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Form 3160-3
(June 2015)

FORM APPROVED
OMB No. 1004-0137
Expires: January 31, 2018

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

APPLICATION FOR PERMIT TO DRILL OR REENTER

5. Lease Serial No.	NMNM0002425
6. If Indian, Allotee or Tribe Name	
7. If Unit or CA Agreement, Name and No.	
8. Lease Name and Well No.	THUNDERBIRD DEVELOPMENT UNIT 4H 326054
9. API Well No.	30-015-46459
10. Field and Pool, or Exploratory	YESO / LOCO HILLS; GLORIETA-YESO
11. Sec., T. R. M. or Blk. and Survey or Area	SEC 33 / T16S / R30E / NMP
12. County or Parish	EDDY
13. State	NM

1a. Type of work: ☑ DRILL ☐ REENTER

1b. Type of Well: ☑ Oil Well ☐ Gas Well ☐ Other

1c. Type of Completion: ☐ Hydraulic Fracturing ☐ Single Zone ☑ Multiple Zone

2. Name of Operator: APACHE CORPORATION

3a. Address: 303 Veterans Airpark Lane #1000 Midland TX 79705

3b. Phone No. *(include area code)*: (432)818-1000

4. Location of Well *(Report location clearly and in accordance with any State requirements.*)*

At surface: SENE / 2411 FNL / 1130 FEL / LAT 32.8786638 / LONG -103.9720438

At proposed prod. zone: SWSE / 100 FSL / 1746 FEL / LAT 32.8565697 / LONG -103.9740442

14. Distance in miles and direction from nearest town or post office*: 5.4 miles

15. Distance from proposed* location to nearest property or lease line, ft. (Also to nearest drig. unit line, if any)	100 feet	16. No of acres in lease: 599.35	17. Spacing Unit dedicated to this well: 279.64
18. Distance from proposed location* to nearest well, drilling, completed, applied for, on this lease, ft.	40 feet	19. Proposed Depth: 5129 feet / 13021 feet	20. BLM/BIA Bond No. in file: FED: NMB000736
21. Elevations (Show whether DF, KDB, RT, GL, etc.): 3738 feet		22. Approximate date work will start*: 08/15/2019	23. Estimated duration: 20 days

24. Attachments

The following, completed in accordance with the requirements of Onshore Oil and Gas Order No. 1, and the Hydraulic Fracturing rule per 43 CFR 3162.3-3 (as applicable)

1. Well plat certified by a registered surveyor.
2. A Drilling Plan.
3. A Surface Use Plan (if the location is on National Forest System Lands, the SUPO must be filed with the appropriate Forest Service Office).
4. Bond to cover the operations unless covered by an existing bond on file (see Item 20 above).
5. Operator certification.
6. Such other site specific information and/or plans as may be requested by the BLM.

25. Signature: (Electronic Submission)	Name *(Printed/Typed)*: Sorina Flores / Ph: (432)818-1167	Date: 02/07/2019
Title: Supv of Drilling Services		
Approved by *(Signature)*: (Electronic Submission)	Name *(Printed/Typed)*: Cody Layton / Ph: (575)234-5959	Date: 10/24/2019
Title: Assistant Field Manager Lands & Minerals	Office: CARLSBAD	

Application approval does not warrant or certify that the applicant holds legal or equitable title to those rights in the subject lease which would entitle the applicant to conduct operations thereon.

Conditions of approval, if any, are attached.

Title 18 U.S.C. Section 1001 and Title 43 U.S.C. Section 1212, make it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious or fraudulent statements or representations as to any matter within its jurisdiction.

APPROVED WITH CONDITIONS

Approval Date: 10/24/2019

Need GCP

RWP 12-3-19

(Continued on page 2)

*(Instructions on page 2)

INSTRUCTIONS

GENERAL: This form is designed for submitting proposals to perform certain well operations, as indicated on Federal and Indian lands and leases for action by appropriate Federal agencies, pursuant to applicable Federal laws and regulations. Any necessary special instructions concerning the use of this form and the number of copies to be submitted, particularly with regard to local, area, or regional procedures and practices, either are shown below or will be issued by, or may be obtained from local Federal offices.

ITEM I: If the proposal is to redrill to the same reservoir at a different subsurface location or to a new reservoir, use this form with appropriate notations. Consult applicable Federal regulations concerning subsequent work proposals or reports on the well.

ITEM 4: Locations on Federal or Indian land should be described in accordance with Federal requirements. Consult local Federal offices for specific instructions.

ITEM 14: Needed only when location of well cannot readily be found by road from the land or lease description. A plat, or plats, separate or on the reverse side, showing the roads to, and the surveyed location of, the wen, and any other required information, should be furnished when required by Federal agency offices.

ITEMS 15 AND 18: If well is to be, or has been directionany drilled, give distances for subsurface location of hole in any present or objective productive zone.

ITEM 22: Consult applicable Federal regulations, or appropriate officials, concerning approval of the proposal before operations are started.

ITEM 24: If the proposal will involve hydraulic fracturing operations, you must comply with 43 CFR 3162.3-3, including providing information about the protection of usable water. Operators should provide the best available information about all formations containing water and their depths. This information could include data and interpretation of resistivity logs run on nearby wells. Information may also be obtained from state or tribal regulatory agencies and from local BLM offices.

NOTICES

The Privacy Act of 1974 and regulation in 43 CFR 2.48(d) provide that you be furnished the following information in connection with information required by this application.

AUTHORITY: 30 U.S.C. 181 et seq., 25 U.S.C. 396; 43 CFR 3160

PRINCIPAL PURPOSES: The information will be used to: (1) process and evaluate your application for a permit to drill a new oil, gas, or service wen or to reenter a plugged and abandoned well; and (2) document, for administrative use, information for the management, disposal and use of National Resource Lands and resources including (a) analyzing your proposal to discover and extract the Federal or Indian resources encountered; (b) reviewing procedures and equipment and the projected impact on the land involved; and (c) evaluating the effects of the proposed operation on the surface and subsurface water and other environmental impacts.

ROUTINE USE: Information from the record and/or the record win be transferred to appropriate Federal, State, and local or foreign agencies, when relevant to civil, criminal or regulatory investigations or prosecution, in connection with congressional inquiries and for regulatory responsibilities.

EFFECT OF NOT PROVIDING INFORMATION: Filing of this application and disclosure of the information is mandatory only if you elect to initiate a drilling or reentry operation on an oil and gas lease.

The Paperwork Reduction Act of 1995 requires us to inform you that:

The BLM conects this information to anow evaluation of the technical, safety, and environmental factors involved with drilling for oil and/or gas on Federal and Indian oil and gas leases. This information will be used to analyze and approve applications. Response to this request is mandatory only if the operator elects to initiate drilling or reentry operations on an oil and gas lease. The BLM would like you to know that you do not have to respond to this or any other Federal agency-sponsored information collection unless it displays a currently valid OMB control number.

BURDEN HOURS STATEMENT: Public reporting burden for this form is estimated to average 8 hours per response, including the time for reviewing instructions, gathering and maintaining data, and completing and reviewing the form. Direct comments regarding the burden estimate or any other aspect of this form to U.S. Department of the Interior, Bureau of Land Management (1004-0137), Bureau Information Conection Clearance Officer (WO-630), 1849 C Street, N.W., Mail Stop 401 LS, Washington, D.C. 20240.

(Continued on page 3)

Additional Operator Remarks

Location of Well

1. SHL: SENE / 2411 FNL / 1130 FEL / TWSP: 16S / RANGE: 30E / SECTION: 33 / LAT: 32.8786638 / LONG: -103.9720438 (TVD: 0 feet, MD: 0 feet)
   PPP: NWSE / 2487 FSL / 1457 FEL / TWSP: 16S / RANGE: 30E / SECTION: 33 / LAT: 32.8776057 / LONG: -103.9731079 (TVD: 5039 feet, MD: 5312 feet)
   BHL: SWSE / 100 FSL / 1746 FEL / TWSP: 16S / RANGE: 30E / SECTION: 4 / LAT: 32.8565697 / LONG: -103.9740442 (TVD: 5129 feet, MD: 13021 feet)

BLM Point of Contact

Name: Ciji Methola
Title: GIS Support - Adjudicator
Phone: 5752345924
Email: cmethola@blm.gov

Review and Appeal Rights

A person contesting a decision shall request a State Director review. This request must be filed within 20 working days of receipt of the Notice with the appropriate State Director (see 43 CFR 3165.3). The State Director review decision may be appealed to the Interior Board of Land Appeals, 801 North Quincy Street, Suite 300, Arlington, VA 22203 (see 43 CFR 3165.4). Contact the above listed Bureau of Land Management office for further information.

PECOS DISTRICT
DRILLING CONDITIONS OF APPROVAL

OPERATOR'S NAME:	**Apache Corporation**
LEASE NO.:	**NMNM0002425**
WELL NAME & NO.:	Thunderbird Development Unit 4H
SURFACE HOLE FOOTAGE:	2411'/N & 1130'/E
BOTTOM HOLE FOOTAGE	100'/S & 1746'/E
LOCATION:	Section 33, T.16 S., R.30 E., NMPM
COUNTY:	Eddy County, New Mexico

COA

H2S	(•) Yes	( ) No	
Potash	(•) None	( ) Secretary	( ) R-111-P
Cave/Karst Potential	(•) Low	( ) Medium	( ) High
Cave/Karst Potential	( ) Critical		
Variance	( ) None	(•) Flex Hose	( ) Other
Wellhead	( ) Conventional	( ) Multibowl	(•) Both
Other	[ ] 4 String Area	[ ] Capitan Reef	[ ] WIPP
Other	[ ] Fluid Filled	[ ] Cement Squeeze	[ ] Pilot Hole
Special Requirements	[ ] Water Disposal	[ ] COM	[x] Unit

A. HYDROGEN SULFIDE

A Hydrogen Sulfide (H2S) Drilling Plan shall be activated 500 feet prior to drilling into the **Yates, Tansill, Queen** formation. As a result, the Hydrogen Sulfide area must meet Onshore Order 6 requirements, which includes equipment and personnel/public protection items. If Hydrogen Sulfide is encountered, please provide measured values and formations to the BLM.

B. CASING

1. The **13-3/8** inch surface casing shall be set at approximately **400 feet** (a minimum of **70 feet (Eddy County)** into the Rustler Anhydrite and above the salt) and cemented to the surface.

    a. If cement does not circulate to the surface, the appropriate BLM office shall be notified and a temperature survey utilizing an electronic type temperature survey with surface log readout will be used or a cement bond log shall be run to verify the top of the cement. Temperature survey will be run a minimum of six hours after pumping cement and ideally between 8-10 hours after completing the cement job.
    b. Wait on cement (WOC) time for a primary cement job will be a minimum of **8**

hours or 500 pounds compressive strength, whichever is greater. (This is to include the lead cement)

c. Wait on cement (WOC) time for a remedial job will be a minimum of 4 hours after bringing cement to surface or 500 pounds compressive strength, whichever is greater.
d. If cement falls back, remedial cementing will be done prior to drilling out that string.

2. The minimum required fill of cement behind the **9-5/8** inch intermediate casing shall be set at approximately **3200 feet** is:

Option 1 (Single Stage):

- Cement to surface. If cement does not circulate see B.1.a, c-d above.

Option 2:

Operator has proposed a DV tool, the depth may be adjusted as long as the cement is changed proportionally. The DV tool may be cancelled if cement circulates to surface on the first stage.

a. First stage to DV tool: Cement to circulate. If cement does not circulate off the DV tool, contact the appropriate BLM office before proceeding with second stage cement job.

b. Second stage above DV tool:

- Cement to surface. If cement does not circulate, contact the appropriate BLM office.

3. The minimum required fill of cement behind the production casing is:

Option 1 (Single Stage):

- Cement should tie-back at least **200 feet** into previous casing string. Operator shall provide method of verification.

Option 2:

Operator has proposed a DV tool, the depth may be adjusted as long as the cement is changed proportionally. The DV tool may be cancelled if cement circulates to surface on the first stage.

a. First stage to DV tool: Cement to circulate. If cement does not circulate off the DV tool, contact the appropriate BLM office before proceeding with second stage cement job.

b. Second stage above DV tool:

- Cement should tie-back at least **200 feet** into previous casing string. Operator shall provide method of verification.

C. PRESSURE CONTROL

1. Variance approved to use flex line from BOP to choke manifold. Manufacturer's specification to be readily available. No external damage to flex line. Flex line to be installed as straight as possible (no hard bends).'

2.

Option 1:

a. Minimum working pressure of the blowout preventer (BOP) and related equipment (BOPE) required for drilling below the surface casing shoe shall be **2000 (2M)** psi.

b. Minimum working pressure of the blowout preventer (BOP) and related equipment (BOPE) required for drilling below the intermediate casing shoe shall be **2000 (2M)** psi.

Option 2:

1. Operator has proposed a multi-bowl wellhead assembly. This assembly will only be tested when installed on the surface casing. Minimum working pressure of the blowout preventer (BOP) and related equipment (BOPE) required for drilling below the surface casing shoe shall be **2000 (2M)** psi.

    a. Wellhead shall be installed by manufacturer's representatives, submit documentation with subsequent sundry.
    b. If the welding is performed by a third party, the manufacturer's representative shall monitor the temperature to verify that it does not exceed the maximum temperature of the seal.
    c. Manufacturer representative shall install the test plug for the initial BOP test.
    d. If the cement does not circulate and one inch operations would have been possible with a standard wellhead, the well head shall be cut off, cementing operations performed and another wellhead installed.
    e. Whenever any seal subject to test pressure is broken, all the tests in OOGO2.III.A.2.i must be followed.

D. SPECIAL REQUIREMENT (S)

Unit Wells

The well sign for a unit well shall include the unit number in addition to the surface and bottom hole lease numbers. This also applies to participating area numbers. If a participating area has not been established, the operator can use the general unit designation, but will replace the unit number with the participating area number when the sign is replaced.

Commercial Well Determination

A commercial well determination shall be submitted after production has been established for at least six months.

GENERAL REQUIREMENTS

The BLM is to be notified in advance for a representative to witness:

a. Spudding well (minimum of 24 hours)
b. Setting and/or Cementing of all casing strings (minimum of 4 hours)
c. BOPE tests (minimum of 4 hours)

☒ Eddy County
Call the Carlsbad Field Office, 620 East Greene St., Carlsbad, NM 88220, (575) 361-2822

☒ Lea County
Call the Hobbs Field Station, 414 West Taylor, Hobbs NM 88240, (575) 393-3612

1. Unless the production casing has been run and cemented or the well has been properly plugged, the drilling rig shall not be removed from over the hole without prior approval.

   a. In the event the operator has proposed to drill multiple wells utilizing a skid/walking rig. Operator shall secure the wellbore on the current well, after installing and testing the wellhead, by installing a blind flange of like pressure rating to the wellhead and a pressure gauge that can be monitored while drilling is performed on the other well(s).
   b. When the operator proposes to set surface casing with Spudder Rig
      - Notify the BLM when moving in and removing the Spudder Rig.
      - Notify the BLM when moving in the 2nd Rig. Rig to be moved in within 90 days of notification that Spudder Rig has left the location.
      - BOP/BOPE test to be conducted per Onshore Oil and Gas Order No. 2 as soon as 2nd Rig is rigged up on well.

2. Floor controls are required for 3M or Greater systems. These controls will be on the rig floor, unobstructed, readily accessible to the driller and will be operational at all times during drilling and/or completion activities. Rig floor is defined as the area immediately around the rotary table; the area immediately above the substructure on which the draw works are located, this does not include the dog house or stairway area.

3. The record of the drilling rate along with the GR/N well log run from TD to surface (horizontal well – vertical portion of hole) shall be submitted to the BLM office as well as all other logs run on the borehole 30 days from completion. If available, a digital copy of the logs is to be submitted in addition to the paper copies. The Rustler top and top and bottom of Salt are to be recorded on the Completion Report.

A. CASING

1. Changes to the approved APD casing program need prior approval if the items substituted are of lesser grade or different casing size or are Non-API. The Operator can exchange the components of the proposal with that of superior strength (i.e. changing from J-55 to N-80, or from 36# to 40#). Changes to the approved cement program need prior approval if the altered cement plan has less volume or strength or if the changes are substantial (i.e. Multistage tool, ECP, etc.). The initial wellhead installed on the well will remain on the well with spools used as needed.

2. Wait on cement (WOC) for Potash Areas: After cementing but before commencing any tests, the casing string shall stand cemented under pressure until both of the following conditions have been met: 1) cement reaches a minimum compressive strength of 500 psi for all cement blends, 2) until cement has been in place at least 24 hours. WOC time will be recorded in the driller's log. The casing intergrity test can be done (prior to the cement setting up) immediately after bumping the plug.

3. Wait on cement (WOC) for Water Basin: After cementing but before commencing any tests, the casing string shall stand cemented under pressure until both of the following conditions have been met: 1) cement reaches a minimum compressive strength of 500 psi at the shoe, 2) until cement has been in place at least 8 hours. WOC time will be recorded in the driller's log. See individual casing strings for details regarding lead cement slurry requirements. The casing intergrity test can be done (prior to the cement setting up) immediately after bumping the plug.

4. Provide compressive strengths including hours to reach required 500 pounds compressive strength prior to cementing each casing string. Have well specific cement details onsite prior to pumping the cement for each casing string.

5. No pea gravel permitted for remedial or fall back remedial without prior authorization from the BLM engineer.

6. On that portion of any well approved for a 5M BOPE system or greater, a pressure integrity test of each casing shoe shall be performed. Formation at the shoe shall be tested to a minimum of the mud weight equivalent anticipated to control the formation pressure to the next casing depth or at total depth of the well. This test shall be performed before drilling more than 20 feet of new hole.

7. If hardband drill pipe is rotated inside casing, returns will be monitored for metal. If metal is found in samples, drill pipe will be pulled and rubber protectors which have a larger diameter than the tool joints of the drill pipe will be installed prior to continuing drilling operations.
8. Whenever a casing string is cemented in the R-111-P potash area, the NMOCD requirements shall be followed.

B. PRESSURE CONTROL

1. All blowout preventer (BOP) and related equipment (BOPE) shall comply with well control requirements as described in Onshore Oil and Gas Order No. 2 and API RP 53 Sec. 17.

2. If a variance is approved for a flexible hose to be installed from the BOP to the choke manifold, the following requirements apply: The flex line must meet the requirements of API 16C. Check condition of flexible line from BOP to choke manifold, replace if exterior is damaged or if line fails test. Line to be as straight as possible with no hard bends and is to be anchored according to Manufacturer's requirements. The flexible hose can be exchanged with a hose of equal size and equal or greater pressure rating. Anchor requirements, specification sheet and hydrostatic pressure test certification matching the hose in service, to be onsite for review. These documents shall be posted in the company man's trailer and on the rig floor.

3. 5M or higher system requires an HCR valve, remote kill line and annular to match. The remote kill line is to be installed prior to testing the system and tested to stack pressure.

4. If the operator has proposed a multi-bowl wellhead assembly in the APD. The following requirements must be met:

    a. Wellhead shall be installed by manufacturer's representatives, submit documentation with subsequent sundry.
    b. If the welding is performed by a third party, the manufacturer's representative shall monitor the temperature to verify that it does not exceed the maximum temperature of the seal.
    c. Manufacturer representative shall install the test plug for the initial BOP test.
    d. Whenever any seal subject to test pressure is broken, all the tests in OOGO2.III.A.2.i must be followed.
    e. If the cement does not circulate and one inch operations would have been possible with a standard wellhead, the well head shall be cut off, cementing operations performed and another wellhead installed.

