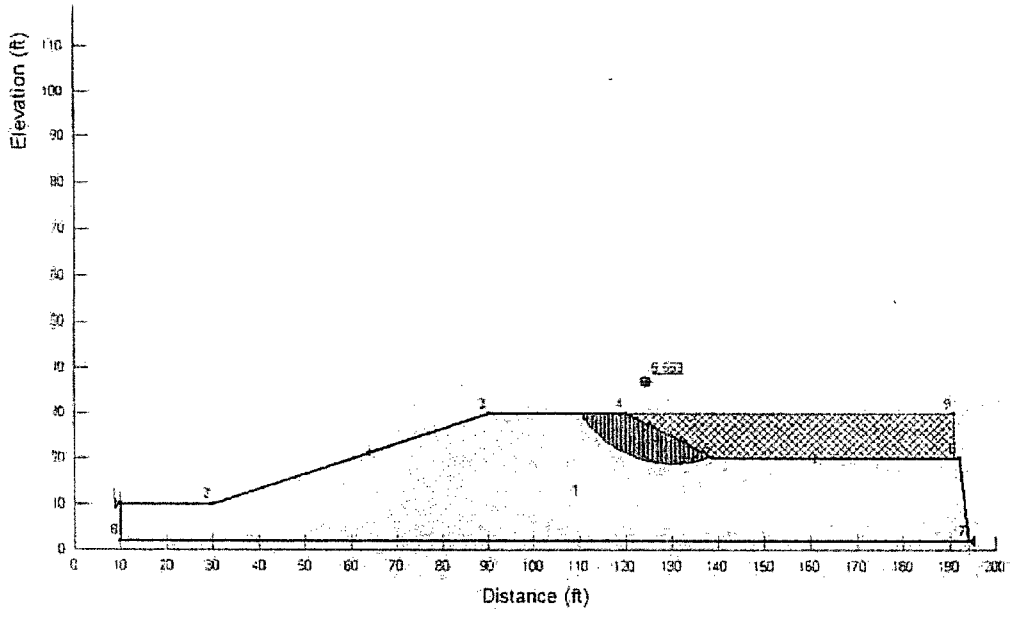
The analyses shown above indicate that the theoretical factor of safety for the proposed slope inclinations based on a hypothetical dike height of twenty (20) feet ranges from approximately 2.3 to 2.4. This theoretical factor of safety indicates that the proposed lined pond slope geometry may be considered as being stable.

In addition, we analyzed the same slope configurations shown above, but with the addition of water impounded in the pond. These analyses are shown below.

3:1.H:V Filled Pond Condition; Exterior Slopes

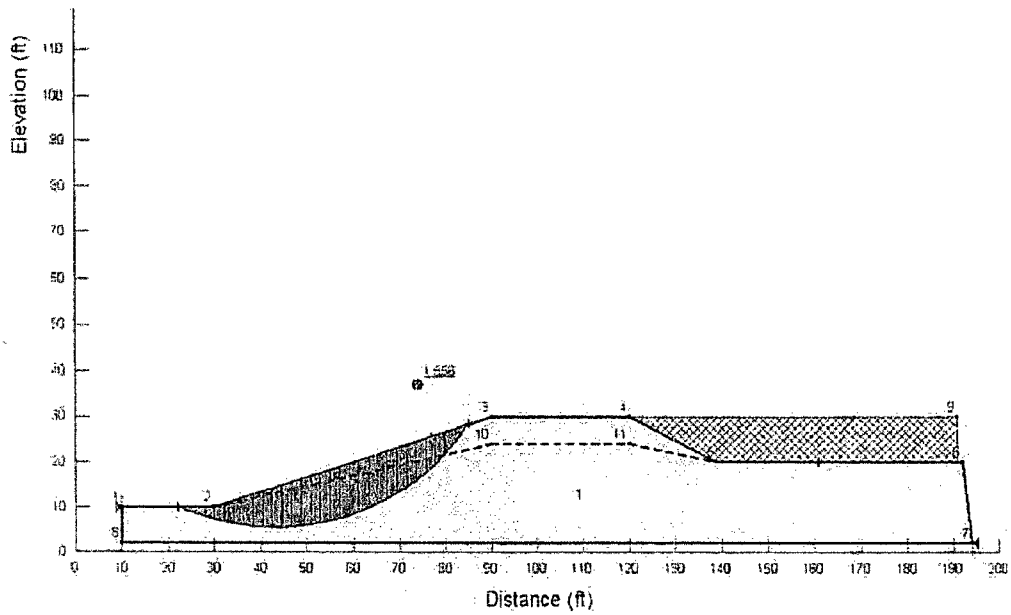


2:1,H:V Filled Pond Condition: Interior Slopes



As shown, the theoretical factor of safety of the exterior slope decreases slightly to approximately 2.25 while the theoretical factor of safety of the interior slopes increases substantially to approximately 5.55. The decrease in stability of the exterior slopes and increase in stability of the interior slopes is due to the fluid pressures exerted on the dike by the water. The stability of the geometry shown above may be considered as stable for the proposed lined ponds.

The above analyses represent the stability of the embankment slope under normal soil moisture conditions. The stability of the embankment slope will be dramatically reduced if a phreatic water elevation is allowed to develop in any of the proposed embankment dikes. The stability below represents the theoretical factor of safety of the exterior pond slope with a hypothetical subsurface phreatic water surface within the embankment materials. The top of the hypothetical phreatic water surface is approximately five (5) feet below the top of the dike and exits at the toe of the embankment slope. This analysis is shown below.



As shown in the analysis above, the theoretical factor of safety of the exterior pond slope is reduced from approximately 2.25 to approximately 1.55. This situation may still be considered as stable, however if a phreatic water surface does develop above the elevation represented above, the theoretical factor of safety may decrease to an unacceptable level. We recommend that a subsurface drain system be considered to reduce the potential for subsurface water to accumulate in the pond dike, particularly in the taller areas of the proposed embankment berms. The subsurface drain system concept is discussed below.

5.1.1 Erosion Protection Considerations

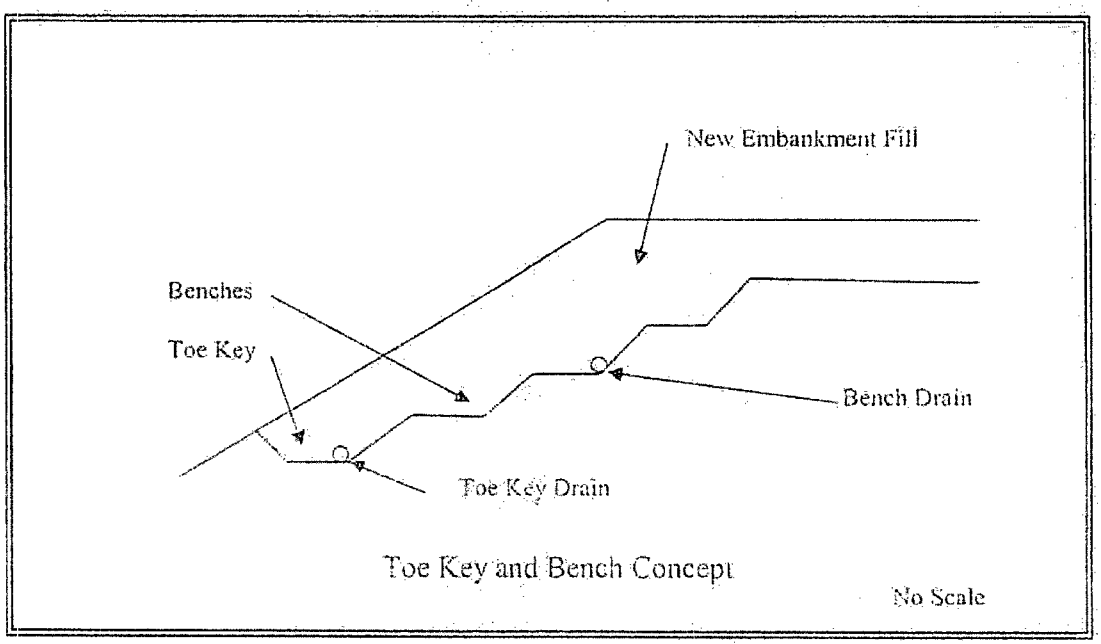
We do not typically provide erosion protection design recommendations. However, due to the poorly graded sand material that is proposed for use in construction of the embankments at the site that an erosion protection strategy be developed.

The slopes should be protected with either a commercial rock product, geotextile material, or a combination of these products. We are available to provide geotechnical engineering parameters such as grain size distribution of the soils and imported rock products as needed.

5.2 Pond Dike Construction Recommendations

The native clayey sand soil material may be used to construct the pond dikes. The material should be moisture conditioned to plus or minus two (2) percent of the optimum moisture content as established by ASTM D1557, "Laboratory Compaction Characteristics of Soil Using Modified Effort" (Modified Proctor Test). The fill material should be placed and compacted in lift depths not to exceed twelve (12) inches. The material should be compacted to a dry density of at least ninety (90) percent of the maximum dry density as defined by ASTM D1557, Modified Proctor Test.

As mentioned above, it may be prudent to construct a subsurface drain system in the pond dike, particularly in the more extensive dike areas. This concept is shown below.



Toe Key and Bench Concept

No Scale

The width of the toe key should be at least one-fourth (1/4) of the height of the fill. The elevation difference between each bench, width, and geometry of each bench is not critical, but generally the elevation difference between each lift should not exceed about three (3) to four (4) feet. The benches should be of sufficient width to allow for placement of horizontal lifts of fill material, therefore the size of the compaction equipment used will influence the bench widths.

The toe key and bench drains shown above should be placed to reduce the potential for water accumulation in the embankment fill and in the soils adjacent to the embankment fill. The placement of these drains is more critical on larger fill areas, areas where subsurface water exists and in areas where the slopes are marginally stable. We generally suggest that toe drains be considered for fill areas where the vertical height exceeds about 8 feet and bench drains be considered with toe drains for total fill heights of greater than about (16) feet. The need for these drain systems should be determined by the project civil engineer. We are available to provide additional information, if needed.

The toe key and bench drains may consist of a perforated pipe which is surrounded by a free draining material which is wrapped by a geotextile filter fabric. The pipe should be surrounded by four (4) to six (6) cubic feet of free draining material per lineal foot of drain pipe.

5.3 Post Construction Settlement Considerations of the Pond

We analyzed the anticipate post construction settlement of the pond dike fill material. We anticipate that pond dike heights in the range of eight (8) to twelve (12) feet will have a total settlement ranging from approximately one (1) to three (3) inches in the central portion of the fill mass. Dike heights ranging from twelve (12) to twenty (20) feet in height will have an estimated total settlement ranging from two (2) to four (4) inches. Due to the sandy nature of the soil, we estimate that about fifty (50) percent of the settlement will occur during the construction process.

Due to the variable height of the proposed embankment berms and the variable thickness of support soil between the berms and the underlying formational material we suspect that some differemntial settlement of the berms may occur. It is not possible to realistically calculate the total differential settlement, but is will likely be in the range of about One (1) to three (3) inches. The proposed pond liner must be constructed to permit some amount of differential settlement of the pond structure.

6.0 CONSTRUCTION CONSIDERATIONS

The section of the report provides comments, considerations and recommendations for aspects of the site construction which may influence, or be influenced by the geotechnical engineering considerations discussed above. The information presented below is not intended to discuss all aspects of the site construction conditions and considerations that may be encountered as the project progresses. If any questions arise as a result of our recommendations presented above, or if unexpected subsurface conditions are encountered during construction we should be contacted immediately.

6.1 *Fill Placement Recommendations*

There are several references throughout this report regarding natural soil fill recommendations. The recommendations presented below are appropriate for the fill placement considerations discussed throughout the report above.

All areas to receive fill, structural components (if any), or other site improvements should be properly prepared and grubbed at the initiation of the project construction. The grubbing operations should include scarification and removal of organic material and soil. No fill material or concrete should be placed in areas where existing vegetation or fill material exist.

6.1.1 *Natural Soil Fill*

Any natural soil used for any fill purpose should be free of all deleterious material, such as organic material and construction debris. Natural soil fill includes excavated and replaced material or in-place scarified material.

The natural soils should be moisture conditioned, either by addition of water to dry soils, or by processing to allow drying of wet soils. The proposed fill materials should be moisture conditioned to between about optimum and about two (2) percent above optimum soil moisture content. This moisture content can be estimated in the field by squeezing a sample of the soil in the palm of the hand. If the material easily makes a cast of soil which remains in-tact, and a minor amount of surface moisture develops on the cast, the material is close to the desired moisture content. Material testing during construction is the best means to assess the soil moisture content.

Moisture conditioning of clay or silt soils may require many hours of processing. If possible, water should be added and thoroughly mixed into fine grained soil such as clay or silt the day prior to use of the material. This technique will allow for development of a more uniform moisture content and will allow for better compaction of the moisture conditioned materials.

The moisture conditioned soil should be placed in lifts that do not exceed the capabilities of the compaction equipment used and compacted to at least ninety (90) percent of maximum dry density as defined by ASTM D1557, modified Proctor test. We typically recommend a maximum fill lift thickness of six (6) inches for hand operated equipment and eight (8) to ten (10) inches for larger equipment. Care should be exercised in placement of utility trench backfill so that the compaction operations do not damage the underlying utilities.

6.1.2 *Granular Compacted Structural Fill*

We do not anticipate that much granular structural fill will be constructed as part of this site development. However, if ancillary structures are planned the recommendations presented in this section of our report should be considered.. Granular compacted structural fill should be constructed using an imported commercially produced rock product such as aggregate road base. Many products other than road base, such as clean aggregate or select crusher fines may be suitable, depending on the intended use. If a specification is needed by the design professional for development of project specifications, a material conforming to the Colorado Department of Transportation "Class 6" aggregate road base material can be specified. This specification can include an option for testing and approval in the event the contractor's desired material does not conform to the Class 6 aggregate specifications.

All compacted structural fill should be moisture conditioned and compacted to at least ninety (90) percent of maximum dry density as defined by ASTM D1557, modified Proctor test. Areas where the structural fill will support traffic loads under concrete slabs or asphalt concrete should be compacted to at least ninety-five (95) percent of maximum dry density as defined by ASTM D1557, modified Proctor test.

6.2 *Excavation Considerations*

Unless a specific classification is performed, the site soils should be considered as an Occupational Safety and Health Administration (OSHA) Type C soil and should be sloped and/or benched according to the current OSHA regulations. Excavations should be sloped and benched to prevent wall collapse. Daily observations of the excavations should be conducted by OSHA competent site personnel to assess safety considerations.

We did not encounter free subsurface water in our test borings. If water is encountered during construction, it may be necessary to dewater excavations to provide for suitable working conditions.

If possible excavations should be constructed to allow for water flow from the excavation the event of precipitation during construction. If this is not possible it may be necessary to remove water from snowmelt or precipitation from the foundation excavations to help reduce the influence of this water on the soil support conditions and the site construction characteristics.

We encountered formational material in our test borings. We suspect that it may be difficult to excavate this material using conventional techniques. If blasting is planned it must be conducted strategically to reduce the affect of the blasting on the support characteristics of the site materials and the stability of adjacent slopes.

6.2.1 *Excavation Cut Slopes*

We anticipate that some permanent excavation cut slopes may be included in the site development. Temporary cut slopes should not exceed five (5) feet in height and should not be steeper than about one to one (1:1, horizontal to vertical) for most soils. Permanent cut slopes of greater than five (5) feet or steeper than two and one-half to one (2½:1, h:v) must be analyzed on a site specific basis.

We did not observe evidence of existing unstable slope areas influencing the site, but due to the steepness and extent of the slopes in the area we suggest that the magnitude of the proposed excavation slopes be minimized and/or supported by retaining structures.

6.4 *Exterior Grading and Drainage Comments*

The ground surface adjacent to the structure should be sloped to promote water flow away from the structure. The project civil engineering consultant or builder should develop a drainage scheme for the site. We typically suggest a minimum fall of about eight (8) to ten (10) percent away from the structure, in the absence of design criteria from others. Care should be taken to not direct water onto adjacent property or to areas that would negatively influence existing structures or improvements.

7.0 CONSTRUCTION MONITORING AND TESTING

Construction monitoring including engineering observations and materials testing during construction is a critical aspect of the geotechnical engineering contribution to any project. Unexpected subsurface conditions are often encountered during construction. The site structure excavation should be observed by the geotechnical engineer or a representative during the early stages of the site construction to verify that the actual subsurface soil and water conditions were properly characterized as part of field exploration, laboratory testing and engineering analysis. If the subsurface conditions encountered during construction are different than those that were the basis of the geotechnical engineering report then modifications to the design may be implemented prior to placement of fill materials or foundation concrete.

Compaction testing of fill material should be performed throughout the project construction so that the engineer and contractor may monitor the quality of the fill placement techniques being used at the site. Generally we recommend that compaction testing be performed for any fill material that is placed as part of the site development. Compaction tests should be performed on each lift of material placed in areas proposed for support of structural components. In addition to compaction testing we recommend that the grain size distribution, clay content and swell

potential be evaluated for any imported materials that are planned for use on the site. We are available to develop a testing program for soil, aggregate materials, concrete and asphaltic concrete for this project.

8.0 CONCLUSIONS AND CONSIDERATIONS

We feel that it is feasible to develop this site for the proposed industrial use. The information presented in this report is based on our understanding of the proposed construction that was provided to us and on the data obtained from our field and laboratory studies. We recommend that we be contacted during the design and construction phase of this project to aid in the implementation of our recommendations. Please contact us immediately if you have any questions, or if any of the information presented above is not appropriate for the proposed site construction.

The recommendations presented above are intended to be used only for this project site and the proposed construction which was provided to us. The recommendations presented above are not suitable for adjacent project sites, or for proposed construction that is different than that outlined for this study.

Our recommendations are based on limited field and laboratory sampling and testing. Unexpected subsurface conditions encountered during construction may alter our recommendations. We should be contacted during construction to observe the exposed subsurface soil conditions to provide comments and verification of our recommendations. We are available to review and tailor our recommendations as the project progresses and additional information which may influence our recommendations becomes available.

Please contact us if you have any questions, or if we may be of additional service.

Respectfully,
TRAUTNER GEOTECH

Jonathan P. Butler, P.E.
Geotechnical Engineer

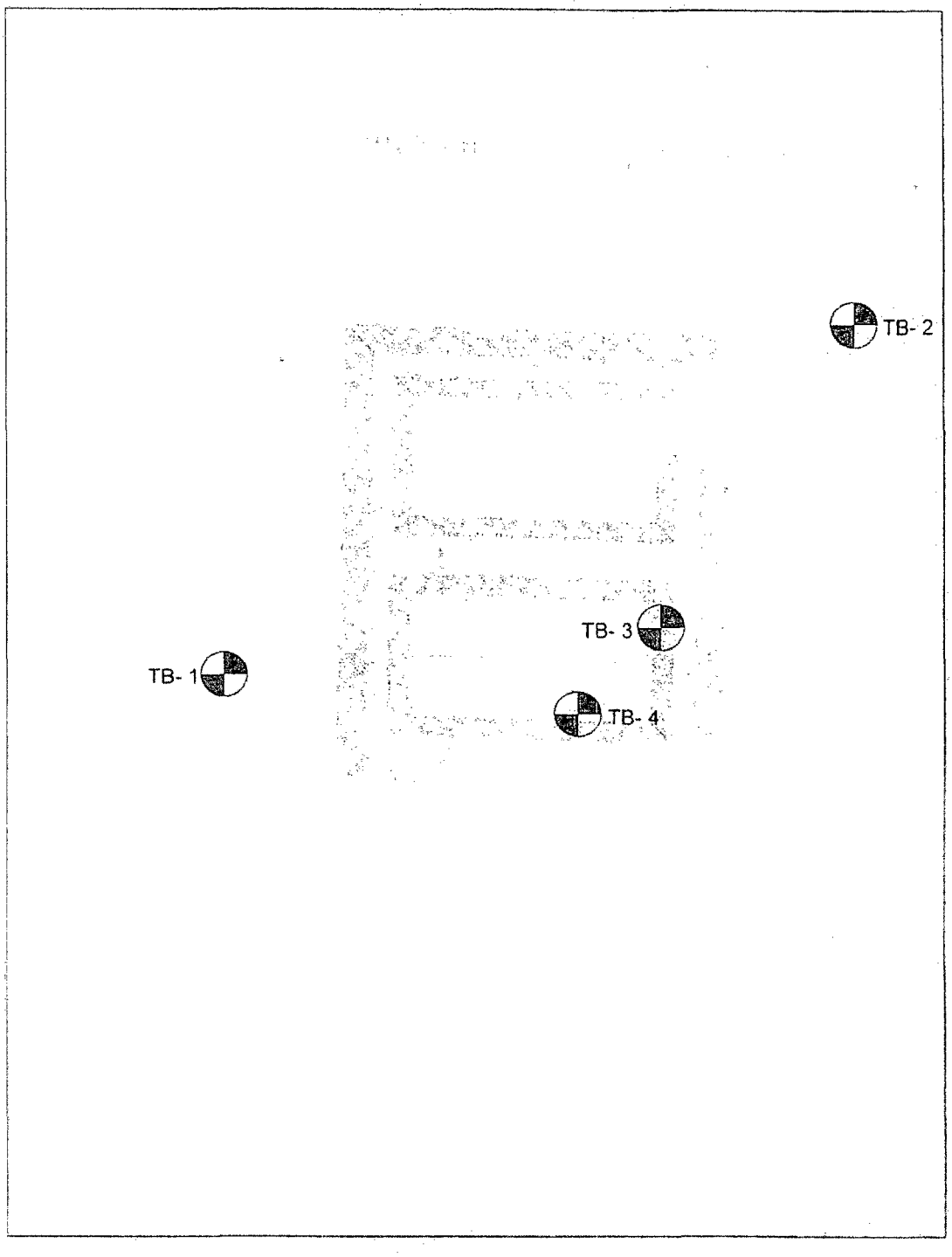
Reviewed

David L. Trautner, P.E.
Principal Geotechnical Engineer

TRAUTNER GEOTECH
A DIVISION OF TRIGON

Project Number:	50924GE
Figure:	1

TEST BORING LOCATION SKETCH



Not to Scale

THIS SYMBOL INDICATES THE APPROXIMATE TEST BORING LOCATION.

This sketch was prepared using our field notes and/or site plans provided by others. This sketch presents approximate test boring locations only.

TRAUTNER GEOTECH
A DIVISION OF TRIGON TECH

Field Engineer	: D. Trautner
Hole Diameter	: 4" solid
Drilling Method	: Continuous Flight Auger
Sampling Method	: Mod. California Sampler
Date Drilled	: 3/13/2007
Total Depth	: 50'
Location	: See Figure 1

LOG OF BORING TB1

Sand Rock Evaporation Pond
Muleshoe Engineering
Mr. David Simpson, P.E.

Project #50924GE

Sample Type
- Mod. California Sampler
- Bag Sample
- Standard Split Spoon

Water Level
- Water Level During Drilling
- Water Level After Drilling

Depth in Feet	DESCRIPTION	USCS	GRAPHIC	Samples	Blow Count	Water Level	REMARKS
0-5	SAND, clayey, medium dense, slightly moist, tan	SC					
5-15	Weathered Formational Material, sandstone, some claystone lenses, hard, slightly moist, tan to white	SS					
15-35	Formational Material, claystone and sandstone, hard to very hard, slightly moist, tan to white Increase in Moisture at 30 feet	SS					
35-38	Formational Material, sandstone, very hard, moist, gray	SS					
38-46	Formational Material, sandstone, hard to very hard, slightly moist, gray	SS					
46-50	Formational Material, sandstone, very hard, moist, gray	SS					
50-51	Bottom of test boring at 50 feet						

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TRAUTNER GEOTECH
A DIVISION OF TRIGON GEC

Field Engineer	: D. Trautner
Hole Diameter	: 4" solid
Drilling Method	: Continuous Flight Auger
Sampling Method	: Mod. California Sampler
Date Drilled	: 3/13/2007
Total Depth	: 50'
Location	: See Figure 1

LOG OF BORING TB2

Sand Rock Evaporation Pond
Muleshoe Engineering
Mr. David Simpson, P.E.

Project #50924GE

Sample Type
- Mod. California Sampler
- Bag Sample
- Standard Split Spoon

Water Level
- Water Level During Drilling
- Water Level After Drilling

Depth in Feet	DESCRIPTION	USCS	GRAPHIC	Samples	Blow Count	Water Level	REMARKS
0–9	SAND, clayey, medium dense, dry to slightly moist, brown	SC					
10–25	SAND, slightly clayey, dense, dry, tan	SP			18/12		
26–50	CLAY, sandy, stiff, moist, brown	CL					
51	Bottom of test boring at 50 feet						

TRAUTNER GEOTECH
A DIVISION OF TRIGON GEO

Field Engineer	J. Butler
Hole Diameter	4" solid
Drilling Method	Continuous Flight Auger
Sampling Method	Mod. California Sampler
Date Drilled	3/13/2007
Total Depth	19'
Location	See Figure 1

LOG OF BORING TB3

Sand Rock Evaporation Pond
Muleshoe Engineering
Mr. David Simpson, P.E.

Project #50924GE

Sample Type
- Mod. California Sampler
- Bag Sample
- Standard Split Spoon

Water Level
- Water Level During Drilling
- Water Level After Drilling

Depth in Feet	DESCRIPTION	USCS	GRAPHIC	Samples	Blow Count	Water Level	REMARKS
0	SAND, clayey, medium dense, slightly moist, tan	SC			10/6 13/6		
10	SAND, slightly clayey, dense, moist, tan	SC					
19	Bottom of test boring at 19 feet						
20							

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TRAUTNER GEOTECH
A DIVISION OF TRIGON

Field Engineer	J. Butler
Hole Diameter	4" solid
Drilling Method	Continuous Flight Auger
Sampling Method	Mod. California Sampler
Date Drilled	3/13/2007
Total Depth	15'
Location	See Figure 1

LOG OF BORING TB4

Sand Rock Evaporation Pond
Muleshoe Engineering
Mr. David Simpson, P.E.

Project #50924GE

Sample Type
- Mod. California Sampler
- Bag Sample
- Standard Split Spoon

Water Level
- Water Level During Drilling
- Water Level After Drilling

Depth in Feet	DESCRIPTION	USCS	GRAPHIC	Samples	Blow Count	Water Level	REMARKS
0	SAND, slightly clayey, dense, slightly moist, tan	SC			22/12		
10	Formational Material, sandstone, very hard, slightly moist, white	SS					
15	Bottom of test boring at 15 feet						

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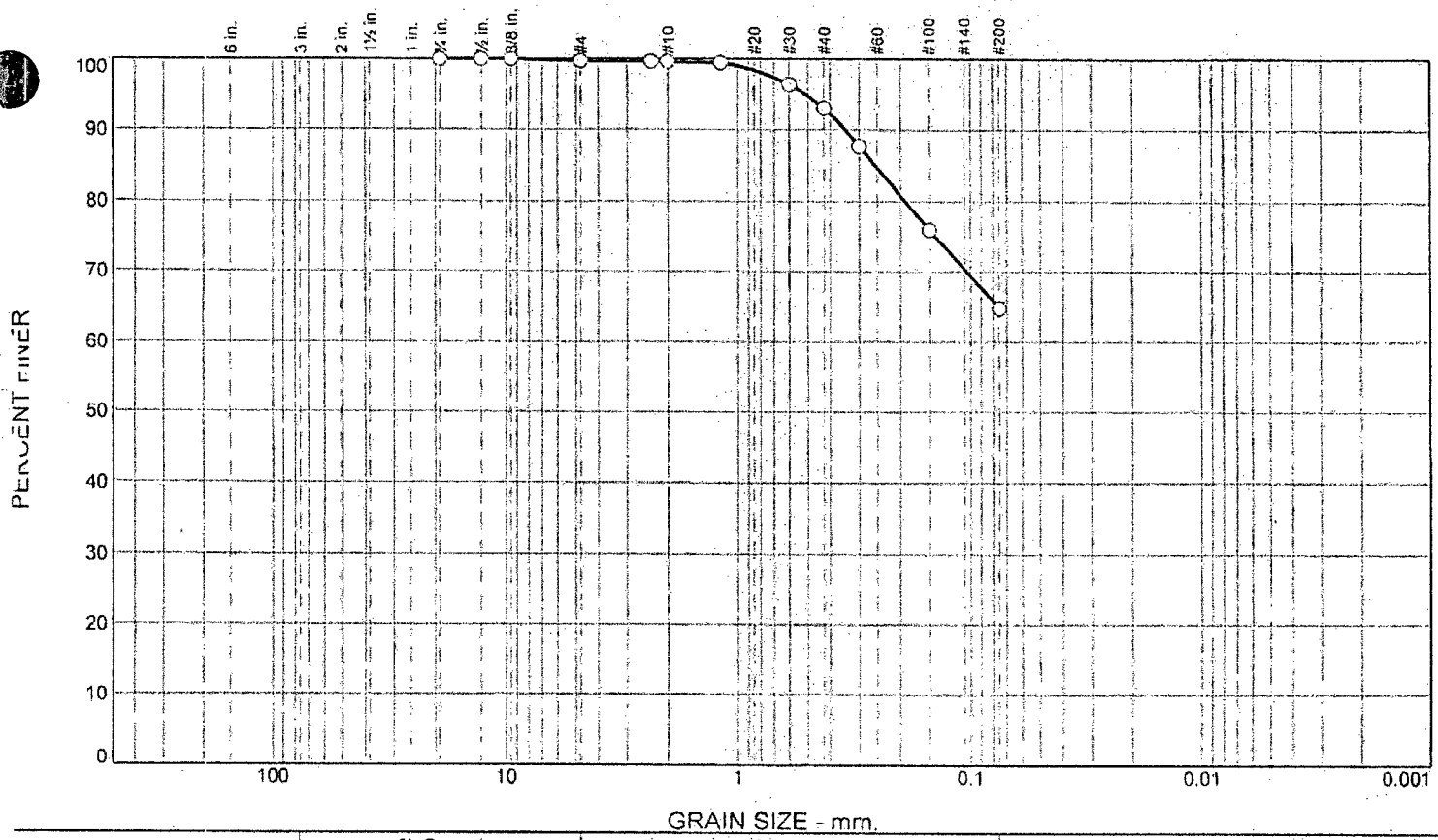
Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.3	0.1	6.5	28.4	64.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	100.0		
.375	100.0		
#4	99.7		
#8	99.6		
#10	99.6		
#16	99.4		
#30	96.4		
#40	93.1		
#50	87.7		
#100	75.9		
#200	64.7		

* (no specification provided)

Material Description

Atterberg Limits (ASTM D 4318)

PL= 17 LL= 42 PI= 25

Classification

USCS= CL AASHTO= A-7-6(14)

Coefficients

D_{85}= 0.2561 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Date Tested: 3-13-07 **Tested By:** B. Bunker

Remarks

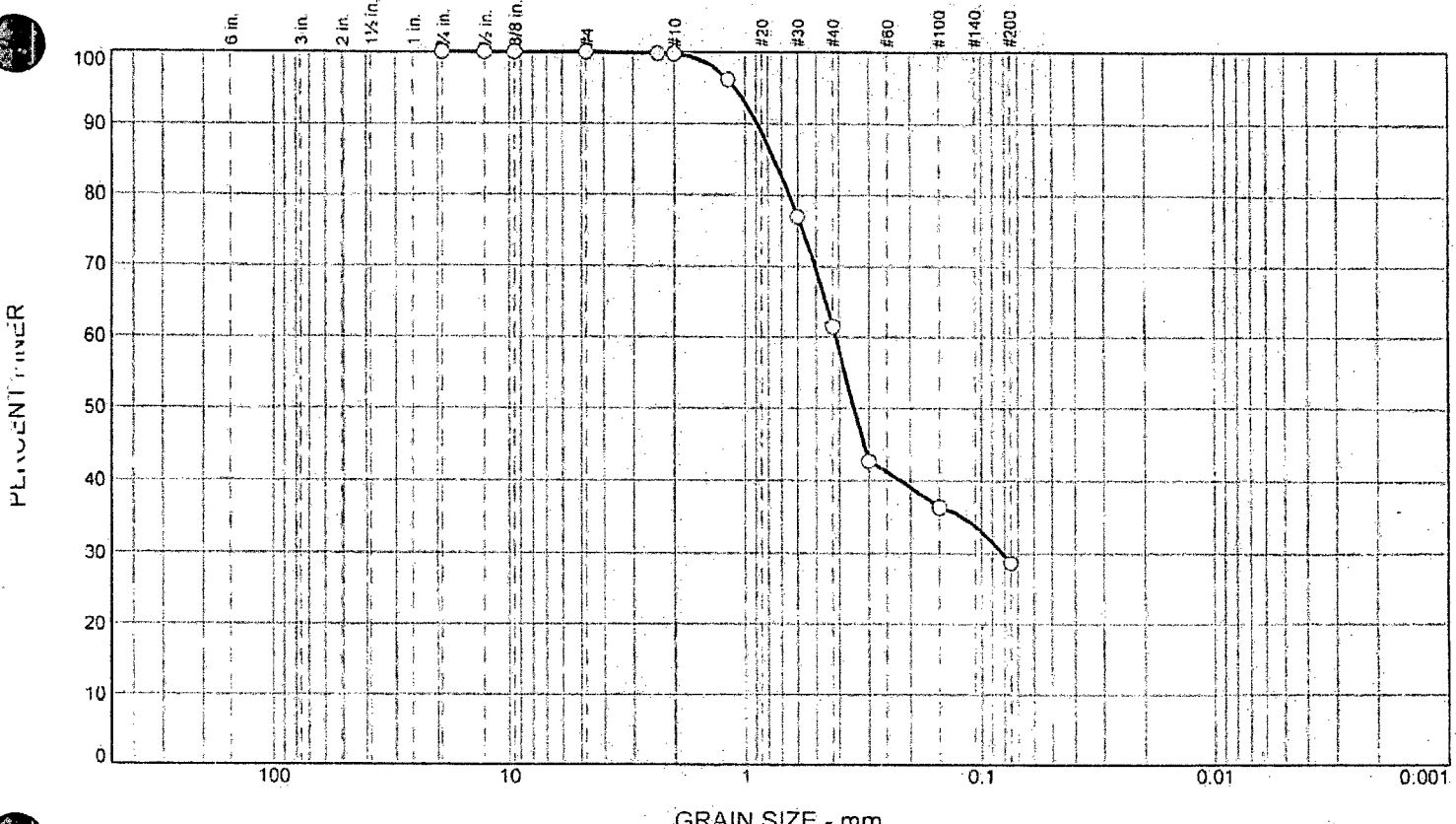
Sample No.: 10410-A **Source of Sample:** Test boring 2 **Date Sampled:** 3-14-07
Location: **Elev./Depth:** 0 to 4 ft.
Checked By: G. Denten **Title:** Laboratory Manager

