State of New Mexico
Energy, Minerals and Natural Resources Department

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: 8/15/17
Well information;
Operator 6905, Well Name and Number Hero 2308 09L COM 4H

API# 30-045-35547, Section 9, Township 23 N/S, Range 8 E/W

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
- ✓ Hold C-104 for NSL, NSP, DHC
- o Spacing rule violation. Operator must follow up with change of status notification on other well to be shut in or abandoned
- o 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
- o 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
- o 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.

Charlie Perrin — 10-23-2017
NMOCD Approved by Signature — Date

1220 South St. Francis Drive • Santa Fe, New Mexico 87505
Phone (505) 476-3441 • Fax (505) 476-3462 • www.emnrd.state.nm.us/ocd

Form 3160-3
(March 2012)

FORM APPROVED
OMB No. 1004-0137
Expires October 31, 2014

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

APPLICATION FOR PERMIT TO DRILL OR REENTER

5. Lease Serial No.: NMNM18463

6. If Indian, Allotee or Tribe Name:

1a. Type of work: ☑ DRILL ☐ REENTER

7. If Unit or CA Agreement, Name and No.:

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

8. Lease Name and Well No.: HEROS 2308 09L COM 4H

2. Name of Operator: LOGOS OPERATING LLC

9. API Well No.: 30-045-35847

3a. Address: 2010 Afton Place FARMINGTON NM 87401

3b. Phone No. *(include area code)*: (503)324-4145

10. Field and Pool, or Exploratory: NAGEEZI GALLUP

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

At surface: L NWSW / 1476 FSL / 300 FWL / LAT 36.238493 / LONG -107.694637

At proposed prod. zone: H SENE / 2358 FNL / 290 FEL / LAT 36.227912 / LONG -107.679035

11. Sec., T. R. M. or Blk. and Survey or Area: SEC 9 / T23N / R8W / NMP

14. Distance in miles and direction from nearest town or post office*: 3.1 miles

12. County or Parish: SAN JUAN

13. State: NM

15. Distance from proposed* location to nearest property or lease line, ft. (Also to nearest drig. unit line, if any): 300 feet

16. No. of acres in lease: 2243.16

17. Spacing Unit dedicated to this well: 280

18. Distance from proposed location* to nearest well, drilling, completed, applied for, on this lease, ft.: 30 feet

19. Proposed Depth: 5164 feet / 10827 feet

20. BLM/BIA Bond No. on file: FED: NMB001387

KP

21. Elevations (Show whether DF, KDB, RT, GL, etc.): 6913 feet

22. Approximate date work will start*: 11/01/2017

23. Estimated duration: 45 days

24. Attachments

The following, completed in accordance with the requirements of Onshore Oil and Gas Order No.1, must be attached to this form:

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 required by the BLM.

25. Signature	Name *(Printed/Typed)*	Date
(Electronic Submission)	Tamra Sessions / Ph: (505)436-3790	08/15/2017

Title: REGULATORY SPECIALIST

Approved by *(Signature)*	Name *(Printed/Typed)*	Date
/s/ Maryann Maestas AFM		10/13/17
Title	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.

(Continued on page 2)

*(Instructions on page 2)

DRILLING OPERATIONS AUTHORIZED ARE SUBJECT TO COMPLIANCE WITH ATTACHED "GENERAL REQUIREMENTS"

BLM'S APPROVAL OR ACCEPTANCE OF THIS ACTION DOES NOT RELIEVE THE LESSEE AND OPERATOR FROM OBTAINING ANY OTHER AUTHORIZATION REQUIRED FOR OPERATIONS ON FEDERAL AND INDIAN LANDS

This action is subject to technical and procedural review pursuant to 43 CFR 3165.3 and appeal pursuant to 43 CFR 3165.4

NMOCD AV

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. 88210
Phone: (575) 748-1283 Fax: (575) 748-9720

DISTRICT III
1000 Rio Brazos Rd., Aztec, N.M. 87410
Phone: (505) 334-6178 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	[2] Pool Code	[3] Pool Name
30-045-35847	47540	NAGEEZI GALLUP

[4] Property Code	[5] Property Name	[6] Well Number
317282	HEROS 2308 09L COM	#4H

