

State of New Mexico
Energy, Minerals and Natural Resources Department

Michelle Lujan Grisham
Governor

Sarah Cottrell Propst
Cabinet Secretary

Todd E. Leahy, JD, PhD
Deputy Secretary

Adrienne Sandoval, Division Director
Oil Conservation Division



New Mexico Oil Conservation Division approval and conditions listed below are made in accordance with OCD Rule 19.15.7.11 and are in addition to the actions approved by BLM on the following 3160-3 APD form.

Operator Signature Date: 3/13/2019

Well information;

Operator LOGOS, Well Name and Number Federal 2407 28mCom1H

API# 30-039-31380, Section 28, Township 24NS, Range 7 EW

Conditions of Approval: (See the below checked and handwritten conditions)

- ☒ Notify Aztec OCD 24hrs prior to casing & cement.
- ☒ Hold C-104 for directional survey & "As Drilled" Plat - 5.9 compliance
- ☒ Hold C-104 for NSL, NSP, DHC pending perforations
- ☐ Spacing rule violation. Operator must follow up with change of status notification on other well to be shut in or abandoned
- ☐ Regarding the use of a pit, closed loop system or below grade tank, the operator must comply with the following as applicable:
 - A pit requires a complete C-144 be submitted and approved prior to the construction or use of the pit, pursuant to 19.15.17.8.A
 - A closed loop system requires notification prior to use, pursuant to 19.15.17.9.A
 - A below grade tank requires a registration be filed prior to the construction or use of the below grade tank, pursuant to 19.15.17.8.C
- ☐ Once the well is spud, to prevent ground water contamination through whole or partial conduits from the surface, the operator shall drill without interruption through the fresh water zone or zones and shall immediately set in cement the water protection string
- ☐ Submit Gas Capture Plan form prior to spudding or initiating recompletion operations
- ☒ Regarding Hydraulic Fracturing, review EPA Underground Injection Control Guidance 84
- ☒ Oil base muds are not to be used until fresh water zones are cased and cemented providing isolation from the oil or diesel. This includes synthetic oils. Oil based mud, drilling fluids and solids must be contained in a steel closed loop system.
- ☒ Well-bore communication is regulated under 19.15.29 NMAC. This requires well-bore Communication to be reported in accordance with 19.15.29.8.
- ☒ If cement doesn't circulate on any string notify regulatory agencies before proceeding


NMOCD Approved by Signature

12/12/19
Date

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

APPLICATION FOR PERMIT TO DRILL OR REENTER

NMOC

NOV 12 2019

DISTRICT 11

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

1a. Type of work: ☒ DRILL ☐ REENTER		5. Lease Serial No. NMNM0557391
1b. Type of Well: ☒ Oil Well ☐ Gas Well ☐ Other		6. If Indian, Allottee or Tribe Name
1c. Type of Completion: ☐ Hydraulic Fracturing ☒ Single Zone ☐ Multiple Zone		7. If Unit or CA Agreement, Name and No. NMNM139655
2. Name of Operator LOGOS OPERATING LLC		8. Lease Name and Well No. FEDERAL 2407 28M COM 1H
3a. Address 2010 Afton Place FARMINGTON NM 87401	3b. Phone No. (include area code) (505)324-4145	9. API Well No. 30-039-31380
4. Location of Well (Report location clearly and in accordance with any State requirements. *) At surface SWSW / 0 FSL / 863 FWL / LAT 36.277359 / LONG -107.586293 At proposed prod. zone SWSW / 20 FSL / 330 FWL / LAT 36.262976 / LONG -107.587755		10. Field and Pool, or Exploratory ESCRITO / GALLUP
11. Sec., T. R. M. or Blk. and Survey or Area SEC 28 / T24N / R7W / NMP		12. County or Parish RIO ARRIBA
13. State NM		14. Distance in miles and direction from nearest town or post office* 46.9 miles
15. Distance from proposed* location to nearest property or lease line, ft. (Also to nearest drig. unit line, if any) 0 feet	16. No of acres in lease 562.37	17. Spacing Unit dedicated to this well 320
18. Distance from proposed location* to nearest well, drilling, completed, applied for, on this lease, ft. 30 feet	19. Proposed Depth 6052 feet / 11991 feet	20. BLM/BIA Bond No. in file FED: NMB001387
21. Elevations (Show whether DF, KDB, RT, GL, etc.) 7388 feet	22. Approximate date work will start* 04/01/2019	23. Estimated duration 45 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. | 4. Bond to cover the operations unless covered by an existing bond on file (see Item 20 above). |
| 2. A Drilling Plan. | 5. Operator certification. |
| 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). | 6. Such other site specific information and/or plans as may be requested by the BLM. |

25. Signature (Electronic Submission)	Name (Printed/Typed) Marie Florez / Ph: (505)324-4145	Date 03/13/2019
Title Regulatory Specialist		
Approved by (Signature) (Electronic Submission)	Name (Printed/Typed) Richard Fields / Ph: (505)564-7612	Date 11/07/2019
Title Field Manager		
Office FARMINGTON		

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.



NMOC

DISTRICT I
1625 N. French Dr., Hobbs, N.M. 88240
Phone: (575) 393-6161 Fax: (575) 393-0720

DISTRICT II
811 S. First St., Artesia, N.M. 86210
Phone: (575) 748-1283 Fax: (575) 748-9720

DISTRICT III
1000 Rio Brazos Rd., Artesia, N.M. 87410
Phone: (505) 334-6176 Fax: (505) 334-6170

DISTRICT IV
1220 S. St. Francis Dr., Santa Fe, NM 87505
Phone: (505) 476-3460 Fax: (505) 476-3462

State of New Mexico
Energy, Minerals & Natural Resources Department
OIL CONSERVATION DIVISION
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-102
Revised August 1, 2011
Submit one copy to appropriate
District Office

☐ AMENDED REPORT

WELL LOCATION AND ACREAGE DEDICATION PLAT

¹ API Number 30-039-31380	² Pool Code 22619	³ Pool Name ESCRITO GALLUP
⁴ Property Code 3216485	⁵ Property Name FEDERAL 2407 28M COM	⁶ Well Number 1H
⁷ GRID No. 289408	⁸ Operator Name LOGOS OPERATING, LLC	⁹ Elevation 7388

¹⁰ Surface Location

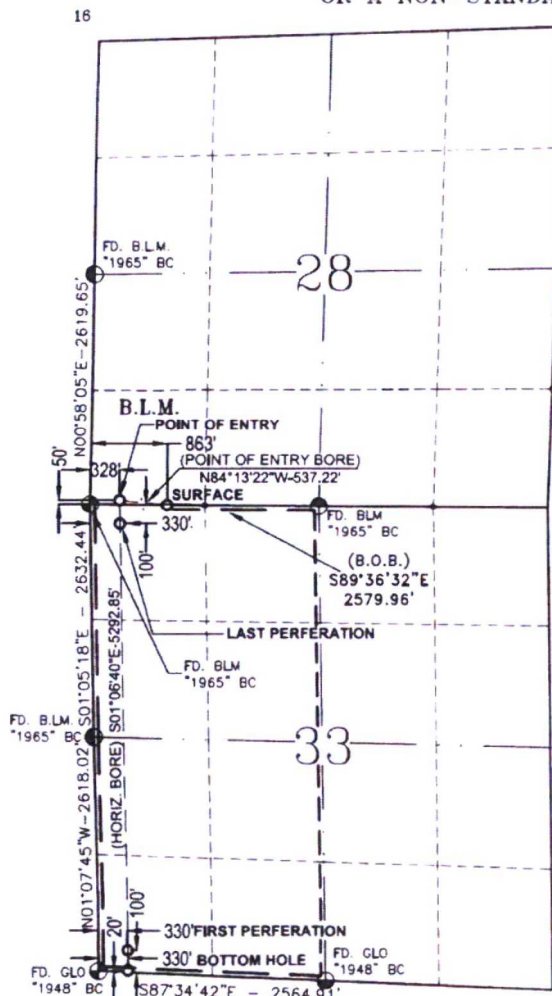
UL or lot no	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
M	28	24-N	7-W		0	SOUTH	863	WEST	RIO ARRIBA

¹¹ Bottom Hole Location If Different From Surface

UL or lot no	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
M	33	24-N	7-W		20	SOUTH	330	WEST	RIO ARRIBA

¹² Dedicated Acres EG= W/2 320 ACRE SEC. 33	¹³ Joint or Infill	¹⁴ Consolidation Code	¹⁵ Order No.
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NO ALLOWABLE WILL BE ASSIGNED TO THIS COMPLETION UNTIL ALL INTERESTS HAVE BEEN CONSOLIDATED
OR A NON-STANDARD UNIT HAS BEEN APPROVED BY THE DIVISION



SURFACE
0' FSL, 863' FWL SEC. 28
LATITUDE: 36°16.6408' N
LONGITUDE: 107°35.1411' W
NAD27
LATITUDE: 36.277359° N
LONGITUDE: 107.586293° W
NAD83

POINT OF ENTRY
50' FSL, 328' FWL SEC. 28
LATITUDE: 36°16.6497' N
LONGITUDE: 107°35.2498' W
NAD27
LATITUDE: 36.277507° N
LONGITUDE: 107.588105° W
NAD83

FIRST PERFERATION
100' FSL, 330' FWL SEC. 33
LATITUDE: 36°15.7910' N
LONGITUDE: 107°35.2291' W
NAD27
LATITUDE: 36.263196° N
LONGITUDE: 107.587760° W
NAD83

BOTTOM HOLE
20' FSL, 330' FWL SEC. 33
LATITUDE: 36°15.7778' N
LONGITUDE: 107°35.2288' W
NAD27
LATITUDE: 36.262976° N
LONGITUDE: 107.587755° W
NAD83

BASIS OF BEARING:

BETWEEN FOUND MONUMENTS AT THE
NORTHWEST CORNER AND THE NORTH QUARTER
CORNER OF SECTION 33, TOWNSHIP 24 NORTH,
RANGE 7 WEST, N.M.P.M. RIO ARRIBA COUNTY,
NEW MEXICO.

LINE BEARS: S 89°36'32" E A DISTANCE OF
2579.96 FEET AS MEASURED BY G.P.S. LOCAL
GRID NAD83.



17 OPERATOR CERTIFICATION

I hereby certify that the information contained herein
is true and complete to the best of my knowledge and
belief, and that this organization either owns
a working interest or unleased mineral interest in the
land including the proposed bottom hole location or
has a right to drill this well at this location pursuant
to a contract with an owner of such a mineral or
a working interest, or to a voluntary pooling agreement
or a compulsory pooling order heretofore entered by the
division.

Signature Mary G. Hartz Date _____

Printed Name _____

E-mail Address _____

18 SURVEYOR CERTIFICATION

I hereby certify that the well location shown on this plat
was plotted from field notes of actual surveys made by
me or under my supervision, and that the same is true
and correct to the best of my belief.

FEBRUARY 13, 2019

Date of Survey

Signature and Seal of Professional Surveyor



GLEN W. RUSSELL

Certificate Number

15703



LOGOS Operating, LLC Operations Plan

Note: This procedure will be adjusted onsite based upon actual conditions

Date:	February 6, 2019	Pool:	Escrito Gallup
Well Name:	Federal 2407 28M Com 1H	Elevation:	7,388'
Surface Location:	Sec 28, T24N, R7W 0 FNL, 863 FWL (36.277359° N, 107.586293° W – NAD83)	Measured Depth:	11,991'
Bottom Hole Location:	Sec 33, T24N, R7W 20 FSL, 330 FWL (36.262976° N, 107.587755° W – NAD83)	County:	Rio Arriba

Lease Serial #NMSF-0078924, NMNM-127900 (Unleased)

I. GEOLOGY

A. Formation Tops (KB): Estimated top of important geological markers:

SURFACE FORMATION - NACIMIENTO

NAME	MD	TVD	NAME	MD	TVD
OJO ALAMO	1872	1872	MENEFEE	4185	4170
KIRTLAND	2012	2012	*POINT LOOKOUT	4821	4802
*FRUITLAND	2392	2389	*MANCOS	5116	5095
*PICTURED CLIFFS	2527	2524	GALLUP	6075	6047
LEWIS	2666	2662	KICKOFF POINT	5,386	5,269
CHACRA	2981	2974	LANDING POINT	6,699	6,150
*CLIFF HOUSE	4122	4108	TD	11,991	6,052

* indicates depth at which anticipated water, oil, gas or other mineral bearing formations are expected to be encountered.

B. **MUD LOGGING PROGRAM:** Mudlogger on location from KOP to TD.

C. **LOGGING PROGRAM:** LWD GR from surface casing to TD.

D. **NATURAL GAUGES:** Gauge any noticeable increases in gas flow. Record all gauges in Tour book and on morning reports.

II. DRILLING

- A. **MUD PROGRAM:** LSND mud (WBM) will be used to drill the 12-1/4" Surface hole, the 8 3/4" Directional Vertical hole, and the curve portion of the wellbore. A LSND (WBM) or (OBM) will be used to drill the lateral portion of well. Treat for lost circulation as necessary. Obtain 100% returns prior to cementing. Notify Engineering of any mud losses.
- B. **BOPE TESTING:** While drill pipe is in use, the pipe rams and the blindrams will be function tested once each trip. The BOPE will be tested to **250 psi (Low) for 5 minutes** and **1500 psi (High) for 10 minutes**. Pressure test surface casing to **600 psi for 30 minutes** and intermediate casing to **1500 psi for 30 minutes**. Utilize a BOPE Testing Unit with a recording chart and appropriate test plug for testing. The drum brakes will be



inspected and tested each tour. All tests and inspections will be recorded and logged with time and results.