TRAUTNER GEOTECH
A DIVISION OF TRIGON TEC

Client: David Simpson
Project: Sand Rock Evaporation Pond

Project No: 50924GE

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	39	32	29	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100		
.5	100		
.375	100		
#4	100		
#8	100		
#10	100		
#16	96		
#30	77		
#40	61		
#50	43		
#100	36		
#200	29		

* (no specification provided)

Material Description

Atterberg Limits (ASTM D 4318)

PL= 18 LL= 25 PI= 7

Classification

USCS= SC-SM AASHTO= A-2-4(0)

Coefficients

D_{85}= 0.7507 D_{60}= 0.4139 D_{50}= 0.3480
D_{30}= 0.0818 D_{15}= D_{10}=
C_u= C_c=

Date Tested: 3-14-07 **Tested By:** B. Bunker

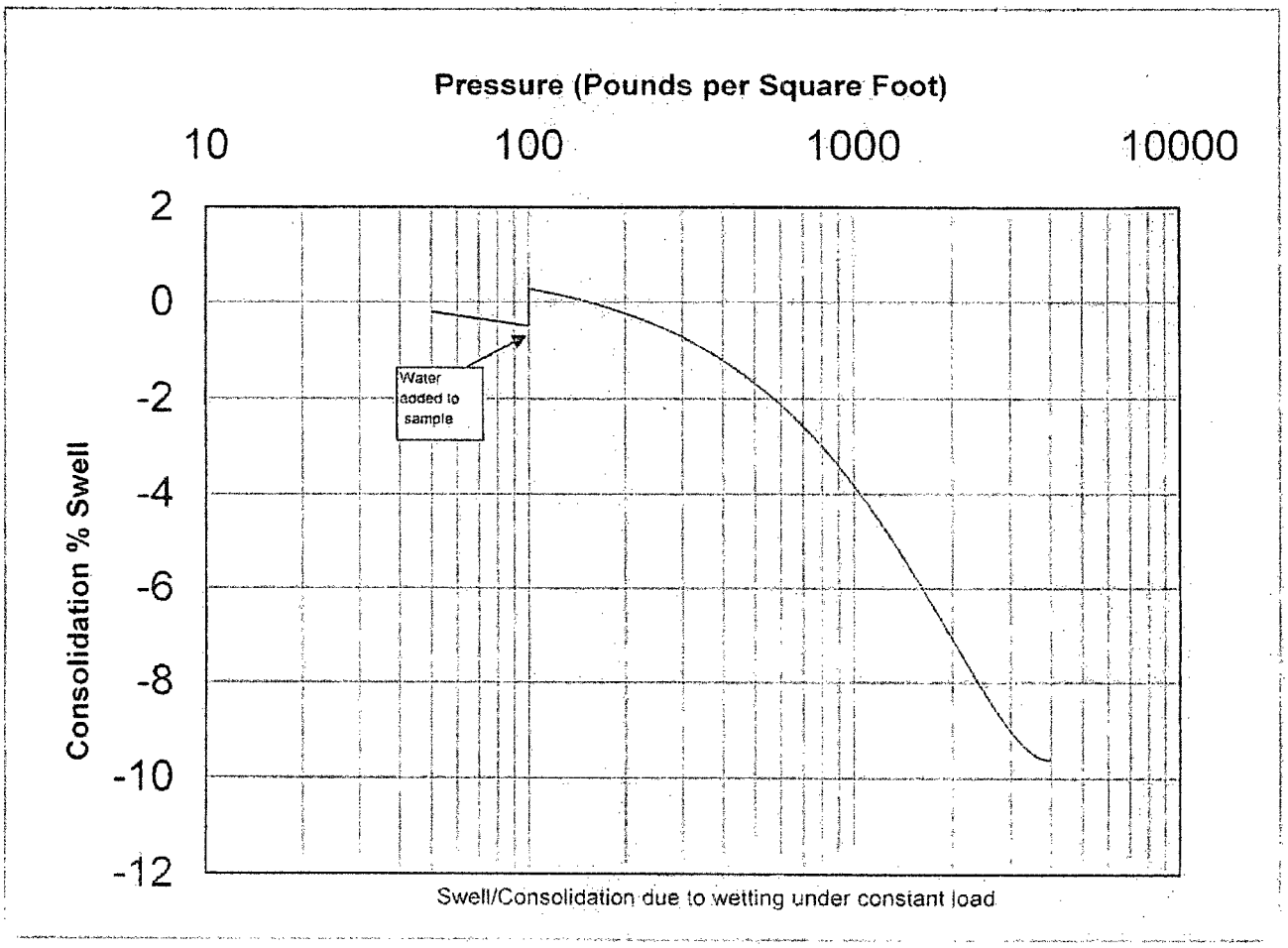
Remarks

Sample No.: 10410-H **Source of Sample:** Test boring 4 **Date Sampled:** 3-13-07
Location: **Elev./Depth:** 0 to 4 ft.
Checked By: G. Denten **Title:** Laboratory Manager

RAUTNER GEOTECH
A DIVISION OF TRIGON EPC

Client: David Simpson
Project: Sand Rock Evaporation Pond
Project No: 50924GE

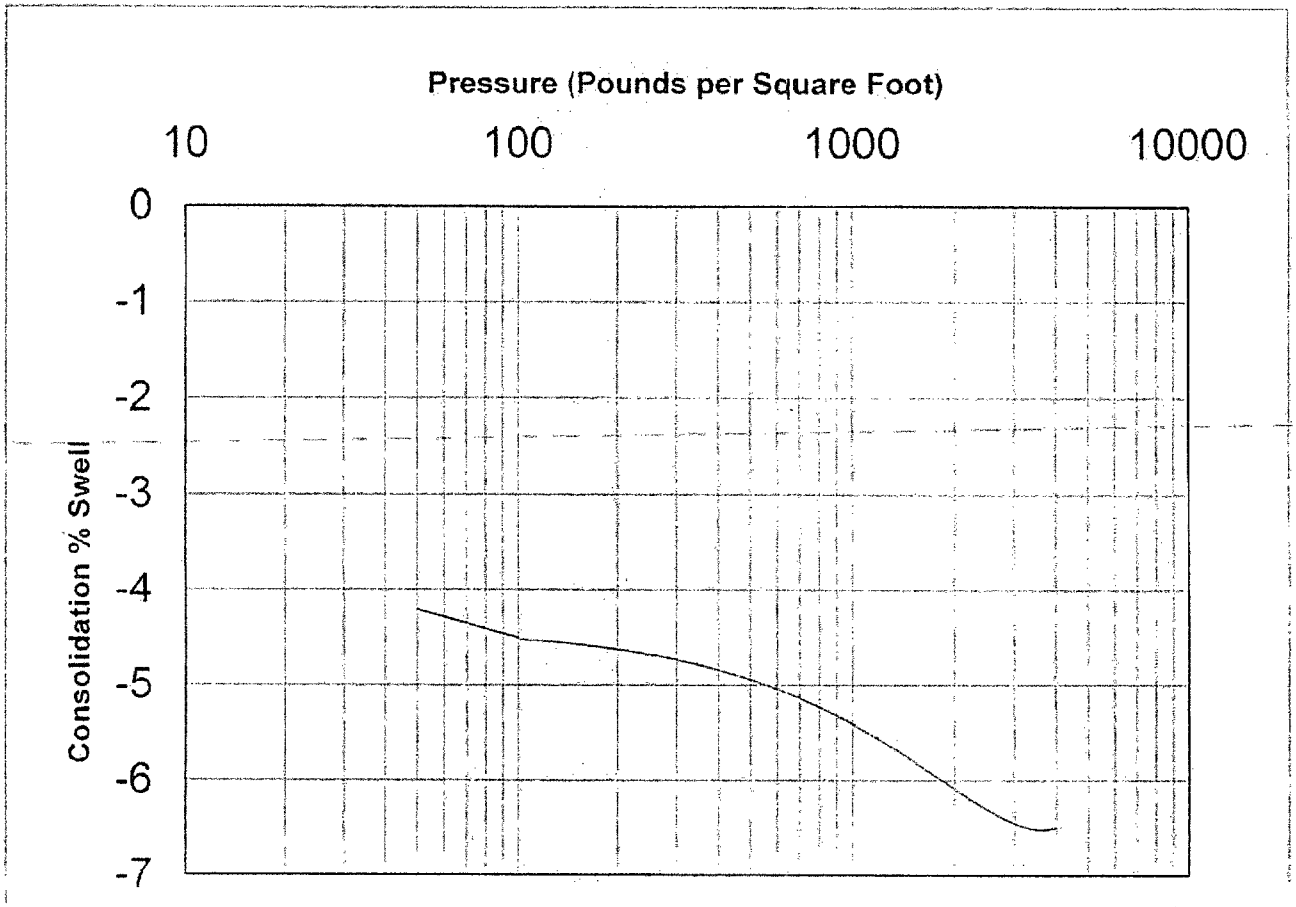
SWELL - CONSOLIDATION TEST



SUMMARY OF TEST RESULTS		
Sample Source	TB 2 @ 9'	
Soil Description	Sand (SM)	
Swell Pressure (P.S.F)	550	
	Initial	Final
Moisture Content (%)	6.4	22.1
Dry Density (P.C.F)	102.3	110.4
Height (in.)	1.000	0.903
Diameter (in.)	1.94	1.94

Project Number	50924GE
Date	March 14, 2007
Figure	4.1

SWELL - CONSOLIDATION TEST

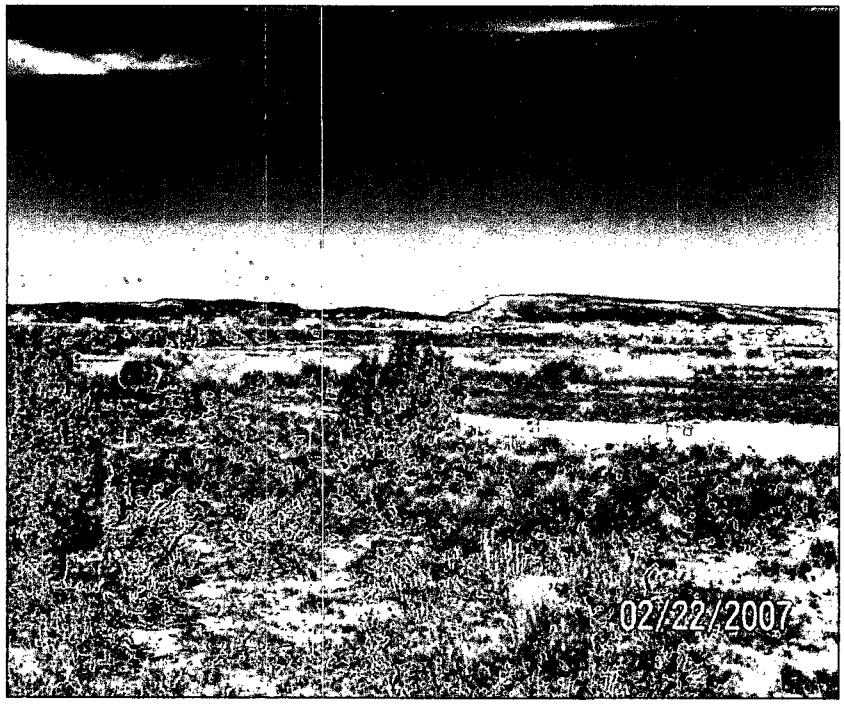


SUMMARY OF TEST RESULTS		
Sample Source	TB 4 @ 4'	
Soil Description	Sand (SM)	
Swell Pressure (P.S.F)	Consolidation	
	Initial	Final
Moisture Content (%)	3.3	3.0
Dry Density (P.C.F)	106.8	111.1
Height (in.)	1.000	0.935
Diameter (in.)	1.94	1.94

Project Number	50924GE
Date	March 22, 2007
Figure	4.2

Attachment "C" Hydrology Report

Sand Rock Surface Waste Management Facility Geological and Hydrological Analysis



Prepared for:

MuleShoe Engineering
Mr. David Simpson
P.O. Box 637
Flora Vista, NM 87415

Wright Water Engineers, Inc.

April 2007

071-021.000

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TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

Wright Water Engineers, Inc. (WWE) prepared the following report, per request of Muleshoe Engineering, consultant to Noble Energy for Sand Rock Surface Waste Management Facility (Sand Rock). Sand Rock is a proposed lined evaporation pond located in Section 23, Township 31 North, Range 13 West, N.M.P.M., San Juan County, New Mexico (Figure 1). The approximate elevation of this site is 5,670 feet. Sand Rock is classified as a surface waste management facility, and therefore regulated by Title 19, Chapter 15, Part 36 of the New Mexico Register (19.15.36). As part of the requirements under this regulation, applications for surface waste management facilities must include, among other items, specific geological and hydrological data for the proposed area, location of areas of interest that may be near the site, and a plan to control run-on and run-off water from the site.

2.0 GEOLOGICAL & HYDROLOGICAL ANALYSIS

Section 8, subsection C-15 of the aforementioned regulations outlines specific geological and hydrological information, which must be provided for the proposed location. Regarding this specific geological and hydrological information, WWE's analysis was specific to four of these requirements:

- identification of the location of watercourses and water wells within one mile of the proposed site,
- identification of the location, type and thickness of the shallowest fresh water aquifer,
- development of a potentiometric map of the shallowest fresh water aquifer;
- and a water quality analysis of the shallowest freshwater aquifer below the site.

Each requirement is explained in more detail in the following sections.

2.1 Nearby Watercourses and Water Wells

The proposed location of Sand Rock, and the watercourses and water wells within a one-mile radius are shown schematically in Figure 2. The following watercourses are located within one-mile of the site: the La Plata River, Helton Ditch, Thompson Arroyo, and Two Cross Arroyo. In addition to these water features, two water wells appear to be located within a one-mile radius of the proposed site. The location of the wells, owners, and permit numbers of the wells are listed in Table 1. The New Mexico State Engineer's IWATERS website, a database of all permitted wells in New Mexico, was utilized to identify the wells within the 1-mile radius. For wells drilled in New Mexico, the State Engineer's Office requires an application to appropriate underground water, and upon completion of the well, filing of a well record. Completion of the wells was verified by the existence of a well record on the IWATERS database.

2.2 Fresh Water Aquifer

WWE analyzed well records for nearby wells from the IWATERS database (Table 2), and borings performed by Trautner GeoTech to evaluate the nature of the shallowest fresh water aquifer underlying the proposed site. Additionally, WWE consulted a USGS Map Series of the hydrogeology in the San Juan Structural Basin of New Mexico, Colorado, Arizona, and Utah.

Water wells in the area that were used to analyze the regional groundwater system encompassing Sand Rock are shown in Figure 3 and listed in Table 2. The well records can be found in Appendix A. The depths to water listed in Table 2 and shown on Figure 3 are based on where water was first encountered during drilling as indicated by the well log. This may be different then static water level due to stabilizing and pumping conditions. Based on the depth of groundwater and the location of the wells, it appears as though the regional groundwater flow is generally southwesterly.

The USGS map series includes potentiometric surfaces, outcrops, and elevation data for the San Juan, Animas and Nacimiento formations (Appendix B). The report associated with the map indicates that aquifers in these formations are hydrologically connected. This series shows an outcrop of the Nacimiento formation in the region encompassing Sand Rock, and extending

down to an elevation of approximately 5,000 feet, or 670 feet below the surface of Sand Rock. Therefore, groundwater wells in the area likely bedrock wells completed in the Nacimiento formation. The potentiometric map shows water surface elevations for wells completed in the represented formations. Based on review of the USGS data and the water surfaces in the area, the regional groundwater flow is driven by bedrock in a southwesterly direction and part of a consolidated system.

Contrary to the regional groundwater system, which is driven by bedrock, there may be a local unconsolidated groundwater system controlled by topography, which in the region of Sand Rock is northwesterly. Upon reaching La Plata River alluvium, groundwater flow will change to that of the river system, which is southwesterly.

Test borings performed by Trautner GeoTech indicate a relatively shallow layer of unconsolidated material overlying denser "formational material" (bedrock). This is particularly the case for test borings TB-1 and TB-4 as referenced from Trautner's report dated March 28, 2007 (Trautner Report). At these locations, the Trautner Report indicates "formational material" at a depth of 5 feet in TB-1 and 10 feet in TB-4. TB-2 and TB-3 report sandy and clayey material to their total depths of 50 feet and 19 feet, respectively. None of these four borings encountered saturated conditions.

Given the lack of any observed shallow unconsolidated alluvial system, it is believed the shallowest freshwater groundwater system is that within the regional bedrock system. In comparing Well No. 10 and Well No. 2 from Figure 3, the regional groundwater flow system gradient is approximately 45 ft per mile to the southwest. Extrapolating from this information and considering that Sand Rock is located between wells Nos. 10 and 2, the estimated groundwater surface elevation below the site would be at approximately 5,600 feet. Given the approximate surface elevation of Sand Rock is 5,670 feet, it is estimated the depth to groundwater is approximately 70 feet, which is deeper then any geotechnical borings performed to date.

2.3 Potentiometric Map

Section 8C, subsection 15f of the governing regulations requires a potentiometric map for the shallowest fresh water aquifer associated with a proposed site. As mentioned previously, groundwater flow was not observed in the shallow unconsolidated material underlying the site. Should there be groundwater in this unconsolidated material, it would be locally controlled by topography. However, according to borings performed by Trautner, there is no shallow unconsolidated groundwater surface associated with Sand Rock. A more relevant potentiometric map would be of the deeper, consolidated bedrock aquifer system. The USGS potentiometric map is included in Appendix B and is considered representative of the consolidated aquifer system for wells completed in the represented formations. Figure 4 illustrates the potentiometric surface associated with nearby wells. Potentiometric surfaces associated with nearby wells appear to be consistent with the published USGS information.

2.4 Water Quality Sampling

As outlined already, there is no shallow unconfined groundwater below Sand Rock. Four borings, two to a depth of fifty feet, encountered no groundwater. Evidence indicates the shallowest groundwater associated with the site is likely part of a regional, confined groundwater system. Additionally, as indicated in Figure 2, there are no wells in the immediate vicinity of Sand Rock from which a water quality sample can be obtained. For these reasons, WWE respectfully requests a variance to the groundwater sampling requirement.

3.0 PROXIMITY TO OTHER FEATURES

Under sub-section 13B, the location of a surface waste management facility is governed by the following required minimum distances from nearby zones and features:

- 200 feet from a watercourse, lakebed, sinkhole or playa lake
- 500 feet of a wetland
- 500 feet from any residence or institution

- Additionally, no surface waste management facility can be located within the 100-year flood plain, at a location where groundwater is within 50 feet from the surface, or an existing wellhead protection area.

WWE performed a site visit of the proposed site for Sand Rock on February 22, 2007. During this site visit it was apparent the proposed site is more than 200 feet from any water feature. However, all water features of interest in the area are shown in Figure 2. Also, during this site visit, it was apparent there are no residences or institutions within 500 feet of the site. The closest residences are located on the west side of the La Plata River, and the La Plata River is approximately 1,200 feet west of Sand Rock.

In order for an area to be considered a wetland, it must meet specific criteria relating to vegetation, soils, and hydrology. The region in which Sand Rock is located has a depth to water greater then 18 inches and is primarily sandy and clayey soils. During the site visit, there was no wetland species observed. Any one of these characteristics would exclude the area for consideration as a wetland.

The 100-year flood plain map for the area is included in Appendix C. Sand Rock is located within grid 2D of this map. This map shows a flood plain associated with Thompson Arroyo to the North and the La Plata River to the West. However, Sand Rock is located outside of the 100-year floodplain.

Lastly, surface waste management facilities are restricted in wellhead protection areas and locations where groundwater is within 50 feet of the surface. As stated previously, only two wells are potentially located within a one-mile radius of the site. According to the well records, these wells are private wells and not associated with a public drinking water system. The nearest well head protection area is likely associated with the Town of Flora Vista, which derives its water supply from groundwater. The Drinking Water Bureau of the New Mexico Environmental Department recommends a 1000-foot radius for wells in a wellhead protection program. However, Flora Vista is several miles to the south of the site and a wellhead protection area associated with the drinking water supply would not extend as far north as Sand Rock. Lastly,

the borings performed by Trautner and referenced earlier indicate the groundwater surface is deeper than 50 feet from the surface.

4.0 CONTROL OF 25-YEAR EVENT

An additional requirement under the governing regulations, section 13M, is recommendations for control of run-off and run-on water for the 25-year event. In developing these recommendations, WWE focused on calculation of the 25-year flow associated with the sub-basin effecting Sand Rock. A summary of this process is outlined below, and a detail of the calculations can be found in Appendix D.

The sub-basin area that must be considered in calculating the 25-year flow is shown in Figure 5. As indicated on the map, the area is approximately 2.45 acres. Using the method outlined in the Urban Storm Drainage Criteria Manual, the time of concentration for the sub-basin outlined in Figure 5 is 19.3 minutes.

For a basin of this size, the Rational method is appropriate for determining flow. Using information from National Oceanic and Atmospheric Administration (NOAA) Atlas 14 for a location near Flora Vista, New Mexico, the rainfall intensity for the calculated time of concentration is 2.64 inches per hour (in./hr.). Based on assumptions outlined in Appendix D on the calculation sheet, this translates into a 25-year flow of approximately 2.4 cubic feet per second (cfs).

A ditch or swale with a cross-sectional area capable of conveying a minimum of 2.4 cfs will be required to control run-off water associated with Sand Rock. The approximate location of this structure is shown in Figure 5.

5.0 CONCLUSIONS

WWE prepared this report per request of Muleshoe Engineering for the proposed Sand Rock Surface Waste Management Facility. This report was prepared as required by New Mexico Regulation 19.15.36, and addresses the following sections: 8C.15a, 8C.15b, 8C.15c, 8C.15f, 13B, and 13M. Considering only the regulations outlined in these sub-sections, it is WWE's recommendation that Sand Rock receive approval for operation.

\\Animas\data\Documents\Wwe Wei\2006\071-021\Maez Evaporation\report\prelimreport.doc

TABLES

TABLE 1
Sand Rock Evaporation Pond
Wells Within One Mile[1]

Map Reference[2] #	Well Permit Number	Owner Name	Section[3]
1	3611	Williams	23
2	3351	Dunn	27

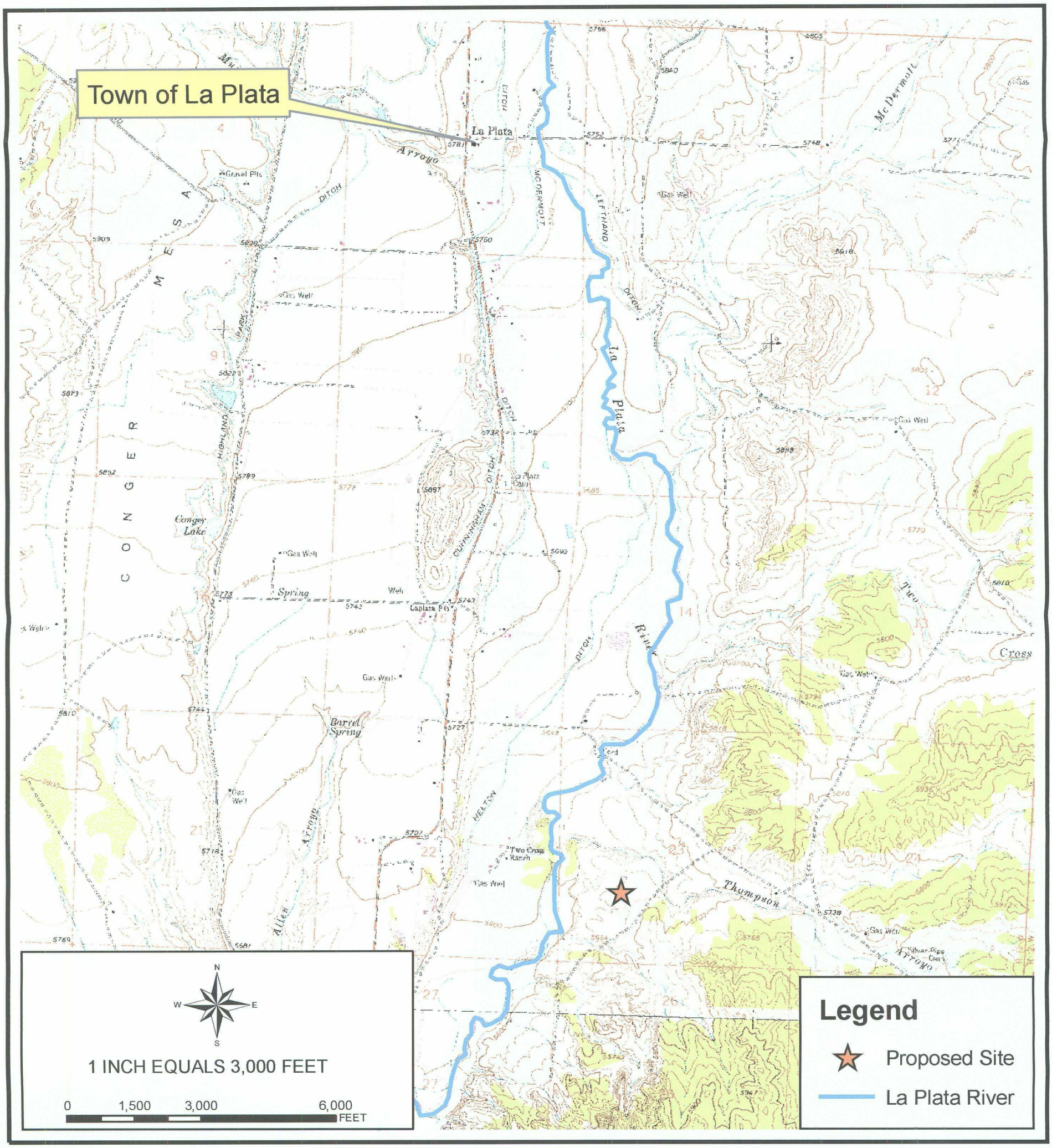
Notes:
1) Locations based upon UTM coordinates or Township, Range, Section and quarter section data provided by the New Mexico State Engineer's Office IWATERS Database.
2) Refers to Figure 2.
3) All wells located within T31N, R13W, NMPM.

TABLE 2
Sand Rock Evaporation Pond
Wells In Vacinity Used in Analysis
of Ground Water Table[1]

Map Reference[2] #	Well Permit Number	Owner Name	Well Depth[3] (ft.)	Depth to Water[4] (ft.)	Well Elevation[5] (ft)	Groundwater Surface Elev.[6] (ft.)
1	3611	Williams	24	14	5620	5606
2	3351	Dunn	42	30	5570	5540
3	2729	Packer	100	87	5680	5593
4	2753	Watkins	74	40	5665	5625
5	2737	Thille	78	40	5685	5645
6	2836	Weaver	100	70	5685	5615
7	1820	Dowdy	50	35	5700	5665
8	965	Sheppard	115	100	5720	5620
9	2048	Conduff	54	29	5740	5711
10	2904	Montoya	325	270	6040	5770

Notes:
1) Locations based upon UTM coordinates or Township, Range, Section and quarter section data provided by the New Mexico State Engineer's Office IWATERS Database (Wells beyond one mile of site).
2) Refers to Figure 3.
3) Based on Well Driller's Log.
4) Based on Well Driller's Log.
5) Based on USGS Topographic Maps (See Figure 3).
6) Column (5) - Column (4); Displayed on Figure 3.

FIGURES



G://2006/071-021/mapping/GenSite1

USGS Quads: Farmington North, La Plata

WRIGHT WATER ENGINEERS, INC.
1666 N. Main Ave., Suite C
Durango, CO 81301
(970) 259-7411

SAN JUAN COUNTY, NEW MEXICO

GENERAL LOCATION

SAND ROCK EVAPORATION POND

T31 NORTH, R13 WEST, N.M.P.M.

PROJECT NO.	FIGURE
071-021.000	1

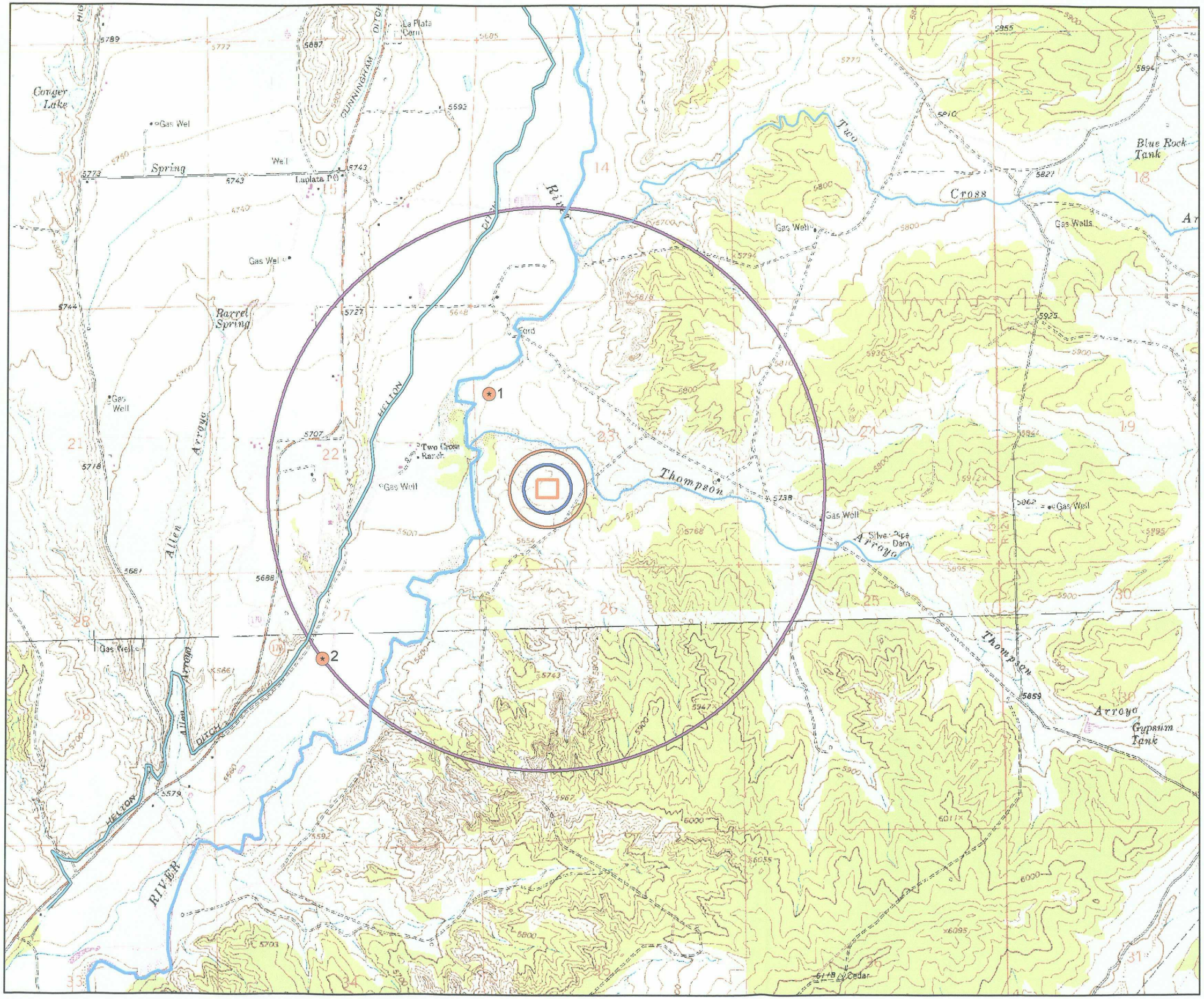


FIGURE 2

PROJECT NO. 071-021.000

SAN JUAN COUNTY, NEW MEXICO

NEARBY WELLS & WATER FEATURES

SAND ROCK EVAPORATION POND

T 31N, R 13W NMPM

Legend

- Water Well
- One Mile Radius
- 500 Ft. Radius
- 200 Ft. Radius
- Evaporation Pond
- La Plata River
- Helton Ditch
- Arroyo

N W E S

1 INCH EQUALS 2,000 FEET

0 1,000 2,000 FEET

WRIGHT WATER ENGINEERS, INC.
1666 N. Main Ave., Suite C
Durango, CO. 81301
(970) 259-7411