5. The appropriate BLM office shall be notified a minimum of 4 hours in advance for a representative to witness the tests.

    a. In a water basin, for all casing strings utilizing slips, these are to be set as soon as the crew and rig are ready and any fallback cement remediation has been done. The casing cut-off and BOP installation can be initiated four hours after installing the slips, which will be approximately six hours after bumping the plug. For those casing strings not using slips, the minimum wait time before cut-off is eight hours after bumping the plug. BOP/BOPE testing can begin after cut-off or once cement reaches 500 psi compressive strength (including lead when specified), whichever is greater. However, if the float does not

hold, cut-off cannot be initiated until cement reaches 500 psi compressive strength (including lead when specified).

b. In potash areas, for all casing strings utilizing slips, these are to be set as soon as the crew and rig are ready and any fallback cement remediation has been done. For all casing strings, casing cut-off and BOP installation can be initiated at twelve hours after bumping the plug. However, **no tests** shall commence until the cement has had a minimum of 24 hours setup time, except the casing pressure test can be initiated immediately after bumping the plug (only applies to single stage cement jobs).

c. The tests shall be done by an independent service company utilizing a test plug not a cup or J-packer. The operator also has the option of utilizing an independent tester to test without a plug (i.e. against the casing) pursuant to Onshore Order 2 with the pressure not to exceed 70% of the burst rating for the casing. Any test against the casing must meet the WOC time for water basin (8 hours) or potash (24 hours) or 500 pounds compressive strength, whichever is greater, prior to initiating the test (see casing segment as lead cement may be critical item).

d. The test shall be run on a 5000 psi chart for a 2-3M BOP/BOP, on a 10000 psi chart for a 5M BOP/BOPE and on a 15000 psi chart for a 10M BOP/BOPE. If a linear chart is used, it shall be a one hour chart. A circular chart shall have a maximum 2 hour clock. If a twelve hour or twenty-four hour chart is used, tester shall make a notation that it is run with a two hour clock.

e. The results of the test shall be reported to the appropriate BLM office.

f. All tests are required to be recorded on a calibrated test chart. A copy of the BOP/BOPE test chart and a copy of independent service company test will be submitted to the appropriate BLM office.

g. The BOP/BOPE test shall include a low pressure test from 250 to 300 psi. The test will be held for a minimum of 10 minutes if test is done with a test plug and 30 minutes without a test plug. This test shall be performed prior to the test at full stack pressure.

h. BOP/BOPE must be tested by an independent service company within 500 feet of the top of the Wolfcamp formation if the time between the setting of the intermediate casing and reaching this depth exceeds 20 days. This test does not exclude the test prior to drilling out the casing shoe as per Onshore Order No. 2.

C. DRILLING MUD

Mud system monitoring equipment, with derrick floor indicators and visual and audio alarms, shall be operating before drilling into the Wolfcamp formation, and shall be used until production casing is run and cemented.

D. WASTE MATERIAL AND FLUIDS

All waste (i.e. drilling fluids, trash, salts, chemicals, sewage, gray water, etc.) created as a result of drilling operations and completion operations shall be safely contained and disposed of properly at a waste disposal facility. No waste material or fluid shall be disposed of on the well location or surrounding area.

Porto-johns and trash containers will be on-location during fracturing operations or any other crew-intensive operations.

PECOS DISTRICT
SURFACE USE
CONDITIONS OF APPROVAL

OPERATOR'S NAME:	Apache Corporation
WELL NAME & NO.:	Thunderbird Development Unit 4H
SURFACE HOLE FOOTAGE:	2411'/N & 1130'/E
BOTTOM HOLE FOOTAGE	100'/S & 1746'/E
LOCATION:	Section 33, T.16 S., R.30 E., NMPM
COUNTY:	Eddy County, New Mexico

TABLE OF CONTENTS

Standard Conditions of Approval (COA) apply to this APD. If any deviations to these standards exist or special COAs are required, the section with the deviation or requirement will be checked below.

I. GENERAL PROVISIONS

The approval of the Application For Permit To Drill (APD) is in compliance with all applicable laws and regulations: 43 Code of Federal Regulations 3160, the lease terms, Onshore Oil and Gas Orders, Notices To Lessees, New Mexico Oil Conservation Division (NMOCD) Rules, National Historical Preservation Act As Amended, and instructions and orders of the Authorized Officer. Any request for a variance shall be submitted to the Authorized Officer on Form 3160-5, Sundry Notices and Report on Wells.

II. PERMIT EXPIRATION

If the permit terminates prior to drilling and drilling cannot be commenced within 60 days after expiration, an operator is required to submit Form 3160-5, Sundry Notices and Reports on Wells, requesting surface reclamation requirements for any surface disturbance. However, if the operator will be able to initiate drilling within 60 days after the expiration of the permit, the operator must have set the conductor pipe in order to allow for an extension of 60 days beyond the expiration date of the APD. (Filing of a Sundry Notice is required for this 60 day extension.)

III. ARCHAEOLOGICAL, PALEONTOLOGY & HISTORICAL SITES

Any cultural and/or paleontological resource discovered by the operator or by any person working on the operator's behalf shall immediately report such findings to the Authorized Officer. The operator is fully accountable for the actions of their contractors and subcontractors. The operator shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery shall be made by the Authorized Officer to determine the appropriate actions that shall be required to prevent the loss of significant cultural or scientific values of the discovery. The operator shall be held responsible for the cost of the proper mitigation measures that the Authorized Officer assesses after consultation with the operator on the evaluation and decisions of the discovery. Any unauthorized collection or disturbance of cultural or paleontological resources may result in a shutdown order by the Authorized Officer.

IV. NOXIOUS WEEDS

The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes the roads, pads, associated pipeline corridor, and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

V. SPECIAL REQUIREMENT(S)

Timing Limitation Stipulation / Condition of Approval for lesser prairie-chicken: Oil and gas activities including 3-D geophysical exploration, and drilling will not be allowed in lesser prairie-chicken habitat during the period from March 1st through June 15th annually. During that period, other activities that produce noise or involve human activity, such as the maintenance of oil and gas facilities, pipeline, road, and well pad construction, will be allowed except between 3:00 am and 9:00 am. The 3:00 am to 9:00 am restriction will not apply to normal, around-the-clock operations, such as venting, flaring, or pumping, which do not require a human presence during this period. Additionally, no new drilling will be allowed within up to 200 meters of leks known at the time of permitting. Normal vehicle use on existing roads will not be restricted. Exhaust noise from pump jack engines must be muffled or otherwise controlled so as not to exceed 75 db measured at 30 feet from the source of the noise.

Ground-level Abandoned Well Marker to avoid raptor perching: Upon the plugging and subsequent abandonment of the well, the well marker will be installed at ground level on a plate containing the pertinent information for the plugged well. For more installation details, contact the Carlsbad Field Office at 575-234-5972.

Timing Limitation Exceptions:
The Carlsbad Field Office will publish an annual map of where the LPC timing and noise stipulations and conditions of approval (Limitations) will apply for the identified year (between March 1 and June 15) based on the latest survey information. The LPC Timing Area map will identify areas which are Habitat Areas (HA), Isolated Population Area (IPA), and Primary Population Area (PPA). The LPC Timing Area map will also have an area in red crosshatch. The red crosshatch area is the only area where an operator is required to submit a request for exception to the LPC Limitations. If an operator is operating outside the red crosshatch area, the LPC Limitations do not apply for that year and an exception to LPC Limitations is not required.

Dunes Sagebrush Lizard Trenching Monitor Stipulation

- Pre-construction contact with a BLM wildlife biologist is required 5 days prior to any ground disturbing activities associated with the project occurs.

- Successful completion of the BLM Trench Stipulation Workshop is required for a non-agency person to be approved as a monitor.

- Any trench left open for (8) hours or less is not required to have escape ramps; however, before the trench is backfilled, an agency approved monitor shall walk the entire length of the open trench and remove all trapped vertebrates. The bottom surface of the trench will be disturbed a minimum of 2 inches in order to

arouse any buried vertebrates. All vertebrates will be released a minimum of 100 yards from the trench.

- For trenches left open for eight (8) hours or more the following requirements apply:

    - Earthen escape ramps and/or structures (built at no more than a 30 degree slope and spaced no more than 500 feet apart) shall be placed in the trench. Metal structures will not be authorized. Options will be discussed in detail at the required Trench Stipulation Workshop.
    - One approved monitor shall be required to survey up to three miles of trench between the hours of 11 AM-2 PM. A daily report (consolidate if there is more than one monitor) on the vertebrates found and removed from the trench shall be provided to the BLM (email/fax is acceptable) the following morning.
    - Prior to backfilling of the trench all structures used as escape ramps will be removed and the bottom surface of the trench will be disturbed a minimum of 2 inches in order to arouse any buried vertebrates. All vertebrates will be released a minimum of 100 yards from the trench.

- This stipulation shall apply to the entire length of the project in the DSL habitat polygon regardless of land ownership or CCA/CCAA enrollment status.

- A project closeout will be required within three business days of the completion of the project.

Hydrology

The entire well pad will be bermed to prevent oil, salt, and other chemical contaminants from leaving the well pad. The compacted berm shall be constructed at a minimum of 12 inches with impermeable mineral material (e.g. caliche). Topsoil shall not be used to construct the berm. No water flow from the uphill side(s) of the pad shall be allowed to enter the well pad. The integrity of the berm shall be maintained around the surfaced pad throughout the life of the well and around the downsized pad after interim reclamation has been completed. Any water erosion that may occur due to the construction of the well pad during the life of the well will be quickly corrected and proper measures will be taken to prevent future erosion. Stockpiling of topsoil is required. The top soil shall be stockpiled in an appropriate location to prevent loss of soil due to water or wind erosion and not used for berming or erosion control. If fluid collects within the bermed area, the fluid must be vacuumed into a safe container and disposed of properly at a state approved facility.

When crossing ephemeral drainages the pipeline will be buried to a minimum depth of 48 inches from the top of pipe to ground level. Erosion control methods such as gabions and/or rock aprons should be placed on both up and downstream sides of the pipeline crossing. In addition, curled (weed free) wood/straw fiber wattles/logs and/or silt fences should be placed on the downstream side for sediment control during construction and maintained until soils and vegetation have stabilized. Water bars should be placed within the ROW to divert and dissipate surface runoff. A pipeline access road is not permitted to cross these ephemeral drainages. Traffic should be diverted to a preexisting route. Additional seeding may be required in floodplains and drainages to restore energy dissipating vegetation.

Tank battery locations will be lined and bermed. A 20 mil permanent liner will be installed with a 4 oz. felt backing to prevent tears or punctures. Tank battery berms must be large enough to contain 1 ½ times the content of the largest tank or 24 hour production, whichever is greater. Automatic shut off, check valves, or similar systems will be installed for tanks to minimize the effects of catastrophic line failures used in production or drilling.

A leak detection plan will be submitted to the BLM Carlsbad Field Office for approval prior to pipeline installation. The method could incorporate gauges to detect pressure drops, situating valves and lines so they can be visually inspected periodically or installing electronic sensors to alarm when a leak is present. The leak detection plan will incorporate an automatic shut off system that will be installed for proposed pipelines to minimize the effects of an undesirable event.

Any water erosion that may occur due to the construction of overhead electric line and during the life of the power line will be quickly corrected and proper measures will be taken to prevent future erosion. A power pole should not be placed in drainages, playas, wetlands, riparian areas, or floodplains and must span across the features at a distance away that would not promote further erosion.

VI. CONSTRUCTION

A. NOTIFICATION

The BLM shall administer compliance and monitor construction of the access road and well pad. Notify the Carlsbad Field Office at (575) 234-5909 at least 3 working days prior to commencing construction of the access road and/or well pad.

When construction operations are being conducted on this well, the operator shall have the approved APD and Conditions of Approval (COA) on the well site and they shall be made available upon request by the Authorized Officer.

B. TOPSOIL

The operator shall strip the top portion of the soil (root zone) from the entire well pad area and stockpile the topsoil along the edge of the well pad as depicted in the APD. The root zone is typically six (6) inches in depth. All the stockpiled topsoil will be redistributed over the interim reclamation areas. Topsoil shall not be used for berming the pad or facilities. For final reclamation, the topsoil shall be spread over the entire pad area for seeding preparation.

Other subsoil (below six inches) stockpiles must be completely segregated from the topsoil stockpile. Large rocks or subsoil clods (not evident in the surrounding terrain) must be buried within the approved area for interim and final reclamation.

C. CLOSED LOOP SYSTEM

Tanks are required for drilling operations: No Pits.

The operator shall properly dispose of drilling contents at an authorized disposal site.

D. FEDERAL MINERAL MATERIALS PIT

Payment shall be made to the BLM prior to removal of any federal mineral materials. Call the Carlsbad Field Office at (575) 234-5972.

E. WELL PAD SURFACING

Surfacing of the well pad is not required.

If the operator elects to surface the well pad, the surfacing material may be required to be removed at the time of reclamation. The well pad shall be constructed in a manner which creates the smallest possible surface disturbance, consistent with safety and operational needs.

F. EXCLOSURE FENCING (CELLARS & PITS)

Exclosure Fencing
The operator will install and maintain exclosure fencing for all open well cellars to prevent access to public, livestock, and large forms of wildlife before and after drilling operations until the pit is free of fluids and the operator initiates backfilling. (For examples of exclosure fencing design, refer to BLM's Oil and Gas Gold Book, Exclosure Fence Illustrations, Figure 1, Page 18.)

G. ON LEASE ACCESS ROADS

Road Width
The access road shall have a driving surface that creates the smallest possible surface disturbance and does not exceed fourteen (14) feet in width. The maximum width of surface disturbance, when constructing the access road, shall not exceed twenty-five (25) feet.

Surfacing
Surfacing material is not required on the new access road driving surface. If the operator elects to surface the new access road or pad, the surfacing material may be required to be removed at the time of reclamation.

Where possible, no improvements should be made on the unsurfaced access road other than to remove vegetation as necessary, road irregularities, safety issues, or to fill low areas that may sustain standing water.

The Authorized Officer reserves the right to require surfacing of any portion of the access road at any time deemed necessary. Surfacing may be required in the event the road deteriorates, erodes, road traffic increases, or it is determined to be beneficial for future field development. The surfacing depth and type of material will be determined at the time of notification.

Crowning
Crowning shall be done on the access road driving surface. The road crown shall have a grade of approximately 2% (i.e., a 1" crown on a 14' wide road). The road shall conform to Figure 1; cross section and plans for typical road construction.

Ditching
Ditching shall be required on both sides of the road.

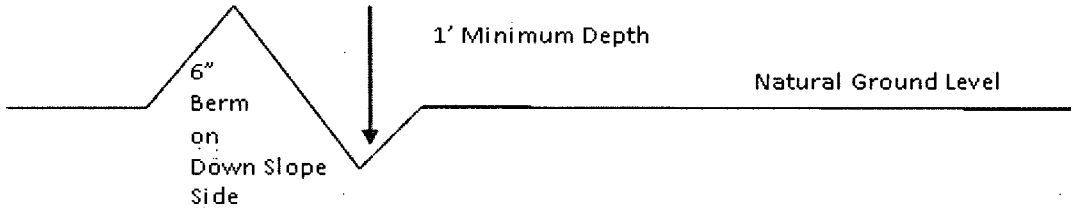
Turnouts
Vehicle turnouts shall be constructed on the road. Turnouts shall be intervisible with interval spacing distance less than 1000 feet. Turnouts shall conform to Figure 1; cross section and plans for typical road construction.

Drainage

Drainage control systems shall be constructed on the entire length of road (e.g. ditches, sidehill outsloping and insloping, lead-off ditches, culvert installation, and low water crossings).

A typical lead-off ditch has a minimum depth of 1 foot below and a berm of 6 inches above natural ground level. The berm shall be on the down-slope side of the lead-off ditch.

Cross Section of a Typical Lead-off Ditch



All lead-off ditches shall be graded to drain water with a 1 percent minimum to 3 percent maximum ditch slope. The spacing interval are variable for lead-off ditches and shall be determined according to the formula for spacing intervals of lead-off ditches, but may be amended depending upon existing soil types and centerline road slope (in %);

Formula for Spacing Interval of Lead-off Ditches

Example - On a 4% road slope that is 400 feet long, the water flow shall drain water into a lead-off ditch. Spacing interval shall be determined by the following formula:

$$\text{400 foot road with 4\% road slope: } \frac{400'}{4\%} + 100' = 200' \text{ lead-off ditch interval}$$

Cattle guards

An appropriately sized cattle guard sufficient to carry out the project shall be installed and maintained at fence/road crossings. Any existing cattle guards on the access road route shall be repaired or replaced if they are damaged or have deteriorated beyond practical use. The operator shall be responsible for the condition of the existing cattle guards that are in place and are utilized during lease operations.

Fence Requirement

Where entry is granted across a fence line, the fence shall be braced and tied off on both sides of the passageway prior to cutting. The operator shall notify the private surface landowner or the grazing allotment holder prior to crossing any fences.

Public Access

Public access on this road shall not be restricted by the operator without specific written approval granted by the Authorized Officer.

Construction Steps

1. Salvage topsoil
2. Construct road
3. Redistribute topsoil
4. Revegetate slopes

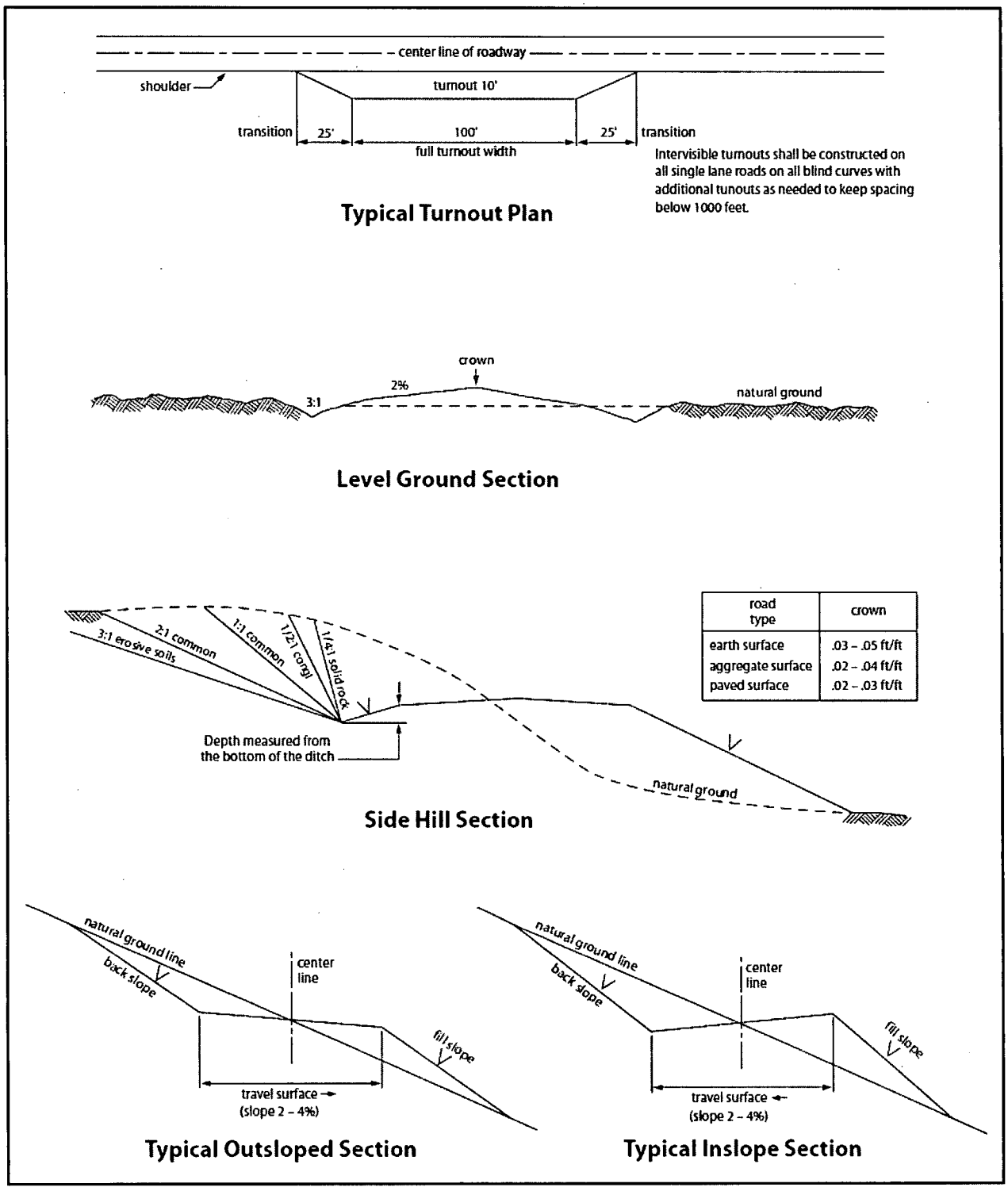


Figure 1. Cross-sections and plans for typical road sections representative of BLM resource or FS local and higher-class roads.

VII. PRODUCTION (POST DRILLING)

A. WELL STRUCTURES & FACILITIES

Placement of Production Facilities
Production facilities should be placed on the well pad to allow for maximum interim recontouring and revegetation of the well location.

Exclosure Netting (Open-top Tanks)
Immediately following active drilling or completion operations, the operator will take actions necessary to prevent wildlife and livestock access, including avian wildlife, to all open-topped tanks that contain or have the potential to contain salinity sufficient to cause harm to wildlife or livestock, hydrocarbons, or Resource Conservation and Recovery Act of 1976-exempt hazardous substances. At a minimum, the operator will net, screen, or cover open-topped tanks to exclude wildlife and livestock and prevent mortality. If the operator uses netting, the operator will cover and secure the open portion of the tank to prevent wildlife entry. The operator will net, screen, or cover the tanks until the operator removes the tanks from the location or the tanks no longer contain substances that could be harmful to wildlife or livestock. Use a maximum netting mesh size of 1 ½ inches. The netting must not be in contact with fluids and must not have holes or gaps.