III. MATERIALS

A. CASING EQUIPMENT:

CASING TYPE	OH SIZE (IN)	DEPTH (MD)	CSG SIZE	WEIGHT	GRADE	CON N
SURFACE	12.25"	320'	9.625"	36 LBS	J-55 or equiv	STC
INTERMEDIATE	8.75"	6,699'	7"	23 LBS	J-55 or equiv	LTC
PRODUCTION	6.125"	6,549' – 11,991'	4.5"	11.6 LBS	P-110 or equiv	LTC
TIE BACK	6.125"	Surf. – 6,549'	4.5"	11.6 LBS	P-110 or equiv	LTC

B. FLOAT EQUIPMENT:

1. SURFACE CASING: 9-5/8" notched regular pattern guide shoe. Run (1) standard centralizer on each of the bottom (4) joints of Surface Casing.
2. INTERMEDIATE CASING: 7" cement nose guide shoe with a self-fill insert float. Place float collar one joint above the shoe. Install (1) centralizer on each of the bottom (3) joints and one standard centralizer every (3) joints to 2,500 ft. Run (1) centralizer at 2,500 ft., 2,300ft., 2,000ft., 1,500 ft., and 1,000 ft.
3. PRODUCTION LINER: Run 4-1/2" Liner with cement nose guide Float Shoe+ 2jts. of 4-1/2" casing+ Landing Collar+ 4-1/2" pup joint+ 1 RSI (Sliding Sleeve) positioned inside the 100 ft Hard line. Centralizer program will be determined by wellbore condition. Set seals on Liner Hanger. Liner to be pressure tested during completion operations.

C. CEMENTING:

(Note: Volumes may be adjusted onsite due to actual conditions)

1. SURFACE: 5 bbl Fresh Water Spacer, 100 sx (161 cu.ft.) of 14.5 ppg Type 1-11 (Neat G) + 20% Fly Ash cement w/ 7.41 gal/sack mix water ratio @ 1.61 cu ft/sx yield. Calculated @volume+ 50% excess. WOC 12 hours. Test csg to 600 psi. Total Volume: (160cu-ft/100 sx/ Bbls). TOC at Surface.
2. INTERMEDIATE: Stage 1: Spacer #1: 20 bbl (112 cuft) Chemwash. Lead Cement: 226.5 bbls, 652 sks (1272 cu.ft.), 12.3 ppg@ 1.95 cuft/sk yield. Tail Cement: 58 bbls, 250 sks, (325 cuft), 13.5 ppg@ 1.3 cu'ft/sk yield. Displacement: Displace w/ +/- 262 bbl Drilling mud or water. Total Cement: 284 bbls, 902 sks, (1597 cuft)
3. PRODUCTION LINER: Spacer #1: 10 bbl (56 cu-ft) Water Spacer. Spacer #2: 40 bbl 9.5 ppg (224.6 cu-ft) Tuned Spacer III. Spacer #3: 10 bbl Water Spacer. Lead Cement: Extencem TM System. Yield 1.36 cuft/sk 13.3 ppg (491 sx / 668 cuft /119 bbls). Tail Spacer: 40 BBL of MMCR. Displacement: Displace w/ +/- 155 bbl.



IV. COMPLETION

A. CBL

CBLs and/or Temperature Surveys Will Be Performed as Needed or Required

B. PRESSURE TEST

Pressure test 4-1/2" casing to 4000 psi max, hold at 1500 psi for 30 minutes. Increase pressure to Open RSI sleeves.

C. STIMULATION

Stimulate with sand, water and N₂. Isolate stages with flow through frac plugs. Drill out frac plugs and flowback lateral.

D. PRODUCTION TUBING

Run 2-7/8", 6.5#, J-55, EUE tubing

Surface Casing Design - Evacuated/Max SICP (collapse & burst), 100k overpull (tension)

Federal 2407 28M Com 1H

	Size	Weight	Grade	Conn	Collapse	Burst	Tension	Notes
Surface	9.625	36	J55	STC	2,020	3,520	394,000	0' - 320'
					1.125	1.000	1.200	

341 psi (Maximum Estimated SIP)

36 ppf K55 STC

Collapse	Casing Depth	MW in	MW out	Pres in	Pres out	SF
	320	0	9	0	146	13.79

Burst	320	9	0	146	0	24.04
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Tension	Casing Depth	Mud Wt	Air Wt	Bouy Wt	BW +100k	SF	100k over pull
	320	9	11,520	9,937	109,937	3.58	
		BF					BF= 1- (MW)/65.5
		0.8626					

Intermediate Casing Design - Evacuated/Max Mud Wt (collapse & burst), 100k overpull (tension)

Federal 2407 28M Com 1H										
Intermediate Interval 1	Top Interval	Btm Interval	Size	Weight	Grade	Conn	Collapse	Burst	Tension	Notes
	0	6699	7	23	J55	LTC	3,270 1.125	4,360 1.000	313,000 1.200	0'-6699'

Collapse

Interval 1	Top Interval	Btm Interval	Depth TVD	MW in	MW out	Pres in	Pres out	SF - 1.125
23	J55	6699	6150	0	9	0	2878	1.14

Burst

Interval 1	Top Interval	Btm Interval	Depth TVD	MW in	MW out	Pres in	Pres out	SF - 1.0	Frac Pres
23	J55	6699	6150	9	0	2878 2878	0	1.51	0

Tension

Interval 1	Top Interval	Btm Interval	Depth TVD	Mud Wt	Air Wt	Bouy Wt	BW +100k	SF - 1.2
23	J55	6699	6150	9 BF 0.8626	141,450	122,014	222,014	1.41

$$BF = 1 - (MW)/65.5$$

Liner Casing Design - Evacuation/Max Mud Wt (collapse), Max Frac Pres (burst) & 100k overpull (tension)

Federal 2407 28M Com 1H

Liner	Size	Weight	Grade	Conn	Collapse	Burst	Tension	Notes
Interval 1	4.5	11.6	P-110	LTC	7,560 1.125	10,690 1.000	278,000 1.200	TD 11991', TVD 6150'
Collapse	Casing Depth (TVD) 6150	MW in 0.00	MW out 9.00	Pres in 0	Pres out 2878	SF 2.63		
Burst	6150	9.00	0.00	2878 9378	0	1.14	6500	6500 psi frac pressure + no backup Burst pressure = Hyd + frac pressure
Tension	6150	Mud Wt 8.80 BF 0.8656	Air Wt 71,340	Bouy Wt 61,755	BW +100k 161,755	1.72		100k over pull BF= 1- (MW)/65.5



Company: Logos Operating LLC
 Project: Rio Arriba, NM NAD83
 Site: Federal 2407-28M
 Well: Federal 2407-28M 1H
 Wellbore: OH
 Design: Plan #2

PROJECT DETAILS: Rio Arriba, NM NAD83

Geodetic System: US State Plane 1983
 Datum: North American Datum 1983
 Ellipsoid: GRS 1980
 Zone: New Mexico Western Zone
 System Datum: Mean Sea Level
 Local North: True



Azimuths to True North
 Magnetic North: 8.75°

Magnetic Field
 Strength: 49492.9nT
 Dip Angle: 62.87°
 Date: 12/17/2018
 Model: HDGM

WELL DETAILS: Federal 2407-28M 1H

GL 7388' & RKB 14' @ 7402.00usft
 +N/-S +E/-W Northing Easting Latitude Longitude
 0.00 0.00 1920350.72 2795906.42 36.2773590 -107.5862930

Plan: Plan #2 (Federal 2407-28M 1H/OH)

Created By: Janie Collins Date: 12:53, January 03 2019

DESIGN TARGET DETAILS

Name	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
Fed 28M 1H LP	8150.00	53.88	-534.09	1920403.24	2795372.20	36.2775070	-107.5881050
Fed 28M 1H BHL	6052.00	-5235.79	-431.01	1915113.85	2795488.78	36.2629760	-107.5877550

SECTION DETAILS

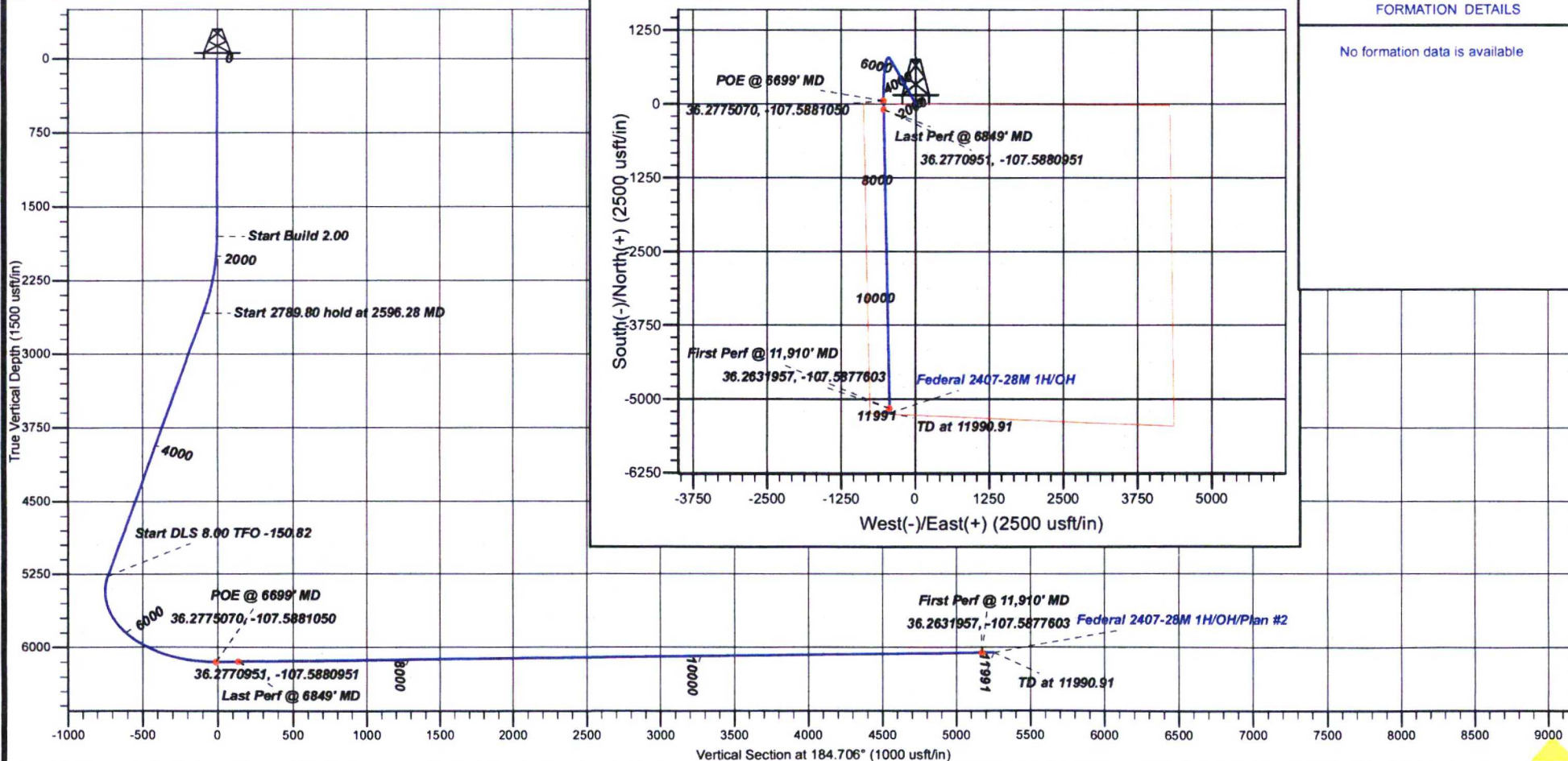
MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	VFace	Target
0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00	
1800.00	0.00	0.000	1800.00	0.00	0.00	0.00	0.00	0.00	
2596.28	15.93	330.793	2586.06	95.97	-53.65	2.00	330.79	-91.25	
5386.07	15.93	330.793	5268.78	764.14	-427.18	0.00	0.00	-726.52	
6999.33	91.06	178.884	6150.00	53.88	-534.09	8.00	-150.82	-9.88	Fed 28M 1H LP
11990.91	91.06	178.884	6052.00	-5235.79	-431.01	0.00	0.00	5253.50	Fed 28M 1H BHL

CASING DETAILS

No casing data is available

FORMATION DETAILS

No formation data is available





Logos Operating LLC

Rio Arriba, NM NAD83

Federal 2407-28M

Federal 2407-28M 1H

OH

Plan: Plan #2

Standard Planning Report

03 January, 2019



www.scientificdrilling.com



Scientific Drilling, Intl
Planning Report



Database: Grand Junction District
Company: Logos Operating LLC
Project: Rio Arriba, NM NAD83
Site: Federal 2407-28M
Well: Federal 2407-28M 1H
Wellbore: OH
Design: Plan #2

Local Co-ordinate Reference: Well Federal 2407-28M 1H
TVD Reference: GL 7388' & RKB 14' @ 7402.00usft
MD Reference: GL 7388' & RKB 14' @ 7402.00usft
North Reference: True
Survey Calculation Method: Minimum Curvature

Project	Rio Arriba, NM NAD83		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	New Mexico Western Zone		

Site	Federal 2407-28M				
Site Position:		Northing:	1,920,350.72 usft	Latitude:	36.2773590
From:	Lat/Long	Easting:	2,795,906.42 usft	Longitude:	-107.5862930
Position Uncertainty:	0.00 usft	Slot Radius:	13.20 in	Grid Convergence:	0.15 °

Well	Federal 2407-28M 1H					
Well Position	+N/-S	0.00 usft	Northing:	1,920,350.72 usft	Latitude:	36.2773590
	+E/-W	0.00 usft	Easting:	2,795,906.42 usft	Longitude:	-107.5862930
Position Uncertainty		0.00 usft	Wellhead Elevation:	0.00 usft	Ground Level:	7,388.00 usft

Wellbore	OH				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	HDGM	12/17/2018	8.75	62.87	49,493