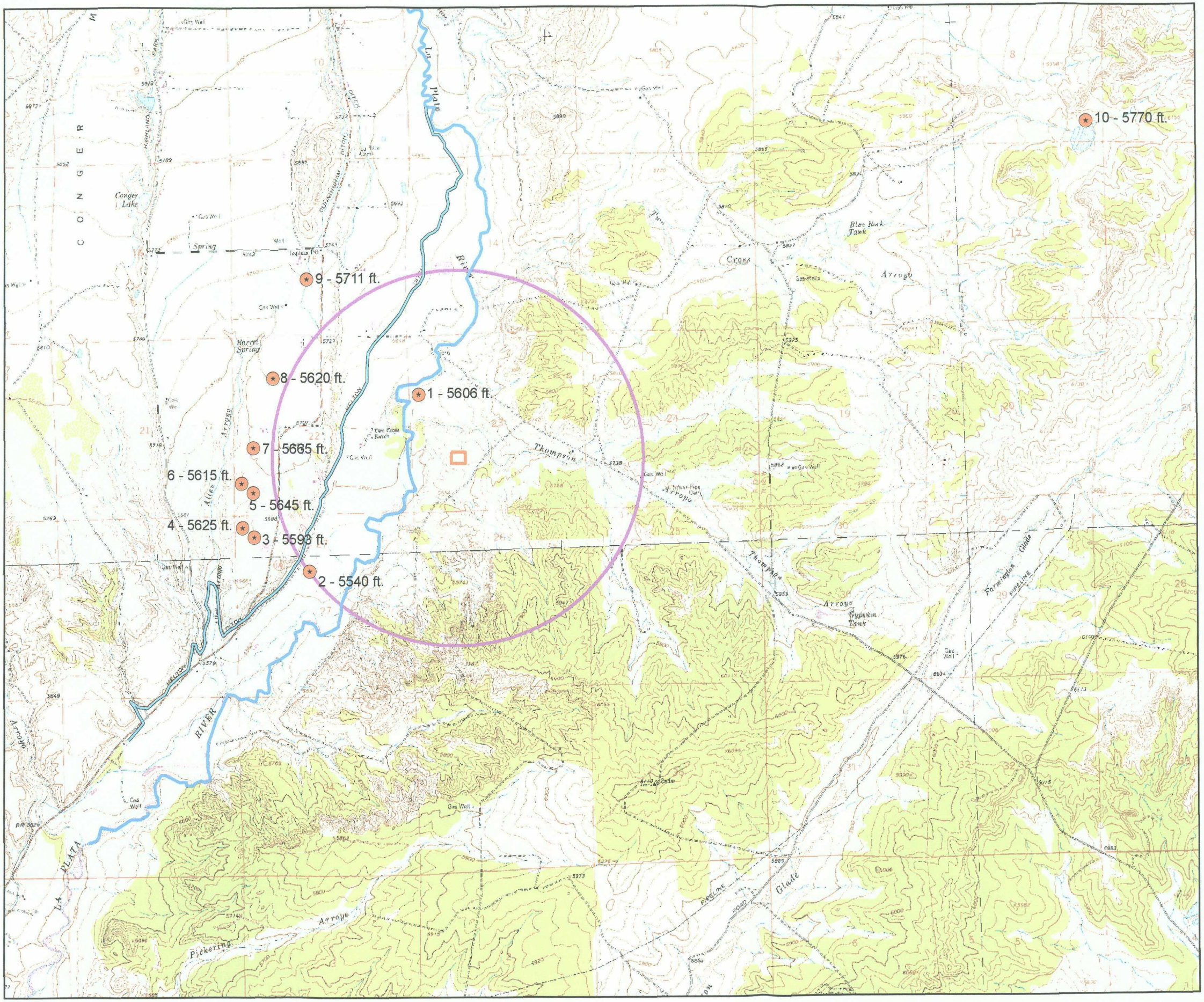


FIGURE 3

PROJECT NO. 071-021.000

SAN JUAN COUNTY, NEW MEXICO

ESTIMATED GROUND WATER SURFACE ELEVATIONS

SAND ROCK EVAPORATION POND

T 31N, R 13W N.M.P.M

Legend

- Water Well *(Approx. Groundwater Surface Elevation)*
- Helton Ditch
- La Plata River
- Evaporation Pond
- One Mile Radius

N W E S

1 INCH EQUALS 3,000 FEET

0 1,500 3,000 FEET

WRIGHT WATER ENGINEERS, INC.
1666 N. Main Ave., Suite C
Durango, CO. 81301
(970) 259-7411

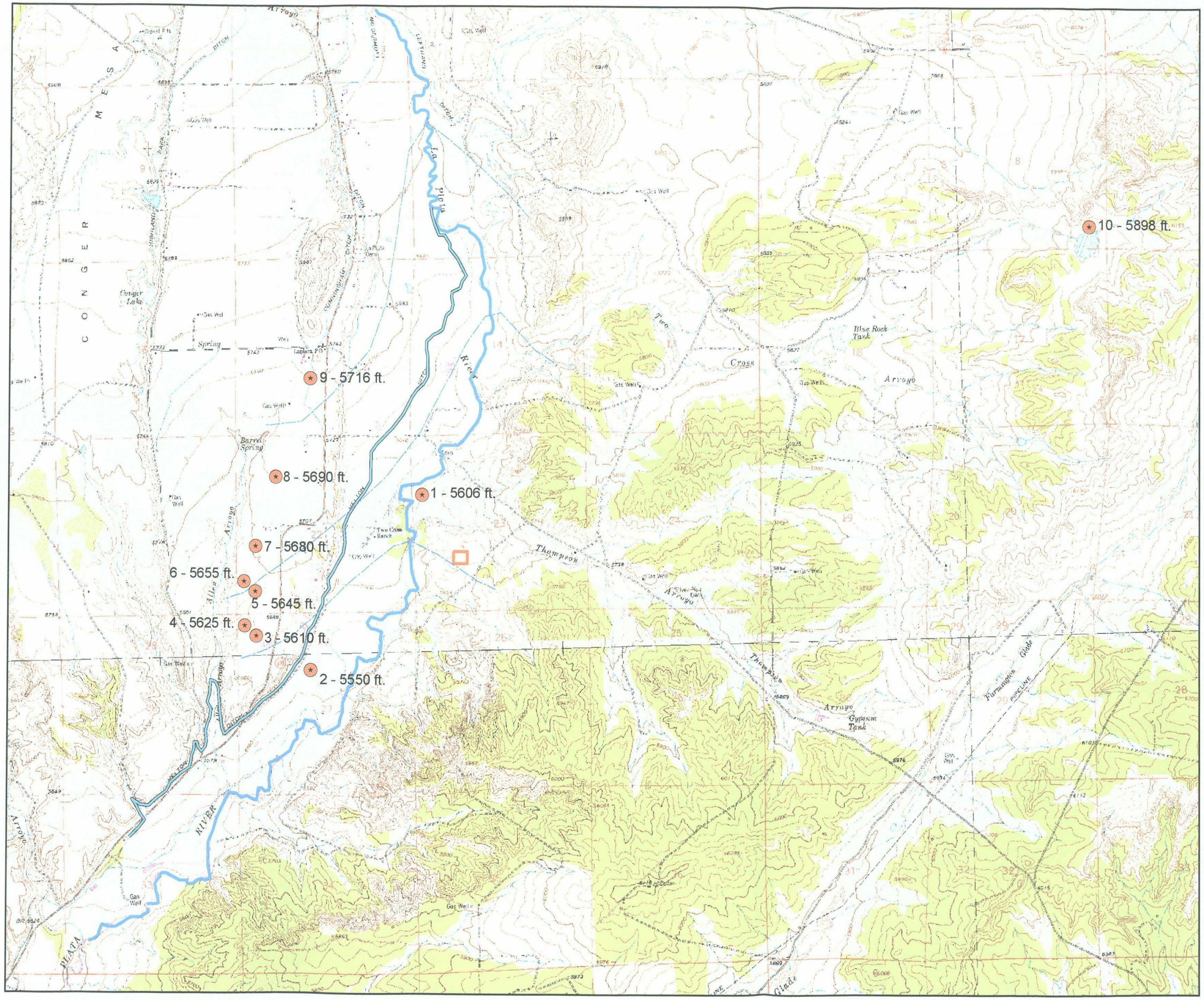


FIGURE 4

PROJECT NO. 071-021.000

SAN JUAN COUNTY, NEW MEXICO

POTENTIOMETRIC SURFACES

SAND ROCK
EVAPORATION POND

T 31N, R 13W N.M.P.M.

Legend

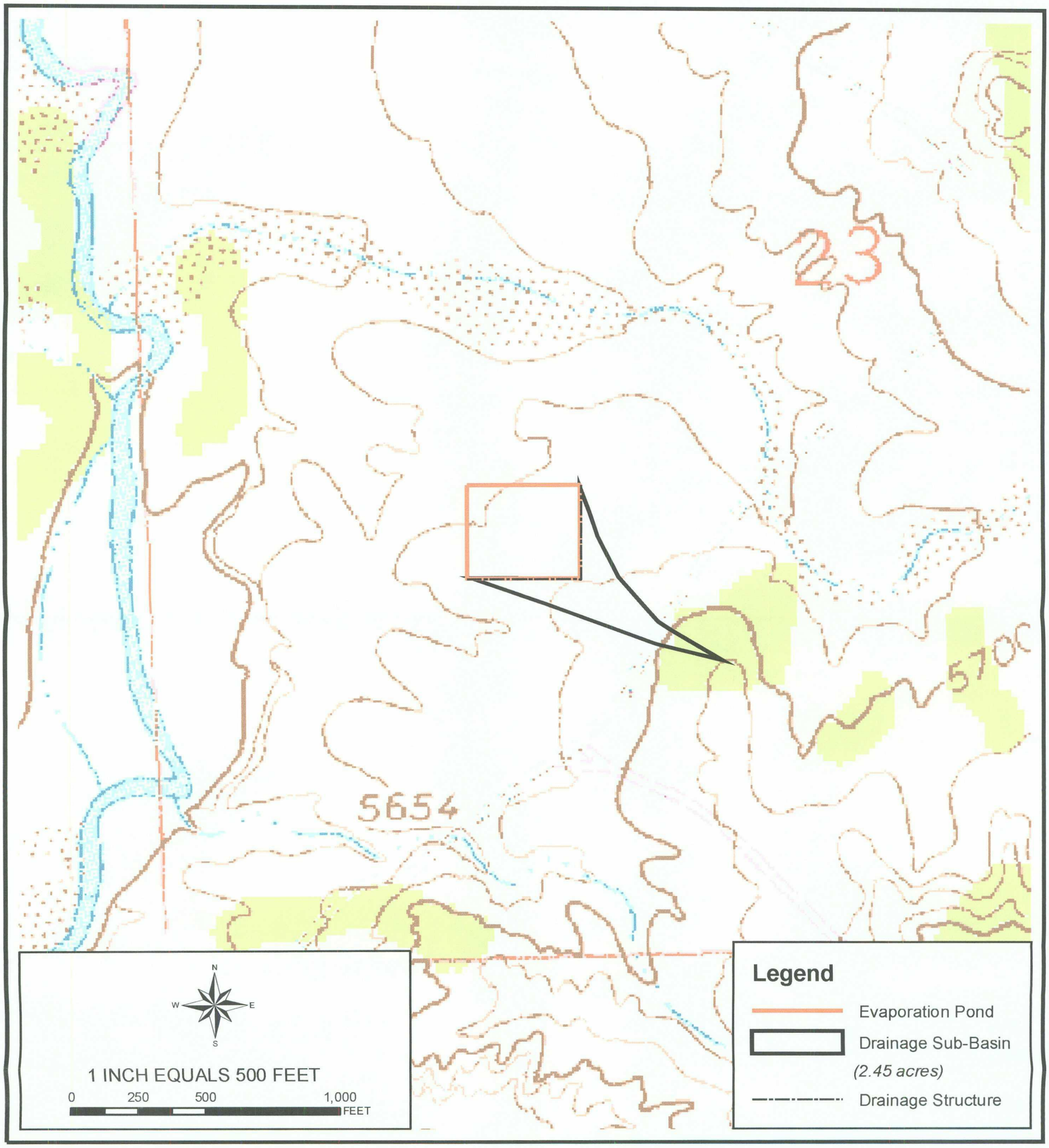
- Water Well *(Static Water Elevation)*
- Helton Ditch
- La Plata River
- Evaporation Pond
- Approximate potentiometric surface

N
W E
S

1 INCH EQUALS 3,000 FEET

0 1,500 3,000
FEET

WRIGHT WATER ENGINEERS, INC.
1666 N. Main Ave., Suite C
Durango, CO. 81301
(970) 259-7411



G://2006/071-021/Drainage1

USGS Quads: La plata, Farmington North

WRIGHT WATER ENGINEERS, INC.
1666 N. Main Ave., Suite C
Durango, CO 81301
(970)259-7411

SAN JUAN COUNTY, NEW MEXICO

SAND ROCK EVAPORATION POND

DRAINAGE BASIN

SECTION 23, T31N, R13W, N.M.P.M.

PROJECT NO. 071-021.000

FIGURE 5

APPENDICES

APPENDIX A

Well Records

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Michael Williams Owner's Well No. _____

Street or Post Office Address PO 1719

City and State Kirtland NM 87417

Well was drilled under Permit No. SJ 3611 and is located in the:

a. NW ¼ SW ¼ NW ¼ _____ ¼ of Section 23 Township 31N Range 13W N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
Subdivision, recorded in San Juan County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in the _____ Grant.

(B) Drilling Contractor Terry Hood License No. WD-717

Address P.O. Box 826, Aztec, NM 87410

Drilling Began 3/20/06 Completed 3/21/06 Type tools _____ Size of hole 6 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 24 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 14 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
14	24	10	Sand & Gravel	10

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
6	14		0	24	24		19	24

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

2006 FEB 22 AM 8 32

RECEIVED
STATE ENGINEER OFFICE
SANTA FE, NEW MEXICO

Section 5. PLUGGING RECORD

Plugging Contractor _____

Address _____

Plugging Method _____

Date Well Plugged _____

Plugging approved by: _____
State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received March 22, 2006

Quad _____ FWL _____ FSL _____

File No. SJ-3611 Use Domestic Location No. 31N.13W.23.131

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	14	14	Clay
14	24	10	Sand & Gravel

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, ~~personally~~ typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Revised June 1972

STATE ENGINEER OFFICE
WELL RECORD

Section 1. GENERAL INFORMATION

(a) Owner of well: Steven Dunn — Owner's Well No. 1
Street or Post Office Address: PO Box 298
City and State: La Plata, NM 87418

Well was drilled under Permit No. SJ-3351 and is located in the:

a. ___ ¼ NE ¼ SE ¼ NW ¼ of Section 27 Township 31N Range 13W N.M.P.M.

b. Tract No. ___ of Map No. ___ of the ___

c. Lot No. ___ of Block No. ___ of the ___
Subdivision, recorded in San Juan County.

d. X= ___ feet, Y= ___ feet, N.M. Coordinate System ___ Zone in the ___ Grant.

(b) Drilling Contractor 3D Drilling License No. WD-1479

Address PO Box 1207 Flora Vista, NM 87415

Drilling Began 5/23/03 Completed 5/23/03 Type tools Top Drive Size of hole 7.44 in.

Elevation of land surface or ___ at well is ___ ft. Total depth of well 42 ft.

Completed well is [x] shallow [ ] artesian Depth to water upon completion of well 20 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
30	37	7	sand and river rock	30

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
6 5/8	12.92	Weld	0	42	42	Drildex 6	28	40

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

Section 5. PLUGGING RECORD

Plugging Contractor ___
Address ___
Plugging Method ___
Date Well Plugged ___
Plugging approved by: ___
State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received 5-27-2003 Quad ___ FWL ___ FSL ___

File No. SJ-3351 Use Domestic Location No. 31N.13W.27.142

MAY 27 2003
OIL CONS. DIV.
DIST. 3

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	30	30	Sand and clay
30	37	7	Sand and river rock
37	42	5	Sandstone

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Dee Hiles
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 3, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

#229651

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

STATE ENGINEER OFFICE

'97 FEB 6 AM 10 51

Section 1. GENERAL INFORMATION

(A) Owner of well ANDREW PACKER Owner's Well No. 1

Street or Post Office Address 4203N. ORCHARD

City and State FARMINGTON, NM 87401 96 AUG 14 P2:58

Well was drilled under Permit No. SJ-2729 and is located in the:

a. SW ¼ SW ¼ SW ¼ ¼ of Section 22 Township 31N Range 13W N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
Subdivision, recorded in SAN JUAN County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in the _____ Grant.

(B) Drilling Contractor LEON THOMPSON License No. WD-527

Address PO BOX 1651 FARMINGTON, NM 87499

Drilling Began 7-26-96 Completed 8-1-96 Type tools CABLETOOL Size of hole 6 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 100 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 70 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
87	100	13	SAND and GRAVEL	10

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
6	23	WELDED			40	REINFORCED	35	40
4½	PVC	GLUED			100		90	100

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

Section 5. PLUGGING RECORD

Plugging Contractor _____

Address _____

Plugging Method _____

Date Well Plugged _____

Plugging approved by:

_____
State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received 08-14-96

Quad _____ FWL _____ FSL _____

File No. SJ-2729 Use Dom Location No. 31N.13W.22.333

Section 6. LOG OF HOLE

Depth in Feet		Thickness in Feet	Color and Type of Material Encountered
From	To		
0	15	15	BROWN SAND
15	40	25	SAND and BOULDERS
40	87	47	GRAY SANDSTONE
87	100	13	SAND and GRAVEL W/WATER

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Don Owens
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, ex[cept] Section 5, shall be answered as completely [and] accurately as possible when any well is drilled, repaired or deepened. When this [form] is used as a plugging record, only Section 1[,] and Section 5 need be completed.

229409
Revised June 1972

STATE ENGINEER OFFICE
WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well John Watkins '97 FEB Owner's Well No.
Street or Post Office Address #39 CR 1490
City and State Aztec, N.M. 87410

Well was drilled under Permit No. SJ-2753 and is located in the:

a. ___ ¼ NW ¼ NW ¼ NW ¼ of Section 27 Township 31N Range 13W N.M.P.M.

b. Tract No. ___ of Map No. ___ of the ___

c. Lot No. ___ of Block No. ___ of the ___
Subdivision, recorded in San Juan County.

d. X= ___ feet, Y= ___ feet, N.M. Coordinate System ___ Zone in the ___ Grant.

(B) Drilling Contractor McAnally Wetherhill Drilling License No. WD-705
Address P.O. Box 432 Bloomfield, NM 87413

Drilling Began 11/23/96 Completed 11/25/96 Type tools Cable Size of hole 8 in.

Elevation of land surface or ___ at well is 0 ft. Total depth of well 74 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 40 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
40	65	25	Sand stone	3-5

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
6	—	—	0	74	74	Open	40	74

STATE ENGINEER OFFICE
DEC 05 PM 2000

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

Section 5. PLUGGING RECORD

Plugging Contractor ___
Address ___
Plugging Method ___
Date Well Plugged ___
Plugging approved by:
State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received 12-05-96 Quad ___ FWL ___ FSL ___

File No. SJ-2753 Use DOM Location No. 31N.13W.27.111

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material encountered
0	2	2	Top Soil
2	17	15	Rocks and Gravel
17	35	18	Yellow Sandstone
35	45	10	Gray Sandstone
45	65	20	Yellow Sandstone
65	73	8	Brown clay (shale)
73	74	1	Blue Shale

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

Revised June 1972

#22983.

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Randy Tuttle Owner's Well No. 1

Street or Post Office Address 401 E. 18th Ave #15

City and State Farmington N.M. 87401

'97 FEB 6 AM 10 51

STATE ENGINEER OFFICE
SANTA FE, NEW MEXICO

Well was drilled under Permit No. SJ-27-37 and is located in the:

a. SW ¼ SW ¼ ¼ ¼ of Section 33 Township 31 Range 31 N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
Subdivision, recorded in San Juan County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in the _____ Grant.

(B) Drilling Contractor McDonald Underwood Drilling License No. WD-725

Address P.O. Box 432 Bloomfield N.M.

Drilling Began 8-27-96 Completed 9-1-96 Type tools Cable Size of hole 8 in.

Elevation of land surface or _____ at well is 0 ft. Total depth of well 78 ft.

Completed well is (X) shallow ( ) artesian. Depth to water upon completion of well 40 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
40	65	25	Sand stone	3-5

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
6	—	—	0	78	80	open	40	78

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

Section 5. PLUGGING RECORD

Plugging Contractor _____

Address _____

Plugging Method _____

Date Well Plugged _____

Plugging approved by:

_____
State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received 09-06-96

Quad _____ FWL _____ FSL _____

File No. SJ-2737 Use Dom Location No. 31N.13W.22.330

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	2	2	Top Soil
2	17	15	Rocks and Gravel
17	35	18	Yellow sand stone
35	45	10	Grey sandstone
45	65	20	Yellow Sand stone
65	77	12	Brown Shale
77	78	1	Blue Shale

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

18 33 1

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well RONALD C. OR Cindy L. WEAVER Owner's Well No. 1

Street or Post Office Address 24 CR 1490

City and State La Plata, NM 87418

Well was drilled under Permit No. SJ-2836 and is located in the:

a. NW ¼ SW ¼ SW ¼ ¼ of Section 22 Township 31N Range 13W N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
Subdivision, recorded in San Juan County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in the _____ Grant.

(B) Drilling Contractor Leon Thompson License No. WD-527

Address PO Box 1651 Farmington NM 87499

Drilling Began 4/20/98 Completed 4/22/98 Type tools CABLE TOOL Size of hole 6 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 100 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 30 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
				10

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
4	21	Welded					95	100

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

RECEIVED '98 JUN 9 PM 3 53 OFFICE OF THE STATE ENGINEER NEW MEXICO

Section 5. PLUGGING RECORD

Plugging Contractor _____

Address _____

Plugging Method _____

Date Well Plugged _____

Plugging approved by: _____
State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received 6-9-98

Quad _____ FWL _____ FSL _____

File No. SJ-2836 Use Dom & Stock Location No. 31N.13W.22.331

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness In Feet	Color and Type of Material Encountered
0	30	30	SAND
30	40	40	ROCK AND GRAVEL
40	70	70	SHELL
70	100	100	WATER SAND

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Kelly Thompson
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

228513

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well John Dowdy Owner's Well No. 1

Street or Post Office Address

City and State Kirtland, N.M.

'84 MAY 9 AM 10 52

STATE ENGINEER OFFICE

Well was drilled under Permit No. S J 1820 and is located in the:

a. ___ ¼ NW ¼ SW ¼ ___ ¼ of Section 22 Township SANTA FE Range 13 N.M.P.M.

b. Tract No. 1 of Map No. ___ of the Block 842 Pg. 338 Lot 1

c. Lot No. 1 of Block No. ___ of the Book 902 Pg. 33
Subdivision, recorded in San Juan County.

d. X= ___ feet, Y= ___ feet, N.M. Coordinate System ___ Zone in the ___ Grant.

(B) Drilling Contractor D. W. Elliott & Sons License No. WD-810

Address P.O. Box 495 Aztec, N.M. 87410

Drilling Began 4-30-84 Completed 5-4-84 Type tools Cable Size of hole 8 5/8 in.

Elevation of land surface or ___ at well is ___ ft. Total depth of well 50 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 20 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
0	50	50	Gravel	20

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
8 5/8	24	Weld	0	50	50	None	40	50

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

Section 5. PLUGGING RECORD

Plugging Contractor ___

Address ___

Plugging Method ___

Date Well Plugged ___

Plugging approved by:

State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received May 9, 1984

Quad ___ FWL ___ FSL ___

File No. SJ-1820 Use dom Location No. 31N.13W.22 31

jts san juan county

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	3	3	Top soil Brown
3	30	27	Bolder & gravel water
30	35	5	Sand Stone
35	38	3	Gravel - Water
38	50	12	Blue Shell

Section 7. REMARKS AND ADDITIONAL INFORMATION

Lined with 6" plastic casing and gravel packed

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

David W. Wath
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, ex. Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

227531

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(1A) Owner of well [illegible] Owner's Well No. SJ-965
Street or Post Office Address [illegible]
City and State Farmington, New Mexico 87401

Well was drilled under Permit No. SJ-965 and is located in the:

a. NE ¼ NE ¼ NW ¼ of Section 22 Township 31 Range 13 N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
Subdivision, recorded in San Juan County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in the _____ Grant.

(1B) Drilling Contractor Shorty Thompson License No. WD-87

Address P.O. Box 1691 Farmington, N.M. 87401

Drilling Began 5-1-79 Completed 5-26-79 Type tools Cable tool Size of hole 6 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 115 ft.

Completed well is [X] shallow [ ] artesian. Depth to water upon completion of well 30 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
100	115	15	Gravel	5

(continued)

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
5	.1 blc	Blank			11	None	[illegible]	115

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

Section 5. PLUGGING RECORD

Plugging Contractor _____
Address _____
Plugging Method _____
Date Well Plugged _____
Plugging approved by:
_____ State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received 6/5/79

Quad _____ FWL _____ FSL _____

File No. SJ-965 Use dom. Location No. 31N.13W.22 100
San Juan Co.

jta

Section 6. LOG

Depth in Feet		Thickness in Feet	Color and Type of Material Encountered
From	To		
0	45	45	Sand
45	100	55	Shale
100	115	15	Gr. [illegible]

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS. This form should be [illegible]ed in triplicate, preferably typewritten, and s[illegible]filed to the appropriate district office of the State Engineer. All sections, exce[illegible]ection 5, shall be answered as completely a[illegible]ccurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1 [illegible] and Section 5 need be completed.

TAN 227640

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

96 SEP 25 AM 10 50

(A) Owner of well MARY ALICE CONDUFF Owner's Well No.

Street or Post Office Address #33 RD. 1490

City and State LA PLATA, N.M. 87418

Well was drilled under Permit No. SJ. 2048 and is located in the:

a. SE ¼ NE ¼ SW ¼ ¼ of Section 15 Township 31N Range 13W N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in SAN JUAN County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor D.K. McDONALD License No. WD-225

Address Box 854 · Bloomfield, N.M. 87413

Drilling Began 7-7-86 Completed 7-11-86 Type tools CABLE Size of hole 8¾ in.

Elevation of land surface or ____ at well is ____ ft. Total depth of well 54 ft.

Completed well is ☑ shallow ☐ artesian. Depth to water upon completion of well 24 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
29	50	21	WATER BEARING SANDY GRAVEL	8-10

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
6 PVC			1	54	54	NONE	29	50

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

Section 5. PLUGGING RECORD

Plugging Contractor ____

Address ____

Plugging Method ____

Date Well Plugged ____

Plugging approved by:

State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received July 22, 1986

Quad ____ FWL ____ FSL ____

File No. SJ-2048 Use dom Location No. 31N.13W.15.324 (San Juan)

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
1	2	1	Top Soil
2	20	18	Boulders & Sand
20	29	9	Sandy Gravel
29	50	21	Water Bearing Sandy Gravel
50	54	4	Blue Shale

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

A K McDonald
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

15996

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Montoya sheep & Cattle Owner's Well No. _____

Street or Post Office Address 1592 Hwy 170

City and State Laplata N.M. 87418

Well was drilled under Permit No. SJ 2904 and is located in the:

a. SE ¼ SE ¼ SE ¼ ¼ of Section 8 Township 31N Range 12W N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____ Subdivision, recorded in _____ County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in the _____ Grant.

(B) Drilling Contractor Terry Hood License No. WD 717

Address Aztec N.M.

Drilling Began 1/28/99 Completed 1/29/99 Type tools _____ Size of hole 4¾ in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 325 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 142 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
270	325	55	Blue Sand stone	4

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
4½	pvc		0	325	325		270	325

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

99 FEB 8 PM 4 12

STATE ENGINEER OFFICE AZTEC, NEW MEXICO

Section 5. PLUGGING RECORD

Plugging Contractor _____

Address _____

Plugging Method _____

Date Well Plugged _____

Plugging approved by: _____

State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received 2-8-99

Quad _____ FWL _____ FSL _____

File No. SJ-2904 Use Dom & Stock Location No. 31N.12W.8.444

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	30	30	Sand & clay
30	270	240	Blue shandy shale
270	325	55	Blue sandstone

Section 7. REMARKS AND ADDITIONAL INFORMATION

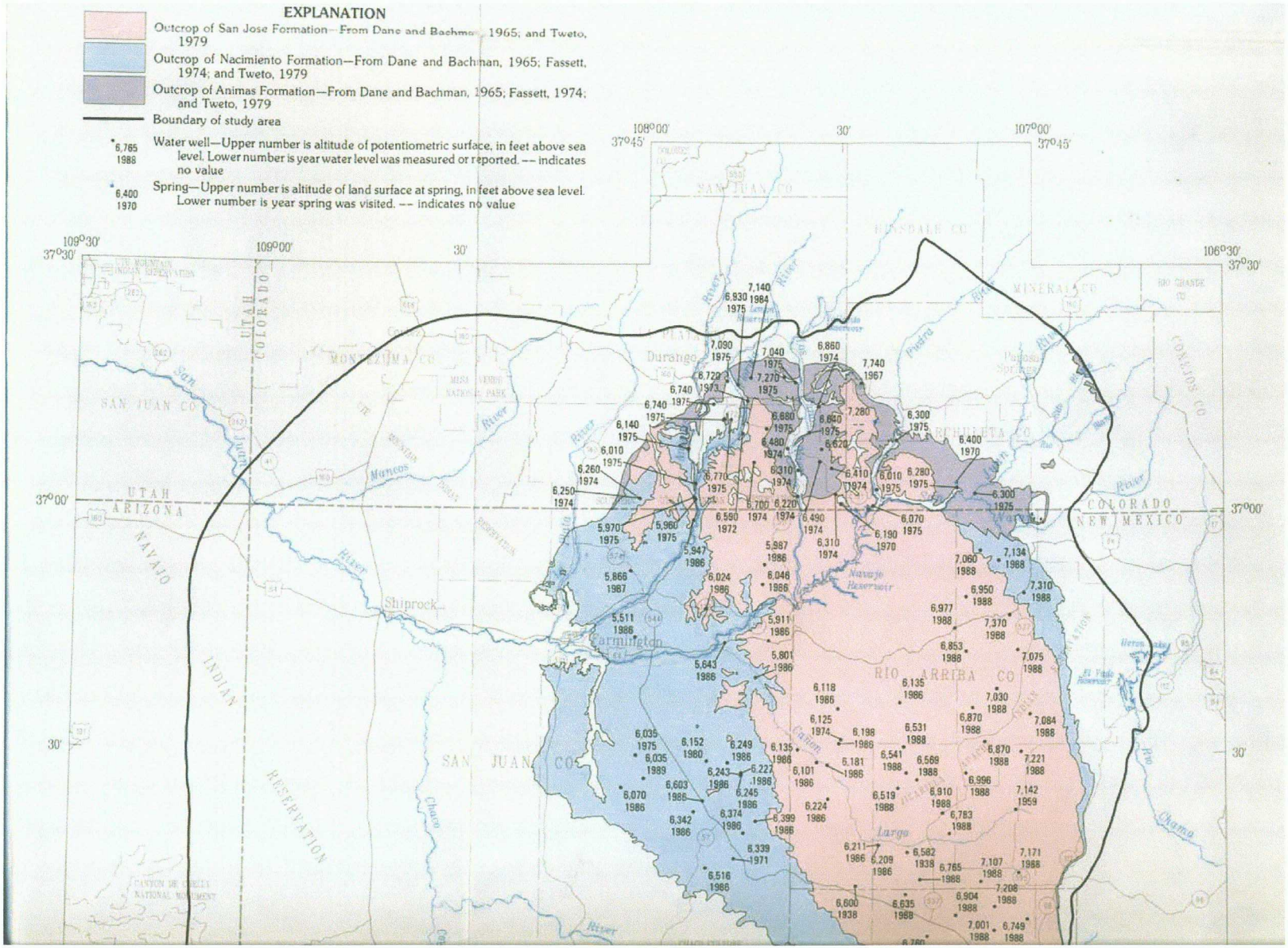
The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

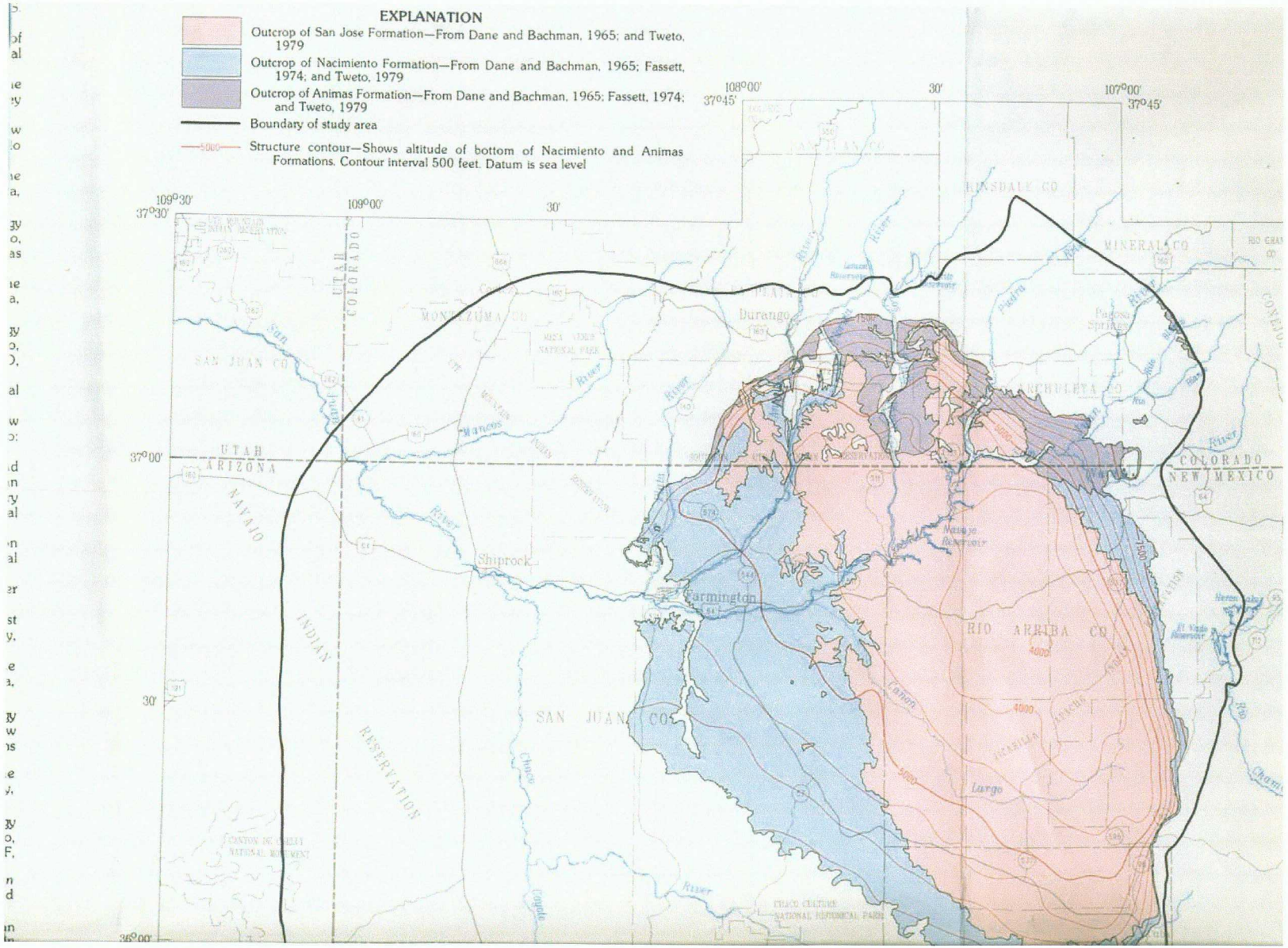
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