Chemical and Fuel Secondary Containment and Exclosure Screening
The operator will prevent all hazardous, poisonous, flammable, and toxic substances from coming into contact with soil and water. At a minimum, the operator will install and maintain an impervious secondary containment system for any tank or barrel containing hazardous, poisonous, flammable, or toxic substances sufficient to contain the contents of the tank or barrel and any drips, leaks, and anticipated precipitation. The operator will dispose of fluids within the containment system that do not meet applicable state or U. S. Environmental Protection Agency livestock water standards in accordance with state law; the operator must not drain the fluids to the soil or ground. The operator will design, construct, and maintain all secondary containment systems to prevent wildlife and livestock exposure to harmful substances. At a minimum, the operator will install effective wildlife and livestock exclosure systems such as fencing, netting, expanded metal mesh, lids, and grate covers. Use a maximum netting mesh size of 1 ½ inches.

Open-Vent Exhaust Stack Exclosures
The operator will construct, modify, equip, and maintain all open-vent exhaust stacks on production equipment to prevent birds and bats from entering, and to discourage perching, roosting, and nesting. (*Recommended exclosure structures on open-vent exhaust stacks are in the shape of a cone.*) Production equipment includes, but may not be limited to, tanks, heater-treaters, separators, dehydrators, flare stacks, in-line units, and compressor mufflers.

Containment Structures

Proposed production facilities such as storage tanks and other vessels will have a secondary containment structure that is constructed to hold the capacity of 1.5 times the largest tank, plus freeboard to account for precipitation, unless more stringent protective requirements are deemed necessary.

Painting Requirement
All above-ground structures including meter housing that are not subject to safety requirements shall be painted a flat non-reflective paint color, **Shale Green** from the BLM Standard Environmental Color Chart (CC-001: June 2008).

B. PIPELINES

BURIED PIPELINE STIPULATIONS

A copy of the application (Grant, APD, or Sundry Notice) and attachments, including conditions of approval, survey plat and/or map, will be on location during construction. BLM personnel may request to you a copy of your permit during construction to ensure compliance with all stipulations.

Holder agrees to comply with the following stipulations to the satisfaction of the Authorized Officer:

1. The Holder shall indemnify the United States against any liability for damage to life or property arising from the occupancy or use of public lands under this grant.

2. The Holder shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder shall comply with the Toxic Substances Control Act of 1976 as amended, 15 USC 2601 et seq. (1982) with regards to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act, section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

3. The holder agrees to indemnify the United States against any liability arising from the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. 9601, et seq. or the Resource Conservation and Recovery Act, 42 U.S.C.6901, et seq.) on the Right-of-Way (unless the release or threatened release is wholly unrelated to the Right-of-Way holder's activity on the Right-of-Way), or resulting from the activity of

the Right-of-Way holder on the Right-of-Way. This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

4. If, during any phase of the construction, operation, maintenance, or termination of the pipeline, any oil or other pollutant should be discharged from the pipeline system, impacting Federal lands, the control and total removal, disposal, and cleaning up of such oil or other pollutant, wherever found, shall be the responsibility of holder, regardless of fault. Upon failure of holder to control, dispose of, or clean up such discharge on or affecting Federal lands, or to repair all damages resulting therefrom, on the Federal lands, the Authorized Officer may take such measures as he deems necessary to control and clean up the discharge and restore the area, including where appropriate, the aquatic environment and fish and wildlife habitats, at the full expense of the holder. Such action by the Authorized Officer shall not relieve holder of any responsibility as provided herein.

5. All construction and maintenance activity will be confined to the authorized right-of-way.

6. The pipeline will be buried with a minimum cover of **36** inches between the top of the pipe and ground level.

7. The maximum allowable disturbance for construction in this right-of-way will be **30** feet:

- Blading of vegetation within the right-of-way will be allowed: maximum width of blading operations will not exceed **20** feet. The trench is included in this area. (*Blading is defined as the complete removal of brush and ground vegetation.*)

- Clearing of brush species within the right-of-way will be allowed: maximum width of clearing operations will not exceed **30** feet. The trench and bladed area are included in this area. (*Clearing is defined as the removal of brush while leaving ground vegetation (grasses, weeds, etc.) intact. Clearing is best accomplished by holding the blade 4 to 6 inches above the ground surface.*)

- The remaining area of the right-of-way (if any) shall only be disturbed by compressing the vegetation. (*Compressing can be caused by vehicle tires, placement of equipment, etc.*)

8. The holder shall stockpile an adequate amount of topsoil where blading is allowed. The topsoil to be stripped is approximately 6 inches in depth. The topsoil will be segregated from other spoil piles from trench construction. The topsoil will be evenly distributed over the bladed area for the preparation of seeding.

9. The holder shall minimize disturbance to existing fences and other improvements on public lands. The holder is required to promptly repair improvements to at least their former state. Functional use of these improvements will be maintained at all times. The holder will contact the owner of any improvements prior to disturbing them. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting of the fence. No permanent gates will be allowed unless approved by the Authorized Officer.

10. Vegetation, soil, and rocks left as a result of construction or maintenance activity will be randomly scattered on this right-of-way and will not be left in rows, piles, or berms, unless otherwise approved by the Authorized Officer. The entire right-of-way shall be recontoured to match the surrounding landscape. The backfilled soil shall be compacted and a 6 inch berm will be left over the ditch line to allow for settling back to grade.

11. In those areas where erosion control structures are required to stabilize soil conditions, the holder will install such structures as are suitable for the specific soil conditions being encountered and which are in accordance with sound resource management practices.

12. The holder will reseed all disturbed areas. Seeding will be done according to the attached seeding requirements, using the following seed mix.

( ) seed mixture 1 ( ) seed mixture 3

() seed mixture 2 ( ) seed mixture 4

(X) seed mixture 2/LPC ( ) Aplomado Falcon Mixture

13. All above-ground structures not subject to safety requirements shall be painted by the holder to blend with the natural color of the landscape. The paint used shall be color which simulates "Standard Environmental Colors" – **Shale Green**, Munsell Soil Color No. 5Y 4/2.

14. The pipeline will be identified by signs at the point of origin and completion of the right-of-way and at all road crossings. At a minimum, signs will state the holder's name, BLM serial number, and the product being transported. All signs and information thereon will be posted in a permanent, conspicuous manner, and will be maintained in a legible condition for the life of the pipeline.

15. The holder shall not use the pipeline route as a road for purposes other than routine maintenance as determined necessary by the Authorized Officer in consultation with the holder before maintenance begins. The holder will take whatever steps are necessary to ensure that the pipeline route is not used as a roadway. As determined necessary during the life of the pipeline, the Authorized Officer may ask the holder to construct temporary deterrence structures.

16. Any cultural and/or paleontological resources (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the Authorized Officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery will be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the Authorized Officer after consulting with the holder.

17. The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes associated roads, pipeline corridor and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

18. Escape Ramps - The operator will construct and maintain pipeline/utility trenches [that are not otherwise fenced, screened, or netted] to prevent livestock, wildlife, and humans from becoming entrapped. At a minimum, the operator will construct and maintain escape ramps, ladders, or other methods of avian and terrestrial wildlife escape in the trenches according to the following criteria:

a. Any trench left open for eight (8) hours or less is not required to have escape ramps; however, before the trench is backfilled, the contractor/operator shall inspect the trench for wildlife, remove all trapped wildlife, and release them at least 100 yards from the trench.
b. For trenches left open for eight (8) hours or more, earthen escape ramps (built at no more than a 30 degree slope and spaced no more than 500 feet apart) shall be placed in the trench.

19. Special Stipulations:

Lesser Prairie-Chicken

Oil and gas activities will not be allowed in lesser prairie-chicken habitat during the period from March 1st through June 15th annually. During that period, other activities

that produce noise or involve human activity, such as the maintenance of oil and gas facilities, geophysical exploration other than 3-D operations, and pipeline, road, and well pad construction, will be allowed except between 3:00 am and 9:00 am. The 3:00 am to 9:00 am restriction will not apply to normal, around-the-clock operations, such as venting, flaring, or pumping, which do not require a human presence during this period. Normal vehicle use on existing roads will not be restricted. Exhaust noise from pump jack engines must be muffled or otherwise controlled so as not to exceed 75 db measured at 30 ft. from the source of the noise.

C. ELECTRIC LINES

STANDARD STIPULATIONS FOR OVERHEAD ELECTRIC DISTRIBUTION LINES

A copy of the grant and attachments, including stipulations, survey plat and/or map, will be on location during construction. BLM personnel may request to you a copy of your permit during construction to ensure compliance with all stipulations.

Holder agrees to comply with the following stipulations to the satisfaction of the Authorized Officer:

1. The holder shall indemnify the United States against any liability for damage to life or property arising from the occupancy or use of public lands under this grant.

2. The holder shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder shall comply with the Toxic Substances Control Act of 1976 as amended, 15 USC 2601 et seq. (1982) with regards to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR, Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR, Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act, section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

3. The holder agrees to indemnify the United States against any liability arising from the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. 9601, et seq. or the Resource Conservation and Recovery Act, 42 U.S.C. 6901, et seq.) on the Right-of-Way (unless the release or threatened release is wholly unrelated to the Right-of-Way holder's activity on the Right-of-Way), or resulting from the activity of the Right-of-Way holder on the Right-of-Way. This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

4. There will be no clearing or blading of the right-of-way unless otherwise agreed to in writing by the Authorized Officer.

5. Power lines shall be constructed and designed in accordance to standards outlined in "Suggested Practices for Avian Protection on Power lines: The State of the Art in 2006" Edison Electric Institute, APLIC, and the California Energy Commission 2006 . The holder shall assume the burden and expense of proving that pole designs not shown in the above publication deter raptor perching, roosting, and nesting. Such proof shall be provided by a raptor expert approved by the Authorized Officer. The BLM reserves the right to require modification or additions to all powerline structures placed on this right-of-way, should they be necessary to ensure the safety of large perching birds. Such modifications and/or additions shall be made by the holder without liability or expense to the United States.

Raptor deterrence will consist of but not limited to the following: triangle perch discouragers shall be placed on each side of the cross arms and a nonconductive perching deterrence shall be placed on all vertical poles that extend past the cross arms.

6. The holder shall minimize disturbance to existing fences and other improvements on public lands. The holder is required to promptly repair improvements to at least their former state. Functional use of these improvements will be maintained at all times. The holder will contact the owner of any improvements prior to disturbing them. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting the fence. No permanent gates will be allowed unless approved by the Authorized Officer.

7. The BLM serial number assigned to this authorization shall be posted in a permanent, conspicuous manner where the power line crosses roads and at all serviced facilities. Numbers will be at least two inches high and will be affixed to the pole nearest the road crossing and at the facilities served.

8. Upon cancellation, relinquishment, or expiration of this grant, the holder shall comply with those abandonment procedures as prescribed by the Authorized Officer.

9. All surface structures (poles, lines, transformers, etc.) shall be removed within 180 days of abandonment, relinquishment, or termination of use of the serviced facility or facilities or within 180 days of abandonment, relinquishment, cancellation, or expiration of this grant, whichever comes first. This will not apply where the power line extends service to an active, adjoining facility or facilities.

10. Any cultural and/or paleontological resource (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the Authorized Officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery will be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant

cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the Authorized Officer after consulting with the holder.

11. Special Stipulations:
    - For reclamation remove poles, lines, transformer, etc. and dispose of properly.
    - Fill in any holes from the poles removed.

Timing Limitation Stipulation/Condition of Approval for Lesser Prairie-Chicken: Oil and gas activities including 3-D geophysical exploration, and drilling will not be allowed in lesser prairie-chicken habitat during the period from March 1st through June 15th annually. During that period, other activities that produce noise or involve human activity, such as the maintenance of oil and gas facilities, geophysical exploration other than 3-D operations, and pipeline, road, and well pad construction, will be allowed except between 3:00 am and 9:00 am. The 3:00 am to 9:00 am restriction will not apply to normal, around-the-clock operations, such as venting, flaring, or pumping, which do not require a human presence during this period. Additionally, no new drilling will be allowed within up to 200 meters of leks known at the time of permitting. Normal vehicle use on existing roads will not be restricted. Exhaust noise from pump jack engines must be muffled or otherwise controlled so as not to exceed 75 db measured at 30 ft. from the source of the noise.

VIII. INTERIM RECLAMATION

During the life of the development, all disturbed areas not needed for active support of production operations should undergo interim reclamation in order to minimize the environmental impacts of development on other resources and uses.

Within six (6) months of well completion, operators should work with BLM surface management specialists (Jim Amos: 575-234-5909) to devise the best strategies to reduce the size of the location. Interim reclamation should allow for remedial well operations, as well as safe and efficient removal of oil and gas.

During reclamation, the removal of caliche is important to increasing the success of revegetating the site. Removed caliche that is free of contaminants may be used for road repairs, fire walls or for building other roads and locations. In order to operate the well or complete workover operations, it may be necessary to drive, park and operate on restored interim vegetation within the previously disturbed area. Disturbing revegetated areas for production or workover operations will be allowed. If there is significant disturbance and loss of vegetation, the area will need to be revegetated. Communicate with the appropriate BLM office for any exceptions/exemptions if needed.

All disturbed areas after they have been satisfactorily prepared need to be reseeded with the seed mixture provided below.

Upon completion of interim reclamation, the operator shall submit a Sundry Notices and Reports on Wells, Subsequent Report of Reclamation (Form 3160-5).

IX. FINAL ABANDONMENT & RECLAMATION

At final abandonment, well locations, production facilities, and access roads must undergo "final" reclamation so that the character and productivity of the land are restored.

Earthwork for final reclamation must be completed within six (6) months of well plugging. All pads, pits, facility locations and roads must be reclaimed to a satisfactory revegetated, safe, and stable condition, unless an agreement is made with the landowner or BLM to keep the road and/or pad intact.

After all disturbed areas have been satisfactorily prepared, these areas need to be revegetated with the seed mixture provided below. Seeding should be accomplished by drilling on the contour whenever practical or by other approved methods. Seeding may need to be repeated until revegetation is successful, as determined by the BLM.

Operators shall contact a BLM surface protection specialist prior to surface abandonment operations for site specific objectives (Jim Amos: 575-234-5909).

Ground-level Abandoned Well Marker to avoid raptor perching: Upon the plugging and subsequent abandonment of the well, the well marker will be installed at ground level on a plate containing the pertinent information for the plugged well.

Seed Mixture for LPC Sand/Shinnery Sites

Holder shall seed all disturbed areas with the seed mixture listed below. The seed mixture shall be planted in the amounts specified in pounds of pure live seed (PLS)* per acre. There shall be no primary or secondary noxious weeds in the seed mixture. Seed will be tested and the viability testing of seed shall be done in accordance with State law(s) and within nine (9) months prior to purchase. Commercial seed shall be either certified or registered seed. The seed container shall be tagged in accordance with State law(s) and available for inspection by the Authorized Officer.

Seed will be planted using a drill equipped with a depth regulator to ensure proper depth of planting where drilling is possible. The seed mixture will be evenly and uniformly planted over the disturbed area (smaller/heavier seeds have a tendency to drop the bottom of the drill and are planted first). Holder shall take appropriate measures to ensure this does not occur. Where drilling is not possible, seed will be broadcast and the area shall be raked or chained to cover the seed. When broadcasting the seed, the pounds per acre are to be doubled. Seeding shall be repeated until a satisfactory stand is established as determined by the Authorized Officer. Evaluation of growth may not be made before completion of at least one full growing season after seeding.

Species to be planted in pounds of pure live seed* per acre:

Species	lb/acre
Plains Bristlegrass	5lbs/A
Sand Bluestem	5lbs/A
Little Bluestem	3lbs/A
Big Bluestem	6lbs/A
Plains Coreopsis	2lbs/A
Sand Dropseed	1lbs/A

*Pounds of pure live seed:

Pounds of seed **x** percent purity **x** percent germination = pounds pure live seed

AFMSS

U.S. Department of the Interior
BUREAU OF LAND MANAGEMENT

Operator Certification Data Report

10/24/2019

Operator Certification

I hereby certify that I, or someone under my direct supervision, have inspected the drill site and access route proposed herein; that I am familiar with the conditions which currently exist; that I have full knowledge of state and Federal laws applicable to this operation; that the statements made in this APD package are, to the best of my knowledge, true and correct; and that the work associated with the operations proposed herein will be performed in conformity with this APD package and the terms and conditions under which it is approved. I also certify that I, or the company I represent, am responsible for the operations conducted under this application. These statements are

NAME: Sorina Flores **Signed on:** 02/07/2019

Title: Supv of Drilling Services

Street Address: 303 Veterans Airpark Ln #1000

City: Midland **State:** TX **Zip:** 79705

Phone: (432)818-1167

Email address: sorina.flores@apachecorp.com

Field Representative

Representative Name:

Street Address:

City: **State:** **Zip:**

Phone:

Email address:

AFMSS

U.S. Department of the Interior
BUREAU OF LAND MANAGEMENT

Application Data Report

10/24/2019

APD ID: 10400038931
Submission Date: 02/07/2019
Operator Name: APACHE CORPORATION
Well Name: THUNDERBIRD DEVELOPMENT UNIT
Well Number: 4H
Well Type: OIL WELL
Well Work Type: Drill

Highlighted data reflects the most recent changes
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Section 1 - General

APD ID: 10400038931
Tie to previous NOS? N
Submission Date: 02/07/2019
BLM Office: CARLSBAD
User: Sorina Flores
Title: Supv of Drilling Services
Federal/Indian APD: FED
Is the first lease penetrated for production Federal or Indian? FED
Lease number: NMNM0002425
Lease Acres: 599.35
Surface access agreement in place?
Allotted?
Reservation:
Agreement in place? NO
Federal or Indian agreement:
Agreement number:
Agreement name:
Keep application confidential? YES
Permitting Agent? NO
APD Operator: APACHE CORPORATION
Operator letter of designation:

Operator Info

Operator Organization Name: APACHE CORPORATION
Operator Address: 303 Veterans Airpark Lane #1000
Zip: 79705
Operator PO Box:
Operator City: Midland
State: TX
Operator Phone: (432)818-1000
Operator Internet Address:

Section 2 - Well Information

Well in Master Development Plan? NO
Master Development Plan name:
Well in Master SUPO? NO
Master SUPO name:
Well in Master Drilling Plan? NO
Master Drilling Plan name:
Well Name: THUNDERBIRD DEVELOPMENT UNIT
Well Number: 4H
Well API Number:
Field/Pool or Exploratory? Field and Pool
Field Name: YESO
Pool Name: LOCO HILLS; GLORIETA-YESO

Operator Name: APACHE CORPORATION

Well Name: THUNDERBIRD DEVELOPMENT UNIT **Well Number:** 4H

Is the proposed well in an area containing other mineral resources? USEABLE WATER

Is the proposed well in a Helium production area? N **Use Existing Well Pad?** NO **New surface disturbance?**

Type of Well Pad: MULTIPLE WELL **Multiple Well Pad Name:** PAD 1 **Number:** 4H

Well Class: HORIZONTAL **Number of Legs:** 1

Well Work Type: Drill

Well Type: OIL WELL

Describe Well Type:

Well sub-Type: INFILL

Describe sub-type:

Distance to town: 5.4 Miles **Distance to nearest well:** 40 FT **Distance to lease line:** 100 FT

Reservoir well spacing assigned acres Measurement: 279.64 Acres

Well plat: ThunderbirdDevUnit4H_Plat_signed_20190207095409.pdf

Well work start Date: 08/15/2019 **Duration:** 20 DAYS

Section 3 - Well Location Table

Survey Type: RECTANGULAR

Describe Survey Type:

Datum: NAD83 **Vertical Datum:** NAVD88

Survey number: **Reference Datum:**

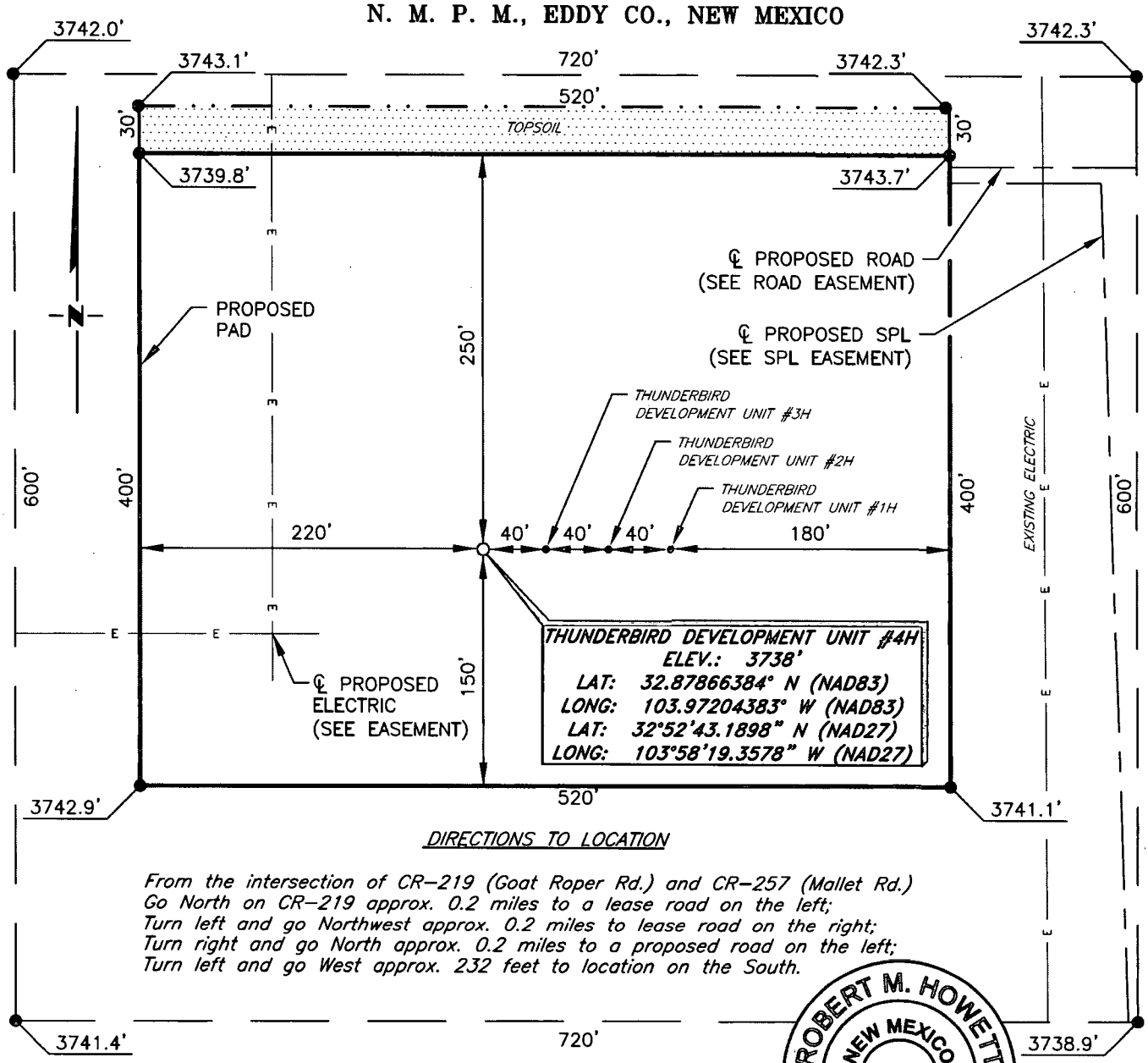
Wellbore	NS-Foot	NS Indicator	EW-Foot	EW Indicator	Twsp	Range	Section	Aliquot/Lot/Tract	Latitude	Longitude	County	State	Meridian	Lease Type	Lease Number	Elevation	MD	TVD	Will this well produce
	2411	FNL	1130	FEL	16S	30E	33	SENE	32.8786638	-103.9720438	EDDY	NEW MEXI	NEW MEXI	F	NMNM 000242	3738	0	0	
	2391	FNL	1204	FEL	16S	30E	33	SENE	32.8787193	-103.9722851	EDDY	NEW MEXI	NEW MEXI	F	NMNM 000242	-823	4562	4561	
	2487	FSL	1457	FEL	16S	30E	33	NWSE	32.8776057	-103.9731079	EDDY	NEW MEXI	NEW MEXI	F	NMLC0 060325	-1301	5312	5039	

Operator Name: APACHE CORPORATION

Well Name: THUNDERBIRD DEVELOPMENT UNIT **Well Number:** 4H

Wellbore	NS-Foot	NS Indicator	EW-Foot	EW Indicator	Twsp	Range	Section	Aliquot/Lot/Tract	Latitude	Longitude	County	State	Meridian	Lease Type	Lease Number	Elevation	MD	TVD	Will this well produce
	100	FSL	1746	FEL	16S	30E	4	SWSE	32.8565697	-103.9740442	EDDY	NEW MEXI	NEW MEXI	F	NMLC060325	-1391	13021	5129	
	100	FSL	1746	FEL	16S	30E	4	SWSE	32.8565697	-103.9740442	EDDY	NEW MEXI	NEW MEXI	F	NMLC060325	-1391	13021	5129	

APACHE CORPORATION
THUNDERBIRD DEVELOPMENT UNIT #4H
(2411' FNL & 1130' FEL)
SECTION 33, T16S, R30E
N. M. P. M., EDDY CO., NEW MEXICO



DIRECTIONS TO LOCATION

From the intersection of CR-219 (Goat Roper Rd.) and CR-257 (Mallet Rd.)
Go North on CR-219 approx. 0.2 miles to a lease road on the left;
Turn left and go Northwest approx. 0.2 miles to lease road on the right;
Turn right and go North approx. 0.2 miles to a proposed road on the left;
Turn left and go West approx. 232 feet to location on the South.

SCALE: 1" = 100'
0 50 100

BEARINGS ARE NAD 83 GRID - NM EAST
DISTANCES ARE GROUND.

ROBERT M. HOWETT
NEW MEXICO
19680
6/17/16
PROFESSIONAL SURVEYOR

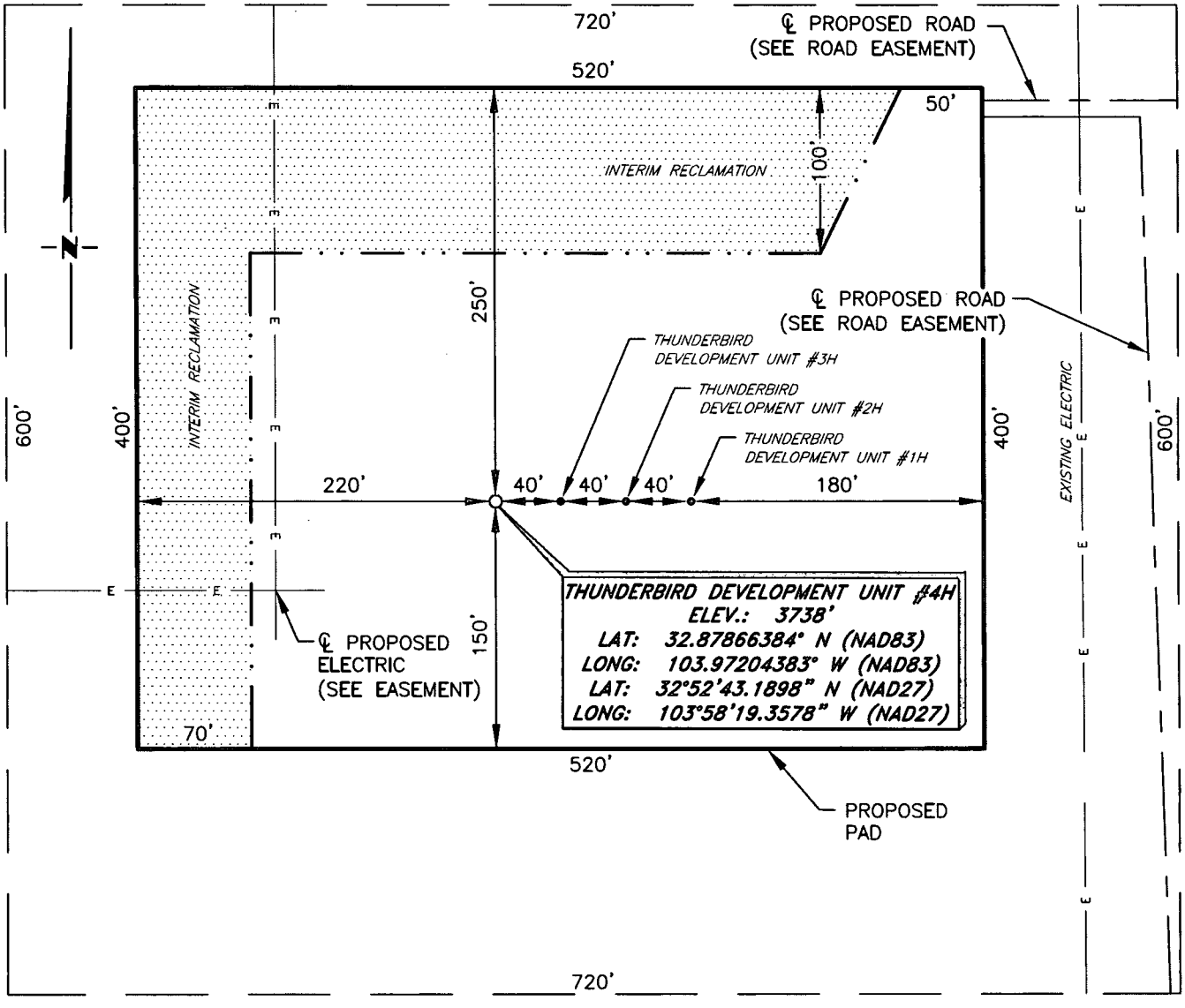
Firm No.: TX 10193838 NM 4655451

NO.	REVISION	DATE
	WELL NAME	1.30.19
JOB NO.: LS1605194		
DWG. NO.: 1605194PAD		

RRC
SURVEYING, LLC
701 S. CECIL ST., HOBBS, NM 88240 (575) 964-8200

SCALE: 1" = 100'
DATE: 6-01-2016
SURVEYED BY: ML/CG
DRAWN BY: RMH
APPROVED BY: RMH
SHEET : 1 OF 1

APACHE CORPORATION
INTERIM RECLAMATION
THUNDERBIRD DEVELOPMENT UNIT #4H
(2411' FNL & 1130' FEL)
SECTION 33, T16S, R30E
N. M. P. M., EDDY CO., NEW MEXICO



DIRECTIONS TO LOCATION

SCALE: 1" = 100'
0 50 100

BEARINGS ARE
NAD 83 GRID – NM EAST
DISTANCES ARE
GROUND.

From the intersection of CR–219 (Goat Roper Rd.) and CR–257 (Mallet Rd.)
Go North on CR–219 approx. 0.2 miles to a lease road on the left;
Turn left and go Northwest approx. 0.2 miles to lease road on the right;
Turn right and go North approx. 0.2 miles to a proposed road on the left;
Turn left and go West approx. 232 feet to location on the South.

	WELL NAME	1.30.19
NO.	REVISION	DATE
JOB NO.: LS1605194		
DWG. NO.: 1605194REC		

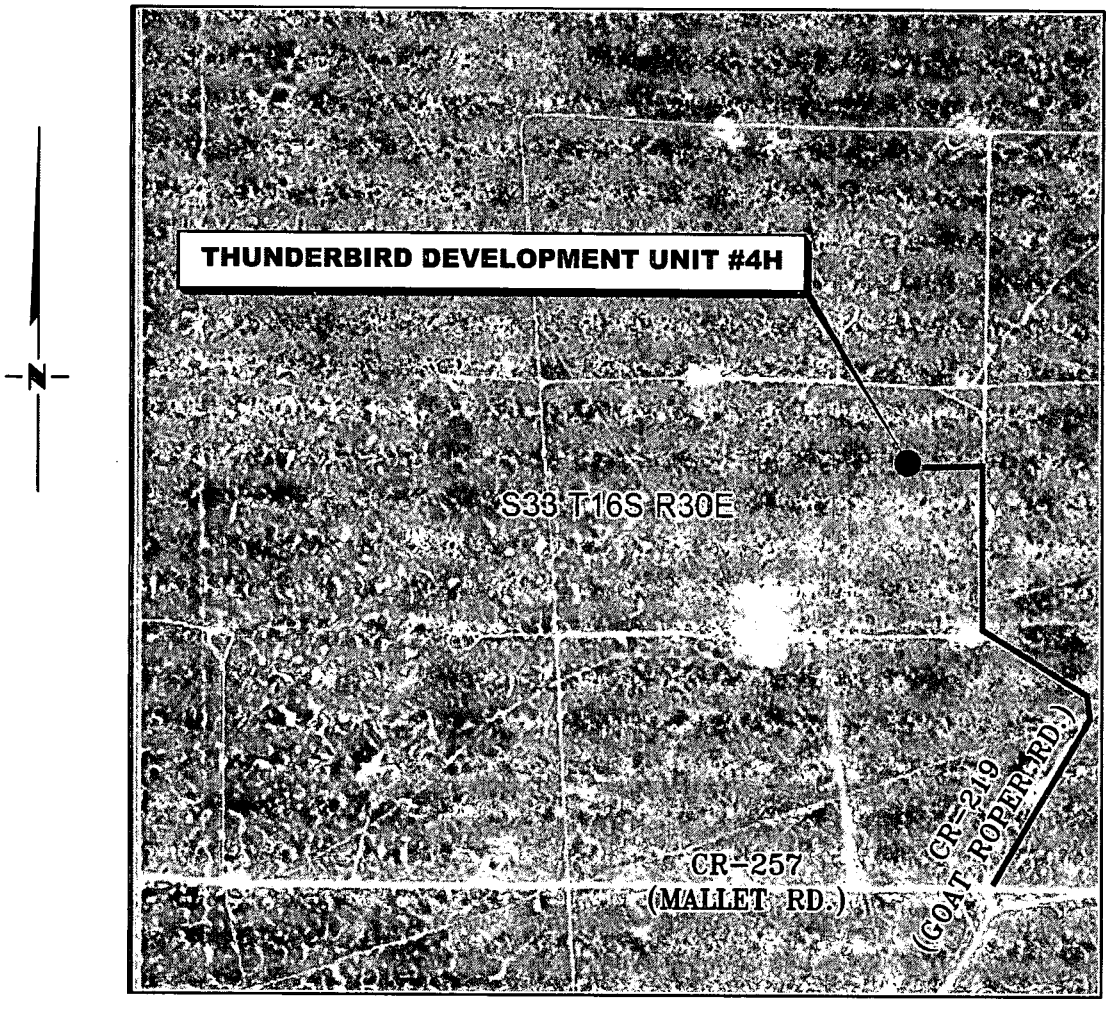
RRC
SURVEYING, LLC

701 S. CECIL ST., HOBBS, NM 88240 (575) 964–8200

SCALE: 1" = 100'
DATE: 6–01–2016
SURVEYED BY: ML/CG
DRAWN BY: RMH
APPROVED BY: RMH
SHEET : 1 OF 1

VICINITY MAP

NOT TO SCALE



SECTION 33, TWP. 16 SOUTH, RGE. 30 EAST,
N. M. P. M., EDDY CO., NEW MEXICO

OPERATOR: Apache Corporation
LEASE: Thunderbird Development Unit
WELL NO.: 4H

LOCATION: 2411' FNL & 1130' FEL
ELEVATION: 3738'

	WELL NAME	1.30.19
NO.	REVISION	DATE
JOB NO.: LS1605194		
DWG. NO.: 1605194VM		

RRC SURVEYING, LLC

701 S. CECIL ST., HOBBS, NM 88240 (575) 964-8200

SCALE: NTS
DATE: 6-01-2016
SURVEYED BY: ML/CG
DRAWN BY: LPS
APPROVED BY: RMH
SHEET : 1 OF 1

APD ID: 10400038931 **Submission Date:** 02/07/2019

Operator Name: APACHE CORPORATION

Well Name: THUNDERBIRD DEVELOPMENT UNIT **Well Number:** 4H

Well Type: OIL WELL **Well Work Type:** Drill

Highlighted data reflects the most recent changes

Show Final Text

Section 1 - Geologic Formations

Formation ID	Formation Name	Elevation	True Vertical Depth	Measured Depth	Lithologies	Mineral Resources	Producing Formation
1	RUSTLER	3738	376	376		POTASH	N
2	TOP SALT	3223	514	514		NONE	N
3	TANSILL	2537	1200	1200		NONE	N
4	YATES	2378	1359	1359		NATURAL GAS,OIL	N
5	SEVEN RIVERS	2118	1619	1619		NATURAL GAS,OIL	N
6	QUEEN	1518	2219	2219		NATURAL GAS,OIL	N
7	GRAYBURG	1085	2652	2652		NATURAL GAS,OIL	N
8	SAN ANDRES	768	2969	2969		NATURAL GAS,OIL	N
9	GLORIETA	-662	4399	4399		NATURAL GAS,OIL	Y
10	YESO	-715	4452	4452		NATURAL GAS,OIL	Y

Section 2 - Blowout Prevention

Pressure Rating (PSI): 2M **Rating Depth:** 8000

Equipment: Rotating Head, Mud Gas Separator, Blow Down Pit, Flare Line, Ignitor

Requesting Variance? YES

Variance request: Apache request a variance to use a flexible hose between BOP and choke manifold. Flex hose may vary pending availability. A quality control inspection and test certificate will be available for review.
Testing Procedure: BOP/BOPE will be tested by independent service company to 250psi low and high pressure indicated above per Onshore Order 2 requirements. System may be upgraded to higher pressure but sill tested to WP listed . If system is upgraded, all components installed will be functional and tested. Pipe rams will be operationally checked each 24 hr period. Blind rams will be operationally checked on each TOOH. These checks will be noted on daily tour sheets. Other accessories to BOP equipment will include Kelly cock and floor safety valve (inside BOP), choke lines and choke manifold. (see attached schematic)

Operator Name: APACHE CORPORATION

Well Name: THUNDERBIRD DEVELOPMENT UNIT **Well Number:** 4H

Choke Diagram Attachment:

ThunderbirdDevUnit_BOP_3M_2M_AnnularManifoldSchematic_20190207100141.pdf

BOP Diagram Attachment:

ThunderbirdDevUnit_BOP_3M_2M_Inst_on_Surf_Manifold_Schem_20190207100148.pdf

Flexline_20190827151745.pdf

Section 3 - Casing

Casing ID	String Type	Hole Size	Csg Size	Condition	Standard	Tapered String	Top Set MD	Bottom Set MD	Top Set TVD	Bottom Set TVD	Top Set MSL	Bottom Set MSL	Calculated casing	Grade	Weight	Joint Type	Collapse SF	Burst SF	Joint SF Type	Joint SF	Body SF Type	Body SF
1	SURFACE	17.5	13.375	NEW	API	N	0	400	0	400	-974	-1374	400	H-40	48	ST&C	7.21	1.39	BUOY	2.07	BUOY	3.47
2	INTERMEDIATE	12.25	9.625	NEW	API	N	0	3200	0	3200	-974	-4174	3200	J-55	36	LT&C	2.19	2.33	BUOY	2.07	BUOY	2.56
3	PRODUCTION	8.5	7.0	NEW	API	N	0	4562	0	4561	-974	-5168	4562	L-80	26	LT&C	2.64	1.125	BUOY	2.29	BUOY	2.68
4	OTHER	8.5	5.5	NEW	API	Y	4562	13021	4561	5129	-5168	-5689	8459	L-80	17	LT&C	2.71	1.17	BUOY	1.87	BUOY	2.17

Casing Attachments

Casing ID: 1 **String Type:** SURFACE

Inspection Document:

Spec Document:

Tapered String Spec:

Casing Design Assumptions and Worksheet(s):

ThunderbirdDevUnit_SurfCsgDesignAssumpt_20190129141122.pdf

Operator Name: APACHE CORPORATION

Well Name: THUNDERBIRD DEVELOPMENT UNIT **Well Number:** 4H

Casing Attachments

Casing ID: 2 **String Type:** INTERMEDIATE

Inspection Document:

Spec Document:

Tapered String Spec:

Casing Design Assumptions and Worksheet(s):

ThunderbirdDevUnit_IntermCsgDesignAssumpt_20190129141134.pdf

Casing ID: 3 **String Type:** PRODUCTION

Inspection Document:

Spec Document:

Tapered String Spec:

Casing Design Assumptions and Worksheet(s):

ThunderbirdDevUnit_ProdCsgDesignAssumpt_20190129141146.pdf

Casing ID: 4 **String Type:** OTHER - Tapered Production String

Inspection Document:

Spec Document:

Tapered String Spec:

ThunderbirdDevUnit4H_ProdCsgTaperedSpecs_20190207100440.pdf

Casing Design Assumptions and Worksheet(s):

ThunderbirdDevUnit_ProdCsgDesignAssumpt_20190205144415.pdf

Section 4 - Cement

Operator Name: APACHE CORPORATION

Well Name: THUNDERBIRD DEVELOPMENT UNIT **Well Number:** 4H

String Type	Lead/Tail	Stage Tool	Top MD	Bottom MD	Quantity(sx)	Yield	Density	Cu Ft	Excess%	Cement type	Additives
OTHER	Lead		0	0	0	0	0	0	0	0	0
SURFACE	Lead		0	400	291	1.33	14.8	387.03	25	Class C	1% Calcium Chloride
INTERMEDIATE	Lead		0	2560	535	1.87	12.9	1000.45	25	Class C	5% Salt + 6% Bentonite + 0.5% Suspension Aid + 0.4 #/sk Defoamer
INTERMEDIATE	Tail		2560	3200	205	1.33	14.8	272.65	25	Class C	0.2% Retarder
PRODUCTION	Lead	4562	0	3650	300	2.03	12.6	609	25	Class C	5% Salt + 6% Bentonite + 0.2% Retarder + 0.4#/sk Defoamer
PRODUCTION	Tail		3650	4562	100	1.48	13	148	25	TXI Lite	1.3% Salt, 5% Gas Migration Expansion Additive , 0.5% Fluid Loss Agent + 0.1% Anti-settling agent, 0.4#/sk Defoamer

Section 5 - Circulating Medium

Mud System Type: Closed

Will an air or gas system be Used? NO

Description of the equipment for the circulating system in accordance with Onshore Order #2:

Diagram of the equipment for the circulating system in accordance with Onshore Order #2:

Describe what will be on location to control well or mitigate other conditions: BOP, Choke Manifold, Gas Buster, Blow Down Pit, Flare Line with Igniter, Pre-Mix Pit, Rotating Head

Describe the mud monitoring system utilized: PVT/Pason/Visual Monitoring

Circulating Medium Table

Operator Name: APACHE CORPORATION

Well Name: THUNDERBIRD DEVELOPMENT UNIT **Well Number:** 4H

Top Depth	Bottom Depth	Mud Type	Min Weight (lbs/gal)	Max Weight (lbs/gal)	Density (lbs/cu ft)	Gel Strength (lbs/100 sqft)	PH	Viscosity (CP)	Salinity (ppm)	Filtration (cc)	Additional Characteristics
0	400	SPUD MUD	8.3	9							
3200	5200	OTHER : Cut Brine	8	9.5							
400	3200	SALT SATURATED	9.8	10.5							

Section 6 - Test, Logging, Coring

List of production tests including testing procedures, equipment and safety measures:

If drill stem tests are performed, Onshore Order 2.III.D shall be followed.