Design	Plan #2			
Audit Notes:				
Version:	Phase:	PLAN	Tie On Depth:	0.00
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)
	0.00	0.00	0.00	184.706

Plan Sections										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	TFO (°)	Target
0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1,800.00	0.00	0.000	1,800.00	0.00	0.00	0.00	0.00	0.00	0.00	
2,596.28	15.93	330.793	2,586.06	95.97	-53.65	2.00	2.00	0.00	330.79	
5,386.07	15.93	330.793	5,268.78	764.14	-427.18	0.00	0.00	0.00	0.00	
6,699.33	91.06	178.884	6,150.00	53.88	-534.09	8.00	5.72	-11.57	-150.82	Fed 28M 1H LP
11,990.91	91.06	178.884	6,052.00	-5,235.79	-431.01	0.00	0.00	0.00	0.00	Fed 28M 1H BHL



Scientific Drilling, Intl
Planning Report



Database: Grand Junction District
Company: Logos Operating LLC
Project: Rio Arriba, NM NAD83
Site: Federal 2407-28M
Well: Federal 2407-28M 1H
Wellbore: OH
Design: Plan #2

Local Co-ordinate Reference: Well Federal 2407-28M 1H
TVD Reference: GL 7388' & RKB 14' @ 7402.00usft
MD Reference: GL 7388' & RKB 14' @ 7402.00usft
North Reference: True
Survey Calculation Method: Minimum Curvature

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100.00	0.00	0.000	100.00	0.00	0.00	0.00	0.00	0.00	0.00
200.00	0.00	0.000	200.00	0.00	0.00	0.00	0.00	0.00	0.00
300.00	0.00	0.000	300.00	0.00	0.00	0.00	0.00	0.00	0.00
400.00	0.00	0.000	400.00	0.00	0.00	0.00	0.00	0.00	0.00
500.00	0.00	0.000	500.00	0.00	0.00	0.00	0.00	0.00	0.00
600.00	0.00	0.000	600.00	0.00	0.00	0.00	0.00	0.00	0.00
700.00	0.00	0.000	700.00	0.00	0.00	0.00	0.00	0.00	0.00
800.00	0.00	0.000	800.00	0.00	0.00	0.00	0.00	0.00	0.00
900.00	0.00	0.000	900.00	0.00	0.00	0.00	0.00	0.00	0.00
1,000.00	0.00	0.000	1,000.00	0.00	0.00	0.00	0.00	0.00	0.00
1,100.00	0.00	0.000	1,100.00	0.00	0.00	0.00	0.00	0.00	0.00
1,200.00	0.00	0.000	1,200.00	0.00	0.00	0.00	0.00	0.00	0.00
1,300.00	0.00	0.000	1,300.00	0.00	0.00	0.00	0.00	0.00	0.00
1,400.00	0.00	0.000	1,400.00	0.00	0.00	0.00	0.00	0.00	0.00
1,500.00	0.00	0.000	1,500.00	0.00	0.00	0.00	0.00	0.00	0.00
1,600.00	0.00	0.000	1,600.00	0.00	0.00	0.00	0.00	0.00	0.00
1,700.00	0.00	0.000	1,700.00	0.00	0.00	0.00	0.00	0.00	0.00
1,800.00	0.00	0.000	1,800.00	0.00	0.00	0.00	0.00	0.00	0.00
Start Build 2.00									
1,900.00	2.00	330.793	1,899.98	1.52	-0.85	-1.45	2.00	2.00	0.00
2,000.00	4.00	330.793	1,999.84	6.09	-3.41	-5.79	2.00	2.00	0.00
2,100.00	6.00	330.793	2,099.45	13.70	-7.66	-13.02	2.00	2.00	0.00
2,200.00	8.00	330.793	2,198.70	24.34	-13.60	-23.14	2.00	2.00	0.00
2,300.00	10.00	330.793	2,297.47	37.99	-21.24	-36.12	2.00	2.00	0.00
2,400.00	12.00	330.793	2,395.62	54.64	-30.55	-51.95	2.00	2.00	0.00
2,500.00	14.00	330.793	2,493.06	74.28	-41.52	-70.62	2.00	2.00	0.00
2,596.28	15.93	330.793	2,586.06	95.97	-53.65	-91.25	2.00	2.00	0.00
Start 2789.80 hold at 2596.28 MD									
2,600.00	15.93	330.793	2,589.64	96.87	-54.15	-92.10	0.00	0.00	0.00
2,700.00	15.93	330.793	2,685.81	120.82	-67.54	-114.87	0.00	0.00	0.00
2,800.00	15.93	330.793	2,781.97	144.77	-80.93	-137.64	0.00	0.00	0.00
2,900.00	15.93	330.793	2,878.13	168.72	-94.32	-160.41	0.00	0.00	0.00
3,000.00	15.93	330.793	2,974.29	192.67	-107.71	-183.18	0.00	0.00	0.00
3,100.00	15.93	330.793	3,070.45	216.62	-121.10	-205.95	0.00	0.00	0.00
3,200.00	15.93	330.793	3,166.62	240.57	-134.49	-228.72	0.00	0.00	0.00
3,300.00	15.93	330.793	3,262.78	264.52	-147.88	-251.49	0.00	0.00	0.00
3,400.00	15.93	330.793	3,358.94	288.47	-161.26	-274.27	0.00	0.00	0.00
3,500.00	15.93	330.793	3,455.10	312.42	-174.65	-297.04	0.00	0.00	0.00
3,600.00	15.93	330.793	3,551.26	336.37	-188.04	-319.81	0.00	0.00	0.00
3,700.00	15.93	330.793	3,647.42	360.32	-201.43	-342.58	0.00	0.00	0.00
3,800.00	15.93	330.793	3,743.59	384.27	-214.82	-365.35	0.00	0.00	0.00
3,900.00	15.93	330.793	3,839.75	408.22	-228.21	-388.12	0.00	0.00	0.00
4,000.00	15.93	330.793	3,935.91	432.17	-241.60	-410.89	0.00	0.00	0.00
4,100.00	15.93	330.793	4,032.07	456.12	-254.99	-433.66	0.00	0.00	0.00
4,200.00	15.93	330.793	4,128.23	480.07	-268.38	-456.43	0.00	0.00	0.00
4,300.00	15.93	330.793	4,224.40	504.02	-281.77	-479.21	0.00	0.00	0.00
4,400.00	15.93	330.793	4,320.56	527.97	-295.16	-501.98	0.00	0.00	0.00
4,500.00	15.93	330.793	4,416.72	551.92	-308.54	-524.75	0.00	0.00	0.00
4,600.00	15.93	330.793	4,512.88	575.87	-321.93	-547.52	0.00	0.00	0.00
4,700.00	15.93	330.793	4,609.04	599.82	-335.32	-570.29	0.00	0.00	0.00
4,800.00	15.93	330.793	4,705.21	623.77	-348.71	-593.06	0.00	0.00	0.00
4,900.00	15.93	330.793	4,801.37	647.72	-362.10	-615.83	0.00	0.00	0.00
5,000.00	15.93	330.793	4,897.53	671.67	-375.49	-638.60	0.00	0.00	0.00



Scientific Drilling, Intl Planning Report



Database: Grand Junction District
Company: Logos Operating LLC
Project: Rio Arriba, NM NAD83
Site: Federal 2407-28M
Well: Federal 2407-28M 1H
Wellbore: OH
Design: Plan #2

Local Co-ordinate Reference: Well Federal 2407-28M 1H
TVD Reference: GL 7388' & RKB 14' @ 7402.00usft
MD Reference: GL 7388' & RKB 14' @ 7402.00usft
North Reference: True
Survey Calculation Method: Minimum Curvature

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
5,100.00	15.93	330.793	4,993.69	695.62	-388.88	-661.37	0.00	0.00	0.00
5,200.00	15.93	330.793	5,089.85	719.57	-402.27	-684.14	0.00	0.00	0.00
5,300.00	15.93	330.793	5,186.02	743.52	-415.66	-706.92	0.00	0.00	0.00
5,386.07	15.93	330.793	5,268.78	764.14	-427.18	-726.52	0.00	0.00	0.00
Start DLS 8.00 TFO -150.82									
5,400.00	14.96	328.689	5,282.21	767.34	-429.05	-729.56	8.00	-6.92	-15.11
5,500.00	9.10	301.549	5,380.04	782.53	-442.51	-743.59	8.00	-5.87	-27.14
5,600.00	8.29	246.827	5,479.05	783.83	-455.90	-743.79	8.00	-0.80	-54.72
5,700.00	13.49	213.254	5,577.31	771.21	-468.95	-730.14	8.00	5.20	-33.57
5,800.00	20.56	200.122	5,672.90	744.93	-481.41	-702.92	8.00	7.06	-13.13
5,900.00	28.11	193.662	5,763.96	705.48	-493.04	-662.66	8.00	7.56	-6.46
6,000.00	35.85	189.794	5,848.73	653.65	-503.60	-610.13	8.00	7.74	-3.87
6,100.00	43.67	187.155	5,925.55	590.43	-512.90	-546.36	8.00	7.82	-2.64
6,200.00	51.54	185.182	5,992.92	517.06	-520.75	-472.60	8.00	7.87	-1.97
6,300.00	59.43	183.600	6,049.54	434.97	-527.00	-390.27	8.00	7.89	-1.58
6,400.00	67.34	182.257	6,094.30	345.76	-531.52	-300.98	8.00	7.91	-1.34
6,500.00	75.26	181.062	6,126.34	251.15	-534.24	-206.47	8.00	7.92	-1.20
6,600.00	83.19	179.951	6,145.02	153.00	-535.10	-108.58	8.00	7.93	-1.11
6,699.33	91.06	178.884	6,150.00	53.88	-534.09	-9.88	8.00	7.93	-1.07
POE @ 6699' MD - 36.2775070, -107.5881050									
6,700.00	91.06	178.884	6,149.99	53.21	-534.07	-9.21	0.00	0.00	0.00
6,800.00	91.06	178.884	6,148.14	-46.76	-532.12	90.26	0.00	0.00	0.00
6,849.33	91.06	178.884	6,147.22	-96.07	-531.16	139.32	0.00	0.00	0.00
Last Perf @ 6849' MD - 36.2770951, -107.5880951									
6,900.00	91.06	178.884	6,146.28	-146.72	-530.18	189.72	0.00	0.00	0.00
7,000.00	91.06	178.884	6,144.43	-246.68	-528.23	289.19	0.00	0.00	0.00
7,100.00	91.06	178.884	6,142.58	-346.65	-526.28	388.66	0.00	0.00	0.00
7,200.00	91.06	178.884	6,140.73	-446.61	-524.33	488.12	0.00	0.00	0.00
7,300.00	91.06	178.884	6,138.88	-546.58	-522.38	587.59	0.00	0.00	0.00
7,400.00	91.06	178.884	6,137.02	-646.54	-520.44	687.06	0.00	0.00	0.00
7,500.00	91.06	178.884	6,135.17	-746.50	-518.49	786.53	0.00	0.00	0.00
7,600.00	91.06	178.884	6,133.32	-846.47	-516.54	885.99	0.00	0.00	0.00
7,700.00	91.06	178.884	6,131.47	-946.43	-514.59	985.46	0.00	0.00	0.00
7,800.00	91.06	178.884	6,129.62	-1,046.40	-512.64	1,084.93	0.00	0.00	0.00
7,900.00	91.06	178.884	6,127.76	-1,146.36	-510.70	1,184.39	0.00	0.00	0.00
8,000.00	91.06	178.884	6,125.91	-1,246.32	-508.75	1,283.86	0.00	0.00	0.00
8,100.00	91.06	178.884	6,124.06	-1,346.29	-506.80	1,383.33	0.00	0.00	0.00
8,200.00	91.06	178.884	6,122.21	-1,446.25	-504.85	1,482.79	0.00	0.00	0.00
8,300.00	91.06	178.884	6,120.36	-1,546.22	-502.90	1,582.26	0.00	0.00	0.00
8,400.00	91.06	178.884	6,118.50	-1,646.18	-500.96	1,681.73	0.00	0.00	0.00
8,500.00	91.06	178.884	6,116.65	-1,746.14	-499.01	1,781.20	0.00	0.00	0.00
8,600.00	91.06	178.884	6,114.80	-1,846.11	-497.06	1,880.66	0.00	0.00	0.00
8,700.00	91.06	178.884	6,112.95	-1,946.07	-495.11	1,980.13	0.00	0.00	0.00
8,800.00	91.06	178.884	6,111.10	-2,046.03	-493.17	2,079.60	0.00	0.00	0.00
8,900.00	91.06	178.884	6,109.24	-2,146.00	-491.22	2,179.06	0.00	0.00	0.00
9,000.00	91.06	178.884	6,107.39	-2,245.96	-489.27	2,278.53	0.00	0.00	0.00
9,100.00	91.06	178.884	6,105.54	-2,345.93	-487.32	2,378.00	0.00	0.00	0.00
9,200.00	91.06	178.884	6,103.69	-2,445.89	-485.37	2,477.47	0.00	0.00	0.00
9,300.00	91.06	178.884	6,101.84	-2,545.85	-483.43	2,576.93	0.00	0.00	0.00
9,400.00	91.06	178.884	6,099.98	-2,645.82	-481.48	2,676.40	0.00	0.00	0.00
9,500.00	91.06	178.884	6,098.13	-2,745.78	-479.53	2,775.87	0.00	0.00	0.00
9,600.00	91.06	178.884	6,096.28	-2,845.75	-477.58	2,875.33	0.00	0.00	0.00
9,700.00	91.06	178.884	6,094.43	-2,945.71	-475.63	2,974.80	0.00	0.00	0.00



Scientific Drilling, Intl
Planning Report



Database: Grand Junction District
Company: Logos Operating LLC
Project: Rio Arriba, NM NAD83
Site: Federal 2407-28M
Well: Federal 2407-28M 1H
Wellbore: OH
Design: Plan #2