APPENDIX B

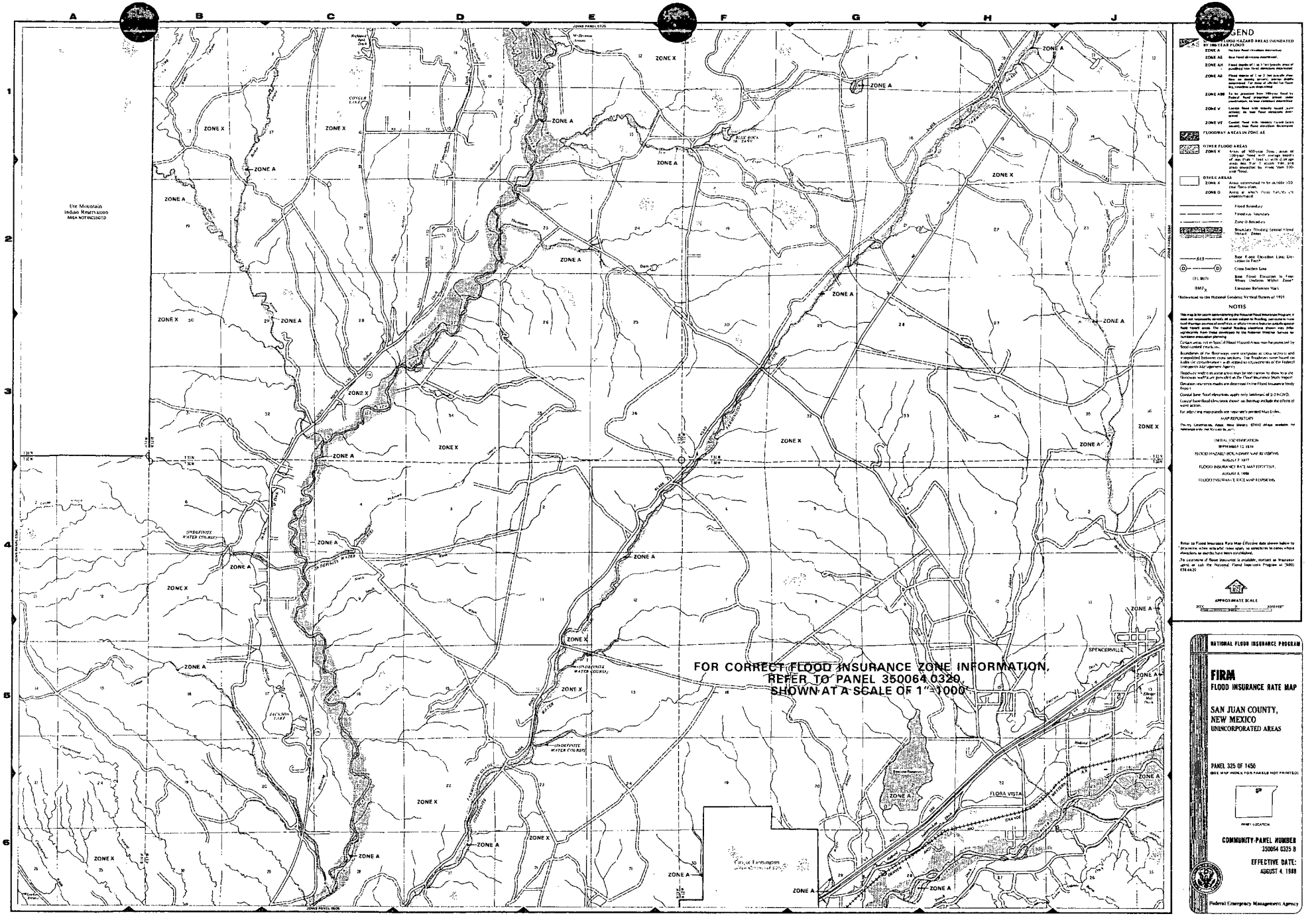
USGS Maps – Hydrogeology of the San Jose, Animas, and Nacimient Formations in the San Juan Structural Basin, New Mexico, Colorado, Arizona, Utah


EXPLANATION
Outcrop of San Jose Formation—From Dane and Bachman, 1965; and Tweto, 1979
Outcrop of Nacimiento Formation—From Dane and Bachman, 1965; Fassett, 1974; and Tweto, 1979
Outcrop of Animas Formation—From Dane and Bachman, 1965; Fassett, 1974; and Tweto, 1979
Boundary of study area
6,765 1988 Water well—Upper number is altitude of potentiometric surface, in feet above sea level. Lower number is year water level was measured or reported. -- indicates no value
6,400 1970 Spring—Upper number is altitude of land surface at spring, in feet above sea level. Lower number is year spring was visited. -- indicates no value
108°00'
30'
107°00'
37°45'
109°30'
109°00'
106°30'
37°30'
37°00'
SAN JUAN CO
RIO ARRIBA CO
MINERAL CO
RIO GRANDE CO
CONEJOS CO
MONTEZUMA CO
LA PLATA CO
ARCHULETA CO
UTAH
COLORADO
ARIZONA
NEW MEXICO
NAVAJO
INDIAN
RESERVATION
Durango
Shiprock
Farmington
Navajo Reservoir
Heron Reservoir
El Vado Reservoir
Mesa Verde National Park
Canyon de Chelly National Monument
San Juan River
Animas River
Mancos River
Piedra River
Los Pinos River
Navajo River
Chama River
Rio Grande
7,140 1984
6,930 1975
7,090 1975
7,040 1975
6,860 1974
7,740 1967
7,270 1975
6,720 1973
6,740 1975
6,880 1975
7,280 --
6,300 1975
6,140 1975
6,480 1974
6,620
6,400 1970
6,010 1975
6,260 1974
6,310 1974
6,410 1974
6,010 1975
6,280 1975
6,770 1975
6,250 1974
6,700 1974
6,220 1974
6,300 1975
6,590 1972
6,490 1974
6,070 1975
5,970 1975
5,960 1975
6,190 1970
5,947 1986
5,987 1986
6,310 1974
7,060 1988
7,134 1988
5,866 1987
6,024 1986
6,046 1986
6,950 1988
7,310 1988
6,977 1988
5,511 1986
5,911 1985
7,370 1988
6,853 1988
5,643 1988
5,801 1986
7,075 1988
6,118 1986
6,135 1986
7,030 1988
6,125 1974
6,198 1986
6,531 1988
6,870 1988
7,084 1988
6,035 1975
6,035 1989
6,152 1980
6,249 1986
6,135 1986
6,541 1988
6,569 1988
6,870 1988
7,221 1988
6,243 1986
6,227 1988
6,101 1986
5,181 1986
6,996 1988
6,603 1988
6,245 1986
6,519 1988
6,910 1988
7,142 1959
6,070 1986
6,374 1986
6,224 1986
6,783 1988
6,342 1986
6,399 1986
6,211 1986
6,562 1938
7,171 1988
6,339 1971
6,209 1986
6,765 1988
7,107 1988
6,516 1986
7,208 1988
6,600 1938
6,635 1988
6,904 1988
7,001 1988
6,749 1988


EXPLANATION
Outcrop of San Jose Formation—From Dane and Bachman, 1965; and Tweto, 1979
Outcrop of Nacimiento Formation—From Dane and Bachman, 1965; Fassett, 1974; and Tweto, 1979
Outcrop of Animas Formation—From Dane and Bachman, 1965; Fassett, 1974; and Tweto, 1979
Boundary of study area
5000
Structure contour—Shows altitude of bottom of Nacimiento and Animas Formations. Contour interval 500 feet. Datum is sea level
108°00'
30'
107°00'
37°45'
109°30'
109°00'
37°30'
37°00'
30'
36°00'
UTAH
COLORADO
ARIZONA
NEW MEXICO
SAN JUAN CO
MONTEZUMA CO
LA PLATA CO
HINSDALE CO
MINERAL CO
RIO ARRIBA CO
ARCHULETA CO
NAVAJO
INDIAN
RESERVATION
Durango
Shiprock
Farmington
Pagosa Springs
Navajo Reservoir
Lemon Reservoir
Vallecito Reservoir
Los Pinos River
San Juan River
Animas River
Mancos River
Piedra River
Florida River
Chaco River
Canyon
Largo
4000
4500
5000
5500
6000
6500
7000
7500
MESA VERDE NATIONAL PARK
CHACO CULTURE NATIONAL HISTORICAL PARK
CANYON DE CHELLY NATIONAL MONUMENT

APPENDIX C

FEMA Flood Insurance Rate Map


A
B
C
D
E
F
G
H
J
1
2
3
4
5
6
ZONE A
ZONE X
Ute Mountain Indian Reservation AREA NOT INCLUDED
FOR CORRECT FLOOD INSURANCE ZONE INFORMATION, REFER TO PANEL 350064 0320, SHOWN AT A SCALE OF 1" = 1000'
SPENCERVILLE
FLORA VISTA
City of Farmington
LEGEND
NOTES
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
SAN JUAN COUNTY, NEW MEXICO
UNINCORPORATED AREAS
PANEL 325 OF 1450
COMMUNITY-PANEL NUMBER
350064 0325 B
EFFECTIVE DATE:
AUGUST 4, 1988
Federal Emergency Management Agency

APPENDIX D

Drainage Calculations and Report for NOAA Atlas 14

Wright Water Engineers	Modified: 4/4/2007 Sheet: 1 of 1
1666 N. Main Ave., Suite C	Project No.: 071-021.000
Durango, CO 81301	Project Name: Sand Rock Evaporation Pond
Tel. (970) 259-7411	Des. by: JGM Ckd. By: TAE

I. Purpose:

* To calculate run-off for the 25-year storm with a duration equal to Time of Concentration (Tc)
* To determine an appropriate size for a ditch or swale to convey the calculated runoff

II. References:

1. "Civil Engineering Reference Manual," Michael R. Lindeburg, PE, Ninth Edition
2. WWE Figure 5, Draiange Area
3. "Urban Storm Drainage Criteria Manual"
4. "Point Precipitation Frequency Estimates", NOAA Atlas 14 for Flora Vista, New Mexico
5. "Soil Survey of San Juan County New Mexico", Eastern Part

III. Assumptions:

1. Time of Concentration (Tc)

Tc = Tinitial + Toverland — Ref #3

Where:

Tinitial = $[0.395(1.1 - C_5)L^{0.5}] / S^{0.33}$

Where:

Runoff Coef. (C, 0% Impervious) =	0.15	Ref #3
(Type C Soils)		Ref #5
Length (L) =	300 ft	Ref #2
Slope (S) =	0.07 ft/ft	Ref #2

Toverland = $L / (Cv \times Sw^{0.5})$

Where:

Conveyance Coef. (Cv, non-cultivated) =	7	Ref #3
Slope (S) =	0.04 ft/ft	Ref #2
Length (L) =	700 ft	Ref #2

2. Rational Formula

Q = C I A — Ref #1

Where:

Runoff Coefficient (C_{25}, Table RO-5) =	0.37	Ref #3
Rainfall Intensity (I_{25}) =	Function of Tc	Ref #4
Drainage Area (A) =	106920 ft^2	Ref #3
	2.45 acres	

IV. Calculations:

1. Time of Concentration:

Tinitial = 15.86 minutes

Toverland = 3.44 minutes

Tc = 0.3 Hours
19.3 minutes

2. Rational Formula:

I_{25} = 2.64 in/hr.

Q = 2.4 cfs (Runoff for 25-yr event)

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

New Mexico 36.784 N 108.065 W 5570 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 1, Version 4
G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2006

Extracted: Thu Mar 29 2007

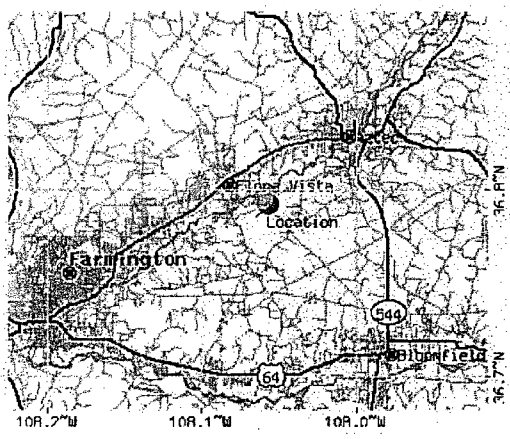
Confidence Limits | Seasonality | Location Maps | Other Info. | GIS data | Maps | Help | D

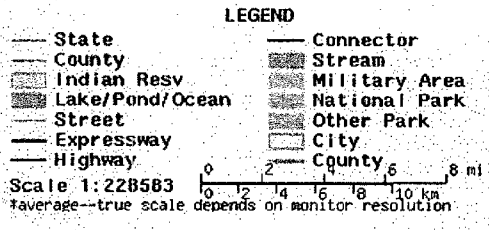
Precipitation Intensity Estimates (in/hr)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	1.75	1.33	1.10	0.74	0.46	0.26	0.19	0.11	0.07	0.04	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00
2	2.24	1.71	1.41	0.95	0.59	0.34	0.24	0.14	0.08	0.05	0.03	0.02	0.01	0.01	0.01	0.00	0.00	0.00
5	3.04	2.31	1.91	1.28	0.80	0.45	0.31	0.18	0.10	0.06	0.03	0.02	0.01	0.01	0.01	0.00	0.00	0.00
10	3.68	2.81	2.32	1.56	0.97	0.54	0.37	0.21	0.12	0.07	0.04	0.02	0.01	0.01	0.01	0.01	0.00	0.00
25	4.62	3.52	2.91	1.96	1.21	0.68	0.46	0.26	0.14	0.08	0.05	0.03	0.02	0.01	0.01	0.01	0.01	0.00
50	5.40	4.11	3.40	2.29	1.42	0.79	0.53	0.30	0.16	0.09	0.05	0.03	0.02	0.01	0.01	0.01	0.01	0.00
100	6.23	4.74	3.92	2.64	1.63	0.91	0.61	0.34	0.18	0.10	0.06	0.03	0.02	0.02	0.01	0.01	0.01	0.01
200	7.14	5.44	4.49	3.02	1.87	1.05	0.70	0.38	0.20	0.12	0.06	0.04	0.02	0.02	0.01	0.01	0.01	0.01
500	8.42	6.41	5.30	3.57	2.21	1.24	0.84	0.44	0.22	0.13	0.07	0.04	0.02	0.02	0.01	0.01	0.01	0.01
1000	9.50	7.23	5.97	4.02	2.49	1.41	0.95	0.50	0.25	0.15	0.08	0.04	0.03	0.02	0.01	0.01	0.01	0.01

Text version of table

* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval. Please refer to the documentation for more information. NOTE: Formatting forces estimates near zero to appear as zero.





Other Maps/Photographs -

View USGS digital orthophoto quadrangle (DOQ) covering this location from TerraServer; USGS Aerial Photograph may also be available
from this site. A DOQ is a computer-generated image of an aerial photograph in which image displacement caused by terrain relief and camera tilts has been removed. It combines the image characteristics of a photograph with the geometric qualities of a map. Visit the USGS for more information.

Watershed/Stream Flow Information -

Find the Watershed for this location using the U.S. Environmental Protection Agency's site.

Climate Data Sources -

Precipitation frequency results are based on data from a variety of sources, but largely NCDC. The following links provide general information
about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study,
please refer to our documentation.

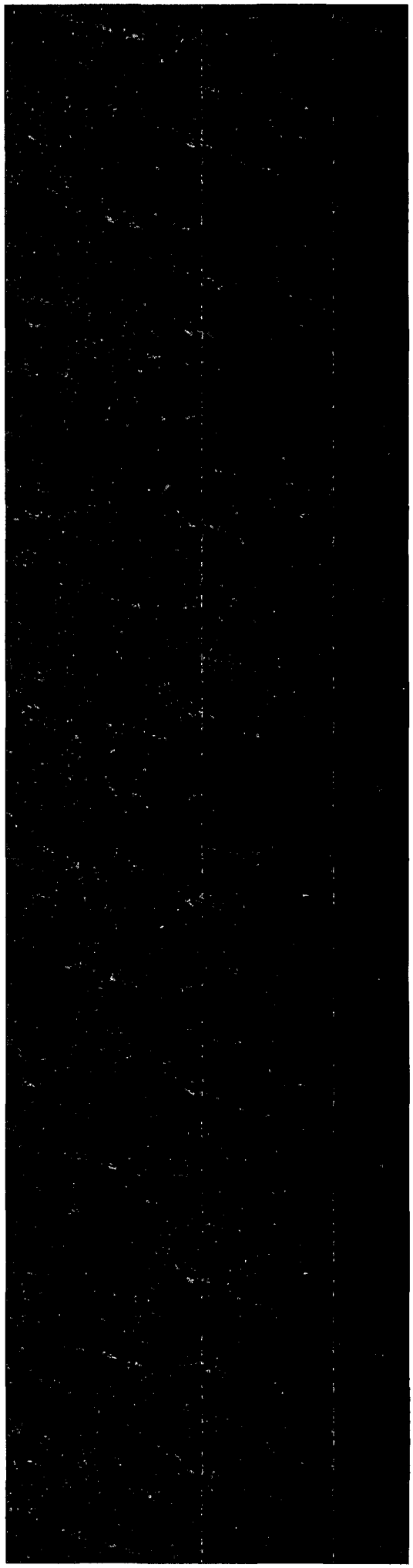
Using the National Climatic Data Center's (NCDC) station search engine, locate other climate stations within:

+/-30 minutes ...OR... +/-1 degree of this location (36.784/-108.065). Digital ASCII data can be obtained directly from NCDC.

Find Natural Resources Conservation Service (NRCS) SNOTEL (SNOwpack TELemetry) stations by visiting the Western Regional Climate Center's state-specific SNOTEL station maps.

Hydrometeorological Design Studies Center
DOC/NOAA/National Weather Service
1325 East-West Highway
Silver Spring, MD 20910
(301) 713-1669
Questions?: HDSC.Questions@noaa.gov

Disclaimer



DENVER
2490 W. 26th Avenue Suite 100A
Denver, Colorado 80211
Phone: 303.480.1700
Fax: 303.480.1020

GLENWOOD SPRINGS
818 Colorado Avenue
P.O.Box 219
Glenwood Springs, Colorado 81602
Phone: 970.945.7755
Fax: 970.945.9210

DURANGO
1666 N. Main Avenue Suite C
Durango, Colorado 81301
Phone: 970.259.7411
Fax: 970.259.8758

www.wrightwater.com

WWE

Wright Water Engineers, Inc.

Attachment "D" Operating and Maintenance Procedures

Sand Rock Evaporation Pond

Operations Procedure

Purpose: This procedure is intended to provide guidance on operating parameters of the evaporation pond.

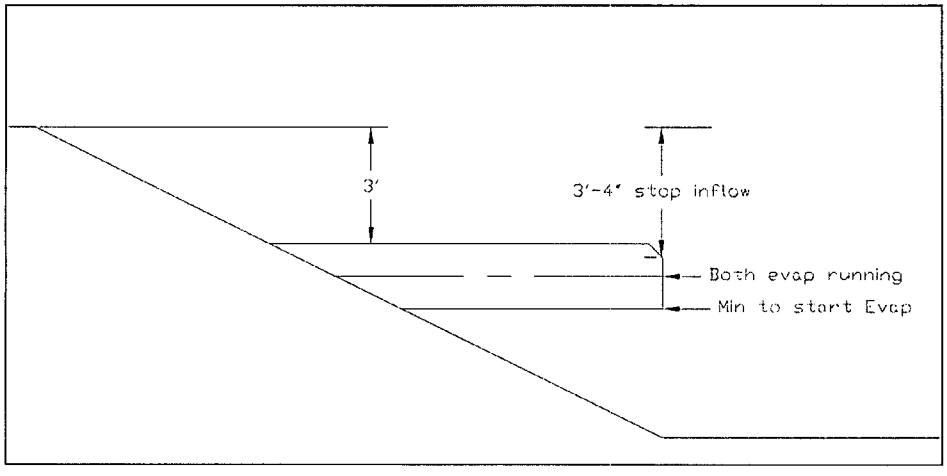
Frequency: As required

Documentation Required: none

Materials Required: none

Procedure:

1. Evaporator operation:



The water level on the 20-inch inflow pipe determines what equipment should be running. During normal operations, the evaporators should not be run while the pond level is below the bottom of the pipe. If special circumstances (e.g., trying to lower water level for maintenance) require running the evaporators below this level, the site must be attended while the evaporators are running. If there is any sign of the evaporator pump ingesting sludge from the pond bottom (e.g., a discoloration of the spray) the evaporator should be stopped immediately.

If one evaporator is running and the level continues to increase to the mid point on the 20-inch then the second evaporator should be started.

If both evaporators are running and the pond-level rises to the bottom of the cut on the inflow pipe, inflow must be stopped and both evaporators should be left running until the level drops below the bevel. As soon as the level drops below the low side of the bevel inflow can be restarted.

2. Site inlet Facility operation

   The burners on both the pre-treat tank and the gun barrel should run at all times the facility is in service.

Sand Rock Evaporation Pond

Monthly Inspection Procedure

Purpose: This procedure is intended and to verify that primary liners are intact and that the pond is not developing unpleasant/dangerous odors.

Frequency: Monthly, must be completed at least once during each calendar month.

Documentation Required: Inspection log completed and filled log-pages retained for 5 years.

Materials Required: Handheld flashlight

Procedure: Each step must be completed:

1. Visually inspect tank berm and truck unloading area for signs of leakage, report any observed leaks to Production Foreman for corrective action.
2. Inspect dry-well for signs of water. If water is present follow the "Primary Liner Leakage Correction" procedure.
3. Check the site for the evidence of odors developing. If odors are detected, take a water sample from each pond and send it to an independent laboratory to be tested for the presence of hydrocarbons or anaerobic bacteria. If anaerobic bacteria are present,
    a. Consult with a chemical supplier for a biocide to shock the pond
    b. Run an air-sparging line into each pond and run it full time for one month and take another sample
    c. If the subsequent sample shows that the levels of anaerobic bacteria are still high, repeat the above procedures with increased chemicals and sample again after an additional month.

Sand Rock Evaporation Pond

Monthly Inspection Checklist

Date	Inspector Initials	Tank berm area free of leaks (yes/no)	Dry well dry? (yes/no)	East pond Odor	West pond Odor	Comments

April 2, 2007

Sand Rock Evaporation Pond

Quarterly Inspection Checklist

Purpose: This procedure is intended to verify the physical integrity of the dike outside surfaces, wind wall supports, bird netting supports, and storm water runoff channels.

Frequency: Quarterly, must be completed at least once during each calendar quarter. Further, this inspection must be performed after any rain event that results in more than 2-inches of rain falling within a 24-hour period.

Documentation Required: Inspection log completed and filled log-pages retained for 5 years. Immediately report any deficiencies to the Production Foreman for correction.

Materials Required: none

Procedure: Each step must be completed:

1. Visually inspect the outside walls of the dike to ensure that it is not eroding.
2. Visually inspect the wind-wall supports to detect if any are leaning out of plumb.
3. Visually inspect the bird-net posts to detect if any are leaning out of plumb
4. Visually inspect the site for evidence of erosion or failure of erosion-control devices.

Sand Rock Evaporation Pond

Quarterly Inspection Checklist

Date	Inspector Initials	Dike berm free of significant erosion (yes/no)	All wind wall supports true and plumb? (yes/no)	All bird-net posts true and plumb (yes/no)	General site erosion problems (yes/no)	Comments

April 2, 2007

Sand Rock Evaporation Pond

Primary Liner Leakage Correction

Purpose: This procedure describes steps to be taken if a failure of the primary liner is observed.

Frequency: To be used in the event of water being observed within the dry well.

Documentation Required: Water samples from the dry well must be provided to the NMOCD

Materials Required: One pint sample bottle, extension pole.

Procedure:

1. Stop inflow to the pond system.
2. Using an extension pole, take a sample of the water in the dry well and send the sample for analysis.
3. Observe which drainage pipe continues to flow into dry well ½ hour after water level is lowered below drainage pipes (it may be necessary to use a vacuum truck to lower the water level below the ends of the drainage pipes).
4. When the leaking pond has been identified:
    a. If the west pond is leaking, fully open both 20-inch knife valves and transfer the pond balls to the east pond
    b. Use the Inflow 20-inch knife valves to direct the inflow to the other pond and isolate the leaking pond.
    c. Shut the 8-inch cross-flow knife valve
    d. Open the site-inlet block valves and allow water to flow into the system.
    e. Use portable pumps to transfer water from the pond that is leaking to the other pond. Frequently inspect the dry well for continued inflow.
    f. When the inflow to the dry well stops, inspect the pond to try to find the damage. Employ manufacture's representatives to evaluate the damage to see if it can be repaired.
    g. Repair or replace the primary liner and return the site to normal operation.
5. Forward a copy of the water analysis to the NMOCD for their review.

Sand Rock Evaporation Pond

Transporter Verification & Waste Acceptance Criteria

Purpose: To ensure that any entity bringing water to the Sand Rock Evaporation Pond has a Form C-133 (Authorization to Move Liquid Waste) approved by the NMOCD prior to allowing them of offload.

Frequency: Each time a transporter is added to the Authorized List

Documentation Required: A current copy of the Authorized List must be available to the site operators.

Materials Required: None

Procedure:

1. Authorization to haul water, adding a transporter
    a. The Patina employee responsible for authorizing new contractors to haul water to this site will obtain a current copy of NM Form C-133.
    b. When the C-133 has been verified, the transporter will be added to a list of authorized transporters and that list will be made available to the operator of the Sand Rock Evaporation Pond.
2. Receipt of water at truck-unloading area:
    a. Any truck unloading at the Sand Rock must be affiliated with a company on Patina's Approved Transporter list
    b. All liquids on the truck must have been collected from sites operated by Patina, this site cannot accept third-party water.

Sand Rock Evaporation Pond

Operator Qualifications and Training

Purpose: To ensure that personnel operating this site are trained in this equipment and the potential safety or environmental risks

Frequency: Each operator or relief operator

Documentation Required: The operator must have had current training in:

1. HAZWOPER
2. H_2S Operations
3. Personnel Protective Equipment
4. NPDES Storm Water Plan
5. Spill Reporting
6. Emergency Response Plan
7. Sand Rock Evaporation Pond
    a. permit conditions,
    b. operations,
    c. sampling methods,
    d. the identification of exempt vs. non-exempt waste and hazardous waste.

Records Retention: Records of annual training must be maintained for 5 years, subject to OCD review.

Materials Required: None

Job Specific Training: Training for the specific equipment, procedures, and inspections will be done on the job.

Attachment "E" Emergency Response Plan

Contingency Plan General

The contingency plan will be maintained in the designated storage location for Contingency Plans and Emergency Response Procedures at the Patina San Juan, Inc. District office, 5802 Bloomfield Highway, Farmington, NM 87401.

This plan will be amended within 5 working days if:

1. the surface waste management facility permit is revised or modified;
2. the plan fails in an emergency;
3. the surface waste management facility changes design, construction, operation, maintenance or other circumstances in a way that increases the potential for fires, explosions or releases of oil field waste constituents that could threaten fresh water, public health, safety or the environment or change the response necessary in an emergency;
4. the list of emergency coordinators or their contact information changes; or
5. the list of emergency equipment changes;

1. CONTINGENCY PLAN

RELEASE OF OILFIELD WASTE RESPONSE GUIDELINES

Procedures to be observed during any release of oil field waste to air, soil, surface water or ground water response:

A. Implement reporting procedures.

B. Do not smoke and have possible ignition sources removed.

C. Restrict access to the area of release by roping or barricading the entire contaminated area and establishing one easily controlled point of entry.

D. Establish reliable communication between persons entering the area of release and those remaining outside.

E. Establish a "buddy system" and rescue mechanism.

F. Unless the release involves a known substance, approach on the assumption that the material is extremely hazardous.

G. Always approach a release site from upwind with a predetermined escape route established.

H. If unidentified fuming liquids or gases are present, do not approach the area without assistance or without a breathing apparatus.

I. Avoid contact with the material.

J. Use construction equipment to form temporary dikes or barriers to prevent released material's movement toward any waterway. If the released material enters waterway, use oil booms to contain it. Use skimmers and absorbent materials to remove the material.

K. Use vacuum truck to pick up free product in containment berms surrounding stock tanks.

L. Excavate all petroleum-contaminated soil. Petroleum-contaminated soils are to be remediated onsite, or hauled to Patina's land treatment facility.

TECHNIQUES FOR CONTROLLING DISCHARGES (LAND & WATER)

PURPOSE

In spite of precautions taken, discharges can occur. Since the location and magnitude of discharges can vary so greatly, this section was written to furnish general guidelines and usable techniques for containment of cleanup operations.

COUNTERMEASURES

Upon discovery of an accidental discharge the first action taken should be the safeguard of life and property. The next step would be to find the source of discharge and stop additional loss of fluid.

A. Controllable Discharge:

In most cases the amount of fluid being discharged is small and operations can be shut down to relieve power oil/gas/water line or flowline pressure while installing a saddle clamp. The same is true when a valve is left open or tanks overflow. If possible the liquids should be transferred into another storage tank or holding tank.

B. Catastrophic Discharge:

The most damaging type of discharge usually occurs when a large volume of liquid is lost in a short period of time. This is usually caused by ruptured tanks, equipment failure, or major power oil/gas/water and flowline breaks. In such cases, the containment equipment and manpower should be concentrated well below the leading edge of the discharge. This will insure ample time for installation of containment dikes, dams and equipment.

C. Flammability:

If discharged material is flammable and is located in a congested area, the local Fire and Police Departments should be notified immediately. They in turn can initiate proper evacuation measures.

CONTAINMENT & REMOVAL

Fast action to contain the discharged fluid is of the utmost importance. It not only reduces the size of the area affected, it also reduces the cost of cleanup operations. The successful handling of any discharge depends on four different operations:

A. Containment

B. Removal

C. Disposal

D. Cleanup

MOBILIZATION

A. The availability of equipment, material and labor is very important. Depending on the terrain and size of the discharge, the following equipment may be needed; dozers, backhoe, tanks or vacuum truck, pumps, hose, booms, fencing, sorbent materials, construction of a skimming pond can be used. The use of several booms in conjunction with a skimming pond at the stream edge is shown in Figures C-1 through C-3.

B. Expedient Booms: Described below are simple booms that can be constructed with materials available from local sources.

1. Tie several bales of straw or hay (end to end) with steel wire. This acts as a sorbent boom. If you want to use it as a containment-type boom, just cover the bales with polyethylene sheets. The boom is attached to a cable and deployed across the stream. Figure C-4 describes this boom.

2. Logs or similar material can also be fastened together (end to end) and deployed across the water channel. Oil, however, passes more easily under this type of barrier. This can be remedied by scattering floating sorbent materials in front of the barrier to help contain the oil. The barrier should also be placed at a sharper angle (10^{o}) to the direction of flow.

3. Filter Fences: Filter fences can be used to control oil in ditches and streams where, generally, the water depth is four feet or less. This type of containment is very useful since it uses materials available in more areas. This fence can be constructed with chicken or hog wire or chain link fence. Steel or wooden posts can be used for support and hay or straw used for the filter. Posts are driven into the streambed 8-10 feet apart and set at an angle to current flow. The wire fencing is then tied to the post, always allowing at least one-foot freeboard (wire above water level). Then anchor the fence to each bank of the stream. The straw or hay is broken out of the bales and spread over the water, the full width of the fence, for 15 to 20 feet back upstream. The depth of the straw or hay should be a minimum of 6 inches thick. In most cases, there should be a series of these filter fences constructed leaving adequate working space between fences. These fences should always be continually maintained so the saturated straw or hay can be replaced as needed (Figure C-4).

C. Flow Construction: It may be possible, where water flow volume is low, terrain permits, and sufficient time is available, to construct a catch basin in the stream channel or divert the water into holding ponds. This allows removal of oil by skimmer, vacuum trucks, etc.

1. Siphon Dam: Figure C-5 illustrates two types of temporary catch basin construction using submerged pipe openings to carry water past the surface barrier which, in turn, retains the floating oil. Care should be taken in selection of pipe diameter or number of pipes used to insure adequate discharge to prevent the dike from overflowing by trapped water.