List of open and cased hole logs run in the well:

CBL,CNL/FDC,DS,GR,MWD,MUDLOG

Coring operation description for the well:

N/A

Section 7 - Pressure

Anticipated Bottom Hole Pressure: 2250 **Anticipated Surface Pressure:** 1121.61

Anticipated Bottom Hole Temperature(F): 116

Anticipated abnormal pressures, temperatures, or potential geologic hazards? NO

Describe:

Contingency Plans geoharzards description:

Contingency Plans geohazards attachment:

Hydrogen Sulfide drilling operations plan required? YES

Hydrogen sulfide drilling operations plan:

ThunderbirdDevUnit_H2SOpsContgPlan_20190130132210.pdf

Operator Name: APACHE CORPORATION

Well Name: THUNDERBIRD DEVELOPMENT UNIT **Well Number:** 4H

Section 8 - Other Information

Proposed horizontal/directional/multi-lateral plan submission:

ThunderbirdDevUnit4H_DirectionalPlan_20190207101258.pdf

ThunderbirdDevUnit4H_DirSurvey_20190207101357.xls

Other proposed operations facets description:

Apache Corp respectfully request approval to utilize a spudder rig to pre-set surf csg. Please see attachment for procedure. Apache has included a 2-stage cement job contingency, see cement detail attached. This well will have an open hole completion attached to the 5-1/2" csg. 5-1/2" will cross over to 7" where a DVT will be placed at the bottom of 7". The 5-1/2" csg will be uncemented and the 7" from DVT to surf will be cemented. Apache also request approval to use multi-bowl wellhead, procedure attached.

Other proposed operations facets attachment:

CameronMN_DS_WellheadProcedureForThunderbirdPermitsToUseMultibowlWellheads_20190130160318.pdf

ThunderbirdDevUnit1H_4H_CmtDetail_20190207101442.pdf

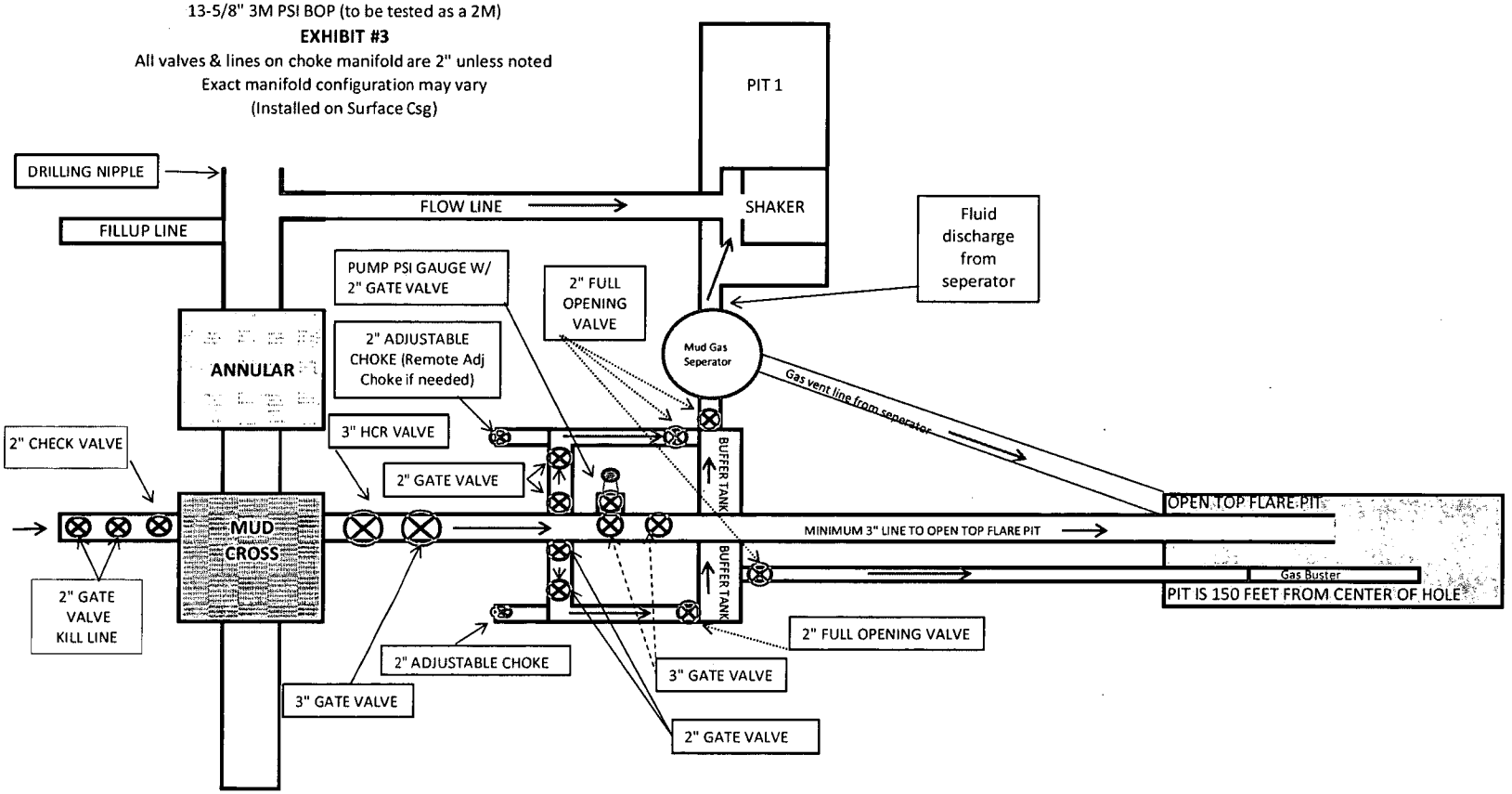
ThunderbirdDevUnit1H_4H_CsgDetail_20190207101442.pdf

ThunderbirdDevUnit4H_SpudderRigProcedure_20190207101443.pdf

Other Variance attachment:

APACHE BOP AND CHOKE MANIFOLD SCHEMATIC

13-5/8" 3M PSI BOP (to be tested as a 2M)
EXHIBIT #3
All valves & lines on choke manifold are 2" unless noted
Exact manifold configuration may vary
(Installed on Surface Csg)



*** If H2S is encountered in quantities greater than 100ppm, Apache will shut in well & install a remote operated choke ***

APACHE BOP AND CHOKE MANIFOLD SCHEMATIC

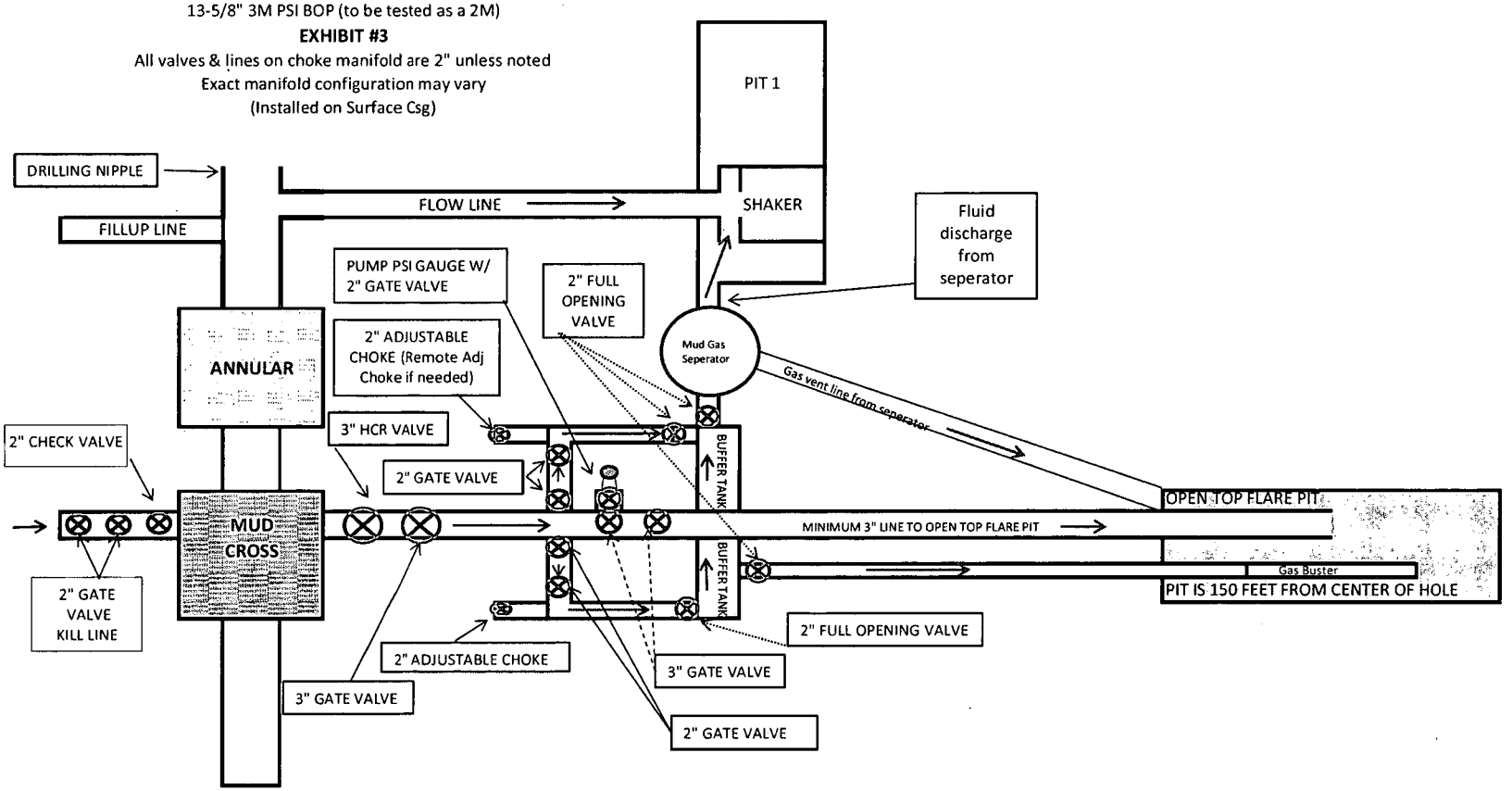
13-5/8" 3M PSI BOP (to be tested as a 2M)

EXHIBIT #3

All valves & lines on choke manifold are 2" unless noted

Exact manifold configuration may vary

(Installed on Surface Csg)



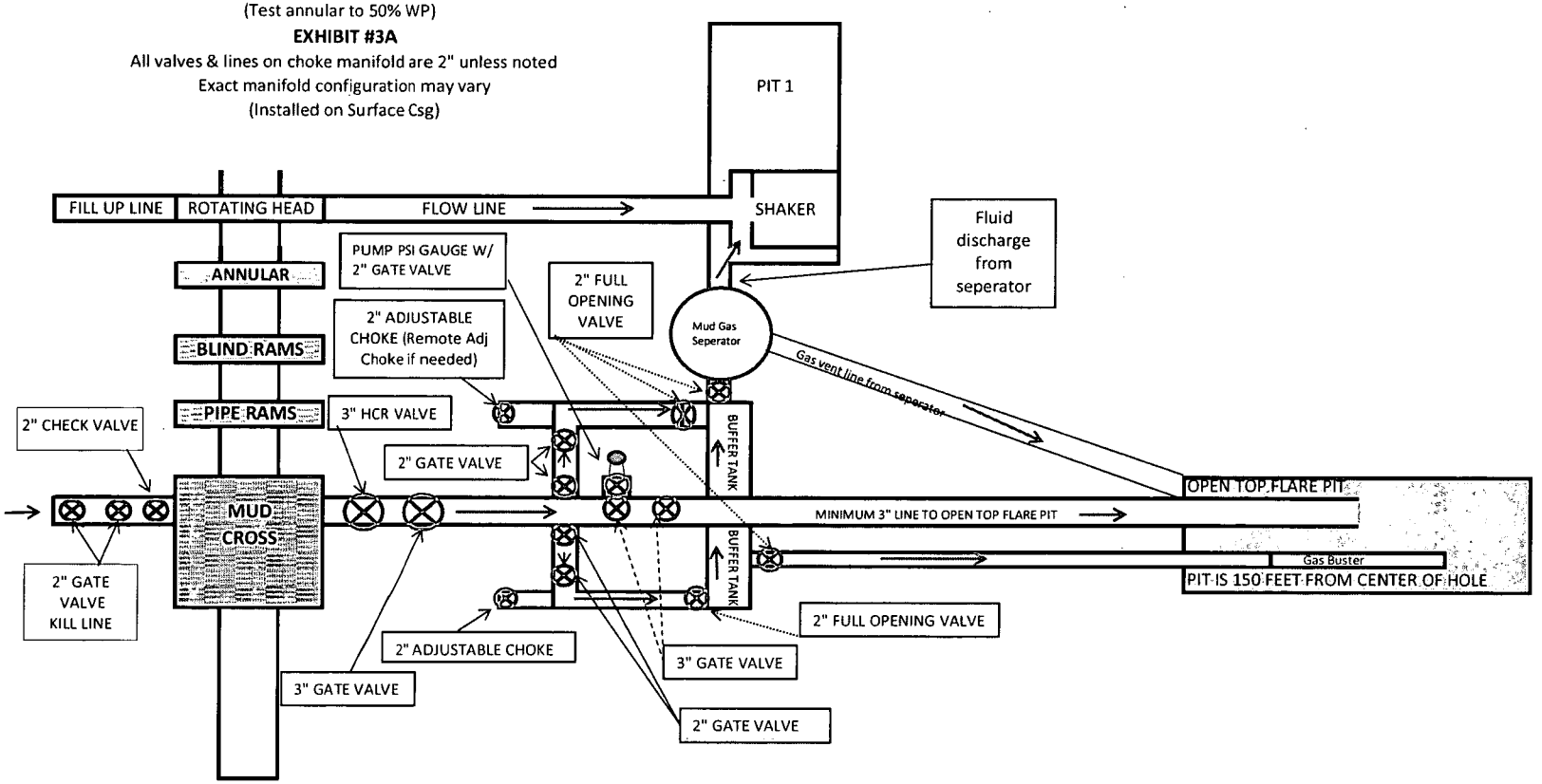
***** If H2S is encountered in quantities greater than 100ppm, Apache will shut in well & install a remote operated choke *****

APACHE BOP AND CHOKE MANIFOLD SCHEMATIC

13-3/8" 3M PSI BOP (to be tested as a 2M)
(Test annular to 50% WP)

EXHIBIT #3A

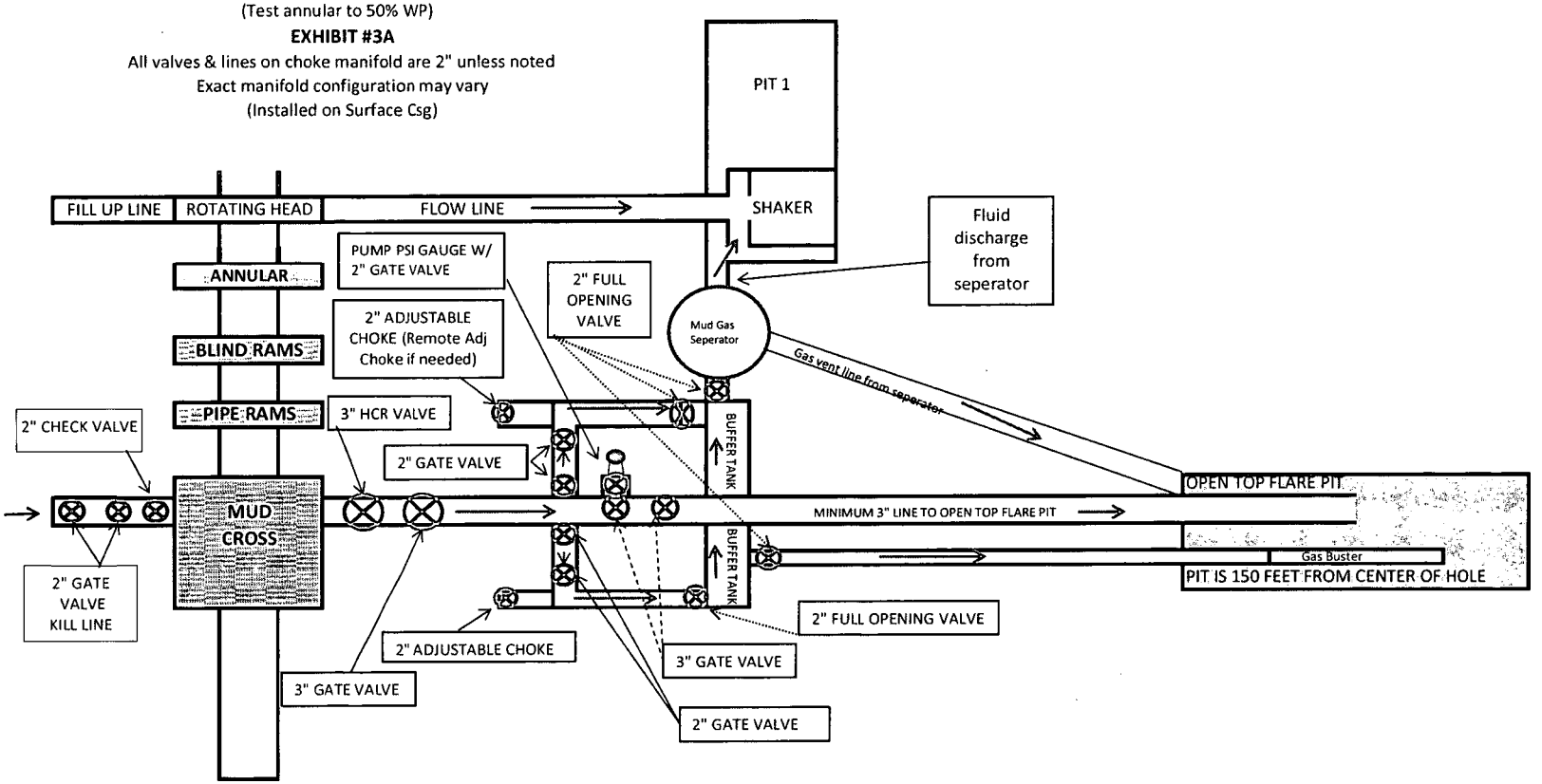
All valves & lines on choke manifold are 2" unless noted
Exact manifold configuration may vary
(Installed on Surface Csg)



*** If H2S is encountered in quantities greater than 100ppm, Apache will shut in well & install a remote operated choke ***

APACHE BOP AND CHOKE MANIFOLD SCHEMATIC

13-3/8" 3M PSI BOP (to be tested as a 2M)
(Test annular to 50% WP)
EXHIBIT #3A
All valves & lines on choke manifold are 2" unless noted
Exact manifold configuration may vary
(Installed on Surface Csg)



*** If H2S is encountered in quantities greater than 100ppm, Apache will shut in well & install a remote operated choke ***

QUALITY CONTROL INSPECTION AND TEST CERTIFICATE				CERT. N°:	581	
PURCHASER:	ContiTech Oil & Marine Corp.			P.O. N°:	4500511543	
CONTITECH RUBBER order N°:	540352	HOSE TYPE:	3" ID	Choke and Kill Hose		
HOSE SERIAL N°:	69915	NOMINAL / ACTUAL LENGTH:		10,67 m / 10,76 m		
W.P. 68,9 MPa	10000 psi	T.P. 103,4 MPa	15000 psi	Duration:	60	min.