Local Co-ordinate Reference: Well Federal 2407-28M 1H
TVD Reference: GL 7388' & RKB 14' @ 7402.00usft
MD Reference: GL 7388' & RKB 14' @ 7402.00usft
North Reference: True
Survey Calculation Method: Minimum Curvature

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
9,800.00	91.06	178.884	6,092.58	-3,045.67	-473.69	3,074.27	0.00	0.00	0.00
9,900.00	91.06	178.884	6,090.72	-3,145.64	-471.74	3,173.74	0.00	0.00	0.00
10,000.00	91.06	178.884	6,088.87	-3,245.60	-469.79	3,273.20	0.00	0.00	0.00
10,100.00	91.06	178.884	6,087.02	-3,345.56	-467.84	3,372.67	0.00	0.00	0.00
10,200.00	91.06	178.884	6,085.17	-3,445.53	-465.89	3,472.14	0.00	0.00	0.00
10,300.00	91.06	178.884	6,083.32	-3,545.49	-463.95	3,571.60	0.00	0.00	0.00
10,400.00	91.06	178.884	6,081.46	-3,645.46	-462.00	3,671.07	0.00	0.00	0.00
10,500.00	91.06	178.884	6,079.61	-3,745.42	-460.05	3,770.54	0.00	0.00	0.00
10,600.00	91.06	178.884	6,077.76	-3,845.38	-458.10	3,870.00	0.00	0.00	0.00
10,700.00	91.06	178.884	6,075.91	-3,945.35	-456.15	3,969.47	0.00	0.00	0.00
10,800.00	91.06	178.884	6,074.06	-4,045.31	-454.21	4,068.94	0.00	0.00	0.00
10,900.00	91.06	178.884	6,072.20	-4,145.28	-452.26	4,168.41	0.00	0.00	0.00
11,000.00	91.06	178.884	6,070.35	-4,245.24	-450.31	4,267.87	0.00	0.00	0.00
11,100.00	91.06	178.884	6,068.50	-4,345.20	-448.36	4,367.34	0.00	0.00	0.00
11,200.00	91.06	178.884	6,066.65	-4,445.17	-446.41	4,466.81	0.00	0.00	0.00
11,300.00	91.06	178.884	6,064.80	-4,545.13	-444.47	4,566.27	0.00	0.00	0.00
11,400.00	91.06	178.884	6,062.94	-4,645.10	-442.52	4,665.74	0.00	0.00	0.00
11,500.00	91.06	178.884	6,061.09	-4,745.06	-440.57	4,765.21	0.00	0.00	0.00
11,600.00	91.06	178.884	6,059.24	-4,845.02	-438.62	4,864.68	0.00	0.00	0.00
11,700.00	91.06	178.884	6,057.39	-4,944.99	-436.67	4,964.14	0.00	0.00	0.00
11,800.00	91.06	178.884	6,055.54	-5,044.95	-434.73	5,063.61	0.00	0.00	0.00
11,900.00	91.06	178.884	6,053.68	-5,144.91	-432.78	5,163.08	0.00	0.00	0.00
11,910.91	91.06	178.884	6,053.48	-5,155.82	-432.56	5,173.93	0.00	0.00	0.00
First Perf @ 11,910' MD - 36.2631957, -107.5877603									
11,990.91	91.06	178.884	6,052.00	-5,235.79	-431.01	5,253.50	0.00	0.00	0.00
TD at 11990.91									

Design Targets

Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
- hit/miss target									
- Shape									
Fed 28M 1H BHL	0.00	0.000	6,052.00	-5,235.79	-431.01	1,915,113.85	2,795,488.78	36.2629760	-107.5877550
- plan hits target center									
- Point									
Fed 28M 1H LP	0.00	0.000	6,150.00	53.88	-534.09	1,920,403.24	2,795,372.20	36.2775070	-107.5881050
- plan hits target center									
- Point									



Scientific Drilling, Intl
Planning Report



Database: Grand Junction District
Company: Logos Operating LLC
Project: Rio Arriba, NM NAD83
Site: Federal 2407-28M
Well: Federal 2407-28M 1H
Wellbore: OH
Design: Plan #2

Local Co-ordinate Reference: Well Federal 2407-28M 1H
TVD Reference: GL 7388' & RKB 14' @ 7402.00usft
MD Reference: GL 7388' & RKB 14' @ 7402.00usft
North Reference: True
Survey Calculation Method: Minimum Curvature

Plan Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
1,800.00	1,800.00	0.00	0.00	Start Build 2.00
2,596.28	2,586.06	95.97	-53.65	Start 2789.80 hold at 2596.28 MD
5,386.07	5,268.78	764.14	-427.18	Start DLS 8.00 TFO -150.82
6,699.33	6,150.00	53.88	-534.09	POE @ 6699' MD
6,699.33	6,150.00	53.88	-534.09	36.2775070, -107.5881050
6,849.33	6,147.22	-96.07	-531.16	Last Perf @ 6849' MD
6,849.33	6,147.22	-96.07	-531.16	36.2770951, -107.5880951
11,910.91	6,053.48	-5,155.82	-432.56	First Perf @ 11,910' MD
11,910.91	6,053.48	-5,155.82	-432.56	36.2631957, -107.5877603
11,990.91	6,052.00	-5,235.79	-431.01	TD at 11990.91



Logos Operating LLC

Rio Arriba, NM NAD83

Federal 2407-28M

Federal 2407-28M 1H

OH

Plan #2

Anticollision Report

03 January, 2019



www.scientificdrilling.com



Scientific Drilling, Intl
Anticollision Report



Company: Logos Operating LLC
Project: Rio Arriba, NM NAD83
Reference Site: Federal 2407-28M
Site Error: 0.00 usft
Reference Well: Federal 2407-28M 1H
Well Error: 0.00 usft
Reference Wellbore: OH
Reference Design: Plan #2

Local Co-ordinate Reference: Well Federal 2407-28M 1H
TVD Reference: GL 7388' & RKB 14' @ 7402.00usft
MD Reference: GL 7388' & RKB 14' @ 7402.00usft
North Reference: True
Survey Calculation Method: Minimum Curvature
Output errors are at: 2.00 sigma
Database: Grand Junction District
Offset TVD Reference: Offset Datum

Reference	Plan #2
Filter type:	NO GLOBAL FILTER: Using user defined selection & filtering criteria
Interpolation Method:	MD Interval 100.00usft
Depth Range:	Unlimited
Results Limited by:	Maximum center-center distance of 15,000.00 usft
Warning Levels Evaluated at:	2.00 Sigma
Error Model:	ISCWSA
Scan Method:	Closest Approach 3D
Error Surface:	Elliptical Conic
Casing Method:	Not applied

Survey Tool Program		Date	1/3/2019	
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description
0.00	11,990.91	Plan #2 (OH)	MWD+HDGM	OWSG MWD + HDGM

Site Name	Reference Measured Depth (usft)	Offset Measured Depth (usft)	Distance Between Centres (usft)	Distance Between Ellipses (usft)	Separation Factor	Warning
Offset Well - Wellbore - Design						
Federal 2407-28M						
Federal 2407-28M 2H - OH - Plan #2	1,800.00	1,801.00	29.98	17.48	2.398	CC
Federal 2407-28M 2H - OH - Plan #2	1,900.00	1,900.98	30.58	17.37	2.314	ES, SF
Federal 2407-28M 3H - OH - Plan #2	1,416.33	1,417.33	59.89	50.14	6.143	CC
Federal 2407-28M 3H - OH - Plan #2	1,500.00	1,500.99	59.89	49.54	5.787	ES
Federal 2407-28M 3H - OH - Plan #2	1,700.00	1,697.80	64.92	53.15	5.515	SF

Offset Design Federal 2407-28M - Federal 2407-28M 2H - OH - Plan #2													Offset Site Error: 0.00 usft
Survey Program: 0-MWD+HDGM													Offset Well Error: 0.00 usft
Reference	Offset	Semi Major Axis		Distance		Minimum Separation		Separation Factor		Warning			
Measured Depth (usft)	Vertical Depth (usft)	Measured Depth (usft)	Vertical Depth (usft)	Reference (usft)	Offset (usft)	Highside Toolface (°)	Offset Wellbore Centre +N/-S (usft)	+E/-W (usft)	Between Centres (usft)	Between Ellipses (usft)	Minimum Separation (usft)	Separation Factor	Warning
0.00	0.00	1.00	1.00	0.00	0.00	79.50	5.46	29.47	29.98				
100.00	100.00	101.00	101.00	0.15	0.16	79.50	5.46	29.47	29.98	29.66	0.31	96.118	
200.00	200.00	201.00	201.00	0.51	0.52	79.50	5.46	29.47	29.98	28.95	1.03	29.137	
300.00	300.00	301.00	301.00	0.87	0.87	79.50	5.46	29.47	29.98	28.23	1.75	17.171	
400.00	400.00	401.00	401.00	1.23	1.23	79.50	5.46	29.47	29.98	27.51	2.46	12.172	
500.00	500.00	501.00	501.00	1.59	1.59	79.50	5.46	29.47	29.98	26.80	3.18	9.428	
600.00	600.00	601.00	601.00	1.95	1.95	79.50	5.46	29.47	29.98	26.08	3.90	7.693	
700.00	700.00	701.00	701.00	2.30	2.31	79.50	5.46	29.47	29.98	25.36	4.61	6.498	
800.00	800.00	801.00	801.00	2.66	2.67	79.50	5.46	29.47	29.98	24.65	5.33	5.624	
900.00	900.00	901.00	901.00	3.02	3.03	79.50	5.46	29.47	29.98	23.93	6.05	4.957	
1,000.00	1,000.00	1,001.00	1,001.00	3.38	3.38	79.50	5.46	29.47	29.98	23.21	6.76	4.432	
1,100.00	1,100.00	1,101.00	1,101.00	3.74	3.74	79.50	5.46	29.47	29.98	22.50	7.48	4.007	
1,200.00	1,200.00	1,201.00	1,201.00	4.10	4.10	79.50	5.46	29.47	29.98	21.78	8.20	3.656	
1,300.00	1,300.00	1,301.00	1,301.00	4.46	4.46	79.50	5.46	29.47	29.98	21.06	8.92	3.362	
1,400.00	1,400.00	1,401.00	1,401.00	4.81	4.82	79.50	5.46	29.47	29.98	20.34	9.63	3.112	
1,500.00	1,500.00	1,501.00	1,501.00	5.17	5.18	79.50	5.46	29.47	29.98	19.63	10.35	2.897	
1,600.00	1,600.00	1,601.00	1,601.00	5.53	5.53	79.50	5.46	29.47	29.98	18.91	11.07	2.709	
1,700.00	1,700.00	1,701.00	1,701.00	5.89	5.89	79.50	5.46	29.47	29.98	18.19	11.78	2.544	
1,800.00	1,800.00	1,801.00	1,801.00	6.25	6.25	79.50	5.46	29.47	29.98	17.48	12.50	2.398	CC
1,900.00	1,899.98	1,900.98	1,900.98	6.61	6.61	111.80	5.46	29.47	30.58	17.37	13.22	2.314	ES, SF
2,000.00	1,999.84	2,000.85	2,000.85	6.96	6.97	120.25	5.46	29.47	32.89	18.96	13.93	2.361	
2,100.00	2,099.45	2,101.69	2,101.67	7.32	7.32	132.60	5.28	27.68	36.35	21.71	14.63	2.484	

CC - Min centre to center distance or convergent point, SF - min separation factor, ES - min ellipse separation



Scientific Drilling, Intl
Anticollision Report



Company: Logos Operating LLC
Project: Rio Arriba, NM NAD83
Reference Site: Federal 2407-28M
Site Error: 0.00 usft
Reference Well: Federal 2407-28M 1H
Well Error: 0.00 usft
Reference Wellbore: OH
Reference Design: Plan #2

Local Co-ordinate Reference: Well Federal 2407-28M 1H
TVD Reference: GL 7388' & RKB 14' @ 7402.00usft
MD Reference: GL 7388' & RKB 14' @ 7402.00usft
North Reference: True
Survey Calculation Method: Minimum Curvature
Output errors are at: 2.00 sigma
Database: Grand Junction District
Offset TVD Reference: Offset Datum