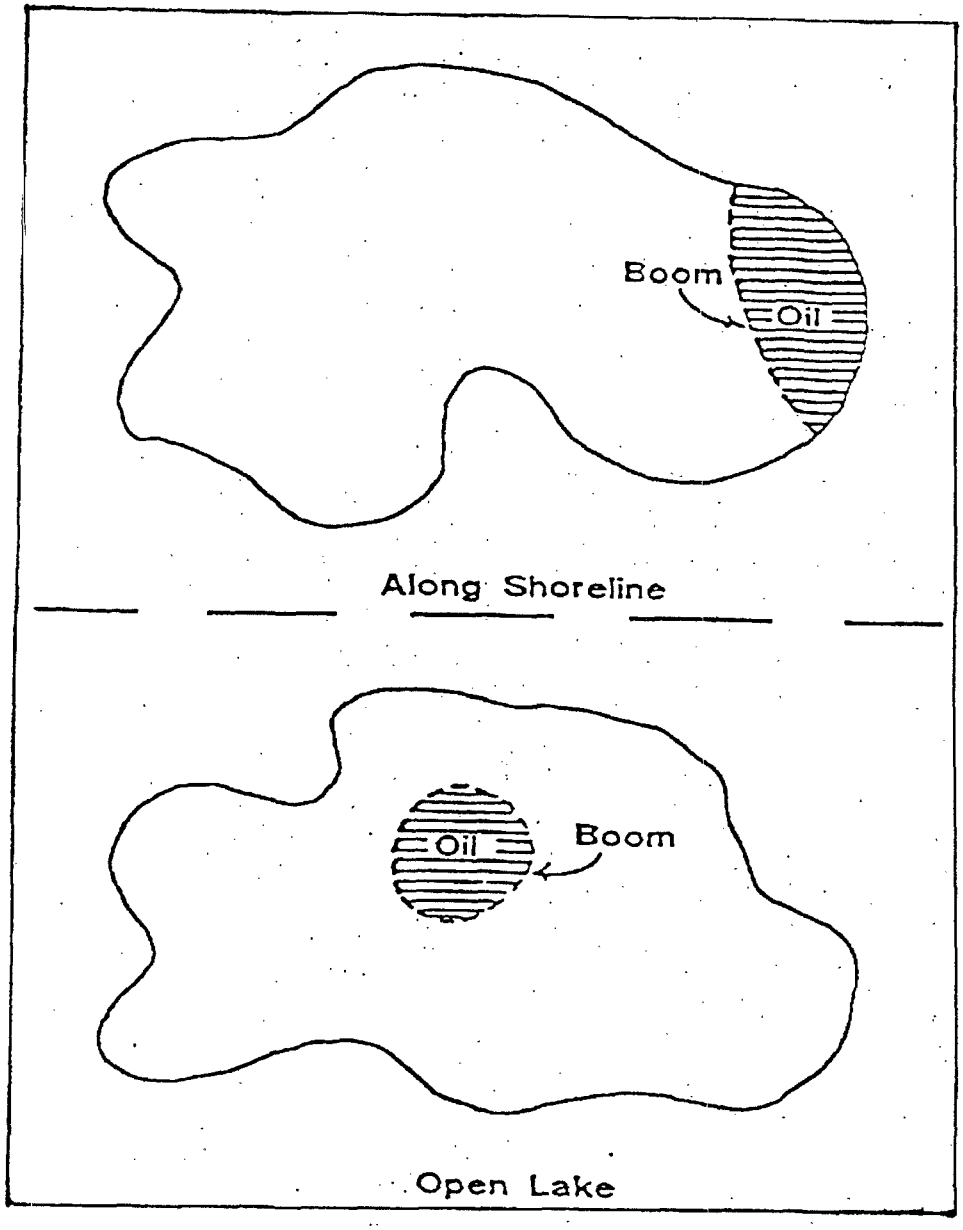


Figure C-1 Boom Deployment in Lakes

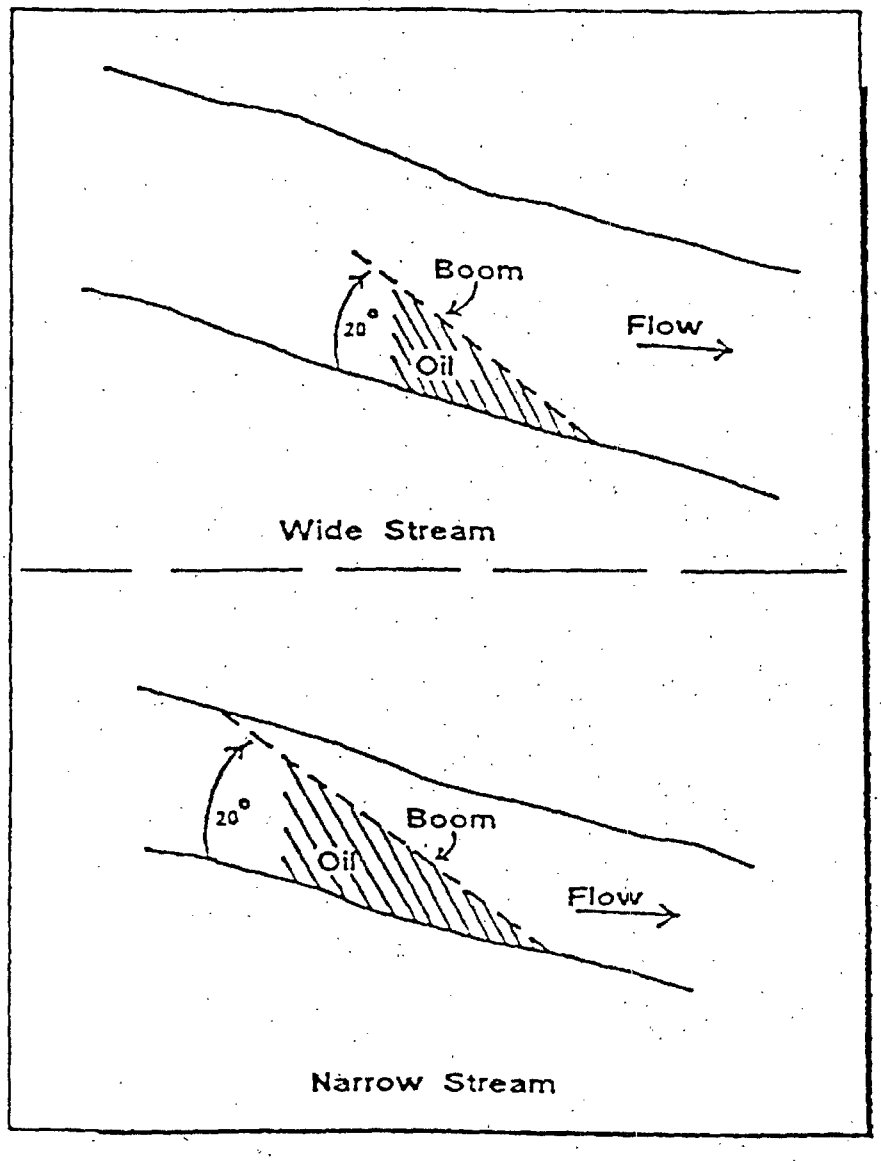


Figure C-2 Boom Deployment in Fast-Flowing Stream

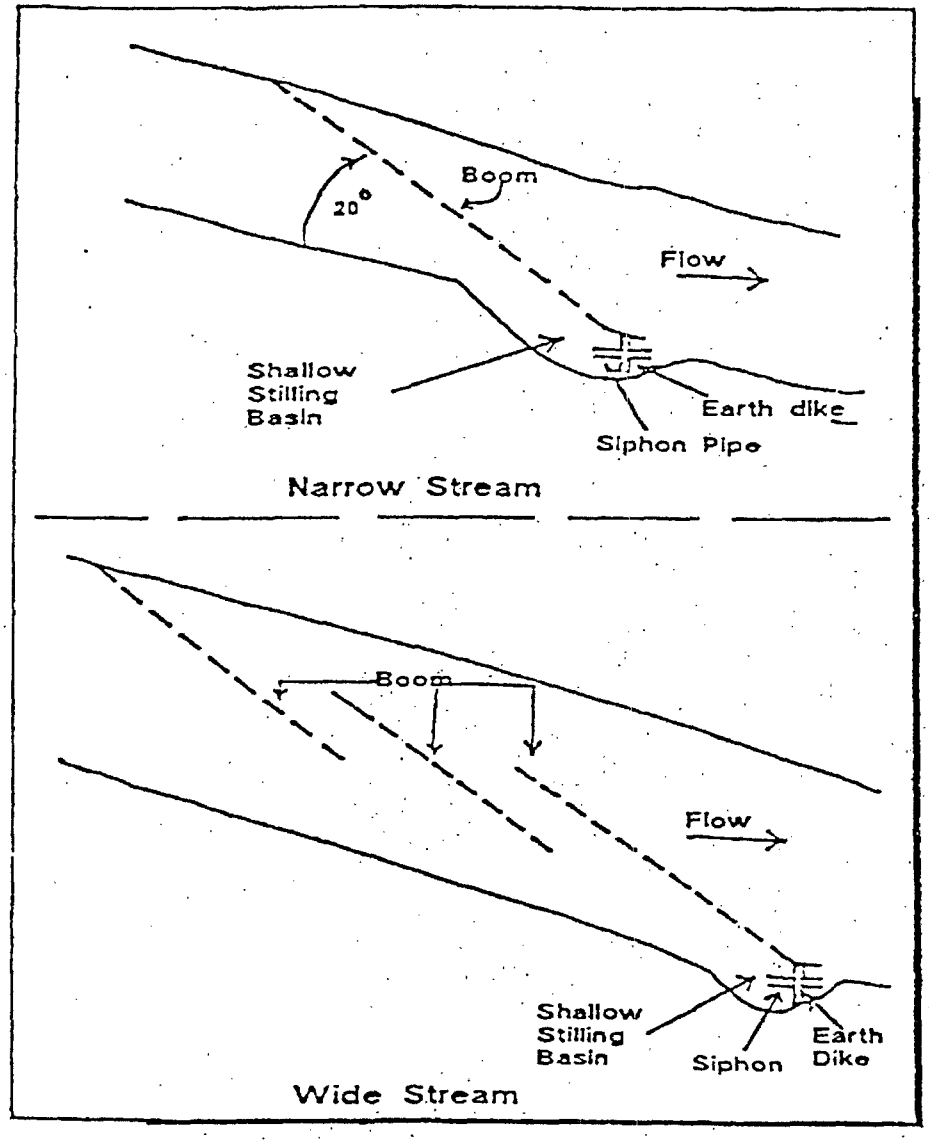


Figure C-3 Boom Deployment in Fast-Flowing Stream
- Alternate Method

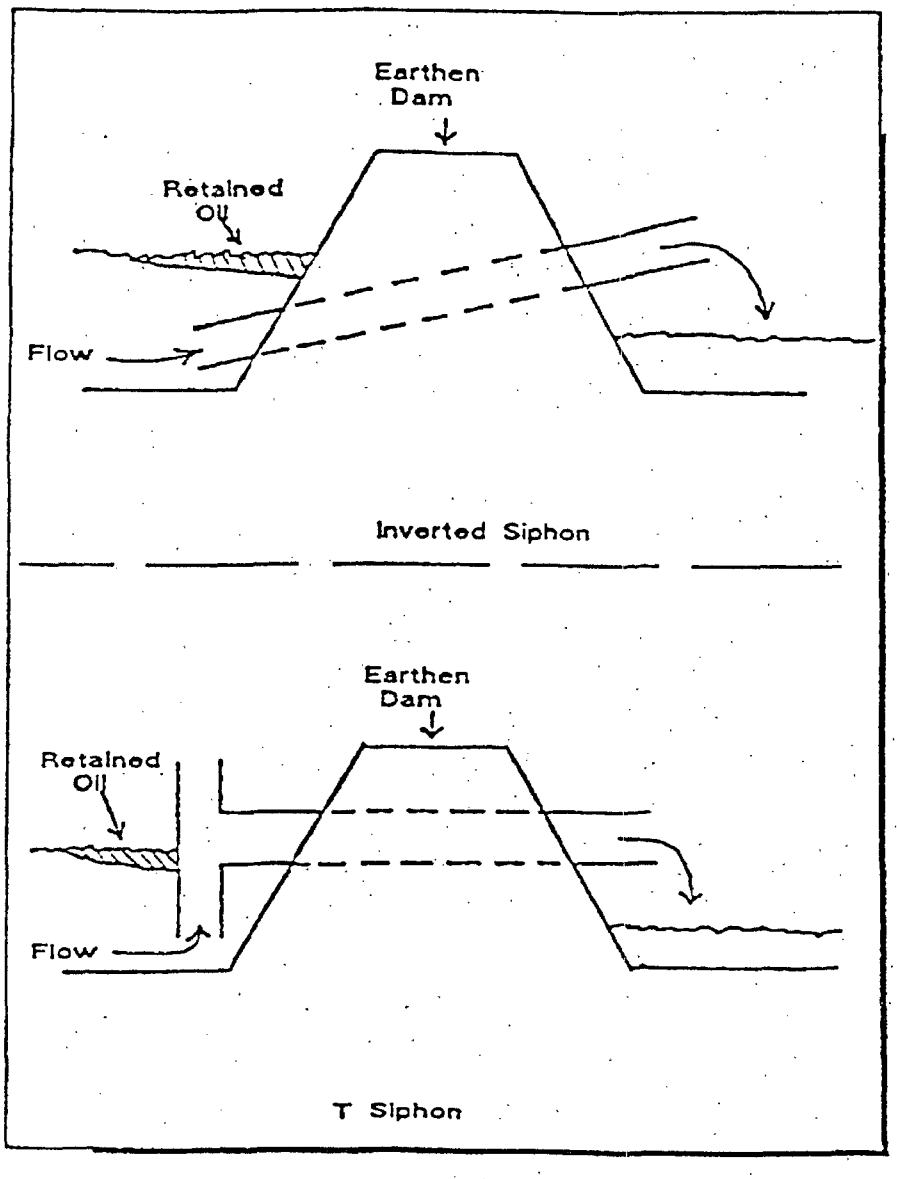


Figure C-5 Earthen Dam Construction

REMOVAL OF OIL FROM WATER

A. Ideally, oil removal will be a two-stage operation. The first step is to consolidate the oil slick as much as possible. The greater oil thickness allows more efficient use of skimming equipment. Oil recovered by this process can often be placed back into the production system and thus recovered. The second stage is to remove the remaining skim of oil. This is done by covering the slick with floating sorbent materials and retrieving the saturated materials by hand labor.

B. Practically, oil is diverted to the most suitable or accessible point where removal equipment can be located. Wind and water currents can be used to help float the oil into pockets for removal. However, wind and water currents can also hinder the operation. Always be aware of these two factors.

TREATING AGENTS

A. Oil spill treating agents are generally classified as dispersants, collecting agents, sinking agents, burning agents, or gelling agents.

B. Chemical agents are not allowed to be used without prior approval of the EPA.

C. Patina does not keep these chemical agents on hand and does not intend for them to be used on any oil spill unless approval is received from the EPA and even then only with prior Management approval.

FINAL CLEANUP

A. The final cleanup phase is to remove the oil stains on banks and vegetation bordering the spill area. *If permission is given* and the residual material is combustible, the remaining oil can be burned. The remaining contamination can be picked up by heavy equipment and removed to a disposal site.

B. In order to protect the shoreline it may be necessary to strip the oil from vegetation by hand or flush with water into a holding pond.

DISPOSAL OF OIL AND SORBENT MATERIALS

Contact the Patina District Environmental Personnel who will determine what samples need to be taken and will evaluate what disposal options are best for the particular site.

SITE-SPECIFIC INFORMATION

INTERNAL EMERGENCY NOTIFICATIONS
PATINA SAN JUAN, INC.

District Environmental Personnel

24-Hour Emergency Hotline.....(866) 662-5304

Emergency Coordinator
District Manager – Billie Maez
Office Phone .....(505) 632-8056
Cellular Phone.....(505) 320-1924
Home Phone.....(505) 334-3330

Production Foreman – Daryl Wright
Office Phone .....(505) 632-8056
Cellular Phone.....(505) 330-0415
Home Phone.....(505) 598-0770

EMERGENCY RESPONSE CONTRACTORS

Vacuum Truck Services
M & R Trucking.....(505) 334-5541

Backhoe Service
Adobe Contractors .....(505) 632-1486

Spill Cleanup Services
Envirotech Inc.....(505) 632-0615
Toll-Free. .....(800) 362-1879

NOTIFICATION OF OUTSIDE PARTIES, PUBLIC SAFETY OFFICIALS, AND GOVERNMENT AGENCIES

PUBLIC SAFETY NOTIFICATION

Police/Sheriff Dispatch

..... **911**

Farmington Police Department .....(505) 334-6622

Fire/Rescue

..... **911**

La Plata Fire Department.....(505) 326-3505

Farmington Fire Department.....(505) 588-0014

San Juan County Fire Department.....(505) 334-1180

Hospital

San Juan Regional Medical Center, Farmington.....(505) 325-5011

GOVERNMENT AGENCY NOTIFICATIONS-VERBAL

New Mexico Environmental Department Emergency Spill Number.....(505) 827-9329
(You must notify NMED within 24 hours)

New Mexico Environmental Department, Petroleum Storage Tank Bureau.....(505) 984-1741

BLM – Farmington Field Office .....(505) 599-8900

U.S. Environmental Protection Agency Region 6

General Information.....(214) 665-6444

Emergency Response Center.....(866) EPA-SPIL

National Response Center 1-800-424-8802
(24 hr/day-7 days/week)

GOVERNMENT AGENCY NOTIFICATIONS-WRITTEN

New Mexico Environmental Department
Petroleum Storage Tank Bureau
2044 Galisteo Street
Sante Fe, New Mexico 87504

Attachment "F" Closure Plan

When the pond reaches the end of its useful life it will be closed in the following steps:

1. Notify NMOCD at least 60 days prior to cessation of operations.
2. Isolate the pond and allow the residual water to evaporate
3. Test the accumulated solids in the bottom of the ponds for NORM and hydrocarbons.
4. Remove the site-inlet facilities
5. Remove the wind walls including the posts.
6. Remove the evaporation units.
7. Remove the bird netting, cables, and posts.
8. Remove the accumulated solids and Primary Liners and transport to an appropriate land fill based on tests above.
9. Remove the GeoNet Fabric, Leak Detection System, and Secondary Liner and dispose of them in an appropriate land fill.
10. Sample the site in accordance with the procedures specified in Chapter nine of EPA publication SW-846 and submit sample results to NMOCD Environmental Bureau.
11. Remove the berm walls to a contour similar to the surrounding topography.
12. Seed the disturbed surface.

Estimates from *B&H Maintenance and Construction* indicated that closing the pond would cost $32,800 in 2007 dollars.

Attachment "G" Liner Specifications

From: David A Simpson
To: 'Tom Snow'
Sent: Wednesday, February 28, 2007 1:34 PM
Subject: RE: Double Lined Ponds

Tom,
Which GeoNet are you recommending? The transmissivity of all of them is amazing, the OCD is looking for greater than 10^{-5} cm^2/s and this stuff works out to around 10^{+7} cm^2/s.

Which liner material are you recommending?

Do you have any examples, case studies, or references that I can include?

David A Simpson
zdas04@muleshoe-eng.com
Phone: 505-326-2115
Cell: 505-320-7299
Fax: 505-326-1237
Web site: www.muleshoe-eng.com

Reply From: 'Tom Snow'
To: David A Simpson

David –

1. Geonet – Recommend the 200 mil product – no real need for anything heavier than that.

2. Liner materials –
Secondary – 60 mil HDPE (to meet the new regs)
Primary – 80 mil HDPE

3. Double Liner Installations with GeoNet:
Praxair/Kirtland, NM (60/40 mil HDPE)
Los Alamos Laboratories/Reverse Osmosis Reject Water (80/40 mil HDPE)
BP America/Cahn Pond (80/40 mil HDPE)
BP America/Schneider Pond (80/40 mil HDPE)
Bureau of Reclamation/Tularosa Desalination Facility (80/40 mil HDPE)
Public Service Company of New Mexico/Afton Power Plant, Las Cruces (80/80 mil HDPE)

4. Critical design consideration is an acceptable rate of liquid appearing in the leak detection zone (usually 300–500 gallons per 24 hours for a pond of this size). This not only determines that

the liner installation is acceptable, but normally is used to determine when corrective action is required while the pond is in operation.

R. T. Snow
The Snow Company, Inc.
Phone (505)345-3225
Fax (505)345-0315

GSE®

GSE STANDARD PRODUCTS

Product Data Sheet

GSE HD

GSE HD is a smooth, high quality, high density polyethylene (HDPE) geomembrane produced from specially formulated, virgin polyethylene resin. This polyethylene resin is designed specifically for flexible geomembrane applications. It contains approximately 97.5% polyethylene, 2.5% carbon black and trace amounts of antioxidants and heat stabilizers; no other additives, fillers or extenders are used. GSE HD has outstanding chemical resistance, mechanical properties, environmental stress crack resistance, dimensional stability and thermal aging characteristics. GSE HD has excellent resistance to UV radiation and is suitable for exposed conditions. *These product specifications meet or exceed GRI GM13.*

Product Specifications

TESTED PROPERTY	TEST METHOD	FREQUENCY	MINIMUM VALUE				
Product Code			HDE 030A000	HDE 040A000	HDE 060A000	HDE 080A000	HDE 100A000
Thickness, mil (mm) or per project specs	ASTM D 5199	every roll	27 (0.69)	36 (0.91)	54 (1.4)	72 (1.8)	90 (2.3)
Density, g/cm^3	ASTM D 1505	200,000 lb	0.94	0.94	0.94	0.94	0.94
Tensile Properties (each direction)	ASTM D 6693, Type IV	20,000 lb					
Strength at Break, lb/in-width (N/mm)	Dumbell, 2 ipm		122 (21)	162 (28)	243 (43)	324 (57)	405 (71)
Strength at Yield, lb/in-width (N/mm)			63 (11)	84 (15)	130 (23)	173 (30)	216 (38)
Elongation at Break, %	G.L. 2.0 in (51 mm)		700	700	700	700	700
Elongation at Yield, %	G.L. 1.3 in (33 mm)		13	13	13	13	13
Tear Resistance, lb (N)	ASTM D 1004	45,000 lb	21 (93)	28 (125)	42 (187)	56 (249)	70 (311)
Puncture Resistance, lb (N)	ASTM D 4833	45,000 lb	59 (263)	79 (352)	119 (530)	158 (703)	180 (800)
Carbon Black Content, %	ASTM D 1603	20,000 lb	2.0	2.0	2.0	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	45,000 lb	+Note 1	+Note 1	+Note 1	+Note 1	+Note 1
Notched Constant Tensile Load, hrs	ASTM D 5397, Appendix	200,000 lb	400	400	400	400	400
REFERENCE PROPERTY	**TEST METHOD**	**FREQUENCY**	**NOMINAL VALUE**				
Oxidative Induction Time, minutes	ASTM D 3895, 200° C; O_2, 1 atm	200,000 lb	>100	>100	>100	>100	>100
Roll Length (approximate), ft (m)			1,120 (341)	870 (265)	560 (171)	430 (131)	340 (104)
Roll Width, ft (m)			22.5 (6.9)	22.5 (6.9)	22.5 (6.9)	22.5 (6.9)	22.5 (6.9)
Roll Area, ft^2 (m^2)			25,200 (2,341)	19,575 (1,819)	12,600 (1,171)	9,675 (899)	7,650 (711)

NOTES:

- +Note 1: Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- GSE HD is available in rolls weighing about 3,900 lb (1,769 kg)
- All GSE geomembranes have dimensional stability of ±2% when tested with ASTM D 1204 and LTB of <-77° C when tested with ASTM D 746.

DS005 R12/08/04

Americas	GSE Lining Technology, Inc.	Houston, Texas	800-435-2008	281-443-8564	Fax: 281-230-8650
Asia/Pacific	GSE Lining Technology Company Ltd.	Bangkok, Thailand		66-2-937-0091	Fax: 66-2-937-0097
Europe/Middle East/Africa	GSE Lining Technology GmbH	Hamburg, Germany		49-40-767420	Fax: 49-40-7674233

This product data sheet is also available on our website at:

www.gseworld.com

GSE HD Textured

Textured HDPE Geomembrane

GSE HD Textured is the textured version of GSE HD. It is a high quality, high density polyethylene (HDPE) geomembrane with one or two coextruded, textured surfaces, and consisting of approximately 97.5% polyethylene, 2.5% carbon black and trace amounts of antioxidants and heat stabilizers; no other additives, fillers or extenders are used. The resin used is specially formulated, virgin polyethylene and is designed specifically for flexible geomembrane applications. GSE HD Textured has excellent resistance to UV radiation and is suitable for exposed conditions. This product allows projects with greater slopes to be designed since frictional characteristics are enhanced.

Product Specifications

TESTED PROPERTY	TEST METHOD	MINIMUM VALUES			
Thickness, mils (mm)	ASTM D 5994	27 (0.69)	36 (0.91)	54 (1.4)	72 (1.8)
Density, g/cm³	ASTM D 1505	0.94	0.94	0.94	0.94
Tensile Properties (each direction)[1]	ASTM D 638, Type IV				
Strength at Break, lb/in-width (N/mm)	Dumbell, 2 ipm	45 (8)	60 (11)	90 (16)	120(21)
Strength at Yield, lb/in-width (N/mm)		63 (11)	84 (15)	130 (23)	173 (30)
Elongation at Break, %	G.L. = 2.0 in (51 mm)	150	150	150	150
Elongation at Yield, %	G.L. = 1.3 in (33 mm)	13	13	13	13
Tear Resistance, lb (N)	ASTM D 1004	21 (93)	28 (124)	42 (187)	56 (249)
Puncture Resistance, lb (N)	ASTM D 4833	54 (240)	72 (320)	108 (480)	144 (641)
Carbon Black Content, %	ASTM D 1603	2.0	2.0	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	+Note 1	+Note 1	+Note 1	+Note 1
Notched Constant Tensile Load[2], hrs	ASTM D 5397, Appendix	400	400	400	400
REFERENCE PROPERTY	**TEST METHOD**	**NOMINAL VALUES**			
Thickness, mils (mm)	ASTM D 5994	30 (0.75)	40 (1.0)	60 (1.5)	80 (20)
Roll Length (approximate), ft (m)		830 (253)	700 (213)	520 (158)	400(122)
Low Temperature Brittleness, °F (°C)	ASTM D 746, Cond. B	<-107 (<-77)	<-107 (<-77)	<-107 (<-77)	<-107 (<-77)
Oxidative Induction Time, minutes	ASTM D 3895, 200° C; O_2, 1 atm	>100	>100	>100	>100
Dimensional Stability (each direction), %	ASTM D 1204, 100° C, 1 hr	±2	±2	±2	±2

NOTES:

+Note 1: Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.

GSE HD Textured is available in rolls approximately 22.5 ft (6.9 m) wide and weighing about 3,700 lb (1,678 kg).

[1]The combination of stress concentrations due to coextrusion texture geometry and the small specimen size results in large variation of test results. Therefore, these tensile properties are minimum average values.

[2]Note: NCTL for HD Textured is conducted on representative smooth membrane samples.

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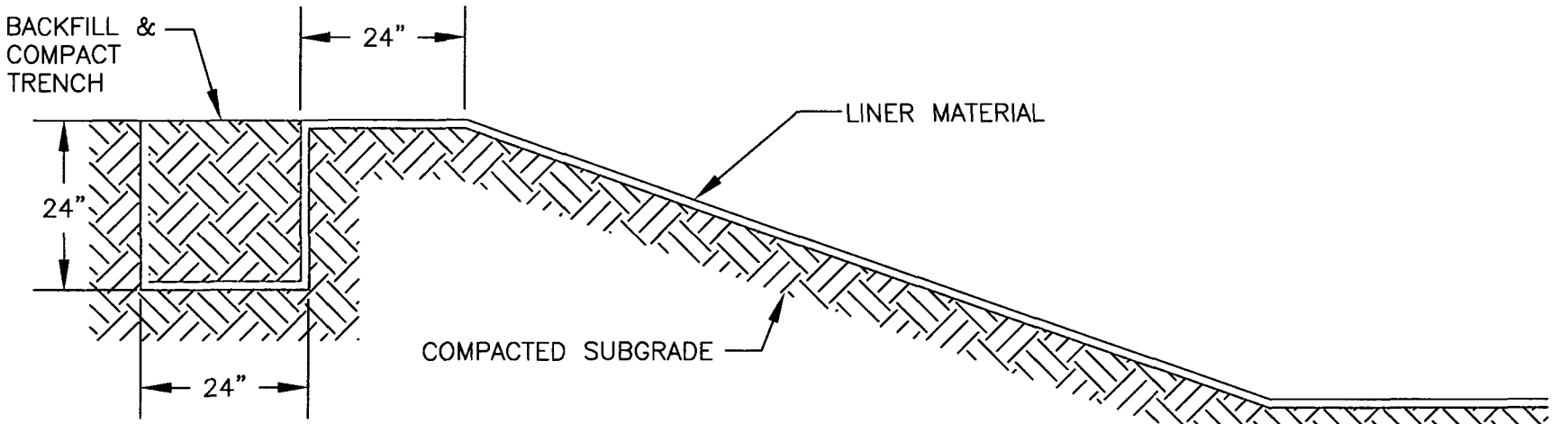
A Gundle/SLT Environmental, Inc. Company
www.gseworld.com

Represented by:

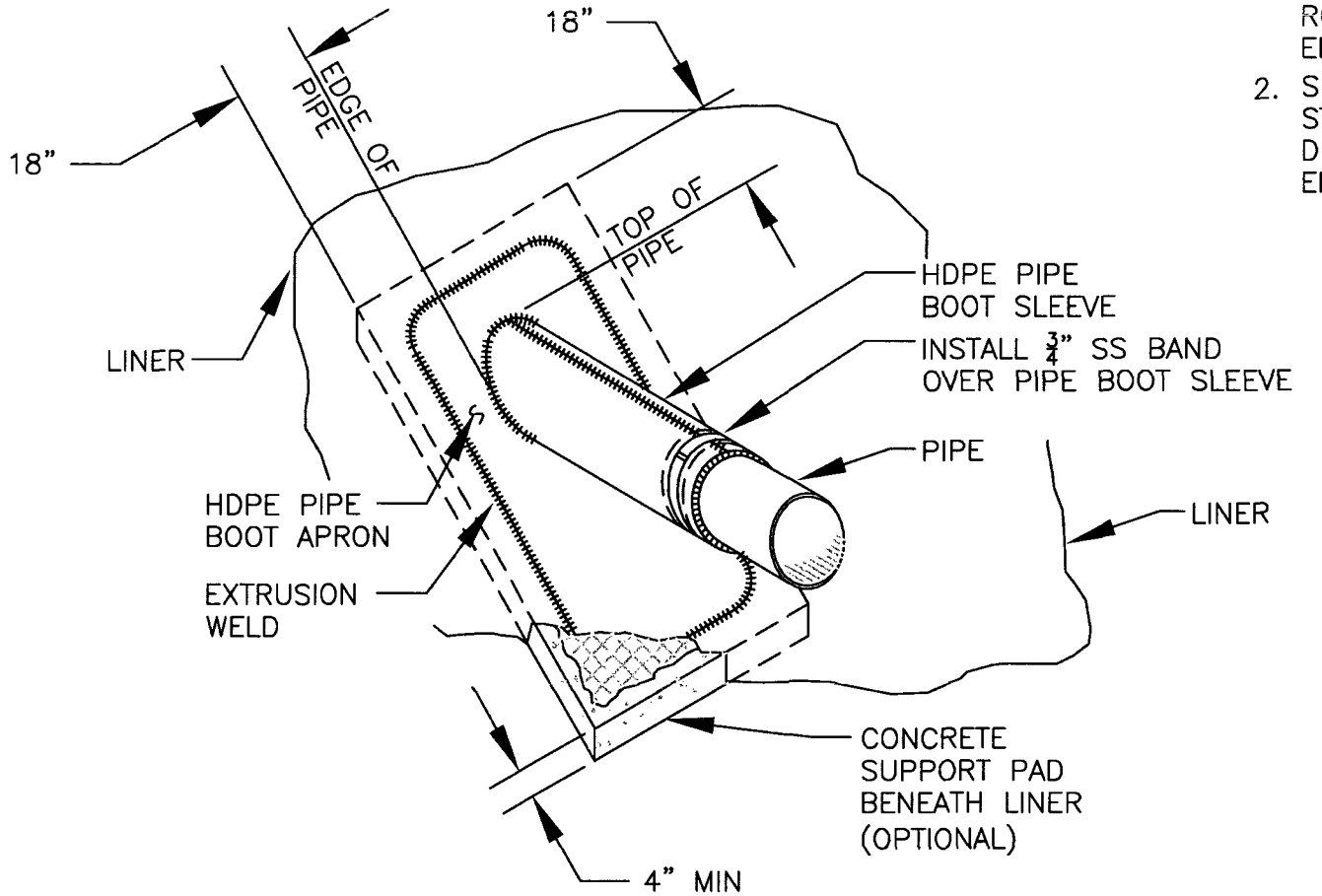


ANCHOR TRENCH DETAIL
NOT TO SCALE

THE SNOW COMPANY, INC.
ANCHOR TRENCH DETAIL

NOTES:

1. CONCRETE SURFACES TO BE STEEL TROWEL FINISHED WITH ROUNDED AND SMOOTHED EDGES.
2. SUGGESTED MINIMUM CONCRETE STRENGTH 4000 PSI OR AS DETERMINED BY THE DESIGN ENGINEER.



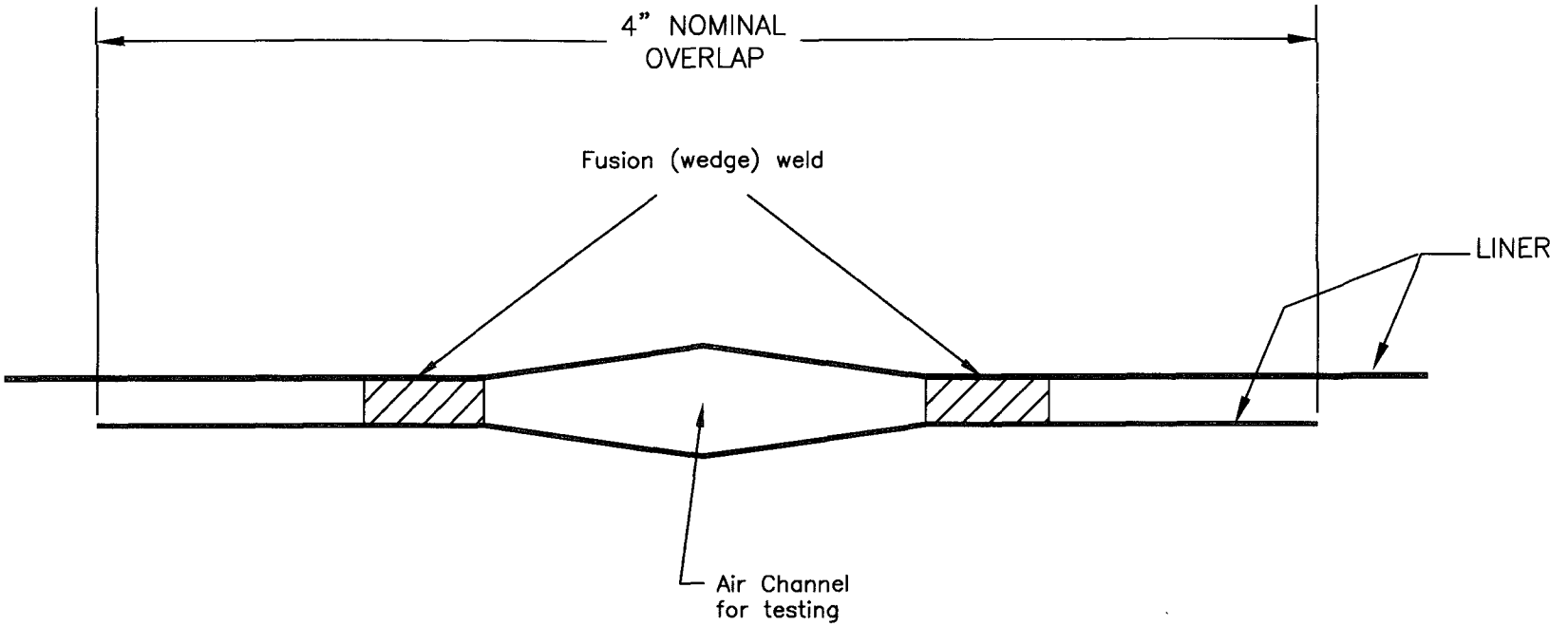
ISOMETRIC VIEW

PIPE PENETRATION BOOT

NOT TO SCALE

The Snow Company, Inc.