Pressure test with water at ambient temperature

See attachment. (1 page)

COUPLINGS Type	Serial N°		Quality	Heat N°
3" coupling with	7563	7565	AISI 4130	A0996X
4 1/16" 10K API b.w. Flange end			AISI 4130	036282

NOT DESIGNED FOR WELL TESTING

API Spec 16 C

Temperature rate:"B"

All metal parts are flawless

WE CERTIFY THAT THE ABOVE HOSE HAS BEEN MANUFACTURED IN ACCORDANCE WITH THE TERMS OF THE ORDER INSPECTED AND PRESSURE TESTED AS ABOVE WITH SATISFACTORY RESULT.

STATEMENT OF CONFORMITY: We hereby certify that the above items/equipment supplied by us are in conformity with the terms, conditions and specifications of the above Purchaser Order and that these items/equipment were fabricated inspected and tested in accordance with the referenced standards, codes and specifications and meet the relevant acceptance criteria and design requirements.

COUNTRY OF ORIGIN HUNGARY/EU

Date:	Inspector	Quality Control
18. March 2015.		ContiTech Rubber Industrial Kft. Quality Control Dept. (1)

ATTACHMENT OF QUALITY CONTROL INSPECTION AND TEST CERTIFICATE *No: 579, 580, 581*

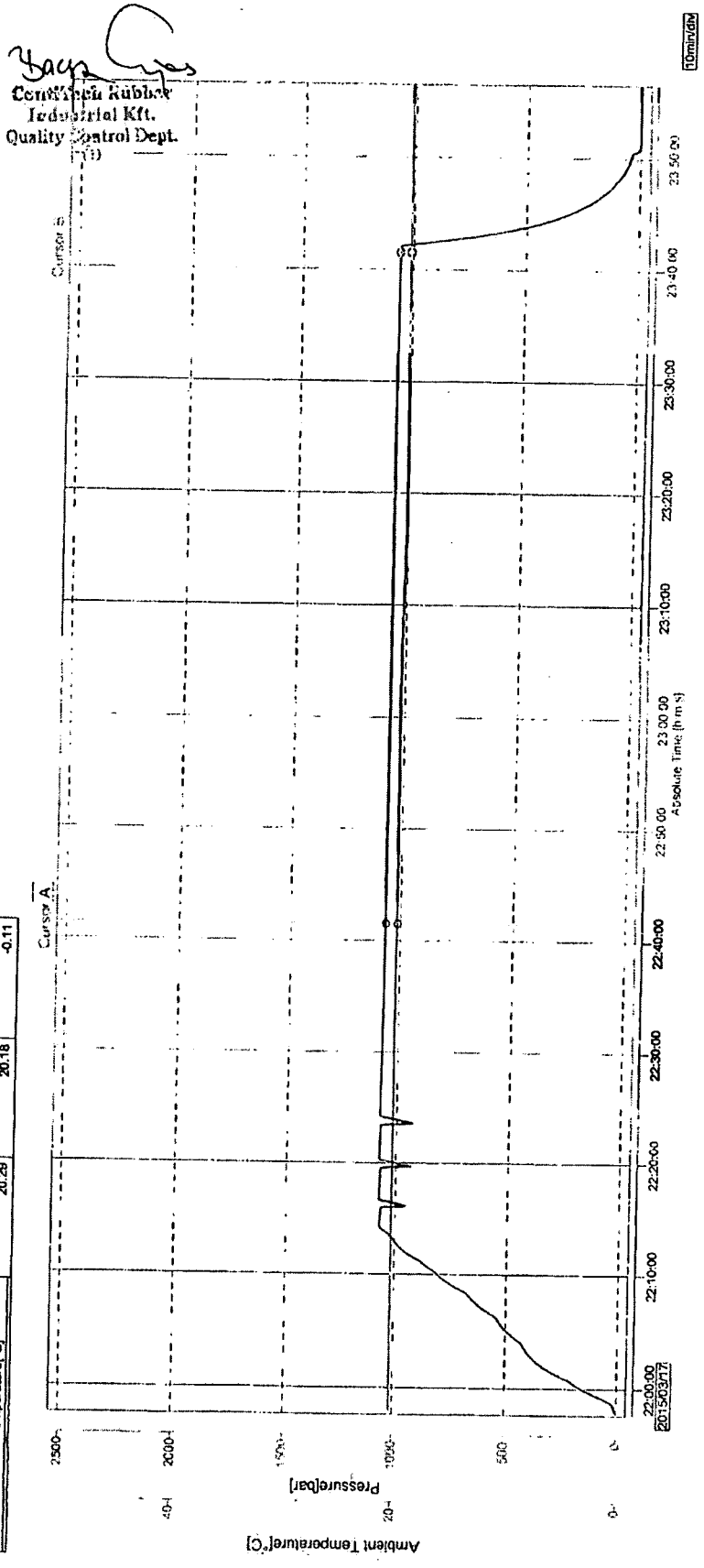
File Name : 004409_69913,-914,-915.GEV,...,004420_69913,-914,-915.GEV
File Message : 69913,69914,69915
Device Type : GX10
Serial No. : S5P606399
Data Count : 1426

Sampling Int. : 5.000 sec
Start Time : 2015/03/17 21:57:40.000
Stop Time : 2015/03/17 23:56:25.000

Print Group : Press-Temp
Print Range : 2015/03/17 21:57:40.000 - 2015/03/17 23:56:25.000
Comment : 69913,69914,69915

	Cursor A	Cursor B	Difference
Data No.	526	1246	720
Absolute Time	2015/03/17 22:41:30.000	2015/03/17 23:41:30.000	01:00:00.000
Tag Comment	Value A	Value B	Value B-A
Pressure[bar]	1089.30	1057.33	-11.97
Ambient Temperature[°C]	20.29	20.18	-0.11

Certified Rubber Industrial Kft. Quality Control Dept.



Thunderbird Development Unit 4H Production Casing Tapered String Specs

All casing design assumptions were ran in StressCheck to determine safety factors which meet or exceed both Apache Corp and BLM minimum requirements. All casing strings will be filled while running in hole in order to not exceed collapse rating of the casing.

String	OD/Weight/Grade	Connection	MD Interval (ft)	Minimum Safety Factor (Abs)		
				Burst	Collapse	Axial
Production Casing	7", 26 ppf, L-80	LTC, L-80	0-4562'	1.125	2.64	2.29
	5 ½", 17 ppf, L-80	LTC, L-80	4562'-13021'	1.17	2.72	1.87

*This will have an open hole completion consisting of open hole hydraulic packers and sliding sleeves attached to the 5-1/2" casing. 5-1/2" will crossover to 7" where a DV tool will be placed at the bottom of the 7" (KOP @~4562'). The 5-1/2" casing will be uncemented and the 7" from the DV tool to surface will be cemented.

Production Casing Burst Design		
Load Case	**External Pressure**	**Internal Pressure**
Pressure Test	Mud base fluid density to TOC, cement mix-water gradient to outer shoe and pore pressure to TD	Fluid in hole (water or produced water) + test psi
Tubing Leak	Mud base fluid density to TOC, cement mix-water gradient to outer shoe and pore pressure to TD	Packer @ KOP, leak below surface 8.6 ppg packer fluid
Stimulation	Mud base fluid density to TOC, cement mix-water gradient to outer shoe and pore pressure to TD	Max frac pressure with heaviest frac fluid
Green Cement Pressure Test	Mud base fluid density to TOC, cement mix-water gradient to outer shoe and pore pressure to TD	Max pressure used to bump the plug during cement job
Production Casing Collapse Design		
Load Case	**External Pressure**	**Internal Pressure**
Full Evacuation	Mud weight string was set in	None
Cementing	Wet cement weight	Water (8.33 ppg)

Production Casing Axial Design	
Load Case	**Assumptions**
Overpull	100 kips
Running in hole	2 ft/s
Green Cement Pressure Test	Max pressure when bumping plug
Service Loads	N/A

Casing Design Assumptions and Load Cases

Surface

All casing design assumptions were ran in StressCheck to determine safety factors which meet or exceed both Apache Corp and BLM minimum requirements. All casing strings will be filled while running in hole in order to not exceed collapse rating of the casing.

Surface Casing Burst Design		
Load Case	**External Pressure**	**Internal Pressure**
Pressure Test	Mud and Cement Mix Water	Test psi with Mud Weight of displacement fluid
Fracture @ shoe w/ Gas Gradient Above	Mud and Cement Mix Water	Fracture psi at shoe and 0.7 gas gravity above shoe
Green Cement Pressure Test	Mud and Cement Mix Water	Max pressure used to bump the plug during cement job
Lost Returns with Water	Mud and Cement Mix Water	Pressure to fracture shoe with water hydrostatic

Surface Casing Collapse Design		
Load Case	**External Pressure**	**Internal Pressure**
Full/Partial Evacuation	Mud weight string was set in	50% casing evacuation with surface mud inside casing
Lost Returns with Mud Drop	Mud weight string was set in	Lost returns at intermediate casing point with brine
Cementing	Wet cement weight	Water (8.33 ppg)

Surface Casing Axial Design	
Load Case	**Assumptions**
Overpull	100 kips
Running in hole	2 ft/s
Green Cement Pressure Test	Max pressure when bumping plug
Service Loads	N/A

Casing Design Assumptions and Load Cases

Intermediate

All casing design assumptions were ran in StressCheck to determine safety factors which meet or exceed both Apache Corp and BLM minimum requirements. All casing strings will be filled while running in hole in order to not exceed collapse rating of the casing.

Intermediate Casing Burst Design		
Load Case	**External Pressure**	**Internal Pressure**
Pressure Test	Mud and Cement Mix Water	Test psi with Mud Weight of displacement fluid
Fracture @ shoe w/ Gas Gradient Above	Mud and Cement Mix Water	Fracture psi at shoe and 0.7 gas gravity above shoe
Green Cement Pressure Test	Mud and Cement Mix Water	Max pressure used to bump the plug during cement job
Lost Returns with Water	Mud and Cement Mix Water	Pressure to fracture shoe with water hydrostatic

Intermediate Casing Collapse Design		
Load Case	**External Pressure**	**Internal Pressure**
Full/Partial Evacuation	Mud weight string was set in	50% casing evacuation with intermediate mud inside casing
Lost Returns with Mud Drop	Mud weight string was set in	Lost returns at TD casing shoe with 8.33 ppg mud
Cementing	Wet cement weight	Water (8.33 ppg)

Intermediate Casing Axial Design	
Load Case	**Assumptions**
Overpull	100 kips
Running in hole	2 ft/s
Green Cement Pressure Test	Max pressure when bumping plug
Service Loads	N/A

Casing Design Assumptions and Load Cases

Production

All casing design assumptions were ran in StressCheck to determine safety factors which meet or exceed both Apache Corp and BLM minimum requirements. All casing strings will be filled while running in hole in order to not exceed collapse rating of the casing.

Production Casing Burst Design		
Load Case	**External Pressure**	**Internal Pressure**
Pressure Test	Mud base fluid density to TOC, cement mix-water gradient to outer shoe and pore pressure to TD	Fluid in hole (water or produced water) + test psi
Tubing Leak	Mud base fluid density to TOC, cement mix-water gradient to outer shoe and pore pressure to TD	Packer @ KOP, leak below surface 8.6 ppg packer fluid
Stimulation	Mud base fluid density to TOC, cement mix-water gradient to outer shoe and pore pressure to TD	Max frac pressure with heaviest frac fluid
Green Cement Pressure Test	Mud base fluid density to TOC, cement mix-water gradient to outer shoe and pore pressure to TD	Max pressure used to bump the plug during cement job

Production Casing Collapse Design		
Load Case	**External Pressure**	**Internal Pressure**
Full Evacuation	Mud weight string was set in	None
Cementing	Wet cement weight	Water (8.33 ppg)

Production Casing Axial Design	
Load Case	**Assumptions**
Overpull	100 kips
Running in hole	2 ft/s
Green Cement Pressure Test	Max pressure when bumping plug
Service Loads	N/A

Casing Design Assumptions and Load Cases

Production

All casing design assumptions were ran in StressCheck to determine safety factors which meet or exceed both Apache Corp and BLM minimum requirements. All casing strings will be filled while running in hole in order to not exceed collapse rating of the casing.

Production Casing Burst Design		
Load Case	**External Pressure**	**Internal Pressure**
Pressure Test	Mud base fluid density to TOC, cement mix-water gradient to outer shoe and pore pressure to TD	Fluid in hole (water or produced water) + test psi
Tubing Leak	Mud base fluid density to TOC, cement mix-water gradient to outer shoe and pore pressure to TD	Packer @ KOP, leak below surface 8.6 ppg packer fluid
Stimulation	Mud base fluid density to TOC, cement mix-water gradient to outer shoe and pore pressure to TD	Max frac pressure with heaviest frac fluid
Green Cement Pressure Test	Mud base fluid density to TOC, cement mix-water gradient to outer shoe and pore pressure to TD	Max pressure used to bump the plug during cement job

Production Casing Collapse Design		
Load Case	**External Pressure**	**Internal Pressure**
Full Evacuation	Mud weight string was set in	None
Cementing	Wet cement weight	Water (8.33 ppg)

Production Casing Axial Design	
Load Case	**Assumptions**
Overpull	100 kips
Running in hole	2 ft/s
Green Cement Pressure Test	Max pressure when bumping plug
Service Loads	N/A

HYDROGEN SULFIDE (H_2S) DRILLING OPERATIONS PLAN

Hydrogen Sulfide Training:

All regularly assigned personnel, contracted or employed by Apache Corporation will receive training from qualified instructor(s) in the following areas prior to commencing drilling possible hydrogen sulfide bearing formations in this well:

- The hazards and characteristics of hydrogen sulfide (H_2S)
- The proper use and maintenance of personal protective equipment and life support systems.
- The proper use of H_2S detectors, alarms, warning systems, briefing area, evacuation procedures & prevailing winds.
- The proper techniques for first aid and rescue procedures.

Supervisory personnel will be trained in the following areas:

- The effects of H_2S on metal components. If high tensile tubulars are to be utilized, personnel will be trained in their special maintenance requirements.
- Corrective action & shut-in procedures when drilling or reworking a well & blowout prevention / well control procedures.
- The contents and requirements of the H_2S Drilling Operations Plan

There will be an initial training session just prior to encountering a known or probable H_2S zone (within 3 days or 500') and weekly H_2S and well control drills for all personnel in each crew. The initial training session shall include a review of the site specific H_2S Drilling Operations Plan and the Public Protection Plan. This plan shall be available at the well site. All personnel will be required to carry documentation that they have received proper training.

H_2S SAFETY EQUIPMENT AND SYSTEMS:

Well Control Equipment that will be available & installed if H_2S is encountered:

- Flare Line with electronic igniter or continuous pilot.
- Choke manifold with a minimum of one remote choke.
- Blind rams & pipe rams to accommodate all pipe sizes with properly sized closing unit.
- Auxiliary equipment to include: annular preventer, mud-gas separator, rotating head & flare gun with flares

Protective Equipment for Essential Personnel:

- Mark II Survive-air 30 minute units located in dog house & at briefing areas, as indicated on wellsite diagram.

H2S Dection and Monitoring Equipment:

- Two portable H_2S monitors positioned on location for best coverage & response. These units have warning lights & audible sirens when H_2S levels of 20 ppm are reached.
- One portable H_2S monitor positioned near flare line.

H2S Visual Warning Systems:

- Wind direction indicators are shown on wellsite diagram.
- Caution / Danger signs shall be posted on roads providing direct access to location. Signs will be painted a high visibility yellow with black lettering of sufficient size to be readable at a reasonable distance from the immediate location. Bilingual signs will be used when appropriate.

Mud Program:

- The Mud Program has been designed to minimize the volume of H_2S circulated to the surface. Proper mud weights, safe drilling practices & the use of H_2S scavengers will minimize hazards when penetrating H_2S bearing zones.
- A mud-gas separator and H_2S gas buster will be utilized as needed.

Metallurgy:

- All drill strings, casing, tubing, wellhead, blowout preventers, drilling spool, kill lines, choke manifold & lines, & valves will be suitable for H_2S service.
- All elastomers used for packing & seals shall be H_2S trim.

Communication:

- Cellular telephone and 2-way radio communications in company vehicles, rig floor and mud logging trailer.

HYDROGEN SULFIDE (H_2S) CONTINGENCY PLAN

Assumed 100 ppm ROE = 3000'

100 ppm H_2S concentration shall trigger activation of this plan.

Emergency Procedures

In the event of a release of gas containing H_2S, the first responder(s) must

- Isolate the area and prevent entry by other persons into the 100 ppm ROE.
- Evacuate any public places encompassed by the 100 ppm ROE.
- Be equipped with H_2S monitors and air packs in order to control the release.
- Use the "buddy system" to ensure no injuries occur during the response
- Take precautions to avoid personal injury during this operation.
- Contact operators and/or local officials to aid in operation. See list of phone numbers attached.
- Have received training in the :
    - Detection of H_2S, and
    - Measures for protection against the gas,
    - Equipment used for protection and emergency response.

Ignition of Gas source

Should control of the well be considered lost and ignition considered, take care to protect against exposure to Sulfur Dioxide (SO_2). Intentional ignition must be coordinated with the NMOCD and local officials. Additionally the NM State Police may become involved. NM State Police shall be the Incident Command on scene of any major release. Take care to protect downwind whenever this is an ignition of the gas.

Characteristics of H_2S and SO_2

Common Name	Chemical Formula	Specific Gravity	Threshold Limit	Hazardous Limit	Lethal Concentration
Hydrogen Sulfide	H_2S	1.189 Air = I	10 ppm	100 ppm/hr	600 ppm
Sulfur Dioxide	SO_2	2.21 Air = I	2 ppm	N/A	1000 ppm

Contacting Authorities

Apache Corporation personnel must liaison with local and state agencies to ensure a proper response to a major release. Additionally, the OCD must be notified of the release as soon as possible but no later than 4 hours. Agencies will ask for information such as type and volume of release, wind direction, location of release, etc. Be prepared with all information available including directions to site. The following call list of essential and potential responders has been prepared for use during a release. Apache's response must be in coordination with the State of New Mexico's *"Hazardous Materials Emergency Response Plan" (HMER).*

WELL CONTROL EMERGENCY RESPONSE PLAN

I. GENERAL PHILOSOPHY

Our objective is to ensure that during an emergency, a predetermined procedure is followed so that prompt decisions can be made based on accurate information.

The best way to handle and emergency is with an experienced organization set up for the sole purpose of solving the problem. The *Well Control Emergency Response Team* was organized to handle dangerous & expensive well control problems. The *Team* is structured such that each individual can contribute the most from his area of expertise. Key decision-makers are determined prior to an emergency to avoid confusion about who is in charge.

If the well is flowing uncontrolled at the surface or subsurface, *The Emergency Response Team* will be mobilized. The *Team* is customized for the people currently on the Apache staff. Staff changes may require a change in the plan.

II. EMERGENCY PROCEDURE ON DRILLING OR COMPLETION OPERATIONS

A. In the event of an emergency the *Drilling Foreman or Tool-Pusher* will immediately contact only one of the following starting with the first name listed:

Name	Office	Mobile	Home
Danny Laman – Drlg Superintendent	432-818-1022	432-634-0288	
John Vacek – Drilling Engineer	432-818-1882	281-222-1812	
Bobby Smith – Drilling Manager	432-818-1020	432-556-7701	
Bill Jones – EH&S Coordinator		432-967-9576	

***This one phone call will free the Drilling Foreman to devote his full time to securing the safety of personnel & equipment. This call will initiate the process to mobilize the Well Control Emergency Response Team. Apache maintains an Emergency Telephone Conference Room in the Houston office. This room is available for us by the Permian Region. The room has 50 separate telephone lines.*

B. The Apache employee contacted by the Drilling Foreman will begin contacting the rest of the *Team.* If **DANNY LAMAN** is out of contact, **JOHN VACEK** will be notified.

C. If a member of the *Emergency Response Team* is away from the job, he must be available for call back. Telephone numbers should be left with secretaries or a key decision-maker.

D. Apache's reporting procedure for spills or releases of oil or hazardous materials will be implemented when spills or releases have occurred or are probable.