Offset Design Federal 2407-28M - Federal 2407-28M 2H - OH - Plan #2														Offset Site Error: 0.00 usft
Survey Program: 0-MWD+HDGM														Offset Well Error: 0.00 usft
Reference		Offset		Semi Major Axis			Distance							Warning
Measured Depth (usft)	Vertical Depth (usft)	Measured Depth (usft)	Vertical Depth (usft)	Reference (usft)	Offset (usft)	Highside Toolface (°)	Offset Wellbore Centre +N/-S (usft)	+E/-W (usft)	Between Centres (usft)	Between Ellipses (usft)	Minimum Separation (usft)	Separation Factor		
2,200.00	2,198.70	2,202.26	2,202.10	7.68	7.66	147.77	4.75	22.37	41.03	25.71	15.33	2.677		
2,300.00	2,297.47	2,302.33	2,301.76	8.04	8.01	163.55	3.87	13.62	48.89	32.86	16.03	3.050		
2,400.00	2,395.62	2,400.74	2,399.64	8.41	8.35	175.96	2.84	3.34	61.98	45.24	16.73	3.704		
2,500.00	2,493.06	2,498.57	2,496.93	8.80	8.70	-176.28	1.82	-6.87	80.37	62.93	17.44	4.608		
2,600.00	2,589.64	2,595.71	2,593.53	9.19	9.04	-171.68	0.80	-17.01	103.04	84.89	18.15	5.677		
2,700.00	2,685.81	2,692.49	2,689.78	9.61	9.39	-168.92	-0.21	-27.11	127.64	108.78	18.86	6.769		
2,800.00	2,781.97	2,789.27	2,786.02	10.03	9.74	-167.05	-1.22	-37.21	152.43	132.86	19.57	7.789		
2,900.00	2,878.13	2,886.05	2,882.26	10.46	10.09	-165.71	-2.24	-47.31	177.33	157.04	20.29	8.741		
3,000.00	2,974.29	2,982.82	2,978.51	10.90	10.44	-164.70	-3.25	-57.41	202.30	181.29	21.01	9.628		
3,100.00	3,070.45	3,079.60	3,074.75	11.35	10.80	-163.91	-4.26	-67.51	227.31	205.57	21.74	10.456		
3,200.00	3,166.62	3,176.38	3,171.00	11.81	11.15	-163.27	-5.27	-77.61	252.36	229.89	22.47	11.230		
3,300.00	3,262.78	3,273.16	3,267.24	12.27	11.51	-162.75	-6.29	-87.72	277.43	254.22	23.21	11.954		
3,400.00	3,358.94	3,369.94	3,363.49	12.74	11.87	-162.32	-7.30	-97.82	302.52	278.57	23.95	12.631		
3,500.00	3,455.10	3,466.72	3,459.73	13.21	12.23	-161.95	-8.31	-107.92	327.62	302.93	24.69	13.267		
3,600.00	3,551.26	3,563.49	3,555.97	13.69	12.59	-161.64	-9.33	-118.02	352.73	327.29	25.44	13.865		
3,700.00	3,647.42	3,660.27	3,652.22	14.17	12.95	-161.36	-10.34	-128.12	377.86	351.67	26.19	14.427		
3,800.00	3,743.59	3,757.05	3,748.46	14.66	13.31	-161.12	-11.35	-138.22	402.99	376.04	26.94	14.957		
3,900.00	3,839.75	3,853.83	3,844.71	15.15	13.68	-160.91	-12.36	-148.33	428.12	400.42	27.70	15.457		
4,000.00	3,935.91	3,950.61	3,940.95	15.64	14.04	-160.73	-13.38	-158.43	453.26	424.81	28.46	15.929		
4,100.00	4,032.07	4,047.39	4,037.20	16.13	14.40	-160.56	-14.39	-168.53	478.40	449.19	29.21	16.376		
4,200.00	4,128.23	4,144.16	4,133.44	16.63	14.77	-160.41	-15.40	-178.63	503.55	473.58	29.98	16.799		
4,300.00	4,224.40	4,240.94	4,229.69	17.13	15.13	-160.27	-16.41	-188.73	528.70	497.96	30.74	17.200		
4,400.00	4,320.56	4,337.72	4,325.93	17.63	15.50	-160.15	-17.43	-198.83	553.86	522.35	31.50	17.582		
4,500.00	4,416.72	4,434.50	4,422.17	18.13	15.87	-160.03	-18.44	-208.93	579.01	546.74	32.27	17.944		
4,600.00	4,512.88	4,531.28	4,518.42	18.64	16.23	-159.93	-19.45	-219.04	604.17	571.13	33.03	18.289		
4,700.00	4,609.04	4,628.06	4,614.66	19.14	16.60	-159.83	-20.46	-229.14	629.33	595.52	33.80	18.618		
4,800.00	4,705.21	4,724.83	4,710.91	19.65	16.97	-159.74	-21.48	-239.24	654.49	619.91	34.57	18.931		
4,900.00	4,801.37	4,821.61	4,807.15	20.16	17.34	-159.66	-22.49	-249.34	679.65	644.31	35.34	19.230		
5,000.00	4,897.53	4,918.39	4,903.40	20.67	17.71	-159.59	-23.50	-259.44	704.81	668.70	36.11	19.516		
5,100.00	4,993.69	5,015.17	4,999.64	21.18	18.08	-159.52	-24.52	-269.54	729.98	693.09	36.89	19.790		
5,200.00	5,089.85	5,111.95	5,095.88	21.69	18.45	-159.45	-25.53	-279.64	755.14	717.48	37.66	20.051		
5,300.00	5,186.02	5,208.72	5,192.13	22.20	18.81	-159.39	-26.54	-289.75	780.31	741.87	38.43	20.302		
5,400.00	5,282.21	5,305.54	5,288.41	22.72	19.18	-157.26	-27.55	-299.85	805.34	766.13	39.21	20.540		
5,500.00	5,380.04	5,404.08	5,386.40	23.17	19.56	-130.51	-28.58	-310.14	821.86	781.89	39.98	20.558		
5,600.00	5,479.05	5,503.02	5,493.00	23.51	19.94	-21.26	482.59	-815.92	820.50	790.47	30.03	27.323		
5,700.00	5,577.31	5,601.72	5,592.97	23.76	20.11	24.19	480.04	-813.82	730.72	698.42	32.30	22.620		
5,800.00	5,672.90	5,696.42	5,686.40	23.92	20.53	44.23	448.98	-788.20	640.09	605.50	34.59	18.503		
5,900.00	5,763.96	5,788.98	5,778.96	24.03	20.96	57.78	418.06	-762.44	549.16	512.29	36.86	14.897		
6,000.00	5,848.73	5,873.01	5,863.01	24.08	21.41	68.04	387.08	-736.36	458.57	419.44	39.14	11.718		
6,100.00	5,925.55	5,950.31	5,940.31	24.09	21.87	75.30	356.01	-709.93	369.16	327.70	41.46	8.905		
6,200.00	5,992.92	6,018.71	6,008.71	24.06	22.36	78.90	324.88	-683.14	282.08	238.18	43.90	6.426		
6,300.00	6,049.54	6,075.07	6,065.07	24.03	22.86	77.37	293.71	-656.02	199.58	153.11	46.48	4.294		
6,400.00	6,094.30	6,120.23	6,110.23	23.99	23.38	67.91	262.59	-628.60	127.92	79.90	48.02	2.664		
6,500.00	6,126.34	6,152.05	6,142.05	23.99	23.93	47.61	231.62	-600.94	89.97	51.21	38.76	2.321		
6,508.05	6,128.34	6,154.07	6,144.07	23.99	23.89	45.57	229.14	-598.71	89.73	52.48	37.24	2.409		
6,600.00	6,145.02	6,170.61	6,160.61	24.03	24.50	22.22	200.95	-573.13	116.74	87.98	28.76	4.059		
6,700.00	6,149.99	6,175.16	6,165.16	24.16	24.11	3.83	170.77	-545.32	176.79	143.22	33.57	5.266		
6,800.00	6,148.14	6,173.82	6,163.82	24.41	24.76	-5.73	143.32	-519.58	247.77	210.62	37.15	6.670		
6,900.00	6,146.28	6,171.90	6,161.90	24.79	24.99	-11.05	121.54	-498.78	326.02	288.77	39.26	8.305		
7,000.00	6,144.43	6,169.72	6,159.72	25.29	25.25	-14.69	100.76	-478.59	408.36	368.10	40.26	10.143		
7,100.00	6,142.58	6,167.95	6,157.95	25.88	25.05	-16.80	84.38	-462.37	493.45	452.43	41.02	12.030		
7,200.00	6,140.73	6,166.10	6,156.10	26.56	25.91	-17.99	72.46	-450.37	580.60	538.92	41.67	13.932		

CC - Min centre to center distance or convergent point, SF - min separation factor, ES - min ellipse separation



Scientific Drilling, Intl
Anticollision Report



Company: Logos Operating LLC
Project: Rio Arriba, NM NAD83
Reference Site: Federal 2407-28M
Site Error: 0.00 usft
Reference Well: Federal 2407-28M 1H
Well Error: 0.00 usft
Reference Wellbore: OH
Reference Design: Plan #2

Local Co-ordinate Reference: Well Federal 2407-28M 1H
TVD Reference: GL 7388' & RKB 14' @ 7402.00usft
MD Reference: GL 7388' & RKB 14' @ 7402.00usft
North Reference: True
Survey Calculation Method: Minimum Curvature
Output errors are at 2.00 sigma
Database: Grand Junction District
Offset TVD Reference: Offset Datum

Offset Design Federal 2407-28M - Federal 2407-28M 2H - OH - Plan #2													Offset Site Error: 0.00 usft
Survey Program: 0-MWD+HDGM													Offset Well Error: 0.00 usft
Reference		Offset		Semi Major Axis			Distance						Warning
Measured Depth (usft)	Vertical Depth (usft)	Measured Depth (usft)	Vertical Depth (usft)	Reference (usft)	Offset (usft)	Highside Toolface (°)	Offset Wellbore Centre +N/-S (usft)	+E/-W (usft)	Between Centres (usft)	Between Ellipses (usft)	Minimum Separation (usft)	Separation Factor	
7,300.00	6,138.88	5,918.58	5,867.73	27.32	21.75	-19.04	58.82	-436.40	669.30	627.35	41.95	15.955	
7,400.00	6,137.02	5,900.00	5,852.79	28.14	21.65	-19.50	51.18	-428.44	759.36	716.99	42.37	17.921	
7,500.00	6,135.17	5,872.11	5,829.83	29.01	21.52	-20.02	40.30	-416.93	850.43	807.93	42.50	20.009	
7,600.00	6,133.32	5,850.00	5,811.21	29.94	21.41	-20.29	32.21	-408.18	942.45	899.78	42.67	22.087	
7,700.00	6,131.47	5,834.01	5,797.52	30.92	21.34	-20.43	26.64	-402.07	1,035.24	992.38	42.87	24.150	
7,800.00	6,129.62	5,817.47	5,783.18	31.94	21.26	-20.53	21.15	-395.94	1,128.71	1,085.71	43.01	26.245	
7,900.00	6,127.76	5,800.00	5,767.82	33.00	21.18	-20.59	15.64	-389.68	1,222.77	1,179.67	43.10	28.369	
8,000.00	6,125.91	5,800.00	5,767.82	34.09	21.18	-20.59	15.64	-389.68	1,317.45	1,274.12	43.33	30.402	
8,100.00	6,124.06	5,775.76	5,746.20	35.22	21.07	-20.60	8.50	-381.38	1,412.35	1,369.02	43.32	32.601	
8,200.00	6,122.21	5,750.00	5,722.84	36.37	20.96	-20.54	1.56	-373.04	1,507.93	1,464.64	43.29	34.833	
8,300.00	6,120.36	5,750.00	5,722.84	37.55	20.96	-20.54	1.56	-373.04	1,603.53	1,560.08	43.44	36.910	
8,400.00	6,118.50	5,750.00	5,722.84	38.76	20.96	-20.54	1.56	-373.04	1,699.64	1,656.06	43.57	39.006	
8,500.00	6,116.65	5,750.00	5,722.84	39.99	20.96	-20.54	1.56	-373.04	1,796.17	1,752.49	43.68	41.119	
8,600.00	6,114.80	5,725.00	5,699.81	41.23	20.85	-20.41	-4.52	-365.44	1,892.57	1,848.93	43.64	43.369	
8,700.00	6,112.95	5,700.00	5,676.47	42.50	20.74	-20.24	-9.96	-358.34	1,989.63	1,946.03	43.60	45.635	
8,800.00	6,111.10	5,700.00	5,676.47	43.78	20.74	-20.24	-9.96	-358.34	2,086.51	2,042.83	43.68	47.763	
8,900.00	6,109.24	5,700.00	5,676.47	45.08	20.74	-20.24	-9.96	-358.34	2,183.68	2,139.92	43.76	49.899	
9,000.00	6,107.39	5,700.00	5,676.47	46.39	20.74	-20.24	-9.96	-358.34	2,281.10	2,237.27	43.83	52.044	
9,100.00	6,105.54	5,700.00	5,676.47	47.71	20.74	-20.24	-9.96	-358.34	2,378.72	2,334.83	43.89	54.194	
9,200.00	6,103.69	5,700.00	5,676.47	49.05	20.74	-20.24	-9.96	-358.34	2,476.54	2,432.59	43.95	56.349	
9,300.00	6,101.84	5,677.63	5,655.34	50.40	20.65	-20.04	-14.27	-352.40	2,574.16	2,530.24	43.92	58.609	
9,400.00	6,099.98	5,672.35	5,650.32	51.76	20.63	-19.99	-15.22	-351.06	2,672.11	2,628.15	43.96	60.791	
9,500.00	6,098.13	5,650.00	5,628.95	53.12	20.53	-19.76	-18.88	-345.64	2,770.38	2,726.45	43.93	63.063	
9,600.00	6,096.28	5,650.00	5,628.95	54.50	20.53	-19.76	-18.88	-345.64	2,868.44	2,824.46	43.98	65.220	
9,700.00	6,094.43	5,650.00	5,628.95	55.88	20.53	-19.76	-18.88	-345.64	2,966.62	2,922.59	44.03	67.379	
9,800.00	6,092.58	5,650.00	5,628.95	57.27	20.53	-19.76	-18.88	-345.64	3,064.93	3,020.85	44.08	69.536	
9,900.00	6,090.72	5,650.00	5,628.95	58.67	20.53	-19.76	-18.88	-345.64	3,163.34	3,119.22	44.12	71.696	
10,000.00	6,088.87	5,650.00	5,628.95	60.08	20.53	-19.76	-18.88	-345.64	3,261.84	3,217.68	44.16	73.856	
10,100.00	6,087.02	5,650.00	5,628.95	61.49	20.53	-19.76	-18.88	-345.64	3,360.44	3,316.23	44.21	76.017	
10,200.00	6,085.17	5,650.00	5,628.95	62.90	20.53	-19.76	-18.88	-345.64	3,459.11	3,414.86	44.25	78.175	
10,300.00	6,083.32	5,650.00	5,628.95	64.32	20.53	-19.76	-18.88	-345.64	3,557.86	3,513.57	44.29	80.331	
10,400.00	6,081.46	5,650.00	5,628.95	65.75	20.53	-19.76	-18.88	-345.64	3,656.68	3,612.35	44.33	82.486	
10,500.00	6,079.61	5,629.04	5,608.74	67.18	20.44	-19.52	-21.83	-340.92	3,755.26	3,710.94	44.32	84.729	
10,600.00	6,077.76	5,626.09	5,605.88	68.62	20.43	-19.48	-22.20	-340.29	3,854.12	3,809.76	44.36	86.892	
10,700.00	6,075.91	5,623.26	5,603.14	70.06	20.42	-19.45	-22.56	-339.69	3,953.01	3,908.62	44.39	89.051	
10,800.00	6,074.06	5,620.54	5,600.50	71.50	20.41	-19.41	-22.89	-339.12	4,051.96	4,007.53	44.43	91.207	
10,900.00	6,072.20	5,600.00	5,580.50	72.95	20.33	-19.15	-25.14	-335.01	4,151.15	4,106.73	44.42	93.448	
11,000.00	6,070.35	5,600.00	5,580.50	74.40	20.33	-19.15	-25.14	-335.01	4,250.12	4,205.65	44.46	95.584	
11,100.00	6,068.50	5,600.00	5,580.50	75.85	20.33	-19.15	-25.14	-335.01	4,349.13	4,304.62	44.51	97.716	
11,200.00	6,066.65	5,600.00	5,580.50	77.30	20.33	-19.15	-25.14	-335.01	4,448.19	4,403.64	44.55	99.844	
11,300.00	6,064.80	5,600.00	5,580.50	78.76	20.33	-19.15	-25.14	-335.01	4,547.29	4,502.69	44.60	101.969	
11,400.00	6,062.94	5,600.00	5,580.50	80.23	20.33	-19.15	-25.14	-335.01	4,646.43	4,601.79	44.64	104.089	
11,500.00	6,061.09	5,600.00	5,580.50	81.69	20.33	-19.15	-25.14	-335.01	4,745.60	4,700.92	44.68	106.205	
11,600.00	6,059.24	5,600.00	5,580.50	83.16	20.33	-19.15	-25.14	-335.01	4,844.81	4,800.08	44.73	108.317	
11,700.00	6,057.39	5,600.00	5,580.50	84.63	20.33	-19.15	-25.14	-335.01	4,944.05	4,899.28	44.77	110.423	
11,800.00	6,055.54	5,600.00	5,580.50	86.10	20.33	-19.15	-25.14	-335.01	5,043.32	4,998.50	44.82	112.525	
11,900.00	6,053.68	5,600.00	5,580.50	87.57	20.33	-19.15	-25.14	-335.01	5,142.62	5,097.75	44.87	114.622	
11,990.91	6,052.00	5,600.00	5,580.50	88.91	20.33	-19.15	-25.14	-335.01	5,232.91	5,188.00	44.91	116.524	