PIPE PENETRATION DETAIL



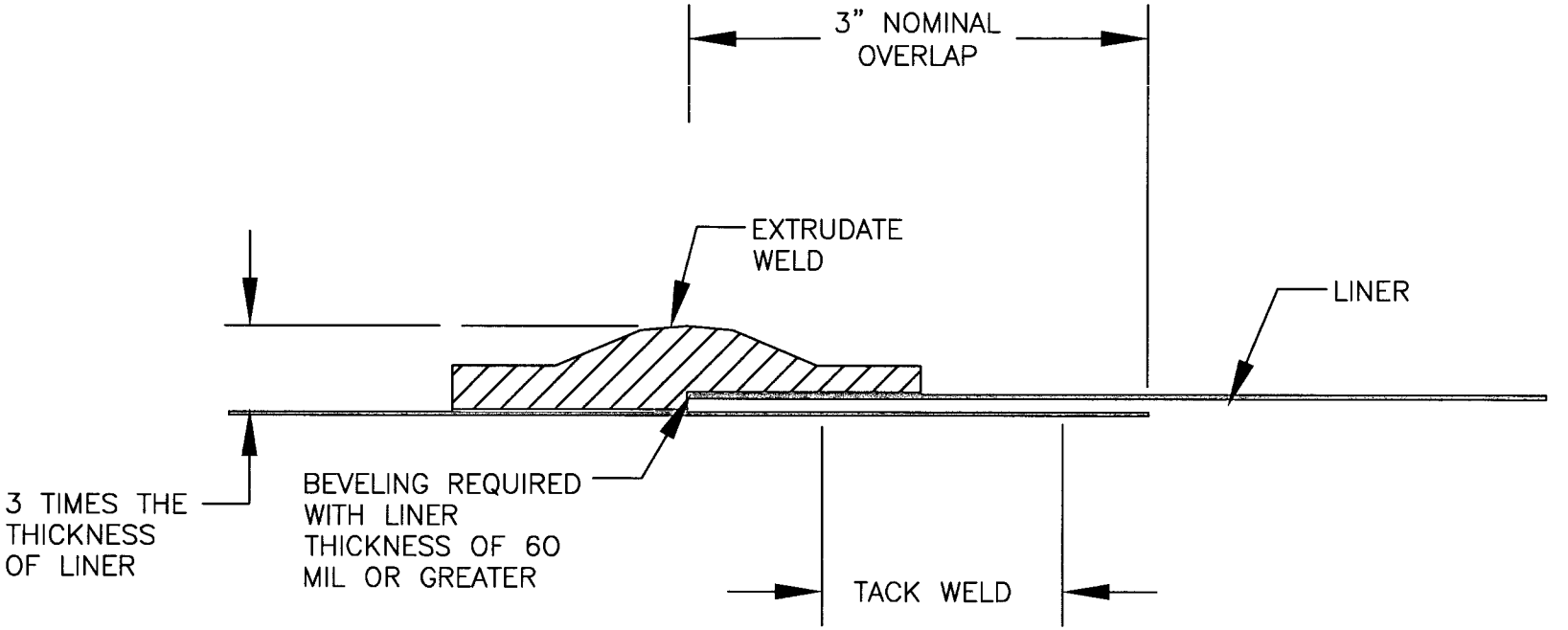
DOUBLE FUSION WELD

NOT TO SCALE

NOTES:

1. DOUBLE FUSION WELDING IS THE PRIMARY SEAMING TECHNIQUE USED.
2. AIR PRESSURE OR VACUUM TESTING ARE THE NON-DESTRUCTIVE SEAM TEST METHODS FOR DOUBLE FUSION WELDS.

The Snow Company, Inc.
DOUBLE FUSION WELD



EXTRUSION WELD

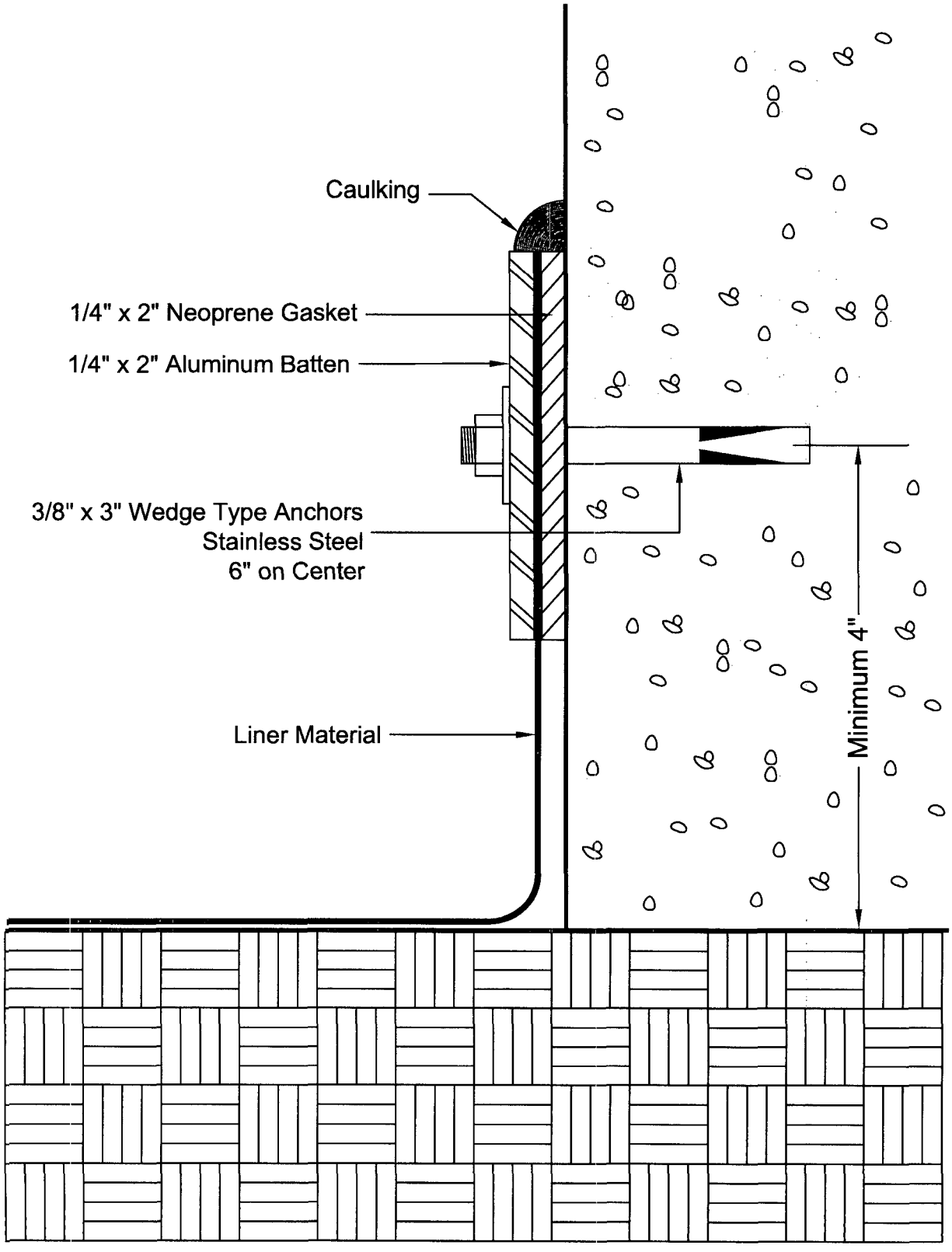
NOT TO SCALE

NOTES:

1. LINER SHEETS TACK WELDED TOGETHER AT OVERLAP TO FORM TEMPORARY BOND PRIOR TO WELDING.
2. GRINDING NOT TO EXCEED 1/4" PAST "SQUEEZE-OUT" ON EITHER SIDE. PROPER CARE SHOULD BE TAKEN IN NOT REMOVING TOO MUCH MATERIAL WHEN GRINDING.
3. VACUUM TESTING IS THE NON-DESTRUCTIVE SEAM TEST METHOD FOR EXTRUSION WELDS.

The Snow Company, Inc.
EXTRUSION WELD

THE SNOW COMPANY, INC.



LINER ATTACHMENT TO CONCRETE

NOTE: CONCRETE SURFACES AT ATTACHMENT AREAS
MUST BE TROWEL FINISHED OR GROUND SMOOTH

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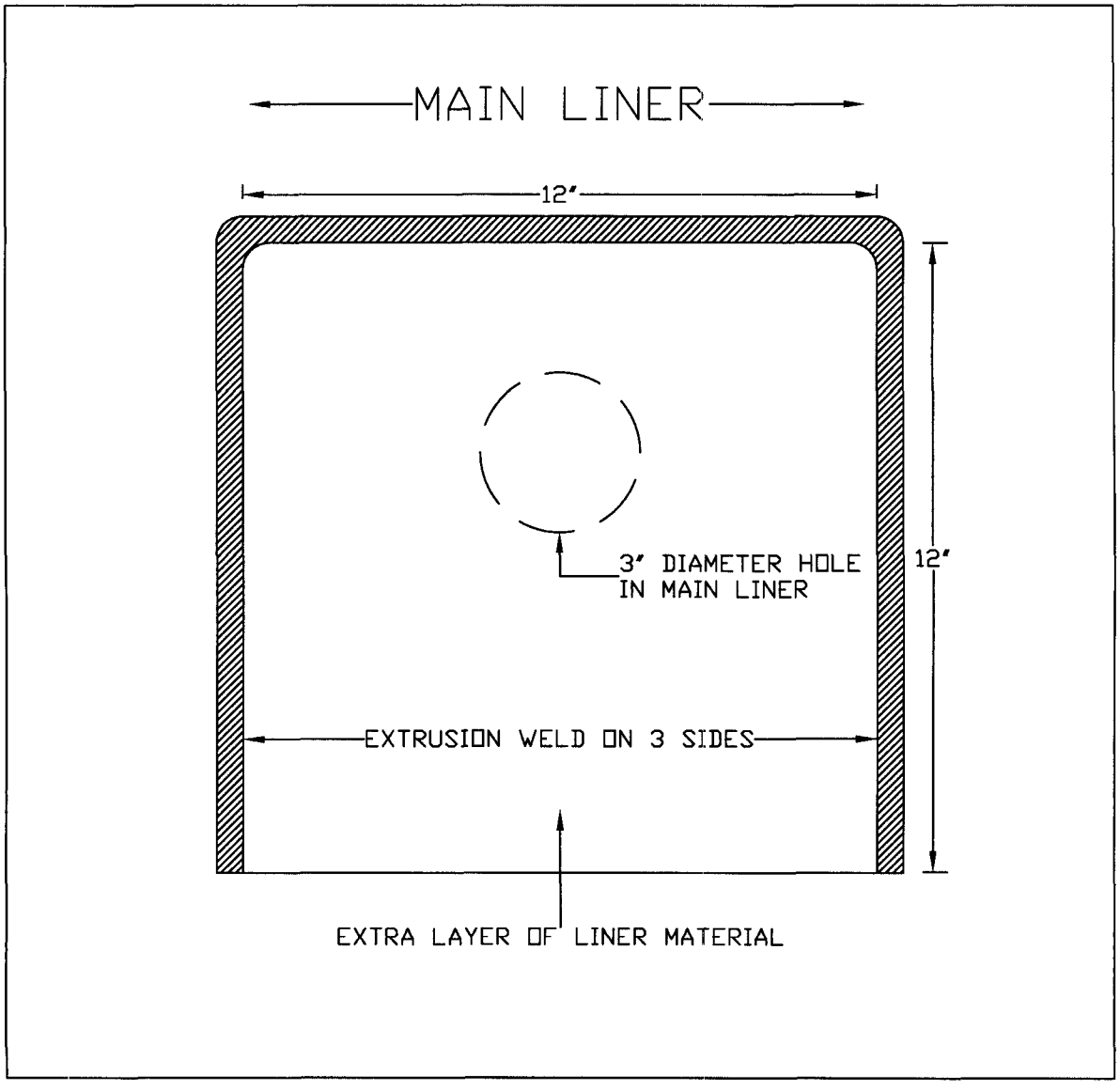

Air/Gas Vents
HDPE Lining Materials

THE SNOW COMPANY, INC.

INSTALLATION PROCEDURES
HIGH DENSITY POLYETHYLENE (HDPE) LINERS

I. HDPE UNLOADING/STORAGE

A. HDPE rolls are to be unloaded under supervision of the liner installer using straps or other devices that will prevent damage to the liner material.

B. Rolls should be stored on subgrade that is clean, dry, and well compacted. HDPE materials shall be stacked not more than three rolls high.

C. If any material damage is noted during unloading, the damaged areas are to be marked with a permanent marker, and a notation made as to the roll number, location of damage, and type of damage. Recording of minor damage to the outer wraps of liner material is not required.

II. MATERIAL DEPLOYMENT

A. Prior to placement of any liner materials, the subgrade is to be inspected and approved by the Project Superintendent. Any areas found to be unacceptable are to be corrected prior to placement of liner material. Documentation of this inspection is to be provided if required by the project specifications.

B. Materials will not be deployed when moisture, high winds, or other adverse weather conditions are expected.

C. HDPE materials are to be deployed using methods that will not crimp, bend, or otherwise damage the material. Unless otherwise approved, HDPE materials are to be deployed using a "spreader bar" manufactured especially for this purpose.

D. If a Liner Installation Plan has been submitted, the geomembrane shall be installed in accordance with said Plan. The panel layout may be adjusted in the field if required by site conditions. Panels are to be identified with a Panel Number that allows ready identification of the location of the panel. The Panel Number is to be written on the liner material with a permanent marker.

E. Temporary sand bags are to be used to prevent material uplift and movement from winds during liner installation.

F. The liner panels shall be oriented at right angles to the toe of the berm (downslope) where possible. Except for roll end (butt) seams, horizontal seams are not allowed on slopes steeper than 8:1. Transition seams between vertical slope panels and horizontal panels will be located at least 5 feet from the toe of the slope. Liner panels are to be deployed in a manner that minimizes field seams.

G. No motorized equipment will be allowed to operate directly over the geomembrane material. Portable equipment (portable generators, compressors, etc.) will be mounted on rubber tires or placed on a sacrificial sheet of material.

H. HDPE liner materials are to be deployed in a manner that minimizes wrinkling, but allows for sufficient material slack to properly conform to the subgrade. Ambient weather conditions and liner temperature are to be taken into account when making this determination.

I. When HDPE materials are deployed at temperatures greater than 80° F and in direct sunlight, the material will be allowed to stabilize overnight before the anchor trenches are backfilled. Stabilizing is accomplished using the following techniques:

1. Leave sufficient excess liner material on the outboard side of the anchor trench to allow for anticipated liner shrinkage.
2. Temporarily weight the liner in the anchor trench using sandbags.
3. Place sufficient sandbags at the toe of the slope to allow the liner to pull the excess material from the anchor trench as it shrinks. The number and placement of sandbags will vary according to the pond design and expected weather conditions.

Continued on Page 2

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THE SNOW COMPANY, INC.

INSTALLATION PROCEDURES
HIGH DENSITY POLYETHYLENE (HDPE) LINERS

II. MATERIAL DEPLOYMENT (Cont.)

4. Inspect the liner material while the material is still cool the following morning. If sufficient liner shrinkage has occurred, backfill the anchor trench is to be backfilled.

III. MATERIAL SEAMING – DUAL HOT WEDGE WELDING

A. After allowing the liner temperature to stabilize, overlap adjacent panels a minimum of 4". Remove any excessive wrinkles prior to seaming.
B. Field seams are to be made using the dual-hot-wedge welding method whenever possible.
C. Prior to seaming any materials, trial seams shall be made. Trial seams are made on scrap pieces of geomembrane to verify that the seaming conditions and equipment are acceptable. At least (3) peel and (3) shear tests are to be conducted on each trial seam, using a field tensiometer furnished by the liner installer. The peel and shear values for trial seams are to meet or exceed the project specifications.
D. Upon completion of a successful test, the date, time, seamer name, wedge welding machine number, machine temperature setting, machine speed setting, and test results are to be recorded in the Trial Seam Log. No seaming is to be done until a successful test seam has been completed and recorded.
E. If a trial seam fails the test, the entire process will be repeated. If the same welding machine and seamer fail the testing a second time, the welding machine and the seamer will not be used for seaming until the deficiencies are corrected and two consecutive successful trial seams are completed
F. Trial seams are to be conducted at immediately prior to the start of any welding period, if the welding equipment has been shut down for a period of more than (10) minutes, or if a substantial change in weather conditions occurs. A trial seam is to be done for each piece of welding equipment to be used during that welding period.
G. The area to be seamed is to be clean and dry. If required, a protective layer is to be placed under the seam to prevent dust or moisture from entering the seam area, and/or the liner material in the seam area is to be wiped with a clean rag.
H. At the start of each seam, the machine operator is to mark the date, time, machine number, machine temperature, machine speed, and operator initials on the lining material with a permanent marker. This information is to be recorded in the project log.
I. The machine operator is responsible for ensuring that the area to be seamed is clean and dry. If any questionable seam areas are noted, the operator is to mark these areas for later inspection and testing.
J. The machine operator is to read the machine temperature at intervals of approximately 100 feet, and mark the temperature on the lining material. This procedure will ensure that seams are made at the proper temperature. If an excessively high or low temperature reading is noted, the operator is to stop seaming and mark the affected area for testing. The cause of the problem is to be located and corrected, and a new trial seam made and tested before seaming resumes.

IV. DUAL HOT WEDGE WELDING - AIR PRESSURE TESTING

A. Wedge welded seams consist of a double seam with an air channel between the seams. Upon completion of a wedge seam, the open ends of the air channel are sealed off and a needle inserted into the air channel. The air channel is pressurized, allowed to stabilize, and the initial pressure reading is taken.
B. The minimum starting test pressure is 30 PSIG. The maximum allowable pressure drop during the five minute test is 4 PSIG.

Continued on Page 3

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THE SNOW COMPANY, INC.

INSTALLATION PROCEDURES
HIGH DENSITY POLYETHYLENE (HDPE) LINERS

IV. DUAL HOT WEDGE WELDING - AIR PRESSURE TESTING (Cont.)

C. After five minutes, the final pressure reading is taken. The date, test start and ending times, and starting and ending pressures are to be written on the material with a permanent marker. This information is also to be recorded in the project log.

D. At the conclusion of the test, a small hole is cut in the air channel at the end of the seam opposite the inflation needle. The air pressure should drop to 0 PSIG with ten seconds of the cut being made. This procedure ensures that the air channel is not blocked. If the air pressure does not drop to 0 PSIG, the cause of the problem is to be located and the seam re-tested.

E If a wedge welded seam area does not pass the air pressure test, the cause of the failure is to be located and repaired, and the seam is to be re-tested. If the cause of the failure cannot be located, the failed seam area must be sealed with an extrusion weld and fully vacuum tested.

V. MATERIAL SEAMING - EXTRUSION WELDING

A. Extrusion welding is to be used for detail work, repairs, and in other areas where wedge welding cannot be used.

B. Prior to the start of any extrusion welding, trial seams are to be conducted per Item III.C through G.

C. Areas to be extrusion welded are to be clean and dry. Surface oxidation is to be removed by grinding. Grinding is to be done not more than one hour prior to the time the extrusion weld is made, using the procedures listed below:

1. The grinding shall not extend more than ¼ inch beyond the limit of the extrudate after seam completion.
2. Grinding shall be performed preferentially in a perpendicular path across the seam.
3. The depth of grinding shall be less than 10 percent of the sheet thickness.
4. All shavings produced from grinding shall be removed from the seaming area prior to welding.

D. Where patches are required, the patches are to be round or oval in shape, and are to overlap the damaged area by a minimum or 4" on all sides. Patches are to be heat sealed to the main liner prior to extrusion welding to prevent the edge of the patch from lifting when the extrudate is applied. The extrusion welder shall be purged prior to beginning a seam until all potentially heat-degraded extrudate has been removed from the barrel.

E. Extrusion welds are to be tested by use of a vacuum box. A soap solution is applied to the area to be tested, and a vacuum applied to the area. The tested area is then observed for soap bubbles. Any defective areas must be marked, repaired, and retested until passing results are achieved.

VI. SEAM TESTING

The following values are considered acceptable for seam tests. All values are expressed in ponds per inch of material width. All testing is done at the speed of two (2) inches per minute. All failures are to exhibit Film Tearing Bond (FTB).

Material Thickness	Shear Strength (PPI)	Fusion Peel (PPI)	Extrusion Peel (PPI)
40 mil	81	65	52
60 mil	121	98	78
80 mil	162	130	104
100 mil	203	162	130

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GSE

GSE STANDARD PRODUCTS

Product Data Sheet

GSE HyperNet Geonets

GSE HyperNet geonets are synthetic drainage materials manufactured from a premium grade high density polyethylene (HDPE) resin. The structure of the HyperNet geonet is formed specifically to transmit fluids uniformly under a variety of field conditions. HDPE resins are inert to chemicals encountered in most of the civil and environmental applications where these materials are used. GSE geonets are formulated to be resistant to ultraviolet light for time periods necessary to complete installation. GSE HyperNet geonets are available in standard, HF, HS, and UF varieties.

The table below provides index physical, mechanical and hydraulic characteristics of GSE geonets. Contact GSE for information regarding performance of these products under site-specific load, gradient, and boundary conditions.

Product Specifications

TESTED PROPERTY	TEST METHOD	FREQUENCY	MINIMUM AVERAGE ROLL VALUE[c]			
			HyperNet	HyperNet HF	HyperNet HS	HyperNet UF
Product Code			XL4000N004	XL5000N004	XL7000N004	XL8000N004
Transmissivity[a], gal/min/ft (m^2/sec)	ASTM D 4716-00	1/540,000 ft^2	9.66 (2 x 10^{-3})	14.49 (3 x 10^{-3})	28.98 (6 x 10^{-3})	38.64 (8 x 10^{-3})
Thickness, mil (mm)	ASTM D 5199	1/50,000 ft^2	200 (5)	250 (6.3)	275 (7)	300 (7.6)
Density, g/cm^3	ASTM D 1505	1/50,000 ft^2	0.94	0.94	0.94	0.94
Tensile Strength (MD), lb/in (N/mm)	ASTM D 5035	1/50,000 ft^2	45 (7.9)	55 (9.6)	65 (11.5)	75 (13.3)
Carbon Black Content, %	ASTM D 1603, modified	1/50,000 ft^2	2.0	2.0	2.0	2.0
Roll Width, ft (m)			15 (4.6)	15 (4.6)	15 (4.6)	15 (4.6)
Roll Length, ft (m)[b]			300 (91)	250 (76)	220 (67)	200 (60)
Roll Area, ft^2 (m^2)			4,500 (418)	3,750 (348)	3,300 (305)	3,000 (278)

NOTES:

- [a] Gradient of 0.1, normal load of 10,000 psf, water at 70° F (20° C), between steel plates for 15 minutes.
- [b] Please check with GSE for other available roll lengths.
- [c] These are MARV values that are based on the cumulative results of specimens tested by GSE.

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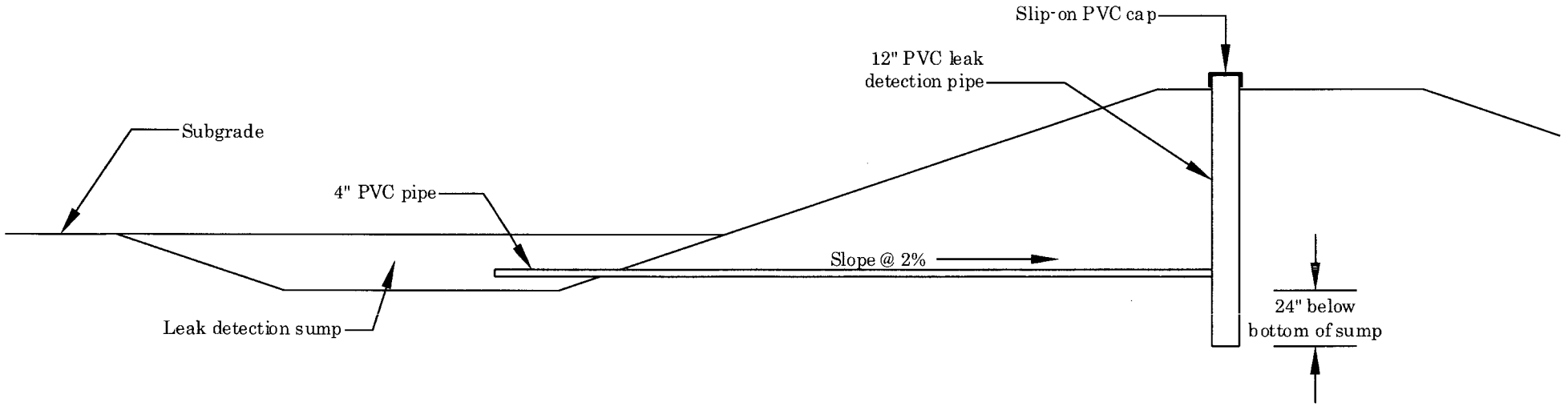
Europe/Middle East/Africa	**GSE Lining Technology GmbH**	**Hamburg, Germany**		**49-40-767420**	**Fax: 49-40-7674233**
Asia/Pacific	**GSE Lining Technology Company Ltd.**	**Bangkok, Thailand**		**66-2-937-0091**	**Fax: 66-2-937-0097**

This product data sheet is also available on our website at

www.gseworld.com

NOTES

1. Fill leak detection sump with clean, 3/4" rounded gravel
2. Liner and pipe boots not shown for clarity
3. Install automatic electric sump pump in leak detection pipe to maintain liquid level below 24"
4. 4" PVC pipe is perforated in leak detection sump area



The Snow Company, Inc.
Double Lined Pond
Leak Detection Sump Details

Attachment "H" Spray Evaporator Details

Evaporative Solutions
SMI COVERS THE WORLD
www.evapor.com

New Product Data Sheet

SMI® 420F Evaporator – a new floating evaporator!

The SMI® 420F Evaporator has the following **features**:

- Floating unit supported by close celled foam containing plastic pontoons
- Low plume height for shorter drift distance of droplets and to allow longer operation in swirling or constantly changing winds
- Heavy industrial construction for durability and long life including stainless control panel, motor enclosure, manifold and fan blade
- Vibration sensor to shut down motor before catastrophic failure due to residue or ice build up
- 200 foot continuous chord (with no splicing needed)
- 7.5 HP stainless steel submersible pump supplying 80 gpm at 100 psi

The SMI® 420F Evaporator provides many **advantages** vs. competitive products.

Little Buildup: the SMI® 420F Evaporator is designed with minimal amount of top surface area for residue or ice to build upon. Little clean up or maintenance required!

High Performance: High speed fan blade rotation (3600 rpm) that creates an optimum water droplet distribution for evaporation. Average annual evaporation rates up to 70% have been achieved with average rates typically between 25 and 60%, depending upon many factors such as ambient temperature, relative humidity, water make up and wind conditions. In general, the warmer and drier the conditions, the higher the evaporation rates achieved.

Easy Maintenance: The machine is designed for easy cleaning and maintenance. The unit requires no weekly greasing of bearings.

Large Orefice Size: The SMI® 420F Evaporator can pass particles up to 3/16" (5 mm) in diameter. This eliminates the need for pre-filtering, filter cleaning and the hassles of clogged nozzles.

Extreme Duty: The SMI® 420F Evaporator design has evolved from 10 years experience in industrial and extreme outdoor applications. The polyethylene plastic pontoons are filled with close celled polyurethane foam, ensuring buoyancy even after any accidental puncturing that may occur of the plastic outer shell. Critical components are constructed of stainless steel for extended life in harsh environmental conditions.

Options: For acidic or high alkaline water applications, SMI offers an upgraded version with the platform composed of stainless steel construction. The fan can be ordered with a special scale resistant coating to reduce build up on the blades from use over time. Longer electrical chord available without splices (just inform us at time of order).

A major benefit is the SMI Expert Advantage. Our industrial evaporation systems have been in use for over 10 years by satisfied customers with over 250 units in the field. We work with over 40 new customers per year on creating solutions to their water management needs. We provide mechanical evaporators, design and engineering analyses of a customer's specific situation, complete automation based on weather conditions or pond levels and pump stations.

SMI® Evaporators manage water in industrial environments and produce water evaporation rates beyond tradition approaches such as misting heads and irrigation systems. Our industrial evaporation systems have been in use for over 10 years by satisfied customers with over 250 units in the field. They are used to expand the capacity or extend the life of current water treatment facilities (such as tailing dams, evaporation and cooling ponds or irrigation fields). Other times, new facilities are designed to maximize the accelerated evaporation rates achieved using our systems. They remove significant amounts of excess and unwanted water economically yet environmentally friendly way.

From providing one evaporator to full systems solutions, SMI has the experience and expertise to meet your needs.

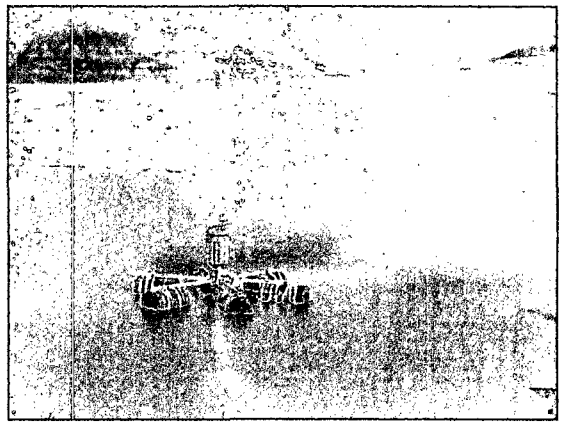
Evaporative Solutions
SMI COVERS THE WORLD
www.evapor.com

New Product Data Sheet

SMI® 420F Evaporator

Specifications

Fan and Head System
Stainless steel motor enclosure with air cooling ports
Patented (20") polished stainless steel propeller
Propeller mounted on motor shaft



Water System
Stainless steel construction
Flow rate of 80 gpm at 100 psi water pressure
3/16" (5 mm) orifice size

Pump
7.5 HP submersible stainless steel pump
Supplying about 80 gpm at 100 psi

Floating Platform
Galvanized steel construction
All stainless steel fasteners
Plastic pontoon composed of UV stabilized polyethylene shell with closed cell polyurethane foam
Customized material construction available on request

Electrical
25 HP premium efficiency motor with service duty impro seals and rotating at 3600 rpm
Stainless Steel control panel
200' (60 m) electrical chord (longer lengths available per customer request)
Motors available in all voltages and cycles

Warranty
Full one year warranty on all parts and workmanship

Options
- For acidic or high alkaline water applications, SMI offers an upgraded version with the platform composed of stainless steel construction
- The fan can be ordered with a special scale resistant coating to reduce build up on the blades from use over time
- Longer electrical chord available without splices

Attachment "I" Biological Resource Survey

BIOLOGICAL SUMMARY
SAND ROCK EVAPORATION PONDS
Patina San Juan, Inc.
Farmingtom, NM

INTRODUCTION

The project is known as the Sand Rock Evaporation Ponds and are located in Section 23, T31N, R13W. The land owner and operator of the project is Patina San Juan, Inc. (Patina). The purpose of the biological summary is to analyze the site of the proposed action for the presence and potential occurrence of special status species and their habitat. This project is located on private land and this report is not supporting any federal permits.

EFFECTED ENVIRONMENT

The proposed Sand Rock Evaporation Ponds are located on generally flat terrain that drains to the west towards the La Plata River. The soils are comprised of Persayo-Fruitland-Shepphard which are derived from alluvial, residual, and eolian materials. The soils can be level to steep and are well drained.

There are approximately 50 shrub-sized to mature juniper trees on the parcel. The dominant shrub is big sagebrush. Other shrubs found on the proposed project site include rabbitbrush and bitterbrush. Opuntia, broom snakeweed, banana yucca, Indian rice grass, and downy brome are scattered across the site. Please see photos 1 & 2.

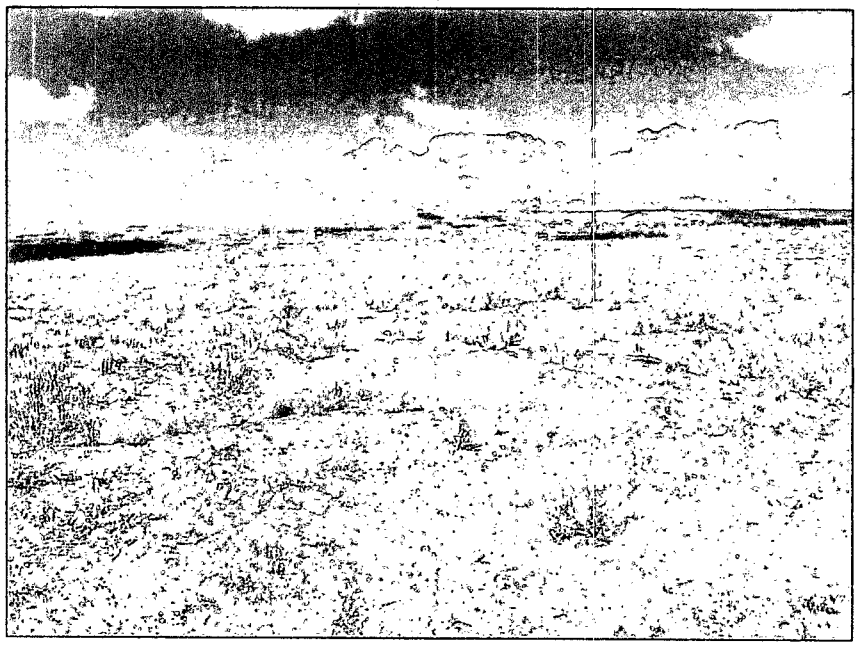


Photo 1: View west

Photo 2: View southwest

The area is primarily utilized for oil and gas development. The area also provides habitat for a variety of wildlife and shows signs of recent cattle grazing. There are no streams or wetlands on the parcel. Cottonwood trees and tamarisks exits in the La Plata River riparian area west of the project.