EMERGENCY RESPONSE NUMBERS:

SHERIFF DEPARTMENT	
Eddy County	575-887-7551
Lea County	575-396-3611
FIRE DEPARTMENT	911
Artesia	575-746-5050
Carlsbad	575-885-2111
Eunice	575-394-2111
Hobbs	575-397-9308
Jal	575-395-2221
Lovington	575-396-2359
HOSPITALS	911
Artesia Medical Emergency	575-746-5050
Carlsbad Medical Emergency	575-885-2111
Eunice Medical Emergency	575-394-2112
Hobbs Medical Emergency	575-397-9308
Jal Medical Emergency	575-395-2221
Lovington Medical Emergency	575-396-2359
AGENT NOTIFICATIONS	
Bureau of Land Management	575-393-3612
New Mexico Oil Conservation Division	575-393-6161

PERMIAN

NW DISTRICT - NM EZ NAD 83
THUNDERBIRD DEV UNIT PAD (1,2,3,4)
THUNDERBIRD DEVL UNIT #4

THUNDERBIRD DEVL UNIT #4

Plan: Design #1

Standard Survey Report

19 October, 2018

apachecorp

Survey Report

Company:	PERMIAN	**Local Co-ordinate Reference:**	Well THUNDERBIRD DEVL UNIT #4
Project:	NW DISTRICT - NM EZ NAD 83	**TVD Reference:**	WELL @ 3764.0ft (Original Well Elev)
Site:	THUNDERBIRD DEV UNIT PAD (1,2,3,4)	**MD Reference:**	WELL @ 3764.0ft (Original Well Elev)
Well:	THUNDERBIRD DEVL UNIT #4	**North Reference:**	Grid
Wellbore:	THUNDERBIRD DEVL UNIT #4	**Survey Calculation Method:**	Minimum Curvature
Design:	Design #1	**Database:**	PEDM

Project NW DISTRICT - NM EZ NAD 83

Map System:	US State Plane 1983	**System Datum:**	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	New Mexico Eastern Zone		

Site THUNDERBIRD DEV UNIT PAD (1,2,3,4)

Site Position:		**Northing:**	683,581.90 ft	**Latitude:**	32° 52' 43.176 N
From:	Map	**Easting:**	652,371.90 ft	**Longitude:**	103° 58' 17.968 W
Position Uncertainty:	0.0 ft	**Slot Radius:**	13.200 in	**Grid Convergence:**	0.20 °

Well THUNDERBIRD DEVL UNIT #4

Well Position	**+N/-S**	0.0 ft	**Northing:**	683,581.50 ft	**Latitude:**	32° 52' 43.176 N
	+E/-W	0.0 ft	**Easting:**	652,252.10 ft	**Longitude:**	103° 58' 19.373 W
Position Uncertainty		0.0 ft	**Wellhead Elevation:**	0.0 ft	**Ground Level:**	3,738.0 ft

Wellbore THUNDERBIRD DEVL UNIT #4

Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	HDGM	10/16/2018	7.42	60.65	48,178

Design Design #1

Audit Notes:

Version:		**Phase:**	PLAN	**Tie On Depth:**	0.0

Vertical Section:	Depth From (TVD) (ft)	+N/-S (ft)	+E/-W (ft)	Direction (°)
	0.0	0.0	0.0	184.17

Survey Tool Program **Date** 10/16/2018

From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description
0.0	13,020.6	Design #1 (THUNDERBIRD DEVL UNIT #	MWD+HDGM (MWD)	OWSG MWD + HDGM

Planned Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.00	0.00	0.00
100.0	0.00	0.00	100.0	0.0	0.0	0.0	0.00	0.00	0.00
200.0	0.00	0.00	200.0	0.0	0.0	0.0	0.00	0.00	0.00
300.0	0.00	0.00	300.0	0.0	0.0	0.0	0.00	0.00	0.00
400.0	0.00	0.00	400.0	0.0	0.0	0.0	0.00	0.00	0.00
500.0	0.00	0.00	500.0	0.0	0.0	0.0	0.00	0.00	0.00
600.0	0.00	0.00	600.0	0.0	0.0	0.0	0.00	0.00	0.00
700.0	0.00	0.00	700.0	0.0	0.0	0.0	0.00	0.00	0.00
800.0	0.00	0.00	800.0	0.0	0.0	0.0	0.00	0.00	0.00
900.0	0.00	0.00	900.0	0.0	0.0	0.0	0.00	0.00	0.00

Company:	PERMIAN	**Local Co-ordinate Reference:**	Well THUNDERBIRD DEVL UNIT #4
Project:	NW DISTRICT - NM EZ NAD 83	**TVD Reference:**	WELL @ 3764.0ft (Original Well Elev)
Site:	THUNDERBIRD DEV UNIT PAD (1,2,3,4)	**MD Reference:**	WELL @ 3764.0ft (Original Well Elev)
Well:	THUNDERBIRD DEVL UNIT #4	**North Reference:**	Grid
Wellbore:	THUNDERBIRD DEVL UNIT #4	**Survey Calculation Method:**	Minimum Curvature
Design:	Design #1	**Database:**	PEDM

Planned Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
1,000.0	0.00	0.00	1,000.0	0.0	0.0	0.0	0.00	0.00	0.00
1,100.0	0.00	0.00	1,100.0	0.0	0.0	0.0	0.00	0.00	0.00
1,200.0	0.00	0.00	1,200.0	0.0	0.0	0.0	0.00	0.00	0.00
1,300.0	0.00	0.00	1,300.0	0.0	0.0	0.0	0.00	0.00	0.00
1,400.0	0.00	0.00	1,400.0	0.0	0.0	0.0	0.00	0.00	0.00
1,500.0	0.00	0.00	1,500.0	0.0	0.0	0.0	0.00	0.00	0.00
1,600.0	1.00	285.00	1,600.0	0.2	-0.8	-0.2	1.00	1.00	0.00
1,700.0	2.00	285.00	1,700.0	0.9	-3.4	-0.7	1.00	1.00	0.00
1,800.0	2.00	285.00	1,799.9	1.8	-6.7	-1.3	0.00	0.00	0.00
1,900.0	2.00	285.00	1,899.8	2.7	-10.1	-2.0	0.00	0.00	0.00
2,000.0	2.00	285.00	1,999.8	3.6	-13.5	-2.6	0.00	0.00	0.00
2,100.0	2.00	285.00	2,099.7	4.5	-16.9	-3.3	0.00	0.00	0.00
2,200.0	2.00	285.00	2,199.7	5.4	-20.2	-3.9	0.00	0.00	0.00
2,300.0	2.00	285.00	2,299.6	6.3	-23.6	-4.6	0.00	0.00	0.00
2,400.0	2.00	285.00	2,399.5	7.2	-27.0	-5.2	0.00	0.00	0.00
2,500.0	2.00	285.00	2,499.5	8.1	-30.3	-5.9	0.00	0.00	0.00
2,600.0	2.00	285.00	2,599.4	9.0	-33.7	-6.6	0.00	0.00	0.00
2,700.0	2.00	285.00	2,699.4	9.9	-37.1	-7.2	0.00	0.00	0.00
2,800.0	2.00	285.00	2,799.3	10.8	-40.5	-7.9	0.00	0.00	0.00
2,900.0	2.00	285.00	2,899.2	11.7	-43.8	-8.5	0.00	0.00	0.00
3,000.0	2.00	285.00	2,999.2	12.6	-47.2	-9.2	0.00	0.00	0.00
3,100.0	2.00	285.00	3,099.1	13.5	-50.6	-9.8	0.00	0.00	0.00
3,200.0	2.00	285.00	3,199.0	14.5	-53.9	-10.5	0.00	0.00	0.00
3,300.0	2.00	285.00	3,299.0	15.4	-57.3	-11.1	0.00	0.00	0.00
3,400.0	2.00	285.00	3,398.9	16.3	-60.7	-11.8	0.00	0.00	0.00
3,500.0	2.00	285.00	3,498.9	17.2	-64.0	-12.5	0.00	0.00	0.00
3,600.0	2.00	285.00	3,598.8	18.1	-67.4	-13.1	0.00	0.00	0.00
3,700.0	2.00	285.00	3,698.7	19.0	-70.8	-13.8	0.00	0.00	0.00
3,800.0	1.00	285.00	3,798.7	19.6	-73.3	-14.3	1.00	-1.00	0.00
3,900.0	0.00	0.00	3,898.7	19.9	-74.2	-14.4	1.00	-1.00	0.00
4,000.0	0.00	0.00	3,998.7	19.9	-74.2	-14.4	0.00	0.00	0.00
4,100.0	0.00	0.00	4,098.7	19.9	-74.2	-14.4	0.00	0.00	0.00
4,200.0	0.00	0.00	4,198.7	19.9	-74.2	-14.4	0.00	0.00	0.00
4,300.0	0.00	0.00	4,298.7	19.9	-74.2	-14.4	0.00	0.00	0.00
4,400.0	0.00	0.00	4,398.7	19.9	-74.2	-14.4	0.00	0.00	0.00
4,500.0	0.00	0.00	4,498.7	19.9	-74.2	-14.4	0.00	0.00	0.00
4,562.8	0.00	0.00	4,561.5	19.9	-74.2	-14.4	0.00	0.00	0.00
4,600.0	4.46	211.75	4,598.7	18.6	-74.9	-13.1	12.00	12.00	0.00
4,700.0	16.46	211.75	4,696.8	3.2	-84.5	2.9	12.00	12.00	0.00
4,800.0	28.46	211.75	4,789.1	-29.2	-104.5	36.7	12.00	12.00	0.00
4,900.0	40.46	211.75	4,871.4	-77.2	-134.3	86.8	12.00	12.00	0.00
5,000.0	52.46	211.75	4,940.1	-138.8	-172.3	150.9	12.00	12.00	0.00
5,100.0	64.46	211.75	4,992.3	-211.1	-217.1	226.4	12.00	12.00	0.00
5,200.0	76.46	211.75	5,025.7	-291.1	-266.6	309.7	12.00	12.00	0.00

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Survey Report

Company:	PERMIAN	**Local Co-ordinate Reference:**	Well THUNDERBIRD DEVL UNIT #4
Project:	NW DISTRICT - NM EZ NAD 83	**TVD Reference:**	WELL @ 3764.0ft (Original Well Elev)
Site:	THUNDERBIRD DEV UNIT PAD (1,2,3,4)	**MD Reference:**	WELL @ 3764.0ft (Original Well Elev)
Well:	THUNDERBIRD DEVL UNIT #4	**North Reference:**	Grid
Wellbore:	THUNDERBIRD DEVL UNIT #4	**Survey Calculation Method:**	Minimum Curvature
Design:	Design #1	**Database:**	PEDM

Planned Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
5,300.0	88.46	211.75	5,038.8	-375.3	-318.7	397.5	12.00	12.00	0.00
5,312.8	90.00	211.75	5,039.0	-386.1	-325.4	408.8	12.00	12.00	0.00
5,400.0	90.00	209.13	5,039.0	-461.3	-369.6	487.0	3.00	0.00	-3.00
5,500.0	90.00	206.13	5,039.0	-549.9	-416.0	578.7	3.00	0.00	-3.00
5,600.0	90.00	203.13	5,039.0	-640.8	-457.6	672.4	3.00	0.00	-3.00
5,700.0	90.00	200.13	5,039.0	-733.7	-494.5	767.8	3.00	0.00	-3.00
5,800.0	90.00	197.13	5,039.0	-828.5	-526.5	864.6	3.00	0.00	-3.00
5,900.0	90.00	194.13	5,039.0	-924.8	-553.4	962.6	3.00	0.00	-3.00
6,000.0	90.00	191.13	5,039.0	-1,022.3	-575.3	1,061.5	3.00	0.00	-3.00
6,100.0	90.00	188.13	5,039.0	-1,120.9	-592.0	1,161.0	3.00	0.00	-3.00
6,200.0	90.00	185.13	5,039.0	-1,220.2	-603.6	1,260.9	3.00	0.00	-3.00
6,300.0	90.00	182.13	5,039.0	-1,320.0	-609.9	1,360.9	3.00	0.00	-3.00
6,378.1	90.00	179.79	5,039.0	-1,398.1	-611.2	1,438.9	3.00	0.00	-3.00
6,400.0	89.56	179.79	5,039.0	-1,420.0	-611.1	1,460.7	2.00	-2.00	0.00
6,417.1	89.22	179.79	5,039.2	-1,437.1	-611.1	1,477.7	2.00	-2.00	0.00
6,500.0	89.22	179.79	5,040.4	-1,520.0	-610.8	1,560.4	0.00	0.00	0.00
6,600.0	89.22	179.79	5,041.7	-1,620.0	-610.4	1,660.1	0.00	0.00	0.00
6,700.0	89.22	179.79	5,043.1	-1,720.0	-610.0	1,759.8	0.00	0.00	0.00
6,800.0	89.22	179.79	5,044.4	-1,820.0	-609.7	1,859.5	0.00	0.00	0.00
6,900.0	89.22	179.79	5,045.8	-1,920.0	-609.3	1,959.2	0.00	0.00	0.00
7,000.0	89.22	179.79	5,047.2	-2,019.9	-608.9	2,058.9	0.00	0.00	0.00
7,100.0	89.22	179.79	5,048.5	-2,119.9	-608.6	2,158.6	0.00	0.00	0.00
7,200.0	89.22	179.79	5,049.9	-2,219.9	-608.2	2,258.3	0.00	0.00	0.00
7,300.0	89.22	179.79	5,051.2	-2,319.9	-607.8	2,358.0	0.00	0.00	0.00
7,400.0	89.22	179.79	5,052.6	-2,419.9	-607.5	2,457.7	0.00	0.00	0.00
7,500.0	89.22	179.79	5,054.0	-2,519.9	-607.1	2,557.4	0.00	0.00	0.00
7,600.0	89.22	179.79	5,055.3	-2,619.9	-606.7	2,657.1	0.00	0.00	0.00
7,700.0	89.22	179.79	5,056.7	-2,719.9	-606.3	2,756.8	0.00	0.00	0.00
7,800.0	89.22	179.79	5,058.0	-2,819.9	-606.0	2,856.5	0.00	0.00	0.00
7,900.0	89.22	179.79	5,059.4	-2,919.9	-605.6	2,956.2	0.00	0.00	0.00
8,000.0	89.22	179.79	5,060.7	-3,019.8	-605.2	3,055.9	0.00	0.00	0.00
8,100.0	89.22	179.79	5,062.1	-3,119.8	-604.9	3,155.6	0.00	0.00	0.00
8,200.0	89.22	179.79	5,063.5	-3,219.8	-604.5	3,255.3	0.00	0.00	0.00
8,300.0	89.22	179.79	5,064.8	-3,319.8	-604.1	3,355.0	0.00	0.00	0.00
8,400.0	89.22	179.79	5,066.2	-3,419.8	-603.8	3,454.7	0.00	0.00	0.00
8,500.0	89.22	179.79	5,067.5	-3,519.8	-603.4	3,554.4	0.00	0.00	0.00
8,600.0	89.22	179.79	5,068.9	-3,619.8	-603.0	3,654.1	0.00	0.00	0.00
8,700.0	89.22	179.79	5,070.3	-3,719.8	-602.7	3,753.8	0.00	0.00	0.00
8,800.0	89.22	179.79	5,071.6	-3,819.8	-602.3	3,853.5	0.00	0.00	0.00
8,900.0	89.22	179.79	5,073.0	-3,919.8	-601.9	3,953.2	0.00	0.00	0.00
9,000.0	89.22	179.79	5,074.3	-4,019.7	-601.6	4,052.9	0.00	0.00	0.00
9,100.0	89.22	179.79	5,075.7	-4,119.7	-601.2	4,152.6	0.00	0.00	0.00
9,200.0	89.22	179.79	5,077.1	-4,219.7	-600.8	4,252.3	0.00	0.00	0.00

apachecorp

Survey Report

Company:	PERMIAN	**Local Co-ordinate Reference:**	Well THUNDERBIRD DEVL UNIT #4
Project:	NW DISTRICT - NM EZ NAD 83	**TVD Reference:**	WELL @ 3764.0ft (Original Well Elev)
Site:	THUNDERBIRD DEV UNIT PAD (1,2,3,4)	**MD Reference:**	WELL @ 3764.0ft (Original Well Elev)
Well:	THUNDERBIRD DEVL UNIT #4	**North Reference:**	Grid
Wellbore:	THUNDERBIRD DEVL UNIT #4	**Survey Calculation Method:**	Minimum Curvature
Design:	Design #1	**Database:**	PEDM

Planned Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
9,300.0	89.22	179.79	5,078.4	-4,319.7	-600.5	4,352.0	0.00	0.00	0.00
9,400.0	89.22	179.79	5,079.8	-4,419.7	-600.1	4,451.7	0.00	0.00	0.00
9,500.0	89.22	179.79	5,081.1	-4,519.7	-599.7	4,551.4	0.00	0.00	0.00
9,600.0	89.22	179.79	5,082.5	-4,619.7	-599.4	4,651.1	0.00	0.00	0.00
9,700.0	89.22	179.79	5,083.9	-4,719.7	-599.0	4,750.8	0.00	0.00	0.00
9,800.0	89.22	179.79	5,085.2	-4,819.7	-598.6	4,850.5	0.00	0.00	0.00
9,900.0	89.22	179.79	5,086.6	-4,919.7	-598.3	4,950.2	0.00	0.00	0.00
10,000.0	89.22	179.79	5,087.9	-5,019.6	-597.9	5,049.9	0.00	0.00	0.00
10,100.0	89.22	179.79	5,089.3	-5,119.6	-597.5	5,149.5	0.00	0.00	0.00
10,200.0	89.22	179.79	5,090.7	-5,219.6	-597.2	5,249.2	0.00	0.00	0.00
10,300.0	89.22	179.79	5,092.0	-5,319.6	-596.8	5,348.9	0.00	0.00	0.00
10,400.0	89.22	179.79	5,093.4	-5,419.6	-596.4	5,448.6	0.00	0.00	0.00
10,500.0	89.22	179.79	5,094.7	-5,519.6	-596.1	5,548.3	0.00	0.00	0.00
10,600.0	89.22	179.79	5,096.1	-5,619.6	-595.7	5,648.0	0.00	0.00	0.00
10,700.0	89.22	179.79	5,097.4	-5,719.6	-595.3	5,747.7	0.00	0.00	0.00
10,800.0	89.22	179.79	5,098.8	-5,819.6	-595.0	5,847.4	0.00	0.00	0.00
10,900.0	89.22	179.79	5,100.2	-5,919.6	-594.6	5,947.1	0.00	0.00	0.00
11,000.0	89.22	179.79	5,101.5	-6,019.5	-594.2	6,046.8	0.00	0.00	0.00
11,100.0	89.22	179.79	5,102.9	-6,119.5	-593.9	6,146.5	0.00	0.00	0.00
11,200.0	89.22	179.79	5,104.2	-6,219.5	-593.5	6,246.2	0.00	0.00	0.00
11,300.0	89.22	179.79	5,105.6	-6,319.5	-593.1	6,345.9	0.00	0.00	0.00
11,400.0	89.22	179.79	5,107.0	-6,419.5	-592.8	6,445.6	0.00	0.00	0.00
11,500.0	89.22	179.79	5,108.3	-6,519.5	-592.4	6,545.3	0.00	0.00	0.00
11,600.0	89.22	179.79	5,109.7	-6,619.5	-592.0	6,645.0	0.00	0.00	0.00
11,700.0	89.22	179.79	5,111.0	-6,719.5	-591.7	6,744.7	0.00	0.00	0.00
11,800.0	89.22	179.79	5,112.4	-6,819.5	-591.3	6,844.4	0.00	0.00	0.00
11,900.0	89.22	179.79	5,113.8	-6,919.5	-590.9	6,944.1	0.00	0.00	0.00
12,000.0	89.22	179.79	5,115.1	-7,019.4	-590.6	7,043.8	0.00	0.00	0.00
12,100.0	89.22	179.79	5,116.5	-7,119.4	-590.2	7,143.5	0.00	0.00	0.00
12,200.0	89.22	179.79	5,117.8	-7,219.4	-589.8	7,243.2	0.00	0.00	0.00
12,300.0	89.22	179.79	5,119.2	-7,319.4	-589.4	7,342.9	0.00	0.00	0.00
12,400.0	89.22	179.79	5,120.6	-7,419.4	-589.1	7,442.6	0.00	0.00	0.00
12,500.0	89.22	179.79	5,121.9	-7,519.4	-588.7	7,542.3	0.00	0.00	0.00
12,600.0	89.22	179.79	5,123.3	-7,619.4	-588.3	7,642.0	0.00	0.00	0.00
12,700.0	89.22	179.79	5,124.6	-7,719.4	-588.0	7,741.7	0.00	0.00	0.00
12,800.0	89.22	179.79	5,126.0	-7,819.4	-587.6	7,841.4	0.00	0.00	0.00
12,900.0	89.22	179.79	5,127.4	-7,919.4	-587.2	7,941.1	0.00	0.00	0.00
13,000.0	89.22	179.79	5,128.7	-8,019.3	-586.9	8,040.8	0.00	0.00	0.00
13,021.1	89.22	179.79	5,129.0	-8,040.4	-586.8	8,061.8	0.00	0.00	0.00