CC - Min centre to center distance or convergent point, SF - min separation factor, ES - min ellipse separation



Scientific Drilling, Intl
Anticollision Report



Company: Logos Operating LLC
Project: Rio Arriba, NM NAD83
Reference Site: Federal 2407-28M
Site Error: 0.00 usft
Reference Well: Federal 2407-28M 1H
Well Error: 0.00 usft
Reference Wellbore: OH
Reference Design: Plan #2

Local Co-ordinate Reference: Well Federal 2407-28M 1H
TVD Reference: GL 7388' & RKB 14' @ 7402.00usft
MD Reference: GL 7388' & RKB 14' @ 7402.00usft
North Reference: True
Survey Calculation Method: Minimum Curvature
Output errors are at 2.00 sigma
Database: Grand Junction District
Offset TVD Reference: Offset Datum

Offset Design Federal 2407-28M - Federal 2407-28M 3H - OH - Plan #2													Offset Site Error: 0.00 usft
Survey Program: 0-MWD+HDGM													Offset Well Error: 0.00 usft
Reference		Offset		Semi Major Axis			Distance						Warning
Measured Depth (usft)	Vertical Depth (usft)	Measured Depth (usft)	Vertical Depth (usft)	Reference (usft)	Offset (usft)	Highside Toolface (°)	Offset Wellbore Centre +N/-S (usft)	Centre +E/-W (usft)	Between Centres (usft)	Between Ellipses (usft)	Minimum Separation (usft)	Separation Factor	
0.00	0.00	1.00	1.00	0.00	0.00	79.85	10.56	58.95	59.89				
100.00	100.00	101.00	101.00	0.15	0.16	79.85	10.56	58.95	59.89	59.58	0.31	192.028	
200.00	200.00	201.00	201.00	0.51	0.52	79.85	10.56	58.95	59.89	58.86	1.03	58.211	
300.00	300.00	301.00	301.00	0.87	0.87	79.85	10.56	58.95	59.89	58.14	1.75	34.305	
400.00	400.00	401.00	401.00	1.23	1.23	79.85	10.56	58.95	59.89	57.43	2.46	24.318	
500.00	500.00	501.00	501.00	1.59	1.59	79.85	10.56	58.95	59.89	56.71	3.18	18.835	
600.00	600.00	601.00	601.00	1.95	1.95	79.85	10.56	58.95	59.89	55.99	3.90	15.369	
700.00	700.00	701.00	701.00	2.30	2.31	79.85	10.56	58.95	59.89	55.27	4.61	12.981	
800.00	800.00	801.00	801.00	2.66	2.67	79.85	10.56	58.95	59.89	54.56	5.33	11.235	
900.00	900.00	901.00	901.00	3.02	3.03	79.85	10.56	58.95	59.89	53.84	6.05	9.903	
1,000.00	1,000.00	1,001.00	1,001.00	3.38	3.38	79.85	10.56	58.95	59.89	53.12	6.76	8.853	
1,100.00	1,100.00	1,101.00	1,101.00	3.74	3.74	79.85	10.56	58.95	59.89	52.41	7.48	8.005	
1,200.00	1,200.00	1,201.00	1,201.00	4.10	4.10	79.85	10.56	58.95	59.89	51.69	8.20	7.305	
1,300.00	1,300.00	1,301.00	1,301.00	4.46	4.46	79.85	10.56	58.95	59.89	50.97	8.92	6.718	
1,400.00	1,400.00	1,401.00	1,401.00	4.81	4.82	79.85	10.56	58.95	59.89	50.26	9.63	6.218	
1,416.33	1,416.33	1,417.33	1,417.33	4.87	4.88	79.85	10.56	58.95	59.89	50.14	9.75	6.143 CC	
1,500.00	1,500.00	1,500.99	1,500.99	5.17	5.18	79.85	10.56	58.95	59.89	49.54	10.35	5.787 ES	
1,600.00	1,600.00	1,600.00	1,599.98	5.53	5.53	78.67	12.00	59.93	61.13	50.06	11.06	5.526	
1,700.00	1,700.00	1,697.80	1,697.64	5.89	5.88	75.52	16.21	62.77	64.92	53.15	11.77	5.515 SF	
1,800.00	1,800.00	1,795.62	1,795.10	6.25	6.23	71.04	23.18	67.49	71.60	59.12	12.48	5.737	
1,900.00	1,899.98	1,892.84	1,891.61	6.61	6.58	96.28	32.83	74.01	81.69	68.51	13.18	6.197	
2,000.00	1,999.84	1,989.36	1,986.98	6.96	6.93	94.14	45.10	82.30	95.18	81.31	13.87	6.861	
2,100.00	2,099.45	2,085.00	2,080.94	7.32	7.28	93.33	59.86	92.29	111.81	97.26	14.55	7.683	
2,200.00	2,198.70	2,179.59	2,173.24	7.68	7.64	93.37	77.02	103.89	131.46	116.24	15.22	8.636	
2,300.00	2,297.47	2,276.85	2,267.71	8.04	8.03	94.22	96.18	116.85	152.97	137.05	15.92	9.606	
2,400.00	2,395.62	2,374.23	2,362.29	8.41	8.42	95.91	115.38	129.83	174.89	158.25	16.64	10.508	
2,500.00	2,493.06	2,471.27	2,456.54	8.80	8.82	98.13	134.50	142.76	197.47	180.09	17.38	11.360	
2,600.00	2,589.64	2,567.86	2,550.35	9.19	9.22	100.70	153.54	155.63	221.01	202.87	18.14	12.181	
2,700.00	2,685.81	2,664.19	2,643.92	9.61	9.63	103.51	172.53	168.48	245.39	226.47	18.92	12.968	
2,800.00	2,781.97	2,760.53	2,737.49	10.03	10.05	105.82	191.52	181.32	270.24	250.52	19.71	13.707	
2,900.00	2,878.13	2,856.87	2,831.06	10.46	10.47	107.74	210.51	194.16	295.42	274.90	20.52	14.397	
3,000.00	2,974.29	2,953.20	2,924.63	10.90	10.89	109.36	229.50	207.00	320.88	299.54	21.33	15.040	
3,100.00	3,070.45	3,049.54	3,018.20	11.35	11.32	110.75	248.49	219.84	346.54	324.38	22.16	15.638	
3,200.00	3,166.62	3,145.87	3,111.77	11.81	11.75	111.94	267.48	232.68	372.36	349.37	22.99	16.195	
3,300.00	3,262.78	3,242.21	3,205.34	12.27	12.18	112.98	286.47	245.52	398.32	374.48	23.83	16.714	
3,400.00	3,358.94	3,338.55	3,298.91	12.74	12.61	113.89	305.46	258.36	424.38	399.70	24.68	17.197	
3,500.00	3,455.10	3,434.88	3,392.48	13.21	13.05	114.69	324.45	271.20	450.53	425.00	25.53	17.648	
3,600.00	3,551.26	3,531.22	3,486.04	13.69	13.49	115.41	343.44	284.04	476.76	450.37	26.39	18.069	
3,700.00	3,647.42	3,627.56	3,579.61	14.17	13.93	116.06	362.43	296.88	503.05	475.80	27.25	18.462	
3,800.00	3,743.59	3,723.89	3,673.18	14.66	14.38	116.64	381.42	309.72	529.39	501.27	28.11	18.831	
3,900.00	3,839.75	3,820.23	3,766.75	15.15	14.82	117.16	400.41	322.56	555.78	526.79	28.98	19.177	
4,000.00	3,935.91	3,916.57	3,860.32	15.64	15.27	117.64	419.40	335.40	582.20	552.35	29.85	19.501	
4,100.00	4,032.07	4,012.90	3,953.89	16.13	15.71	118.07	438.38	348.24	608.66	577.93	30.73	19.807	
4,200.00	4,128.23	4,109.24	4,047.46	16.63	16.16	118.47	457.37	361.08	635.16	603.55	31.61	20.094	
4,300.00	4,224.40	4,205.57	4,141.03	17.13	16.61	118.84	476.36	373.92	661.67	629.18	32.49	20.366	
4,400.00	4,320.56	4,301.91	4,234.60	17.63	17.06	119.18	495.35	386.76	688.22	654.84	33.37	20.622	
4,500.00	4,416.72	4,398.25	4,328.17	18.13	17.51	119.49	514.34	399.61	714.78	680.52	34.26	20.864	
4,600.00	4,512.88	4,494.58	4,421.74	18.64	17.97	119.79	533.33	412.45	741.36	706.21	35.15	21.093	
4,700.00	4,609.04	4,590.92	4,515.31	19.14	18.42	120.06	552.32	425.29	767.96	731.92	36.04	21.310	
4,800.00	4,705.21	4,687.26	4,608.87	19.65	18.87	120.31	571.31	438.13	794.57	757.64	36.93	21.517	
4,900.00	4,801.37	4,783.59	4,702.44	20.16	19.33	120.55	590.30	450.97	821.20	783.37	37.82	21.713	
5,000.00	4,897.53	4,879.93	4,796.01	20.67	19.78	120.77	609.29	463.81	847.83	809.12	38.72	21.899	

CC - Min centre to center distance or convergent point, SF - min separation factor, ES - min ellipse separation



Scientific Drilling, Intl
Anticollision Report



Company: Logos Operating LLC
Project: Rio Arriba, NM NAD83
Reference Site: Federal 2407-28M
Site Error: 0.00 usft
Reference Well: Federal 2407-28M 1H
Well Error: 0.00 usft
Reference Wellbore: OH
Reference Design: Plan #2

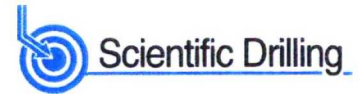
Local Co-ordinate Reference: Well Federal 2407-28M 1H
TVD Reference: GL 7388' & RKB 14' @ 7402.00usft
MD Reference: GL 7388' & RKB 14' @ 7402.00usft
North Reference: True
Survey Calculation Method: Minimum Curvature
Output errors are at: 2.00 sigma
Database: Grand Junction District
Offset TVD Reference: Offset Datum