METHODS

The entire project was pedestrian surveyed on March 1, 2007. The following resources were noted during the review:

- physical and biological description of the proposed project site
- determination of any special status species presence on the site
- determination of any other animal presence on the site
- list of dominant plant species on the site
- presence of any bird nests on the site
- assessment of potential impacts that the proposed action may have on any special status species or designated critical habitat in the project area

RESULTS

During the survey, the weather was overcast and the temperature was approximately 28° F. Common species of this area were observed including a flock of juncos, mule deer (scat and tracks), coyote (scat and tracks), black-tailed jackrabbit, and a mountain cottontail rabbit. A list of species observed during the biological survey, as well as those with potential to occur in the

area, is included in Appendix A . No federal or state listed special status species were identified in the project area. No raptors or nests were discovered.

DISCUSSION

The parcel is 15 acres and approximately 1/3 of this would be used for the proposed project. The biological survey did not identify any sensitive plant or animals species that would be adversely impacted by the proposed project. There are no wetlands or special habitat areas. The proposed project would have negligible effect to the existing environment.

APPENDIX A
List of Observed and Potentially Occurring Wildlife and Plant Species

Mammals

	Whitetail antelope squirrel	*Ammospermophilus leucurus*
	Pallid bat	*Antrozous pallidus*
	Ringtail	*Bassaricus astutus*
	Coyote	*Canis latrans*
	American Elk	*Cervus elaphus*
	Townsend's big-eared bat	*Corynorhinus townsendii*
	Gunnison prairie dog	*Cynomys gunnisoni*
	Ord's Kangaroo rat	*Dipodomys ordii*
	Bannertail kangaroo rat	*Dipodomys spectobilis*
	Big brown bat	*Eptesicus fuscus*
	Porcupine	*Erethizon dorsatum*
	Spotted bat	*Euderma maculata*
	Allen's big-eared bat	*Idionycteris phyllotis*
	Silver-haired bat	*Lasionycteris noctivagans*
	Hoary bat	*Lasiurus cinereus*
*	Blacktail jackrabbit	*Lepus californicus*
	Bobcat	*Lynx rufus*
	Striped skunk	*Mephitis mephitis*
	California myotis	*Myotis californicus*
	Small-footed bat	*Myotis ciliolabrum*
	Long-earred myotis	*Myotis evotis*
	Little brown myotis	*Myotis lucifugus*
	Fringed myotis	*Myotis thysanodes*
	Long-legged bat	*Myotis volans*
	Yuma Bat	*Myotis yumanensis*
	White-throated woodrat	*Neotoma albigula*
	Big free-tailed bat	*Nyctinomops macrotis*
	Mule deer	*Odocoileus hemionus*
	Northern grasshopper mouse	*Onychomys leucogaster*
	Plains pocket mouse	*Perognathus flavescens*
	Silky pocket mouse	*Perognathus flavus*
	North American deermouse	*Peromyscus maniculatus*
	Piñon deermouse	*Peromyscus truei*
	Western pipistrelle	*Pipistrellus herperus*
	Puma	*Puma concolor*
	Merriam's shrew	*Sorex merriami*
	Spotted ground squirrel	*Spermophilus spilosoma*
	Western spotted skunk	*Spilogale gracilis*
	Desert cottontail	*Sylvilagus auduboni*
*	Mountain cottontail	*Sylvilagus nuttallii*
	Least chipmunk	*Tamias minimus*
	American badger	*Taxidea taxus*
	Botta's pocket gopher	*Thomomys bottae*

	Gray fox	*Urocyon cinereoargenteus*
	Kit fox	*Vulpes macrotis*
	Red fox	*Vulpes vulpes*

Birds

	Cooper's hawk	*Accipiter cooperii*
	Sharp-shinned hawk	*Accipiter striatus*
	Sage sparrow	*Amphispiza belli*
	Black-throated sparrow	*Amphispiza bilineata*
	Scrub jay	*Apelocoma californica*
	Golden eagle	*Aquila chrysaetos*
	Juniper titmouse	*Baeolophus griseus*
	Cedar waxwing	*Bombycilla cedrorum*
	Great horned owl	*Bubo virginianus*
	Red-tailed hawk	*Buteo jamaicensis*
	Ferruginous hawk	*Buteo regalis*
	Swainson's hawk	*Buteo swainsoni*
	Gambel's quail	*Callipepla gambelii*
	Lesser goldfinch	*Carduelis psaltria*
	American goldfinch	*Carduelis tristis*
	House finch	*Carpodacus mexicanus*
	Turkey vulture	*Cathartos aura*
	Belted kingfisher	*Ceryle alcyon*
	Lark sparrow	*Chondestes grammacus*
	Common nighthawk	*Chordeiles minor*
	Northern harrier	*Circus cyaneus*
	Northern flicker	*Colaptes auratus*
	Band-tailed pigeon	*Columba fasciata*
	Rock dove	*Columba livia*
	Common raven	*Corvus corax*
	Black-throated gray warbler	*Dendroica nigrescens*
	Gray flycatcher	*Empidonax wrightii*
	Horned lark	*Ermophila alpestris*
	Brewer's blackbird	*Euphagus cyanocephalus*
	Prairie falcon	*Falco mexicanus*
	American kestrel	*Falco spaverius*
	Blue grosbeak	*Guiraca caerulea*
	Pinyon jay	*Gymnorhinus cyanocephalus*
	Bald eagle	*Haliaeetus leucocephalus*
	Barn swallow	*Hirundo rustica*
	Yellow-breasted chat	*Icteria virens*
	Bullock's oriole	*Icterus bullockii*
	Scott's oriole	*Icterus parisorum*
*	Dark-eyed junco	*Junco hyemalis*

	Loggerhead shrike	*Lanius ludovicianus*
	Northern mockingbird	*Mimus polyglottos*
	Brown-headed cowbird	*Molothrus ater*
	Townsend's solitaire	*Myadestes townsendi*
	Ash-throated flycatcher	*Myiarchus cinerascens*
	Sage thrasher	*Oreoscoptes montanus*
	Western screech-owl	*Otus kennicottii*
	House sparrow	*Passer domesticus*
	Lazuli bunting	*Passerina amoena*
	Common poorwill	*Phalaenoptilus nuttallii*
	Black-billed magpie	*Pica hudsonia*
	Blue-gray gnatcatcher	*Polioptila caerulea*
	Vesper sparrow	*Pooecetes gramineus*
	Bushtit	*Psaltriparus minimus*
	Say's phoebe	*Sayornis saya*
	Mountain bluebird	*Sialia currucoides*
	Western bluebird	*Sialia mexicana*
	American tree sparrow	*Spizella arborea*
	Brewer's sparrow	*Spizella breweri*
	Chipping sparrow	*Spizella passerine*
	Western meadowlark	*Sturnella neglecta*
	Starling	*Sturnus vulgaris*
	Bewick's wren	*Thryomanes bewickii*
	House wren	*Troglodytes aedon*
	Robin	*Turdus migratorius*
	Western kingbird	*Tyrannus verticalis*
	Barn owl	*Tyto alba*
	Virginia's warbler	*Vermivora virginiae*
	Gray vireo	*Vireo vicinior*
	Mourning dove	*Zenaidura macroura*
	White-crowned sparrow	*Zonotrichia leucophrys*

Reptiles

	Little striped whiptail	*Cnemidophorus inornatus*
	Plateau whiptail	*Cnemidophorus velox*
	Prairie rattlesnake	*Crotalus viridis*
	Collared lizard	*Crotaphytus collaris*
	Many-lined skink	*Eumeces multivirgatus*
	Lesser earless lizard	*Holbrookia maculata*
	Striped whipsnake	*Masticophis taeniatus*
	Short-horned lizard	*Phrynosoma hernandesi*
	Bull snake	*Pitulophis catenifer*
	Sagebrush lizard	*Sceloporus graciousus*
	Desert spiny lizard	*Sceloporus magister*

	Plateau lizard	*Sceloporus undulates*
	Wandering garter snake	*Thamnophis elegans*
	Side-blotched lizard	*Uta stansburiana*

Grasses

	Crested wheatgrass	*Agropyron cristatum* (l.) Gaertn.
	Western wheatgrass	*Agropyron smithii* Rydb.
	Blue grama	*Bouteloua gracilis* (H.B.K.) Lag. Ex Steud.
	Saltgrass	*Distichlis spicata*
	Canada wildrye	*Elymus canadensis* L.
	Bottlebrush grass	*Elymus hystrix*
	Galleta	*Hilaria jamesii* (Torr.) Benth.
*	Indian ricegrass	*Oryzopsis hymenoides* (R. & S.) Ricker
	Squirreltail	*Sitanion hystrix* Nutt.
	Alkali sacaton	*Sporobolus airoides* Torr.
	Sand dropseed	*Sporobolus cryptandrus* (Torr.) Gray

Shrubs

*	Big sagebrush	*Artemisia tridentate* Nutt.
	Black Sage	*Artemisia nova*
	Fourwing saltbush	*Atriplex canescens* (Pursh) Nutt.
	Shadscale	*Atriplex confertifolia*
	Mountain mahogany	*Cercocarpus montanus* Raf.
*	Rabbitbrush	*Chrysothamnus* sp.
	Cliffrose	*Cowania mexicana* D. Don.
	Mormon tea	*Ephedra* sp.
	New Mexico olive	*Foresteria neomexicana*
*	Bitterbrush	*Purshia tridentata* (Pursh)
	Gamble's oak	*Quercus gambellii* Nut.
	Coyote willow	*Salix exigua*
	Black greasewood	*Scarcobatus vermiculatus*
	Narrowleaf yucca	*Yucca angustissima* Engelm.
*	Banana yucca	*Yucca baccata* Engelm.

Trees

*	Utah juniper	*Juniperus osteosperma* (Torr.) Little
	Piñon pine	*Pinus edulis* Engelm.
	Fremont cottonwood	*Populus fremontii*
	Plains cottonwood	*Populus sargentii*

Forbs

	Aztec gilia	*Gilia formosa*
	Brack's cactus	*Sclerocactus cloveriae brackii*
*	Broom snakeweed	*Gutierrezia sarothrae* (Pursh) Britt. & Rusby
	Buckwheat	*Eriogonum* sp. Benth.
	Cholla cactus	*Opuntia* sp.
	Groundsel	*Scenecio* sp.
	Lupine	*Lupinus* sp.
*	Prickly pear cactus	*Opuntia* sp.
	Prostrate knotweed	*Polygonum aviculare* L.
	Western salsify	*Tragopogon dubius* Scop.

Noxious/Invasive Weeds

*	Downy brome	*Bromus tectorum*
	Musk thistle	*Carduus nutans* L.
	Spotted knapweed	*Centaurea maculosa*
	Russian knapweed	*Centaurea repens*
	Canada thistle	*Cirsium arvense*
	Russian olive	*Elaeagnus angustifolia*
	Filaree	*Erodium cicutarium* (L.) L'Her. Ex Ait.
	Leafy spurge	*Euphorbia esula*
	Kochia	*Kochia scorparia*
	Scotch thistle	*Onopordum acanthium*
	Phragmites	*Phragmites australis*
*	Russian thistle	*Salsola iberica* Sennen
	Tumbleweed mustard	*Sisymbrium altissimum*
	Tamarisk	*Tamarix ramosissima*
	Common mullein	*Verbascum thapsus*
	Cocklebur	*Xanthium* sp.

* Species noted in the field during the survey.

Attachment "J" Evaporation Calculations

Attachment J - Evaporation Calculations

I. Discussion

The Sand Rock Evaporation pond includes two ponds that are each approximately 3.1 acre-ft of empoundment at minimum freeboard (0.716 acres surface area per pond at minimum freeboard). The ponds would empound 9.2 acre-ft if allowed to overflow. Expected inflow to the site is on the order of 1,500 bbl/day.

A. Penpan Equation

The *Penman Equation* is the starting point for most evaporation calculations. This equation requires detailed information about many terms (e.g., net irradiance, variability in the length of daylight, and the declination of the sun) that may not be readily available for most locations (see http://www.treemail.nl/download/treebook7/weather/chapt4.htm [Ref 1] for a detailed description of all of the terms in Penman's 1948 equation). It has been shown (http://www-das.uwyo.edu/~geerts/cwx/penpan.html [Ref 2]) that some simplifying assumptions can be reasonably applied without unduly compromising the validity of the *Penman Equation.* The simplified equation is:

$$E_0 = \left(0.015 + 0.00042T_m + z*10^{-6}\right)\left(0.8*R_s - 40\right) + 2.5*F*u\left(T_m - T_D\right)$$

The terms of this equation are:

E_0	=	Evaporation rate (mm/day)
F	=	A factor that accounts for the change in air density with changes in elevation
R_s	=	Solar irradiance (W/m^2)
T_D	=	Mean dew point temperature (°C)
T_m	=	Mean daily temperature (°C)
u	=	Wind velocity at 2 meters above surface (m/s)
z	=	Elevation above sea level (m)

The air density factor can be reduced to a function of elevation using the following empirical equation:

$$F = 1.0 - 1.7\times10^{-5} * z$$

That leaves Solar Irradiance. This term is a function of several very obscure terms (e.g., albedo, and variability of the earth's rotation). The R_s term can be markedly simplified by considering it a function of temperature for a given elevation and latitude (see Appendix 5 of Ref 2 above):

$$R_s = 9.9*T_m + 177$$

This formulation of R_s is specific to a location in to the latitude and elevation of this site.

"Dew point temperature defines the temperature to which a parcel of air would need to be cooled at constant pressure and constant moisture content in order for the vapor pressure and saturation vapor pressure of the parcel to be

equal. In other words, it is the temperature at which a parcel of air would be saturated (i.e., 100% relative humidity)" [ref 3, Huschke, R. E., Editor, 1959, *Glossary of Meteorology*, American Meteorological Society]. The equations for Dew Point Temperature are empirical and are a function of temperature and relative humidity (both of which are available from federal sources). Saturation vapor pressure can be expressed as:

$$e_s = \exp\left(c_{15} - c_1 T - \frac{c_2}{T}\right)$$

$$e = RH * e_s$$

$$b = c_{15} - \ln(e)$$

$$T_d = \frac{b - \sqrt{b^2 - c_3}}{c_4}$$

The terms of this equation are:

b	=	Place holder
c_1	=	Empirical constant (0.0091379)
c_2	=	Empirical constant (6106.396)
c_3	=	Empirical constant (223.1986)
c_4	=	Empirical constant (0.182758)
c_{15}	=	Empirical constant (26.66082)
e	=	Vapor pressure
e_s	=	Vapor pressure at saturation
RH	=	Relative humidity from NOAA
T	=	Temperature (K)
T_D	=	Dew point temperature (K)

This simplifies the *Penman* Equation into the widely used *Penpan Equation* for this set of ponds to:

$$E_0 = \left(0.015 + 0.00042 * T_m + z * 10^{-6}\right)\left(0.8 * \left[9.9 * T_m + 177\right] - 40\right) + 2.5 * \left[1.0 - 8.7 \times 10^{-5} * z\right] * u\left(T_m - T_D\right)$$

All of the terms in this equation are now either constant or available from federal meteorological sources.

Application of this equation to the data is typically done as a "low evaporation", "mean evaporation" and "high evaporation" case. Each case uses average wind velocity and average dew-point temperature because it is unreasonable to assume that just because temperature is high that wind velocity will also be high while dew point is low. Assuming that all conditions are lined up for maximum evaporation results in evaporation rates over 30 inches per day, which is not reasonable. Conversely, assuming that all conditions are lined up for minimum evaporation results in pond surface rising by 10 inches per day, also not reasonable.

1. *Cases Evaluated*

   a) Low evaporation case

      This case starts with the average minimum temperature for each month and the maximum average precipitation for that month on the assumption that cold years result in the highest precipitation. This calculation results in an average net evaporation of 0.8 inches per day. Some months in a "low evaporation" year would see the level of the ponds increasing with zero produced-water inflow.

   b) Mean evaporation case

      This case uses average temperatures and average precipitation. This case results in an average net evaporation of 2.5 inches per day.

   c) High evaporation case

      This case uses average maximum temperature and minimum average precipitation to provide 4.4 inches of evaporation per day.

2. *Effect of spraying*

   The quantitative effect of spray heads is very difficult to determine. The best information is provided by the irrigation industry. Their goal is to minimize evaporation and their findings are that since evaporation rate on drops larger than 50 microns is a strong function of the droplet surface area, the evaporation rate is much slower with large drops (such as provided by water cannons) than with small drops or mist. Estimates vary significantly from one researcher to the next, but credible sources place the water lost to evaporation at 0.1-0.3% with large drops (greater than 100 microns) and 5-15% with a mist (50-100 microns). An aerosol (1-50 micron droplets) has droplets so small that the evaporation rate becomes a body function instead of a surface function which can increase the evaporation to 50-80% of the volume sprayed.

   The cumulative effect of the shade of the wind walls, the bird netting, and the pond balls will all be to inhibit evaporation. To counter these shading effects, the west pond will be equipped with a pair of SMI 420F evaporators. These high-tech units will pump over 3,000 bbl/day each and will atomize the water into drops smaller than 50 microns. In the expected conditions at the Sand Rock Evaporation Pond we can expect over 50% of the atomized water to evaporate so the combined effect of climate and spraying should result in at least 3,000 bbl/day capacity in the poorest conditions. In better conditions, the evaporation units can be run intermittently to match evaporation to inflow.

   With any spray system, you have to be concerned with overspray. The SMI 420F units float on the surface of the pond which provides the benefit of: (1) the pond-dike freeboard will tend to block wind and collect spray within the lined pond; (2) the tether system will allow the units to be pulled toward the prevailing wind direction; and (3) the spray will be moving directly counter to gravitational forces so the tendency will be for

the spray to fall straight down. The forward vector on the spray heads tends to lose momentum after about 10 ft, so by pointing the heads upward the potential for drift is lessened.

As a final protection against overspray leaving the pond area, the ponds will be surrounded by 20 ft tall wind fences. These fences have proven to be very effective in reducing wind velocity on solid waste management facilities and recreational facilities.

B. Solids Accumulation

Fruitland coal water tends to have about 10,000 mg/L TDS. This equates to 3.5 lbm/bbl, so in the average case we would expect to accumulate about 76 ft^3 of solids per day. This works out to filling the pond to the 3 ft line in 5.6 years in the average evaporation case. The higher evaporation case would shorten this to 3.2 years.

The ponds are set up such that most of the solids will accumulate in the west pond. The plan is to monitor solids accumulation and when it reaches 3 ft from the bottom, shift the evaporators and pond balls to the east pond, dry out the west pond, sample the solids for NORM, hydrocarbon accumulation, and heavy metals and remove the solids and primary liner to an appropriate land fill. Then the primary liner will be replaced and the pond returned to service.

Even with this plan, the east pond will eventually require cleaning. In that case we will close the east head gate in the weir, dry out the east pond, sample the solids, and remove the solids and primary liner to an appropriate landfill.

II. Calculations

All of the calculations below were based on federal data for the "Farmington Ag Center" between January, 1985, and January, 2005.

$i := 1,2..12$ $j := 1,2..3$ $bbl := 42 \cdot gal$

Penpan Equation

$z := 5960 \cdot ft$ Elevation above sea level $z = 1817\,m$

$$NOAA\_Tm := \begin{pmatrix} 20.477 & 31.093 & 43.532 \\ 23.897 & 35.861 & 49.573 \\ 29.508 & 43.963 & 59.992 \\ 36.512 & 51.997 & 67.060 \\ 44.767 & 61.349 & 76.783 \\ 53.834 & 70.951 & 87.166 \\ 59.815 & 74.943 & 90.721 \\ 59.406 & 72.745 & 88.061 \\ 50.936 & 64.746 & 80.320 \\ 39.636 & 53.021 & 68.274 \\ 27.760 & 39.069 & 52.823 \\ 19.589 & 30.076 & 42.897 \end{pmatrix} °F \qquad NOAA\_precip := \begin{pmatrix} 0.0129 & 0.0125 & 0.0032 \\ 0.0149 & 0.0142 & 0.0000 \\ 0.0234 & 0.0177 & 0.0000 \\ 0.0182 & 0.0150 & 0.0001 \\ 0.0132 & 0.0131 & 0.0001 \\ 0.0168 & 0.0177 & 0.0015 \\ 0.0285 & 0.0310 & 0.0035 \\ 0.0326 & 0.0269 & 0.0002 \\ 0.0242 & 0.0218 & 0.0001 \\ 0.0237 & 0.0172 & 0.0034 \\ 0.0167 & 0.0148 & 0.0000 \\ 0.0085 & 0.0081 & 0.0000 \end{pmatrix} \frac{in}{day}$$

$$NOAA\_Td := \begin{pmatrix} 21.436 \\ 22.973 \\ 25.065 \\ 28.611 \\ 33.484 \\ 37.620 \\ 48.735 \\ 52.561 \\ 44.102 \\ 34.359 \\ 25.899 \\ 19.934 \end{pmatrix} °F \qquad NOAA\_u := \begin{pmatrix} 4.869 \\ 5.990 \\ 6.995 \\ 7.633 \\ 7.011 \\ 6.052 \\ 5.130 \\ 4.767 \\ 5.118 \\ 4.833 \\ 5.276 \\ 5.126 \end{pmatrix} \frac{mi}{hr} \qquad DaysInMo := \begin{pmatrix} 31 \\ 28 \\ 31 \\ 30 \\ 31 \\ 30 \\ 31 \\ 31 \\ 30 \\ 31 \\ 30 \\ 31 \end{pmatrix} \cdot day$$

$$E0_{i,j} := \left[\left[0.015 + 0.00042 \cdot \left(\frac{NOAA\_Tm_{i,j}}{K} - 273.15 \right) + \left(\frac{z}{m} \right) \cdot 10^{-6} \right] \cdot \left[0.8 \cdot \left[9.9 \cdot \left(\frac{NOAA\_Tm_{i,j}}{K} - 273.15 \right) + 177 \right] - 40 \right] \ldots \right] \cdot \frac{mm}{day}$$
$$\left[+ 2.5 \cdot \left(1 - 8.7 \cdot 10^{-5} \cdot \frac{z}{m} \right) \cdot \left(\frac{NOAA\_u_i}{\frac{m}{s}} \right) \cdot \left(\frac{NOAA\_Tm_{i,j}}{K} - \frac{NOAA\_Td_i}{K} \right) \right]$$

$$NetEvap_{i,j} := E0_{i,j} - NOAA\_precip_{i,j}$$

$$E_0 = \begin{pmatrix} -0.068 & 1.032 & 2.331 \\ 0.153 & 1.672 & 3.427 \\ 0.698 & 2.840 & 5.235 \\ 1.327 & 3.834 & 6.292 \\ 1.751 & 4.236 & 6.568 \\ 2.190 & 4.430 & 6.574 \\ 1.375 & 3.074 & 4.865 \\ 0.875 & 2.271 & 3.893 \\ 0.874 & 2.411 & 4.162 \\ 0.624 & 2.022 & 3.633 \\ 0.254 & 1.527 & 3.088 \\ -0.011 & 1.130 & 2.537 \end{pmatrix} \frac{in}{day} \quad NetEvap = \begin{pmatrix} -0.081 & 1.019 & 2.328 \\ 0.138 & 1.657 & 3.427 \\ 0.674 & 2.822 & 5.235 \\ 1.308 & 3.819 & 6.292 \\ 1.738 & 4.223 & 6.568 \\ 2.173 & 4.412 & 6.572 \\ 1.347 & 3.043 & 4.862 \\ 0.842 & 2.244 & 3.893 \\ 0.850 & 2.389 & 4.162 \\ 0.600 & 2.005 & 3.630 \\ 0.237 & 1.512 & 3.088 \\ -0.019 & 1.122 & 2.537 \end{pmatrix} \frac{in}{day}$$

Pond Dimensions

$Depth_{operating} := 3 \cdot ft$ $\quad$ $Slope := 2$

$Width_{bottom} := 110 \cdot ft$ $\quad$ $Width_{3ft} := Width_{bottom} + 2 \cdot (Depth_{operating} \cdot Slope)$ $\quad$ $Width_{3ft} = 122\ ft$

$Len_{bottom} := Width_{bottom} \cdot 2$ $\quad$ $Len_{3ft} := Len_{bottom} + 2 \cdot (Depth_{operating} \cdot Slope)$ $\quad$ $Len_{3ft} = 232\ ft$

$$vol := \left(\frac{Len_{bottom} + Len_{3ft}}{2}\right) \cdot \left(\frac{Width_{bottom} + Width_{3ft}}{2}\right) \cdot Depth_{operating} \cdot 2 \qquad vol = 3.611\ acre \cdot ft$$

for two ponds

$$DailyCapacity_{i,j} := NetEvap_{i,j} \cdot Width_{3ft} \cdot Len_{3ft} \cdot 2$$

$$DailyAverage_j := \frac{\sum_i \left(DailyCapacity_{i,j} \cdot DaysInMo_i\right)}{356.25 \cdot day} \qquad DailyAverage = \begin{pmatrix} 705 \\ 2173 \\ 3774 \end{pmatrix} \frac{bbl}{day}$$

Solids Accumulation

$$TDS := 10000 \cdot \frac{mg}{L}$$

$$\rho_{solids} := 1600 \cdot \frac{kg}{m^3} \qquad \rho_{solids} = 99.885 \frac{lb}{ft^3}$$

$m_{solids} := DailyAverage \cdot TDS$ $\quad$ $m_{solids} = \begin{pmatrix} 2472 \\ 7615 \\ 13227 \end{pmatrix} \frac{lb}{day}$

$$q_{solids} := \frac{m_{solids}}{\rho_{solids}} \qquad q_{solids} = \begin{pmatrix} 24.751 \\ 76.239 \\ 132.418 \end{pmatrix} \frac{ft^3}{day}$$

$$Days_{solids} := \frac{vol}{q_{solids}} \qquad Days_{solids} = \begin{pmatrix} 17.4 \\ 5.649 \\ 3.252 \end{pmatrix} yr$$

The Sand Rock Evaporation Pond is proposed for a 15 acre site in the NE SW of Section 23, T31N, R13W. The site is owned in whole by the applicant (list of company officers is on file with NMOCD):

Patina San Juan, Inc.
5802 Highway 64
Farmington, NM 87402

The facilities will be constructed by Patina for the disposal of liquids from wells with Patina interest. No commercial activities are proposed.

Exhibits:

- Sample Letter to Surface Owners within ½ mile of site
- Sample Newspaper Announcement
- Surface owners within ½ mile of the site
- Surface owners who have property more than ½ mile from the site but are within 1 mile
- Map showing surface owners within 1 mile
- Map showing surface owners within 1 mile posted to USGS 7.5 minute quad

PATINA
OIL & GAS CORPORATION

5802 U.S. Highway 64
Farmington, NM 87401

505-632-8056

[date]

Allison, Jeffery R
48 CR 5190
Bloomfield, NM 87413-9710

Sample Letter

Patina San Juan, Inc. (hereafter "Patina") has submitted an application to the New Mexico Oil Conservation Division (NMOCD) under NMAC 19.15.36 to construct a new facility in the SW NW of Section 23, Township 31N, Range 13W (leave CR3526 approx 0.9 miles west of Glade Road, then 1.1 miles along lease road).

This facility will accumulate produced water from gas wells operated by Patina for the purposes of evaporation. The two ponds will each be approximately 0.7 acres and will hold 3.1 acre-ft of water. This facility will have spray equipment and will be enclosed within wind walls to control overspray.

The shallowest fresh-water aquifer under this site is below 50 ft and Patina was unable to contact this aquifer in multiple bores.

If you have any questions about this site please contact David Simpson at 505-326-2115, myself, or the NMOCD directly at:

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

or

Oil Conservation Division
1000 Rio Brazos Road
Aztec, NM 87410

Billie Maez
District Manager

The following advertisement will be placed in both *Albuquerque Journal* and the Farmington *Daily Times* after the application has been deemed administratively complete:

Public Notice

Pursuant to NMAC 19.15.36 Patina San Juan, Inc. is announcing that they have submitted an application to the New Mexico Oil Conservation Division to construct a non-commercial produced-water evaporation pond on private land in NE SW of Section 23, Township 31N, Range 13W in San Juan County. Comments can be submitted to:

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Aviso Público

De conformidad con la norma 19.15.36 del Código Administrativo de Nuevo México, Patina San Juan, Inc. anuncia que ha presentado una solicitud ante la *New Mexico Oil Conservation Division* (Secretaría de Conservación del Petróleo de Nuevo México) para construir un estanque de evaporación de agua producida en forma no comercial en un terreno privado sito en la orientación NE SW de la Sección 23, Municipio 31N, Área 13W en el Condado de San Juan. Los comentarios se pueden enviar a:

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Attachment K – Surface Owners within ½ mile of site

Allison, Jeffery R
48 CR 5190
Bloomfield, NM 87413-9710

Allyn, Roger
PO Box 269
La Plata, NM 87418-0269

Bernhart, James V
3325 W Millstone Place
Tucson, AZ 85741-5741

Big Rock Trading Post Partners
64 RD 6700
Fruitland, NM 87416-9601

Davis, Jeffrey O. Trustees
PO Box 509
La Plata, NM 87418-0509

Dickens, Charles A et al Trust
64 CR 6700
Fruitland, NM 87416-9601

Dickens, F.R % Williams, Michael L
PO Box 1719
Kirkland, NM 87417-7417

Dinning, Robert W Trustees
7219 Driftwood Avenue
Farmington, NM 87402-7402

Freeman, Deborah
3325 W Millstone Place
Tucson, AZ 85741-5741

Freeman, Edward
2514 Santaella Lane
Fairfield, CA 94533-4533

Freeman, Marcus
5484 Rodney
Chubbuck, ID 83202-5365

Freeman, Odell
6400 SW 143 Lane Road
Ocala, FL 34473-5445

Attachment K – Surface Owners within ½ mile of site

Merilatt, Craig Carl
PO Box 466
La Plata, NM 87418-0466

Tannin, Debbie D.
205 E 200 N
Kaysville, UT 84037-4037

Tribble, Duane L Trust
PO Box 2075
Farmington, NM 87499-7499

Yuhas, Marguerita
PO Box 794
Monticello, UT 84535-0794

Allyn, Roger M
PO Box 269
La Plata, NM 87418-0269

Archuleta, Rudy S
1157 NM 170
La Plata, NM 87418-9601

Bramwell, James E
PO Box 55
Chromo, CO 81128-1128

Broten, Inc
PO Box 556
Farmington, NM 87499-0556

Clifton, Bill W
1101 HWY 170
La Plata, NM 87418-7418

Cochran Gerald L. TST
1509 Schofield Lane, Suite B
Farmington, NM 87401-7442

Crabtree, Roy Dean et al
39939 Telescomb Drive
Queen Creek, AZ 85242-5242

De Priest, Lonnie E
1133 Highway 170
La Plata, NM 87418-9601

Dowdy, John L
PO Box 334
La Plata, NM 87418-0334

Dunn, Steven S.
PO Box 298
La Plata, NM 87418-7418

Egeland, Jerry Trustee
PO Box 330
La Plata, NM 87418-0330

Goncz, Gerald J Trust
9 CR 1493
La Plata, NM 87418-7418

Huggins, Kenneth Trust
PO Box 217
La Plata, NM 87418-0217

Izatt, Lynn F
1161 NM 170
La Plata, NM 87418-9601

Johns, Allan B
PO Box 302
La Plata, NM 87418-0302

Kempa, Kenneth E
1156 Highway 170
La Plata, NM 87418-7418

Merilatt, Craig Carl
PO Box 466
La Plata, NM 87418-0466

Murray, Billy W, et al
6 CR 1495
La Plata, NM 87418-7418

Nickles Brothers, Inc
1412 Highway 170
La Plata, NM 87418-9606

Pistole, Clifford Allen
9 CR 1493
La Plata, NM 87418-7418

Silva, Anthony Richard
PO Box 777
Kirkland, NM 87417-7417

Silva, John
52 Jameson Drive
Durango, CO 81301-1301

Silva, John
101 E Main Street
Farmington, NM 87401-2701

Sinkey, Lawrence Owen Et ux
2011 Christie Road NW
Calgary, ABCA T2L - OV6

Sinkey, Leslie Lynee
21 CR 3955
Farmington, NM 87401-7401

Tackitt, Ruth Trustee
4 CR 1494
La Plata, NM 87418-7418

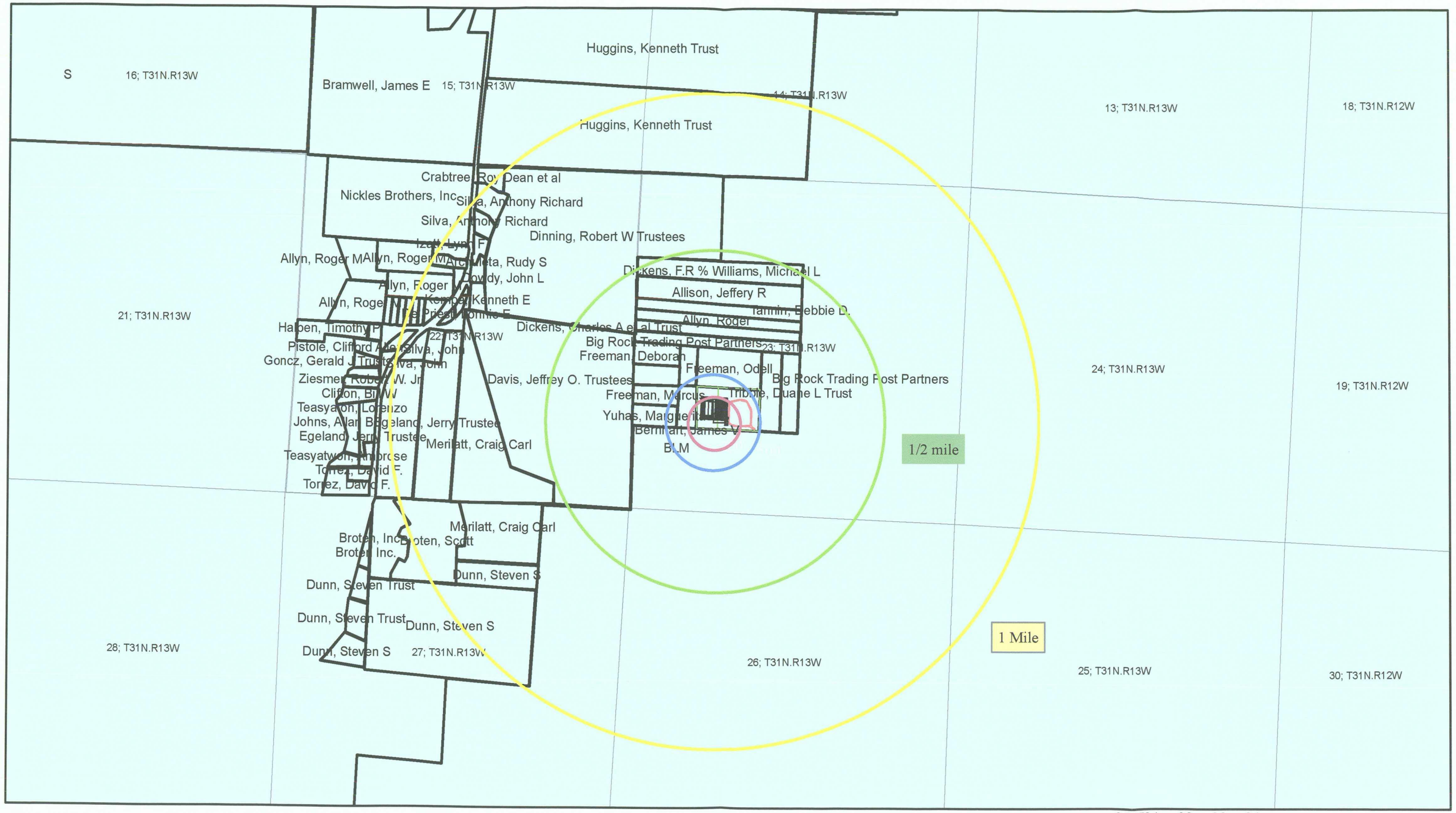
Teasyatwho, Ambrose
PO Box 233
La Plata, NM 87418-0233