Company:	PERMIAN	**Local Co-ordinate Reference:**	Well THUNDERBIRD DEVL UNIT #4
Project:	NW DISTRICT - NM EZ NAD 83	**TVD Reference:**	WELL @ 3764.0ft (Original Well Elev)
Site:	THUNDERBIRD DEV UNIT PAD (1,2,3,4)	**MD Reference:**	WELL @ 3764.0ft (Original Well Elev)
Well:	THUNDERBIRD DEVL UNIT #4	**North Reference:**	Grid
Wellbore:	THUNDERBIRD DEVL UNIT #4	**Survey Calculation Method:**	Minimum Curvature
Design:	Design #1	**Database:**	PEDM

Design Targets

Target Name - hit/miss target - Shape	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (ft)	Easting (ft)	Latitude	Longitude
bhl THUNDERBIRD DE\ - plan hits target center - Point	0.00	0.00	5,129.0	-8,040.4	-586.8	675,541.10	651,665.30	32° 51' 23.638 N	103° 58' 26.574 W

Checked By: _____ Approved By: _____ Date: _____

PERMIAN

NW DISTRICT - NM EZ NAD 83
THUNDERBIRD DEV UNIT PAD (1,2,3,4)
THUNDERBIRD DEVL UNIT #4

THUNDERBIRD DEVL UNIT #4

Plan: Design #1

Standard Survey Report

, 19 October, 2018

apachecorp

Survey Report

Company:	PERMIAN	**Local Co-ordinate Reference:**	Well THUNDERBIRD DEVL UN
Project:	NW DISTRICT - NM EZ NAD 83	**TVD Reference:**	WELL @ 3764.0ft (Original Wel
Site:	THUNDERBIRD DEV UNIT PAD (1,2,3,4)	**MD Reference:**	WELL @ 3764.0ft (Original Wel
Well:	THUNDERBIRD DEVL UNIT #4	**North Reference:**	Grid
Wellbore:	THUNDERBIRD DEVL UNIT #4	**Survey Calculation Method:**	Minimum Curvature
Design:	Design #1	**Database:**	PEDM

Project	NW DISTRICT - NM EZ NAD 83		
Map System:	US State Plane 1983	**System Datum:**	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	New Mexico Eastern Zone		

Site	THUNDERBIRD DEV UNIT PAD (1,2,3,4)				
Site Position:		**Northing:**	683,581.90 ft	**Latitude:**	
From:	Map	**Easting:**	652,371.90 ft	**Longitude:**	
Position Uncertainty:	0.0 ft	**Slot Radius:**	13.200 in	**Grid Convergence:**	

Well Position	**+N/-S**	0.0 ft	**Northing:**	683,581.50 ft	**Latitude:**
	+E/-W	0.0 ft	**Easting:**	652,252.10 ft	**Longitude:**
Position Uncertainty		0.0 ft	**Wellhead Elevation:**	0.0 ft	**Ground Level:**

Wellbore THUNDERBIRD DEVL UNIT #4

Magnetics	**Model Name**	**Sample Date**	**Declination (°)**	**Dip Angle (°)**	**Fi**
	HDGM	10/16/2018	7.42	60.65	

Design Design #1

Audit Notes:

Version:		**Phase:**	PLAN	**Tie On Depth:**	

Vertical Section:	**Depth From (TVD) (ft)**	**+N/-S (ft)**	**+E/-W (ft)**	**Direction (°)**

	0.0	0.0	0.0	184.17

Survey Tool Program **Date** 10/16/2018

From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description
0.0	13,020.6	Design #1 (THUNDERBIRD DEVL UNIT #	MWD+HDGM (MWD)	OWSG MWD + HDG

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vert Sec (f
0.0	0.00	0.00	0.0	0.0	0.0	
100.0	0.00	0.00	100.0	0.0	0.0	
200.0	0.00	0.00	200.0	0.0	0.0	
300.0	0.00	0.00	300.0	0.0	0.0	
400.0	0.00	0.00	400.0	0.0	0.0	
500.0	0.00	0.00	500.0	0.0	0.0	
600.0	0.00	0.00	600.0	0.0	0.0	
700.0	0.00	0.00	700.0	0.0	0.0	
800.0	0.00	0.00	800.0	0.0	0.0	
900.0	0.00	0.00	900.0	0.0	0.0	

Well THUNDERBIRD DEVL UNIT #4

Planned Survey

Planned Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vert Sec (f
1,000.0	0.00	0.00	1,000.0	0.0	0.0	
1,100.0	0.00	0.00	1,100.0	0.0	0.0	
1,200.0	0.00	0.00	1,200.0	0.0	0.0	
1,300.0	0.00	0.00	1,300.0	0.0	0.0	
1,400.0	0.00	0.00	1,400.0	0.0	0.0	
1,500.0	0.00	0.00	1,500.0	0.0	0.0	
1,600.0	1.00	285.00	1,600.0	0.2	-0.8	
1,700.0	2.00	285.00	1,700.0	0.9	-3.4	
1,800.0	2.00	285.00	1,799.9	1.8	-6.7	
1,900.0	2.00	285.00	1,899.8	2.7	-10.1	
2,000.0	2.00	285.00	1,999.8	3.6	-13.5	
2,100.0	2.00	285.00	2,099.7	4.5	-16.9	
2,200.0	2.00	285.00	2,199.7	5.4	-20.2	
2,300.0	2.00	285.00	2,299.6	6.3	-23.6	
2,400.0	2.00	285.00	2,399.5	7.2	-27.0	
2,500.0	2.00	285.00	2,499.5	8.1	-30.3	
2,600.0	2.00	285.00	2,599.4	9.0	-33.7	

2,700.0	2.00	285.00	2,699.4	9.9	-37.1
2,800.0	2.00	285.00	2,799.3	10.8	-40.5
2,900.0	2.00	285.00	2,899.2	11.7	-43.8
3,000.0	2.00	285.00	2,999.2	12.6	-47.2
3,100.0	2.00	285.00	3,099.1	13.5	-50.6
3,200.0	2.00	285.00	3,199.0	14.5	-53.9
3,300.0	2.00	285.00	3,299.0	15.4	-57.3
3,400.0	2.00	285.00	3,398.9	16.3	-60.7
3,500.0	2.00	285.00	3,498.9	17.2	-64.0
3,600.0	2.00	285.00	3,598.8	18.1	-67.4
3,700.0	2.00	285.00	3,698.7	19.0	-70.8
3,800.0	1.00	285.00	3,798.7	19.6	-73.3
3,900.0	0.00	0.00	3,898.7	19.9	-74.2
4,000.0	0.00	0.00	3,998.7	19.9	-74.2
4,100.0	0.00	0.00	4,098.7	19.9	-74.2
4,200.0	0.00	0.00	4,198.7	19.9	-74.2
4,300.0	0.00	0.00	4,298.7	19.9	-74.2
4,400.0	0.00	0.00	4,398.7	19.9	-74.2
4,500.0	0.00	0.00	4,498.7	19.9	-74.2
4,562.8	0.00	0.00	4,561.5	19.9	-74.2
4,600.0	4.46	211.75	4,598.7	18.6	-74.9
4,700.0	16.46	211.75	4,696.8	3.2	-84.5
4,800.0	28.46	211.75	4,789.1	-29.2	-104.5
4,900.0	40.46	211.75	4,871.4	-77.2	-134.3
5,000.0	52.46	211.75	4,940.1	-138.8	-172.3
5,100.0	64.46	211.75	4,992.3	-211.1	-217.1
5,200.0	76.46	211.75	5,025.7	-291.1	-266.6

Planned Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vert Sec (f
5,300.0	88.46	211.75	5,038.8	-375.3	-318.7	
5,312.8	90.00	211.75	5,039.0	-386.1	-325.4	
5,400.0	90.00	209.13	5,039.0	-461.3	-369.6	
5,500.0	90.00	206.13	5,039.0	-549.9	-416.0	
5,600.0	90.00	203.13	5,039.0	-640.8	-457.6	
5,700.0	90.00	200.13	5,039.0	-733.7	-494.5	
5,800.0	90.00	197.13	5,039.0	-828.5	-526.5	
5,900.0	90.00	194.13	5,039.0	-924.8	-553.4	
6,000.0	90.00	191.13	5,039.0	-1,022.3	-575.3	
6,100.0	90.00	188.13	5,039.0	-1,120.9	-592.0	
6,200.0	90.00	185.13	5,039.0	-1,220.2	-603.6	
6,300.0	90.00	182.13	5,039.0	-1,320.0	-609.9	
6,378.1	90.00	179.79	5,039.0	-1,398.1	-611.2	
6,400.0	89.56	179.79	5,039.0	-1,420.0	-611.1	
6,417.1	89.22	179.79	5,039.2	-1,437.1	-611.1	
6,500.0	89.22	179.79	5,040.4	-1,520.0	-610.8	
6,600.0	89.22	179.79	5,041.7	-1,620.0	-610.4	
6,700.0	89.22	179.79	5,043.1	-1,720.0	-610.0	
6,800.0	89.22	179.79	5,044.4	-1,820.0	-609.7	
6,900.0	89.22	179.79	5,045.8	-1,920.0	-609.3	
7,000.0	89.22	179.79	5,047.2	-2,019.9	-608.9	
7,100.0	89.22	179.79	5,048.5	-2,119.9	-608.6	

7,200.0	89.22	179.79	5,049.9	-2,219.9	-608.2
7,300.0	89.22	179.79	5,051.2	-2,319.9	-607.8
7,400.0	89.22	179.79	5,052.6	-2,419.9	-607.5
7,500.0	89.22	179.79	5,054.0	-2,519.9	-607.1
7,600.0	89.22	179.79	5,055.3	-2,619.9	-606.7
7,700.0	89.22	179.79	5,056.7	-2,719.9	-606.3
7,800.0	89.22	179.79	5,058.0	-2,819.9	-606.0
7,900.0	89.22	179.79	5,059.4	-2,919.9	-605.6
8,000.0	89.22	179.79	5,060.7	-3,019.8	-605.2
8,100.0	89.22	179.79	5,062.1	-3,119.8	-604.9
8,200.0	89.22	179.79	5,063.5	-3,219.8	-604.5
8,300.0	89.22	179.79	5,064.8	-3,319.8	-604.1
8,400.0	89.22	179.79	5,066.2	-3,419.8	-603.8
8,500.0	89.22	179.79	5,067.5	-3,519.8	-603.4
8,600.0	89.22	179.79	5,068.9	-3,619.8	-603.0
8,700.0	89.22	179.79	5,070.3	-3,719.8	-602.7
8,800.0	89.22	179.79	5,071.6	-3,819.8	-602.3
8,900.0	89.22	179.79	5,073.0	-3,919.8	-601.9
9,000.0	89.22	179.79	5,074.3	-4,019.7	-601.6
9,100.0	89.22	179.79	5,075.7	-4,119.7	-601.2
9,200.0	89.22	179.79	5,077.1	-4,219.7	-600.8

Planned Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vert Sec (f
9,300.0	89.22	179.79	5,078.4	-4,319.7	-600.5	
9,400.0	89.22	179.79	5,079.8	-4,419.7	-600.1	
9,500.0	89.22	179.79	5,081.1	-4,519.7	-599.7	
9,600.0	89.22	179.79	5,082.5	-4,619.7	-599.4	
9,700.0	89.22	179.79	5,083.9	-4,719.7	-599.0	
9,800.0	89.22	179.79	5,085.2	-4,819.7	-598.6	
9,900.0	89.22	179.79	5,086.6	-4,919.7	-598.3	
10,000.0	89.22	179.79	5,087.9	-5,019.6	-597.9	
10,100.0	89.22	179.79	5,089.3	-5,119.6	-597.5	
10,200.0	89.22	179.79	5,090.7	-5,219.6	-597.2	
10,300.0	89.22	179.79	5,092.0	-5,319.6	-596.8	
10,400.0	89.22	179.79	5,093.4	-5,419.6	-596.4	
10,500.0	89.22	179.79	5,094.7	-5,519.6	-596.1	
10,600.0	89.22	179.79	5,096.1	-5,619.6	-595.7	
10,700.0	89.22	179.79	5,097.4	-5,719.6	-595.3	
10,800.0	89.22	179.79	5,098.8	-5,819.6	-595.0	
10,900.0	89.22	179.79	5,100.2	-5,919.6	-594.6	
11,000.0	89.22	179.79	5,101.5	-6,019.5	-594.2	
11,100.0	89.22	179.79	5,102.9	-6,119.5	-593.9	
11,200.0	89.22	179.79	5,104.2	-6,219.5	-593.5	
11,300.0	89.22	179.79	5,105.6	-6,319.5	-593.1	
11,400.0	89.22	179.79	5,107.0	-6,419.5	-592.8	
11,500.0	89.22	179.79	5,108.3	-6,519.5	-592.4	
11,600.0	89.22	179.79	5,109.7	-6,619.5	-592.0	
11,700.0	89.22	179.79	5,111.0	-6,719.5	-591.7	
11,800.0	89.22	179.79	5,112.4	-6,819.5	-591.3	
11,900.0	89.22	179.79	5,113.8	-6,919.5	-590.9	
12,000.0	89.22	179.79	5,115.1	-7,019.4	-590.6	

12,100.0	89.22	179.79	5,116.5	-7,119.4	-590.2
12,200.0	89.22	179.79	5,117.8	-7,219.4	-589.8
12,300.0	89.22	179.79	5,119.2	-7,319.4	-589.4
12,400.0	89.22	179.79	5,120.6	-7,419.4	-589.1
12,500.0	89.22	179.79	5,121.9	-7,519.4	-588.7
12,600.0	89.22	179.79	5,123.3	-7,619.4	-588.3
12,700.0	89.22	179.79	5,124.6	-7,719.4	-588.0
12,800.0	89.22	179.79	5,126.0	-7,819.4	-587.6
12,900.0	89.22	179.79	5,127.4	-7,919.4	-587.2
13,000.0	89.22	179.79	5,128.7	-8,019.3	-586.9
13,021.1	89.22	179.79	5,129.0	-8,040.4	-586.8

Design Targets

Target Name - hit/miss target - Shape	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (ft)	Eas (f
bhl THUNDERBIRD DEVL UNIT - plan hits target center - Point	0.00	0.00	5,129.0	-8,040.4	-586.8	675,541.10	6

Checked By: Approved By: Date:

IIT #4

l Elev)

l Elev)

32° 52' 43.176 N

103° 58' 17.968 W

0.20 °

32° 52' 43.176 N

103° 58' 19.373 W

3,738.0 ft

eld Strength (nT)

48,178

0.0

M

tical tion t)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
0.0	0.00	0.00	0.00
0.0	0.00	0.00	0.00
0.0	0.00	0.00	0.00
0.0	0.00	0.00	0.00
0.0	0.00	0.00	0.00
0.0	0.00	0.00	0.00
0.0	0.00	0.00	0.00
0.0	0.00	0.00	0.00
0.0	0.00	0.00	0.00
0.0	0.00	0.00	0.00

tical tion t)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
0.0	0.00	0.00	0.00
0.0	0.00	0.00	0.00
0.0	0.00	0.00	0.00
0.0	0.00	0.00	0.00
0.0	0.00	0.00	0.00
0.0	0.00	0.00	0.00
-0.2	1.00	1.00	0.00
-0.7	1.00	1.00	0.00
-1.3	0.00	0.00	0.00
-2.0	0.00	0.00	0.00
-2.6	0.00	0.00	0.00
-3.3	0.00	0.00	0.00
-3.9	0.00	0.00	0.00
-4.6	0.00	0.00	0.00
-5.2	0.00	0.00	0.00
-5.9	0.00	0.00	0.00
-6.6	0.00	0.00	0.00

-7.2	0.00	0.00	0.00
-7.9	0.00	0.00	0.00
-8.5	0.00	0.00	0.00
-9.2	0.00	0.00	0.00
-9.8	0.00	0.00	0.00
-10.5	0.00	0.00	0.00
-11.1	0.00	0.00	0.00
-11.8	0.00	0.00	0.00
-12.5	0.00	0.00	0.00
-13.1	0.00	0.00	0.00
-13.8	0.00	0.00	0.00
-14.3	1.00	-1.00	0.00
-14.4	1.00	-1.00	0.00
-14.4	0.00	0.00	0.00
-14.4	0.00	0.00	0.00
-14.4	0.00	0.00	0.00
-14.4	0.00	0.00	0.00
-14.4	0.00	0.00	0.00
-14.4	0.00	0.00	0.00
-14.4	0.00	0.00	0.00
-13.1	12.00	12.00	0.00
2.9	12.00	12.00	0.00
36.7	12.00	12.00	0.00
86.8	12.00	12.00	0.00
150.9	12.00	12.00	0.00
226.4	12.00	12.00	0.00
309.7	12.00	12.00	0.00

tical tion t)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
397.5	12.00	12.00	0.00
408.8	12.00	12.00	0.00
487.0	3.00	0.00	-3.00
578.7	3.00	0.00	-3.00
672.4	3.00	0.00	-3.00
767.8	3.00	0.00	-3.00
864.6	3.00	0.00	-3.00
962.6	3.00	0.00	-3.00
1,061.5	3.00	0.00	-3.00
1,161.0	3.00	0.00	-3.00
1,260.9	3.00	0.00	-3.00
1,360.9	3.00	0.00	-3.00
1,438.9	3.00	0.00	-3.00
1,460.7	2.00	-2.00	0.00
1,477.7	2.00	-2.00	0.00
1,560.4	0.00	0.00	0.00
1,660.1	0.00	0.00	0.00
1,759.8	0.00	0.00	0.00
1,859.5	0.00	0.00	0.00
1,959.2	0.00	0.00	0.00
2,058.9	0.00	0.00	0.00
2,158.6	0.00	0.00	0.00

2,258.3	0.00	0.00	0.00
2,358.0	0.00	0.00	0.00
2,457.7	0.00	0.00	0.00
2,557.4	0.00	0.00	0.00
2,657.1	0.00	0.00	0.00
2,756.8	0.00	0.00	0.00
2,856.5	0.00	0.00	0.00
2,956.2	0.00	0.00	0.00
3,055.9	0.00	0.00	0.00
3,155.6	0.00	0.00	0.00
3,255.3	0.00	0.00	0.00
3,355.0	0.00	0.00	0.00
3,454.7	0.00	0.00	0.00
3,554.4	0.00	0.00	0.00
3,654.1	0.00	0.00	0.00
3,753.8	0.00	0.00	0.00
3,853.5	0.00	0.00	0.00
3,953.2	0.00	0.00	0.00
4,052.9	0.00	0.00	0.00
4,152.6	0.00	0.00	0.00
4,252.3	0.00	0.00	0.00

tical tion t)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
4,352.0	0.00	0.00	0.00
4,451.7	0.00	0.00	0.00
4,551.4	0.00	0.00	0.00
4,651.1	0.00	0.00	0.00
4,750.8	0.00	0.00	0.00
4,850.5	0.00	0.00	0.00
4,950.2	0.00	0.00	0.00
5,049.9	0.00	0.00	0.00
5,149.5	0.00	0.00	0.00
5,249.2	0.00	0.00	0.00
5,348.9	0.00	0.00	0.00
5,448.6	0.00	0.00	0.00
5,548.3	0.00	0.00	0.00
5,648.0	0.00	0.00	0.00
5,747.7	0.00	0.00	0.00
5,847.4	0.00	0.00	0.00
5,947.1	0.00	0.00	0.00
6,046.8	0.00	0.00	0.00
6,146.5	0.00	0.00	0.00
6,246.2	0.00	0.00	0.00
6,345.9	0.00	0.00	0.00
6,445.6	0.00	0.00	0.00
6,545.3	0.00	0.00	0.00
6,645.0	0.00	0.00	0.00
6,744.7	0.00	0.00	0.00
6,844.4	0.00	0.00	0.00
6,944.1	0.00	0.00	0.00
7,043.8	0.00	0.00	0.00

7,143.5	0.00	0.00	0.00
7,243.2	0.00	0.00	0.00
7,342.9	0.00	0.00	0.00
7,442.6	0.00	0.00	0.00
7,542.3	0.00	0.00	0.00
7,642.0	0.00	0.00	0.00
7,741.7	0.00	0.00	0.00
7,841.4	0.00	0.00	0.00
7,941.1	0.00	0.00	0.00
8,040.8	0.00	0.00	0.00
8,061.8	0.00	0.00	0.00

ting t)	Latitude	Longitude
;51,665.30	32° 51' 23.638 N	103° 58' 26.574 W