Offset Design Federal 2407-28M - Federal 2407-28M 3H - OH - Plan #2													Offset Site Error: 0.00 usft
Survey Program: 0-MWD+HDGM													Offset Well Error: 0.00 usft
Reference		Offset		Semi Major Axis			Distance				Separation Factor	Warning	
Measured Depth (usft)	Vertical Depth (usft)	Measured Depth (usft)	Vertical Depth (usft)	Reference (usft)	Offset (usft)	Highside Toolface (°)	Offset Wellbore Centre +N/-S (usft)	+E/-W (usft)	Between Centres (usft)	Between Ellipses (usft)			Minimum Separation (usft)
5,100.00	4,993.69	4,976.26	4,889.58	21.18	20.24	120.98	628.28	476.65	874.48	834.87	39.61	22.077	
5,200.00	5,089.85	5,072.60	4,983.15	21.69	20.69	121.17	647.27	489.49	901.14	860.63	40.51	22.246	
5,300.00	5,186.02	5,168.94	5,076.72	22.20	21.15	121.36	666.26	502.33	927.81	886.41	41.41	22.407	
5,400.00	5,282.21	5,265.28	5,170.29	22.72	21.61	123.86	685.25	515.17	954.48	912.18	42.31	22.562	
5,500.00	5,380.04	5,361.50	5,263.75	23.17	22.06	152.26	704.22	528.00	980.70	937.56	43.15	22.729	
5,600.00	5,479.05	5,450.00	5,349.76	23.51	22.48	-152.49	721.35	539.84	1,006.18	962.36	43.82	22.962	
5,700.00	5,577.31	5,523.93	5,422.35	23.76	22.80	-118.43	730.03	550.63	1,032.26	988.04	44.22	23.343	
5,800.00	5,672.90	5,600.00	5,497.39	23.92	23.08	-104.90	731.10	562.86	1,059.17	1,014.63	44.55	23.777	
5,900.00	5,763.96	5,674.42	5,570.34	24.03	23.30	-98.10	724.40	575.80	1,086.58	1,041.81	44.77	24.271	
6,000.00	5,848.73	5,750.00	5,643.13	24.08	23.49	-94.00	709.84	589.79	1,114.15	1,069.20	44.96	24.783	
6,100.00	5,925.55	5,832.22	5,719.91	24.09	23.64	-91.37	685.32	605.79	1,141.56	1,096.40	45.16	25.276	
6,200.00	5,992.92	5,915.50	5,794.12	24.06	23.75	-89.55	651.58	622.62	1,168.47	1,123.10	45.37	25.757	
6,300.00	6,049.54	6,002.89	5,867.02	24.03	23.81	-88.34	607.04	640.72	1,194.50	1,148.91	45.59	26.200	
6,400.00	6,094.30	6,095.49	5,937.56	23.99	23.84	-87.64	550.36	660.07	1,219.28	1,173.43	45.85	26.590	
6,500.00	6,126.34	6,194.64	6,004.12	23.99	23.82	-87.39	479.92	680.65	1,242.37	1,196.20	46.17	26.911	
6,600.00	6,145.02	6,301.89	6,064.24	24.03	23.76	-87.56	393.90	702.29	1,263.27	1,216.72	46.54	27.141	
6,700.00	6,149.99	6,418.93	6,114.23	24.16	23.65	-88.15	290.60	724.61	1,281.40	1,234.38	47.02	27.252	
6,800.00	6,148.14	6,549.67	6,149.23	24.41	23.50	-89.85	166.87	747.25	1,297.08	1,249.42	47.66	27.214	
6,900.00	6,146.28	6,691.94	6,161.06	24.79	23.90	-90.49	26.90	768.28	1,310.08	1,261.53	48.55	26.985	
7,000.00	6,144.43	6,792.33	6,159.14	25.29	24.47	-90.48	-72.59	781.52	1,321.34	1,271.85	49.49	26.699	
7,100.00	6,142.58	6,891.69	6,157.24	25.88	25.11	-90.47	-171.07	794.63	1,332.60	1,281.99	50.61	26.333	
7,200.00	6,140.73	6,991.06	6,155.34	26.56	25.83	-90.46	-269.55	807.74	1,343.86	1,291.97	51.89	25.898	
7,300.00	6,138.88	7,090.42	6,153.44	27.32	26.61	-90.46	-368.02	820.85	1,355.12	1,301.79	53.33	25.409	
7,400.00	6,137.02	7,189.78	6,151.54	28.14	27.46	-90.45	-466.50	833.96	1,366.38	1,311.46	54.92	24.881	
7,500.00	6,135.17	7,289.15	6,149.64	29.01	28.38	-90.44	-564.98	847.07	1,377.64	1,321.00	56.63	24.325	
7,600.00	6,133.32	7,388.51	6,147.74	29.94	29.35	-90.44	-663.45	860.18	1,388.90	1,330.43	58.47	23.754	
7,700.00	6,131.47	7,487.88	6,145.84	30.92	30.37	-90.43	-761.93	873.29	1,400.16	1,339.74	60.42	23.175	
7,800.00	6,129.62	7,587.24	6,143.94	31.94	31.44	-90.42	-860.41	886.40	1,411.42	1,348.95	62.46	22.596	
7,900.00	6,127.76	7,686.60	6,142.04	33.00	32.56	-90.42	-958.88	899.51	1,422.67	1,358.08	64.60	22.023	
8,000.00	6,125.91	7,785.97	6,140.14	34.09	33.71	-90.41	-1,057.36	912.62	1,433.93	1,367.12	66.81	21.461	
8,100.00	6,124.06	7,885.33	6,138.24	35.22	34.91	-90.41	-1,155.84	925.73	1,445.19	1,376.09	69.10	20.913	
8,200.00	6,122.21	7,984.70	6,136.34	36.37	36.13	-90.40	-1,254.32	938.84	1,456.45	1,384.99	71.46	20.382	
8,300.00	6,120.36	8,084.06	6,134.44	37.55	37.39	-90.39	-1,352.79	951.95	1,467.71	1,393.84	73.87	19.868	
8,400.00	6,118.50	8,183.42	6,132.54	38.76	38.67	-90.39	-1,451.27	965.06	1,478.97	1,402.63	76.34	19.373	
8,500.00	6,116.65	8,282.79	6,130.64	39.99	39.97	-90.38	-1,549.75	978.17	1,490.23	1,411.37	78.86	18.897	
8,600.00	6,114.80	8,382.15	6,128.74	41.23	41.30	-90.38	-1,648.22	991.28	1,501.49	1,420.07	81.42	18.440	
8,700.00	6,112.95	8,481.52	6,126.84	42.50	42.65	-90.37	-1,746.70	1,004.39	1,512.75	1,428.72	84.03	18.003	
8,800.00	6,111.10	8,580.88	6,124.94	43.78	44.02	-90.37	-1,845.18	1,017.50	1,524.01	1,437.34	86.67	17.585	
8,900.00	6,109.24	8,680.24	6,123.04	45.08	45.41	-90.36	-1,943.66	1,030.60	1,535.27	1,445.93	89.34	17.185	
9,000.00	6,107.39	8,779.61	6,121.14	46.39	46.81	-90.36	-2,042.13	1,043.71	1,546.53	1,454.48	92.04	16.802	
9,100.00	6,105.54	8,878.97	6,119.24	47.71	48.22	-90.35	-2,140.61	1,056.82	1,557.79	1,463.01	94.78	16.437	
9,200.00	6,103.69	8,978.34	6,117.34	49.05	49.65	-90.34	-2,239.09	1,069.93	1,569.05	1,471.51	97.53	16.087	
9,300.00	6,101.84	9,077.70	6,115.44	50.40	51.09	-90.34	-2,337.56	1,083.04	1,580.31	1,479.99	100.31	15.754	
9,400.00	6,099.98	9,177.06	6,113.54	51.76	52.55	-90.33	-2,436.04	1,096.15	1,591.57	1,488.45	103.12	15.435	
9,500.00	6,098.13	9,276.43	6,111.64	53.12	54.01	-90.33	-2,534.52	1,109.26	1,602.82	1,496.89	105.94	15.130	
9,600.00	6,096.28	9,375.79	6,109.74	54.50	55.48	-90.32	-2,632.99	1,122.37	1,614.08	1,505.31	108.78	14.838	
9,700.00	6,094.43	9,475.16	6,107.84	55.88	56.96	-90.32	-2,731.47	1,135.48	1,625.34	1,513.71	111.64	14.559	
9,800.00	6,092.58	9,574.52	6,105.94	57.27	58.45	-90.32	-2,829.95	1,148.59	1,636.60	1,522.09	114.51	14.292	
9,900.00	6,090.72	9,673.88	6,104.04	58.67	59.94	-90.31	-2,928.43	1,161.70	1,647.86	1,530.47	117.40	14.037	
10,000.00	6,088.87	9,773.25	6,102.14	60.08	61.44	-90.31	-3,026.90	1,174.81	1,659.12	1,538.82	120.30	13.792	
10,100.00	6,087.02	9,872.61	6,100.24	61.49	62.95	-90.30	-3,125.38	1,187.92	1,670.38	1,547.17	123.21	13.557	
10,200.00	6,085.17	9,971.98	6,098.34	62.90	64.47	-90.30	-3,223.86	1,201.03	1,681.64	1,555.50	126.14	13.332	

CC - Min centre to center distance or convergent point, SF - min separation factor, ES - min ellipse separation



Scientific Drilling, Intl Anticollision Report



Company: Logos Operating LLC
Project: Rio Arriba, NM NAD83
Reference Site: Federal 2407-28M
Site Error: 0.00 usft
Reference Well: Federal 2407-28M 1H
Well Error: 0.00 usft
Reference Wellbore: OH
Reference Design: Plan #2

Local Co-ordinate Reference: Well Federal 2407-28M 1H
TVD Reference: GL 7388' & RKB 14' @ 7402.00usft
MD Reference: GL 7388' & RKB 14' @ 7402.00usft
North Reference: True
Survey Calculation Method: Minimum Curvature
Output errors are at 2.00 sigma
Database: Grand Junction District
Offset TVD Reference: Offset Datum

Offset Design Federal 2407-28M - Federal 2407-28M 3H - OH - Plan #2													Offset Site Error:	0.00 usft
Survey Program: 0-MWD+HDGM													Offset Well Error:	0.00 usft
Reference		Offset		Semi Major Axis			Distance							Warning
Measured Depth (usft)	Vertical Depth (usft)	Measured Depth (usft)	Vertical Depth (usft)	Reference (usft)	Offset (usft)	Highside Toolface (°)	Offset Wellbore +N-S (usft)	Centre +E-W (usft)	Between Centres (usft)	Between Ellipses (usft)	Minimum Separation (usft)	Separation Factor		
10,300.00	6,083.32	10,071.34	6,096.44	64.32	65.99	-90.29	-3,322.33	1,214.14	1,692.90	1,563.83	129.07	13.116		
10,400.00	6,081.46	10,170.70	6,094.54	65.75	67.51	-90.29	-3,420.81	1,227.25	1,704.16	1,572.14	132.02	12.908		
10,500.00	6,079.61	10,270.07	6,092.64	67.18	69.04	-90.28	-3,519.29	1,240.36	1,715.42	1,580.45	134.97	12.709		
10,600.00	6,077.76	10,369.43	6,090.74	68.62	70.58	-90.28	-3,617.77	1,253.47	1,726.68	1,588.74	137.94	12.518		
10,700.00	6,075.91	10,468.80	6,088.84	70.06	72.12	-90.28	-3,716.24	1,266.58	1,737.94	1,597.03	140.91	12.334		
10,800.00	6,074.06	10,568.16	6,086.94	71.50	73.66	-90.27	-3,814.72	1,279.69	1,749.20	1,605.31	143.89	12.156		
10,900.00	6,072.20	10,667.52	6,085.04	72.95	75.21	-90.27	-3,913.20	1,292.80	1,760.46	1,613.58	146.88	11.986		
11,000.00	6,070.35	10,766.89	6,083.14	74.40	76.76	-90.26	-4,011.67	1,305.91	1,771.72	1,621.84	149.88	11.821		
11,100.00	6,068.50	10,866.25	6,081.24	75.85	78.31	-90.26	-4,110.15	1,319.02	1,782.98	1,630.10	152.88	11.663		
11,200.00	6,066.65	10,965.62	6,079.34	77.30	79.87	-90.26	-4,208.63	1,332.13	1,794.24	1,638.35	155.88	11.510		
11,300.00	6,064.80	11,064.98	6,077.44	78.76	81.43	-90.25	-4,307.10	1,345.24	1,805.50	1,646.60	158.90	11.363		
11,400.00	6,062.94	11,164.34	6,075.54	80.23	82.99	-90.25	-4,405.58	1,358.34	1,816.76	1,654.84	161.92	11.220		
11,500.00	6,061.09	11,263.71	6,073.64	81.69	84.55	-90.24	-4,504.06	1,371.45	1,828.02	1,663.08	164.94	11.083		
11,600.00	6,059.24	11,363.07	6,071.74	83.16	86.12	-90.24	-4,602.54	1,384.56	1,839.28	1,671.31	167.97	10.950		
11,700.00	6,057.39	11,462.44	6,069.84	84.63	87.69	-90.24	-4,701.01	1,397.67	1,850.54	1,679.53	171.00	10.822		
11,800.00	6,055.54	11,561.80	6,067.94	86.10	89.26	-90.23	-4,799.49	1,410.78	1,861.80	1,687.76	174.04	10.698		
11,900.00	6,053.68	11,661.16	6,066.04	87.57	90.84	-90.23	-4,897.97	1,423.89	1,873.06	1,695.98	177.08	10.577		
11,990.91	6,052.00	11,751.49	6,064.31	88.91	92.27	-90.23	-4,987.49	1,435.81	1,883.29	1,703.44	179.85	10.472		