Torrez, David F.
10 CR 6735
Fruitland, NM 87416-7416

Truby, Eugene X % Harrison, Everett Ray Jr
PO Box 383
La Plata, NM 87418-7418

Walter, Laura Trust
12 CR 1495
La Plata, NM 87418-7418

Ziesmer, Robert W. Jr.
7 CR 1493
La Plata, NM 87418-7418



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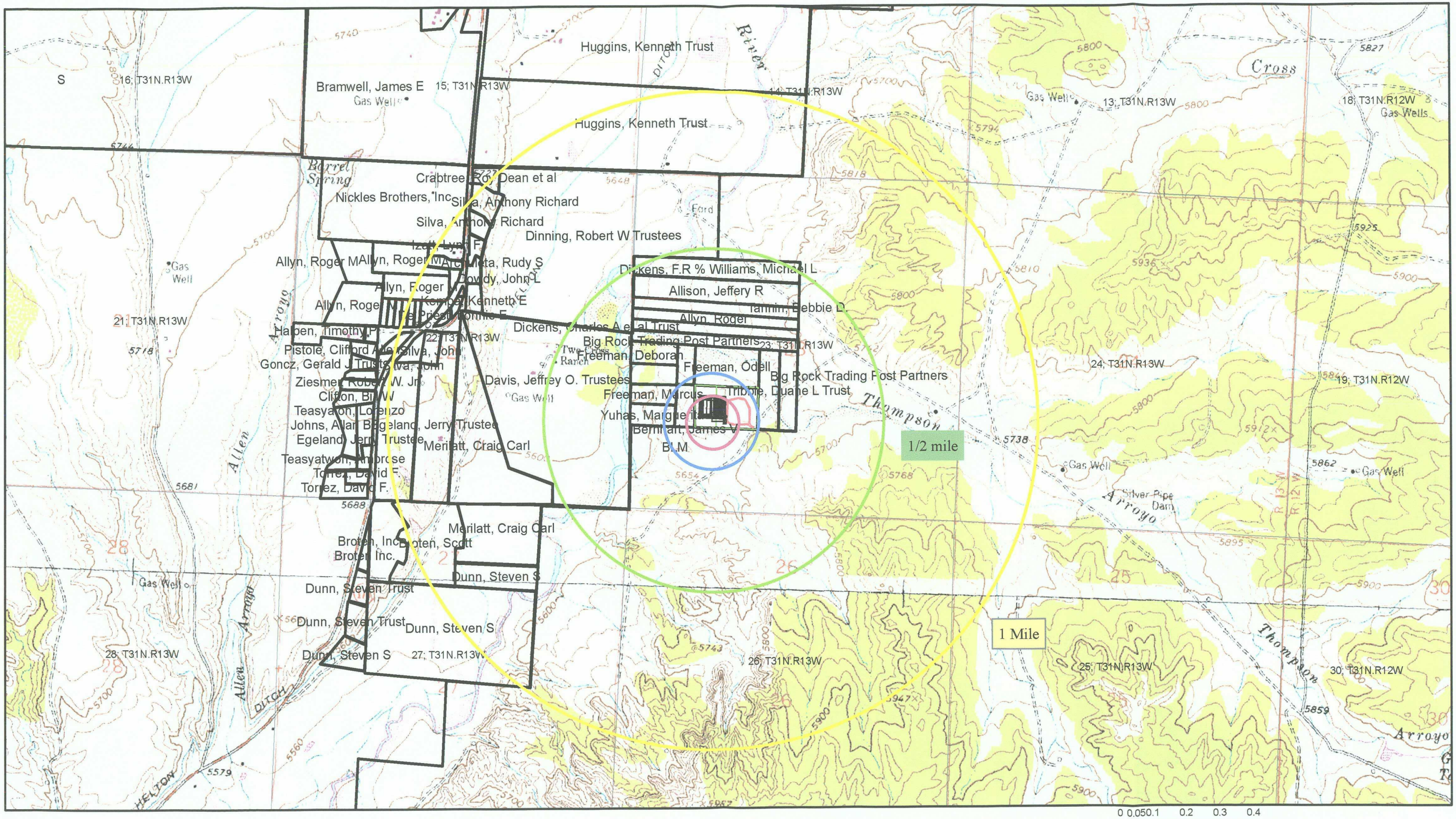
Sand Rock Evaporation Pond
Property Ownership



1:17,281

Sand Rock Evaporation Pond
Property Ownership

Attachment "L" NMAC 19.15.36 Cross Reference

NMAC 19.15.36 Requirement	Location within Application
19.15.36.8.	
C Application requirements for new facilities, major modifications and permit renewals. An applicant or operator shall file an application, form C-137	Front of document
(1) the names and addresses of the applicant and principal officers and owners of 25 percent or more of the applicant;	Attachment "K"
(2) a plat and topographic map showing the surface waste management facility's location in relation to governmental surveys (quarter-quarter section, township and range); highways or roads giving access to the surface waste management facility site; watercourses; fresh water sources, including wells and springs; and inhabited buildings within one mile of the site's perimeter;	Attachment "K"
(3) the names and addresses of the surface owners of the real property on which the surface waste management facility is sited and surface owners of the real property within one mile of the site's perimeter;	Attachment "K"
4) a description of the surface waste management facility with a diagram indicating the location of fences and cattle guards, and detailed construction/installation diagrams of pits, liners, dikes, piping, sprayers, tanks, roads, fences, gates, berms, pipelines crossing the surface waste management facility, buildings and chemical storage areas;	Attachment "A"
(5) engineering designs, certified by a registered professional engineer, including technical data on the design elements of each applicable treatment, remediation and disposal method and detailed designs of surface impoundments;	Attachment "A"
(6) a plan for management of approved oil field wastes that complies with the applicable requirements contained in 19.15.36.13, 19.15.36.14, 19.15.36.15 and 19.15.36.17 NMAC;	Attachment "D"
(7) an inspection and maintenance plan that complies with the requirements contained in Subsection L of 19.15.36.13 NMAC;	Attachment "D"
(8) a hydrogen sulfide prevention and contingency plan that complies with those provisions of 19.15.3.118 NMAC that apply to surface waste management facilities;	Attachment "D"
(9) a closure and post closure plan, including a responsible third party contractor's cost estimate, sufficient to close the surface waste management facility in a manner that will protect fresh water, public health, safety and the environment (the closure and post closure plan shall comply with the requirements contained in Subsection D of 19.15.36.18 NMAC);	Attachment "F"
(10) a contingency plan that complies with the requirements of Subsection N of 19.15.36.13 NMAC and with NMSA 1978, Sections 12-12-1 through 12-12-30, as amended (the Emergency Management Act);	Attachment "E"
(11) a plan to control run-on water onto the site and run-off water from the site that complies with the requirements of Subsection M of 19.15.36.13 NMAC;	Attachment "C"
(12) in the case of an application to permit a new or expanded landfill, a leachate management plan that describes the anticipated amount of leachate that will be generated and the leachate's handling, storage, treatment and disposal, including final post closure options;	Not Applicable
(13) in the case of an application to permit a new or expanded landfill, a gas safety management plan that complies with the requirements of Subsection O of 19.15.36.13 NMAC;	Not Applicable
(14) a best management practice plan to ensure protection of fresh water, public health, safety and the environment;	Attachment "C"
(15) geological/hydrological data including:	

NMAC 19.15.36 Requirement	Location within Application
(a) a map showing names and location of streams, springs or other watercourses, and water wells within one mile of the site;	Attachment "C"
(b) laboratory analyses, performed by an independent commercial laboratory, for major cations and anions; benzene, toluene, ethyl benzene and xylenes (BTEX); RCRA metals; and total dissolved solids (TDS) of ground water samples of the shallowest fresh water aquifer beneath the proposed site;	Aquifer not contacted
(c) depth to, formation name, type and thickness of the shallowest fresh water aquifer;	Attachment "C"
(d) soil types beneath the proposed surface waste management facility, including a lithologic description of soil and rock members from ground surface down to the top of the shallowest fresh water aquifer;	Attachment "B"
(e) geologic cross-sections;	Attachment "B"
(f) potentiometric maps for the shallowest fresh water aquifer;	Attachment "C"
16) certification by the applicant that information submitted in the application is true, accurate and complete to the best of the applicant's knowledge, after reasonable inquiry;	C137 Form
(17) other information that the division may require to demonstrate that the surface waste management facility's operation will not adversely impact fresh water, public health, safety or the environment and that the surface waste management facility will comply with division rules and orders.	To be determined after administrative review
19.15.36.9	
A. Upon receipt of notification of the division's determination that the application is administratively complete, the applicant for a new surface waste management facility permit, permit renewal or major modification shall give written notice of the application, by certified mail, return receipt requested, to the surface owners ofrecord within one-half mile of the surface waste management facility, the county commission of the county where the surface waste management facility site is located, the appropriate city officials if the surface waste management facility site is within city limits or within one-half mile of the city limits, and affected federal, tribal or pueblo governmental agencies. The notice shall contain the information in Paragraphs (1) through (4) of Subsection F of 19.15.36.9 NMAC. The division may extend the distance requirements for notice if the division determines that the proposed surface waste management facility has the potential to adversely impact fresh water, public health, safety or the environment at a distance greater than one-half mile. The applicant shall furnish proof that it has given the required notices.	Written notice will be sent after administrative review, proof of notice will be sent to the Division under separate cover.
E. Within 30 days after receiving the division's tentative decision, the applicant shall provide notice of the tentative decision by:	
(1) publishing a display ad in English and Spanish, in a form approved by the division, in a newspaper of general circulation in this state and in a newspaper of general circulation in the county where the surface waste management facility is or will be located; the display ad shall be at least three inches by four inches and shall not be published in the newspaper's legal or classified sections;	Notice will be published in *Albuquerque Journal* and *Farmington Daily Times*
(2) mailing notice by first class mail or e-mail to persons, as identified to the applicant by the division, who have requested notification of applications generally, or of the particular application, including persons who have filed comments on the particular application during the initial public comment period, and who have included in such comments a legible return address or e-mail address; and	Will be scheduled when the list is provided by the Division

NMAC 19.15.36 Requirement	Location within Application
(3) mailing notice by first class or e-mail to affected local, state, federal or tribal governmental agencies, as determined and identified to the applicant by the division.	Will be scheduled when the list is provided by the Division
19.15.36.11	
A. Centralized facilities. Upon notification by the division that it has approved a permit but prior to the division issuing the permit, an applicant for a new centralized facility permit shall submit acceptable financial assurance in the amount of $25,000 per centralized facility, or a statewide "blanket" financial assurance in the amount of $50,000 to cover all of that applicant's centralized facilities, unless such applicant has previously posted a blanket financial assurance for centralized facilities.	Will be posted
19.15.36.13	
A. Depth to ground water.	
(5) No other surface waste management facility shall be located where ground water is less than 50 feet below the lowest elevation at which the operator will place oil field waste.	Attachment "C"
B. No surface waste management facility shall be located:	
(1) within 200 feet of a watercourse, lakebed, sinkhole or playa lake;	Attachment "C"
(2) within an existing wellhead protection area or 100-year floodplain;	Attachment "C"
(3) within, or within 500 feet of, a wetland;	Attachment "C"
(4) within the area overlying a subsurface mine;	Attachment "C"
(5) within 500 feet from the nearest permanent residence, school, hospital, institution or church in existence at the time of initial application; or	Attachment "C"
(6) within an unstable area, unless the operator demonstrates that engineering measures have been incorporated into the surface waste management facility design to ensure that the surface waste management facility's integrity will not be compromised.	Attachment "B"
C. No surface waste management facility shall exceed 500 acres.	Site less than 15 acres
D. The operator shall not accept oil field wastes transported by motor vehicle at the surface waste management facility unless the transporter has a form C-133, authorization to move liquid waste, approved by the division.	Attachment "D"
E. The operator shall not place oil field waste containing free liquids in a landfill or landfarm cell. Operators shall use the paint filter test, as prescribed by the EPA (EPA SW-846, method 9095) to determine conformance of the oil field waste to this criterion.	Not Applicable
F. Surface waste management facilities shall accept only exempt or non-hazardous waste, except as provided in Paragraph (3) of Subsection F of 19.15.36.13 NMAC. The operator shall not accept hazardous waste at a surface waste management facility. The operator shall not accept wastes containing regulated naturally occurring radioactive material (NORM) at a surface waste management facility except as provided in Subsection C of 19.15.9.714 NMAC. The operator shall require the following documentation for accepting oil field wastes, and both the operator and the generator shall maintain and make the documentation available for division inspection.	Attachment "D"
G. The operator of a commercial facility shall maintain records reflecting the	Not Applicable

NMAC 19.15.36 Requirement	Location within Application
generator, the location of origin, the location of disposal within the commercial facility, the volume and type of oil field waste, the date of disposal and the hauling company for each load or category of oil field waste accepted at the commercial facility. The operator shall maintain such records for a period of not less than five years after the commercial facility's closure, subject to division inspection.	
H. Disposal at a commercial facility shall occur only when an attendant is on duty unless loads can be monitored or otherwise isolated for inspection before disposal. The surface waste management facility shall be secured to prevent unauthorized disposal.	Not Applicable
I. To protect migratory birds, tanks exceeding eight feet in diameter, and exposed pits and ponds shall be screened, netted or covered. Upon the operator's written application, the division may grant an exception to screening, netting or covering upon the operator's showing that an alternative method will protect migratory birds or that the surface waste management facility is not hazardous to migratory birds. Surface waste management facilities shall be fenced in a manner approved by the division.	Attachment "A"
J. Surface waste management facilities shall have a sign, readable from a distance of 50 feet and containing the operator's name; surface waste management facility permit or order number; surface waste management facility location by unit letter, section, township and range; and emergency telephone numbers.	Sign will be installed prior to start-up
K. Operators shall comply with the spill reporting and corrective action provisions of 19.15.1.19 or 19.15.3.116 NMAC.	Attachment "E"
L. Each operator shall have an inspection and maintenance plan that includes the following:	
(1) monthly inspection of leak detection sumps including sampling if fluids are present with analyses of fluid samples furnished to the division; and maintenance of records of inspection dates, the inspector and the leak detection system's status;	Attachment "D"
(2) semi-annual inspection and sampling of monitoring wells as required, with analyses of ground water furnished to the division; and maintenance of records of inspection dates, the inspector and ground water monitoring wells' status; and	Not Applicable to evap ponds
(3) inspections of the berms and the outside walls of pond levees quarterly and after a major rainfall or windstorm, and maintenance of berms in such a manner as to prevent erosion.	Attachment "D"
M. Each operator shall have a plan to control run-on water onto the site and run-off water from the site, such that:	
(1) the run-on and run-off control system shall prevent flow onto the surface waste management facility's active portion during the peak discharge from a 25-year storm; and	Attachment "C"
(2) run-off from the surface waste management facility's active portion shall not be allowed to discharge a pollutant to the waters of the state or United States that violates state water quality standards.	Attachment "C"
N. Contingency plan. Each operator shall have a contingency plan. The operator shall provide the division's environmental bureau with a copy of an amendment to the contingency plan, including amendments required by Paragraph (8) of Subsection N of 19.15.36.13 NMAC; and promptly notify the division's environmental bureau of changes in the emergency coordinator or in the emergency coordinator's contact information. The contingency plan shall be designed to minimize hazards to fresh water, public health, safety or the environment from fires, explosions or an unplanned sudden or non-sudden	

NMAC 19.15.36 Requirement	Location within Application
release of contaminants or oil field waste to air, soil, surface water or ground water. The operator shall carry out the plan's provisions immediately whenever there is a fire, explosion or release of contaminants or oil field waste constituents that could threaten fresh water, public health, safety or the environment; provided that the emergency coordinator may deviate from the plan as necessary in an emergency situation. The contingency plan for emergencies shall:	
(1) describe the actions surface waste management facility personnel shall take in response to fires, explosions or releases to air, soil, surface water or ground water of contaminants or oil field waste containing constituents that could threaten fresh water, public health, safety or the environment;	Attachment "E"
(2) describe arrangements with local police departments, fire departments, hospitals, contractors and state and local emergency response teams to coordinate emergency services;	Attachment "E"
(3) list the emergency coordinator's name; address; and office, home and mobile phone numbers (where more than one person is listed, one shall be named as the primary emergency coordinator);	Attachment "E"
(4) include a list, which shall be kept current, of emergency equipment at the surface waste management facility, such as fire extinguishing systems, spill control equipment, communications and alarm systems and decontamination equipment, containing a physical description of each item on the list and a brief outline of its capabilities;	Attachment "E"
(5) include an evacuation plan for surface waste management facility personnel that describes signals to be used to begin evacuation, evacuation routes and alternate evacuation routes in cases where fire or releases of wastes could block the primary routes;	Attachment "E"
(6) include an evaluation of expected contaminants, expected media contaminated and procedures for investigation, containment and correction or remediation;	Attachment "E"
(7) list where copies of the contingency plan will be kept, which shall include the surface waste management facility; local police departments, fire departments and hospitals; and state and local emergency response teams;	Attachment "E"
(8) indicate when the contingency plan will be amended, which shall be within five working days whenever: **(a)** the surface waste management facility permit is revised or modified; **(b)** the plan fails in an emergency; **(c)** the surface waste management facility changes design, construction, operation, maintenance or other circumstances in a way that increases the potential for fires, explosions or releases of oil field waste constituents that could threaten fresh water, public health, safety or the environment or change the response necessary in an emergency; **(d)** the list of emergency coordinators or their contact information changes; or **(e)** the list of emergency equipment changes;	Attachment "E"
(9) describe how the emergency coordinator or the coordinator's designee, whenever there is an imminent or actual emergency situation, will immediately; **(a)** activate internal surface waste management facility alarms or communication systems, where applicable, to notify surface waste management facility personnel; and	Attachment "E"

NMAC 19.15.36 Requirement	Location within Application
(b) notify appropriate state and local agencies with designated response roles if their assistance is needed;	
(10) describe how the emergency coordinator, whenever there is a release, fire or explosion, will immediately identify the character, exact source, amount and extent of released materials (the emergency coordinator may do this by observation or review of surface waste management facility records or manifests, and, if necessary, by chemical analysis) and describe how the emergency coordinator will concurrently assess possible hazards to fresh water, public health, safety or the environment that may result from the release, fire or explosion (this assessment shall consider both the direct and indirect hazard of the release, fire or explosion);	Attachment "E"
(11) describe how, if the surface waste management facility stops operations in response to fire, explosion or release, the emergency coordinator will monitor for leaks, pressure buildup, gas generation or rupture in valves, pipes or the equipment, wherever this is appropriate;	Attachment "E"
(12) describe how the emergency coordinator, immediately after an emergency, will provide for treating, storing or disposing of recovered oil field waste, or other material that results from a release, fire or explosion at a surface waste management facility;	Attachment "E"
(13) describe how the emergency coordinator will ensure that no oil field waste, which may be incompatible with the released material, is treated, stored or disposed of until cleanup procedures are complete; and	Attachment "E"
(14) provide that the emergency coordinator may amend the plan during an emergency as necessary to protect fresh water, public health, safety or the environment.	Attachment "E"
O. Gas safety management plan. Each operator of a surface waste management facility that includes a landfill shall have a gas safety management plan that describes in detail procedures and methods that will be used to prevent landfill-generated gases from interfering or conflicting with the landfill's operation and protect fresh water, public health, safety and the environment. The plan shall address anticipated amounts and types of gases that may be generated, an air monitoring plan that includes the vadose zone and measuring, sampling, analyzing, handling, control and processing methods. The plan shall also include final post closure monitoring and control options.	Not Applicable
P. Training program. Each operator shall conduct an annual training program for key personnel that includes general operations, permit conditions, emergencies proper sampling methods and identification of exempt and non-exempt waste and hazardous waste. The operator shall maintain records of such training, subject to division inspection, for five years.	Attachment "D"
19.15.36.17 SPECIFIC REQUIREMENTS APPLICABLE TO EVAPORATION, STORAGE, TREATMENT AND SKIMMER PONDS:	
A. Engineering design plan. An applicant for a surface waste management facility permit or modification requesting inclusion of a skimmer pit; an evaporation, storage or treatment pond; or a below-grade tank shall submit with the surface waste management facility permit application a detailed engineering design plan, certified by a registered profession engineer, including	
operating and maintenance procedures;	Attachment "D"
a closure plan;	Attachment "F"
and a hydrologic report that provides sufficient information and detail on the site's topography, soils, geology, surface hydrology and ground water hydrology to enable the division to evaluate the actual and potential effects	Attachment "C"

NMAC 19.15.36 Requirement	Location within Application
on soils, surface water and ground water.	
The plan shall include detailed information on.	
dike protection and structural integrity;	Attachment "B"
leak detection, including an adequate fluid collection and removal system;	Attachment "A"
liner specifications and compatibility;	Attachment "G"
freeboard and overtopping prevention;	Section II.B.4
prevention of nuisance and hazardous odors such as H2S;	Section II.B.4
an emergency response plan, unless the pit is part of a surface waste management facility that has an integrated contingency plan;	Attachment "E"
type of oil field waste stream, including chemical analysis;	Section II.B.7 and Attachment "E"
climatological factors, including freeze-thaw cycles;	Section II.B.6
a monitoring and inspection plan; erosion control;	Attachment "D"
and other pertinent information the division requests	To be determined
B. Construction, standards.	
(1) In general. The operator shall ensure each pit, pond and below-grade tank is designed, constructed and operated so as to contain liquids and solids in a manner that will protect fresh water, public health, safety and the environment.	Attachment "A"
(2) Liners required. Each pit or pond shall contain, at a minimum, a primary (upper) liner and a secondary (lower) liner with a leak detection system appropriate to the site's conditions.	Attachment "G"
(3) Liner specifications. Liners shall consist of a 30-mil flexible PVC or 60-mil HDPE liner, or an equivalent liner approved by the division. Synthetic (geomembrane) liners shall have a hydraulic conductivity no greater than 1 x 10^{-9} cm/sec. Geomembrane liners shall be composed of an impervious, synthetic material that is resistant to petroleum hydrocarbons, salts and acidic and alkaline solutions. Liner materials shall be resistant to ultraviolet light, or the operator shall make provisions to protect the material from sunlight. Liner compatibility shall comply with EPA SW-846 method 9090A.	Attachment "G"
(4) Alternative liner media. The division may approve other liner media if the operator demonstrates to the division's satisfaction that the alternative liner protects fresh water, public health, safety and the environment as effectively as the specified media.	Not Applicable
(5) Each pit or pond shall have a properly constructed foundation or firm, unyielding base, smooth and free of rocks, debris, sharp edges or irregularities, in order to prevent rupture or tear of the liner and an adequate anchor trench; and shall be constructed so that the inside grade of the levee is no steeper than 2H:1V. Levees shall have an outside grade no steeper than 3H:1V. The levees' tops shall be wide enough to install an anchor trench and provide adequate room for inspection and maintenance. The operator shall minimize liner seams and orient them up and down, not across a slope. The operator shall use factory seams where possible. The operator shall ensure field seams in geosynthetic material are thermally seamed (hot wedge) with a double track weld to create an air pocket for	Attachment "A"

NMAC 19.15.36 Requirement	Location within Application
non-destructive air channel testing. A stabilized air pressure of 35 psi, plus or minus one percent, shall be maintained for at least five minutes. The operator shall overlap liners four to six inches before seaming, and orient seams parallel to the line of maximum slope, i.e., oriented along, not across, the slope. The operator shall minimize the number of field seams in corners and irregularly shaped areas. There shall be no horizontal seams within five feet of the slope's toe. Qualified personnel shall perform field seaming.	
(6) At a point of discharge into or suction from the lined pit, the liner shall be protected from excessive hydrostatic force or mechanical damage, and external discharge lines shall not penetrate the liner.	Attachment "A"
(7) Primary liners shall be constructed of a synthetic material.	Attachment "G"
(8) A secondary liner may be a synthetic liner or an alternative liner approved by the division. Secondary liners constructed with compacted soil membranes, i.e., natural or processed clay and other soils, shall be at least three feet thick, placed in six-inch lifts and compacted to 95 percent of the material's standard proctor density, or equivalent. Compacted soil membranes used in a liner shall undergo permeability testing in conformity with ASTM standards and methods approved by the division before and after construction. Compacted soil membranes shall have a hydraulic conductivity of no greater than 1 x 10^{-8} cm/sec. The operator shall submit results of pre-construction testing to the division for approval prior to construction.	Attachment "G"
(9) The operator shall place a leak detection system between the lower and upper geomembrane liners that consists of two feet of compacted soil with a saturated hydraulic conductivity of 1 x 10^{-5} cm/sec or greater to facilitate drainage. The leak detection system shall consist of a properly designed drainage and collection and removal system placed above the lower geomembrane liner in depressions and sloped so as to facilitate the earliest possible leak detection. Piping used shall be designed to withstand chemical attack from oil field waste or leachate; structural loading from stresses and disturbances from overlying oil field waste, cover materials, equipment operation or expansion or contraction; and to facilitate clean-out maintenance. The material placed between the pipes and laterals shall be sufficiently permeable to allow the transport of fluids to the drainage pipe. The slope of the interior sub-grade and of drainage lines and laterals shall be at least a two percent grade, i.e., two feet vertical drop per 100 horizontal feet. The piping collection system shall be comprised of solid and perforated pipe having a minimum diameter of four inches and a minimum wall thickness of schedule 80. The operator shall seal a solid sidewall riser pipe to convey collected fluids to a collection, observation and disposal system located outside the perimeter of the pit or pond. The operator may install alternative methods as approved by the division.	Attachment "A"
(10) The operator shall notify the division at least 72 hours prior to the primary liner's installation so that a division representative may inspect the leak detection system before it is covered.	Attachment "A"
(11) The operator shall construct pits and ponds in a manner that prevents overtopping due to wave action or rainfall, and maintain a three foot freeboard at all times.	Section II.B.4
(12) The maximum size of an evaporation or storage pond shall not exceed 10 acre-feet.	Pond is 3.1 acre ft at minimum freeboard

NMAC 19.15.36 Requirement	Location within Application
C. Operating standards.	
(1) The operator shall ensure that only produced fluids or non-hazardous waste are discharged into or stored in a pit or pond; and that no measurable or visible oil layer is allowed to accumulate or remain anywhere on a pit's surface except an approved skimmer pit.	Attachment "D"
(2) The operator shall monitor leak detection systems pursuant to the approved surface waste management facility permit conditions, maintain monitoring records in a form readily accessible for division inspection and report discovery of liquids in the leak detection system to the division within 24 hours.	Attachment "D"
(3) Fencing and netting. The operator shall fence or enclose pits or ponds to prevent unauthorized access and maintain fences in good repair. Fences are not required if there is an adequate perimeter fence surrounding the surface waste management facility. The operator shall screen, net, cover or otherwise render nonhazardous to migratory birds tanks exceeding eight feet in diameter and exposed pits and ponds. Upon written application, the division may grant an exception to screening, netting or covering requirements upon the operator's showing that an alternative method will adequately protect migratory birds or that the tank or pit is not hazardous to migratory birds.	Attachment "A"
(4) The division may approve spray systems to enhance natural evaporation. The operator shall submit engineering designs for spray systems to the division's environmental bureau for approval prior to installation. The operator shall ensure that spray evaporation systems are operated so that spray-borne suspended or dissolved solids remain within the perimeter of the pond's lined portion.	This facility includes plans for a spray system and is requesting Division review of Attachments "H" and "J"
(5) The operator shall use skimmer pits or tanks to separate oil from produced water prior to water discharge into a pond. The operator shall install a trap device in connected ponds to prevent solids and oils from transferring from one pond to another unless approved in the surface waste management facility permit.	Attachment "A"
19.15.36.18 CLOSURE AND POST CLOSURE	Attachment "F"

Attachment "M" **Chemical Analysis of expected Waste Stream**

ENVIROTECH LABS

CATION / ANION ANALYSIS

Client:	Noble Energy	Project #:	04010-014
Sample ID:	McClintock #1	Date Reported:	02-27-07
Laboratory Number:	40188	Date Sampled:	02-26-07
Chain of Custody:	2125	Date Received:	02-26-07
Sample Matrix:	Water	Date Extracted:	N/A
Preservative:	Cool	Date Analyzed:	02-27-07
Condition:	Cool & Intact		

Parameter	Analytical Result	Units
pH	7.83	s.u.
Conductivity @ 25° C	34,200	umhos/cm
Total Dissolved Solids @ 180C	18,700	mg/L
Total Dissolved Solids (Calc)	18,450	mg/L
SAR	177.4	ratio
Total Alkalinity as CaCO3	1,074	mg/L
Total Hardness as CaCO3	280	mg/L

Bicarbonate as HCO3	1,074	mg/L	17.60	meq/l
Carbonate as CO3	<0.1	mg/L	0.00	meq/L
Hydroxide as OH	<0.1	mg/L	0.00	meq/l
Nitrate Nitrogen	1.2	mg/L	0.02	meq/L
Nitrite Nitrogen	0.009	mg/L	0.00	meq/L
Chloride	10,560	mg/L	297.90	meq/L
Fluoride	1.55	mg/l	0.08	meq/L
Phosphate	7.3	mg/L	0.23	meq/L
Sulfate	<0.1	mg/L	0.00	meq/L
Iron	0.157	mg/L	0.01	meq/L
Calcium	62.4	mg/L	3.11	meq/L
Magnesium	36.0	mg/L	2.96	meq/L
Potassium	18.8	mg/L	0.48	meq/L
Sodium	7,110	mg/L	309.29	meq/l
Cations			315.84	meq/L
Anions			315.83	meq/L
Cation/Anion Difference			0.00%	

Reference: U.S.E.P.A., 600/4-79-020, "Methods for Chemical Analysis of Water and Wastes", 1983.
Standard Methods For The Examination of Water And Waste Water", 18th ed., 1992.

Comments:

Analyst

Review

5796 U.S. Highway 64 • Farmington, NM 87401 • Tel 505 • 632 • 0615 • Fax 505 • 632 • 1865

ENVIROTECH LABS

CATION / ANION ANALYSIS

Client:	Noble Energy	Project #:	04010-014
Sample ID:	Langendorf SWD	Date Reported:	02-27-07
Laboratory Number:	40187	Date Sampled:	02-26-07
Chain of Custody:	2125	Date Received:	02-26-07
Sample Matrix:	Water	Date Extracted:	N/A
Preservative:	Cool	Date Analyzed:	02-27-07
Condition:	Cool & Intact		

Parameter	Analytical Result	Units
pH	7.63	s.u.
Conductivity @ 25° C	33,600	umhos/cm
Total Dissolved Solids @ 180C	18,400	mg/L
Total Dissolved Solids (Calc)	16,220	mg/L
SAR	170.5	ratio
Total Alkalinity as CaCO3	1,080	mg/L
Total Hardness as CaCO3	254	mg/L

Bicarbonate as HCO3	1,080	mg/L	17.70	meq/L
Carbonate as CO3	<0.1	mg/l	0.00	meq/L
Hydroxide as OH	<0.1	mg/L	0.00	meq/l
Nitrate Nitrogen	1.2	mg/L	0.02	meq/L
Nitrite Nitrogen	0.011	mg/L	0.00	meq/L
Chloride	9,200	mg/L	259.53	meq/L
Fluoride	1.86	mg/L	0.10	meq/L
Phosphate	4.9	mg/l	0.15	meq/L
Sulfate	<0.1	mg/L	0.00	meq/L
Iron	0.193	mg/L	0.01	meq/L
Calcium	58.4	mg/L	2.91	meq/L
Magnesium	26.4	mg/L	2.17	meq/L
Potassium	20.5	mg/L	0.52	meq/L
Sodium	6,250	mg/l	271.88	meq/L
Cations			277.49	meq/L
Anions			277.51	meq/L
Cation/Anion Difference			0.01%	

Reference: U.S.E.P.A., 600/4-79-020, "Methods for Chemical Analysis of Water and Wastes", 1983
Standard Methods For The Examination of Water And Waste Water", 18th ed., 1992

Comments:

Analyst

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