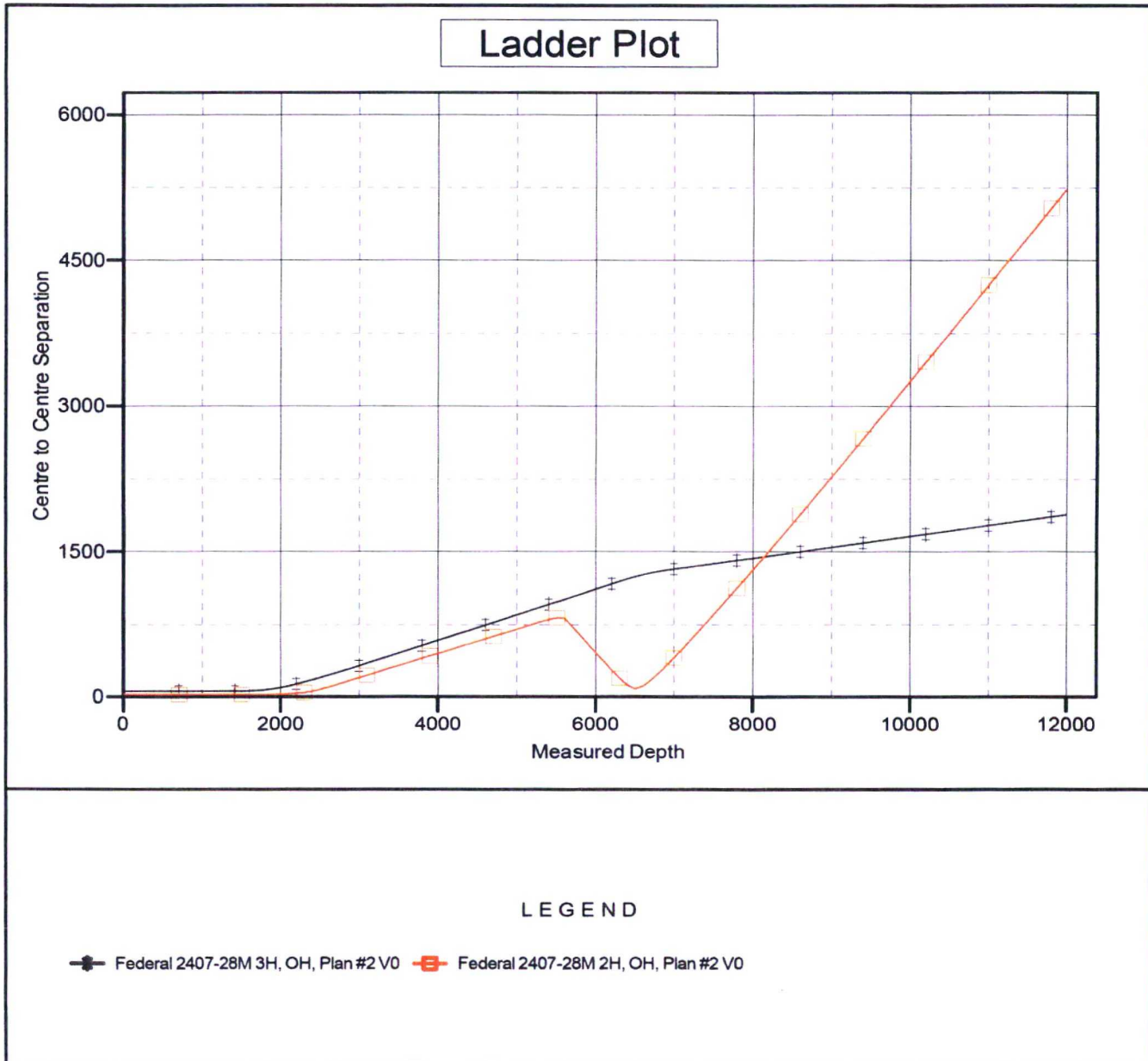
CC - Min centre to center distance or convergent point, SF - min separation factor, ES - min ellipse separation

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North Reference: True
Survey Calculation Method: Minimum Curvature
Output errors are at 2.00 sigma
Database: Grand Junction District
Offset TVD Reference: Offset Datum

Reference Depths are relative to GL 7388' & RKB 14' @ 7402.00usft
Offset Depths are relative to Offset Datum
Central Meridian is -107.8333334

Coordinates are relative to: Federal 2407-28M 1H
Coordinate System is US State Plane 1983, New Mexico Western Zone
Grid Convergence at Surface is: 0.15°





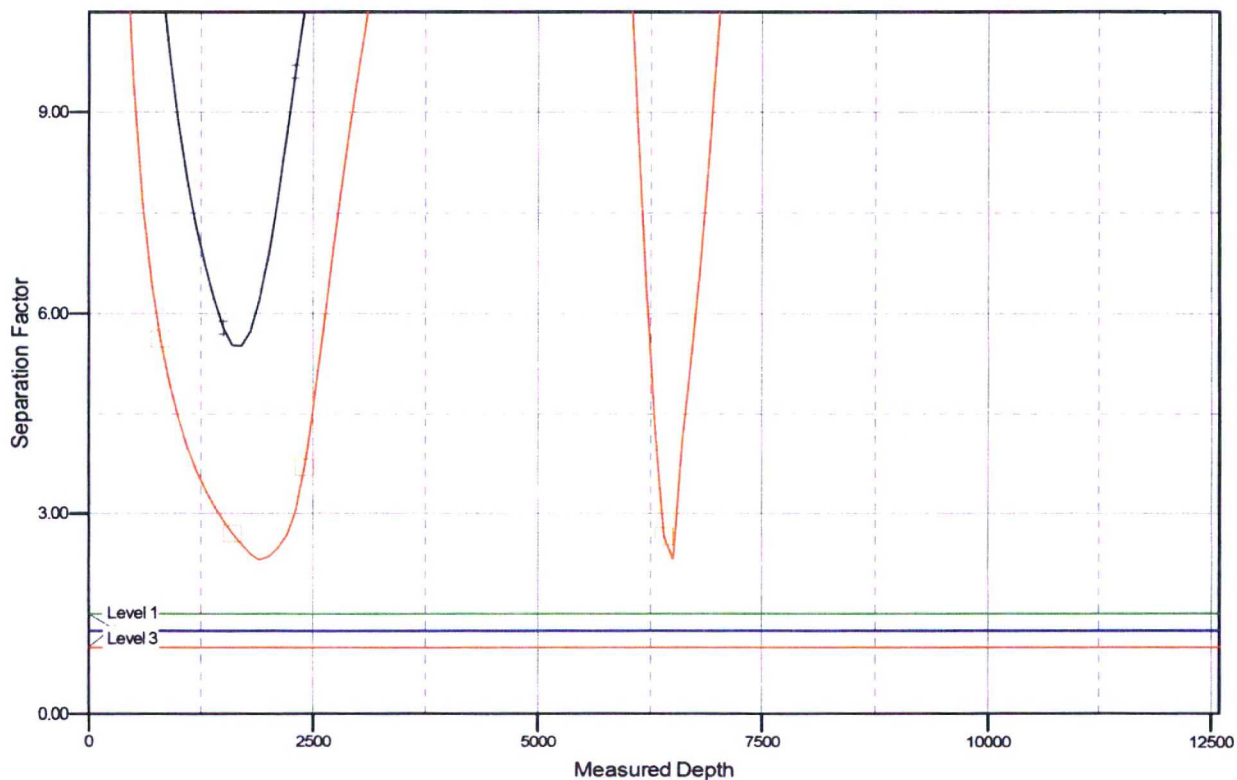
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Coordinate System is US State Plane 1983, New Mexico Western Zone
Grid Convergence at Surface is: 0.15°

Separation Factor Plot



LEGEND

—●— Federal 2407-28M 3H, OH, Plan #2 V0 —■— Federal 2407-28M 2H, OH, Plan #2 V0

6 Construction Materials

Construction material would consist of native borrow material at the site locations. Topsoil at each site would be stripped and placed as a berm along the outer edge of the pad within EOD or as a windrow along the edge of the access and/or pipeline corridor. Topsoil would be stored separately and protected for use during interim reclamation. All pads and roads would be built with a balanced cut and fill, such that all material would be native. Subsoil horizons from cuts would be used as fill material to establish a level working surface, and to construct earthen berms where necessary. If the proposed projects cannot be constructed from the earthen materials present on-site, materials would be imported from a borrow pit or other location approved by the BLM-FFO. Imported fill material would be weed-free, and no concrete or other foreign materials would be brought in for use as fill. Vegetation removed during construction, including small trees and slash/brush, would be chipped or mulched and incorporated into the topsoil as additional organic matter. Trees with trunks that are 3 inches in diameter or greater would be cut, delimbed, and delivered to Navajo Chapter Houses in the area. The subsurface portion of trees (tree stumps) would be hauled to an approved disposal facility.

Whiptail may need to acquire material for use in padding pipelines and backfilling trenches in areas that are extremely rocky. No source for material has yet been identified because the volume that would be needed is unknown. If necessary, Whiptail would pursue permitting a quarry as a separate action.

Construction and maintenance activities would cease if soil or road surfaces become saturated to the extent that construction equipment is unable to stay within the permitted area and/or when activities cause irreparable harm to roads, soils, or streams.

7 Methods for Handling Waste

✓ Drilling operations would utilize a closed-loop mud system. Either water-based or oil-based mud may be used. All cuttings would be stored in metal containment bins until hauled to a commercial disposal facility. No reserve pit would be needed. The drilling operations area would be enclosed by a containment berm and ditches, and the containment berm would be ramped to allow access to the solids control area. The contained operations area would drain gradually to one area of the pad which would be contoured for spill prevention and control.

LOGOS would follow New Mexico Oil Conservation Division Pit Rule and Onshore Orders No. 1 and No. 7 regarding placement, operation, and closure of the closed-loop system. No blow pit would be used. All refuse would be placed in metal trash basket and would be hauled off site and properly disposed in an approved landfill. Portable toilets would be provided and maintained during all construction, drilling and completion operations.

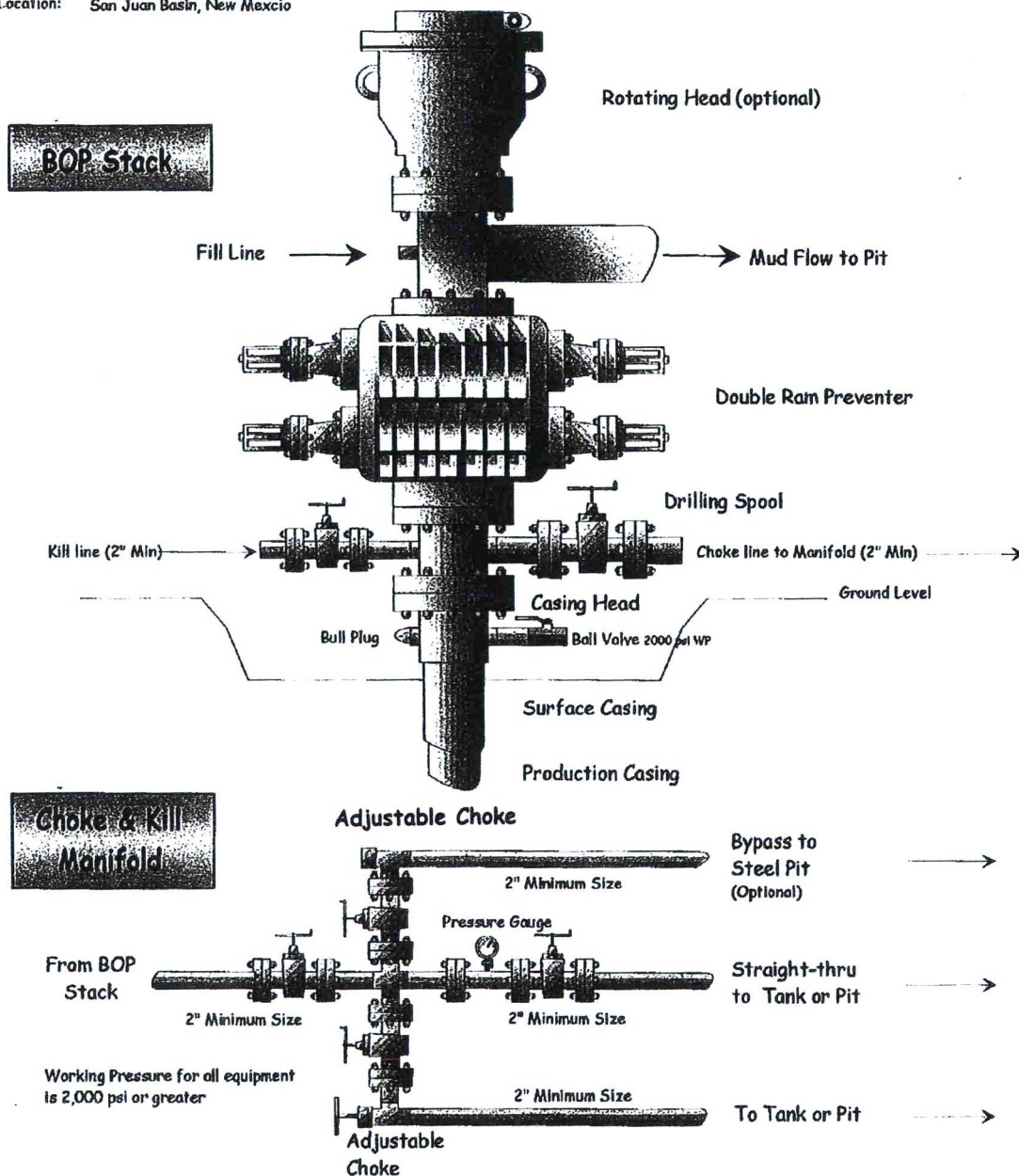
Whiptail is considering development of a fluid transfer facility at the upper boring location (TUA #2). This location could assist operators in testing, treating, and storing water for reuse. All testing, treatment, and storage would be permitted as appropriate through the New Mexico Oil Conservation Division (NMOCD). Development of the site would depend on demand from operators and Whiptail's own needs in the area.

Well Control Equipment Schematic for 2M Service

Attachment to Drilling Technical Program

Exhibit #1 Typical BOP setup

Location: San Juan Basin, New Mexico



**Directions from the Intersection of Highway 550 and Highway
64 in Bloomfield, NM**

to

**LOGOS OPERATING, LLC
FEDERAL 2407 28M COM #1H
0' FSL 863' FWL,
Section 28, T24N, R7W, N.M.P.M.,
RIO ARriba COUNTY, NEW MEXICO
Latitude: 36° 16' 38.492" N
Longitude: 107° 35' 10.655" W
Nad 1983**

**From the Intersection of
Highway 550 & Highway 64, in Bloomfield, N.M.,
Go South on Hwy 550 for 46.9 miles to CR 0377
turn left on CR0377 (northerly) for 4.1 miles,
turn right (easterly) for 0.5 miles
to the new location.**