[7] OGRID No.	[8] Operator Name	[9] Elevation
289408	LOGOS OPERATING, LLC	6913

[10] Surface Location

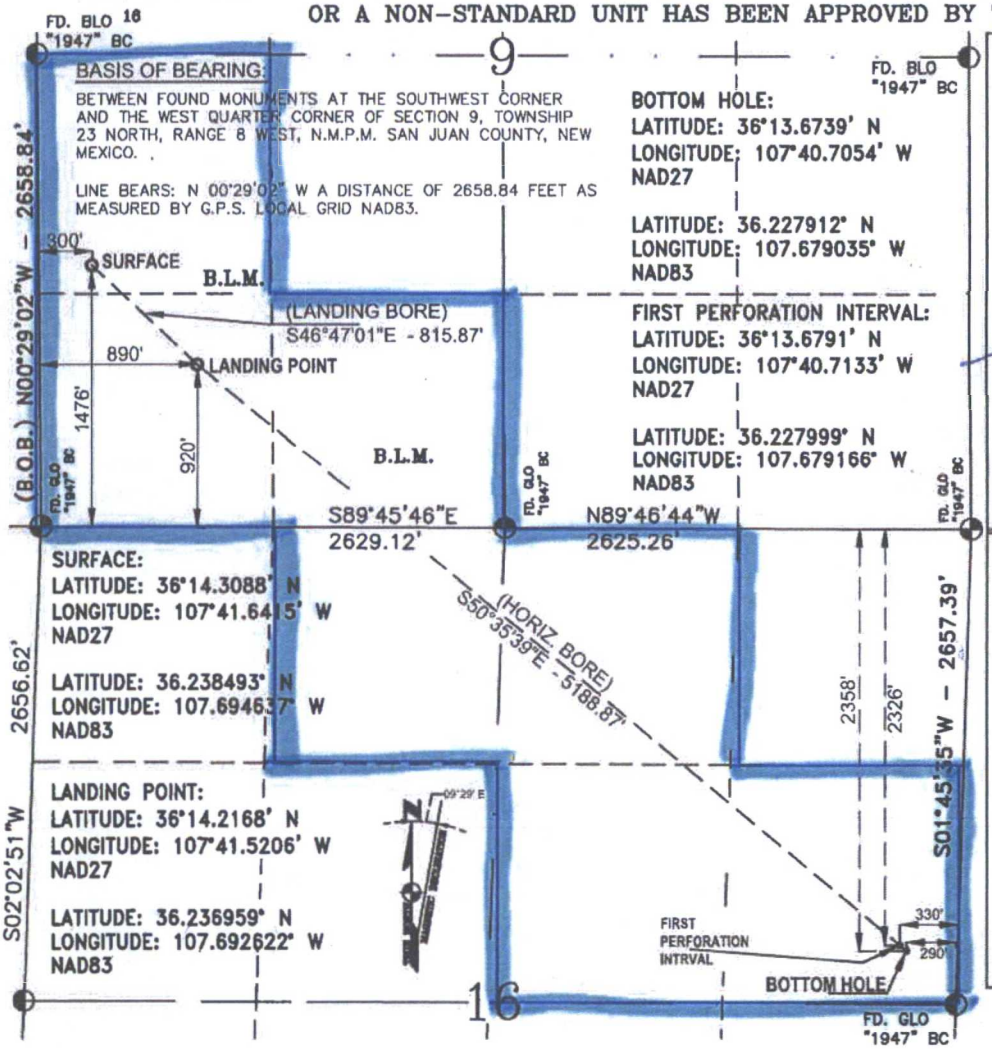
UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
L	9	23-N	8-W		1476	SOUTH	300	WEST	SAN JUAN

[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
H	16	23-N	8-W		2358	NORTH	290	EAST	SAN JUAN

[12] Dedicated Acres	[13] Joint or Infill	[14] Consolidation Code	[15] Order No.
Sec 9: NWSW, S2SW 120 acres Sec 16: NENW, NWNE, S2NE 160 acres Total acres = 280			

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



[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.

Tamra Sessions 7/28/17

Signature Date

Tamra Sessions

Printed Name

tsessions@logosresourcesllc.com

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.

JUNE 21, 2017

Date of Survey

Signature and Seal of Professional Surveyor

GLEN W. RUSSELL
NEW MEXICO
15703
LICENSED PROFESSIONAL SURVEYOR

GLEN W. RUSSELL

Certificate Number 15703

Surface = Indian

APD Drilling Plan
LOGOS Operating, LLC

HEROS 2308 09L Com 4H
Lease Serial # NMNM18463

Surface Location: 1476 FSL, 300FWL
Legal Description: Sec 9, T23N, R8W (36.238493° N, 107.694637° W – NAD83)
Bottom Hole Location: 2358 FNL, 290 FEL
Legal Description: Sec 16, T23N, R8W (36.227912° N, 107.679035° W – NAD83)
San Juan County, NM

1. The elevation of the unprepared ground is 6,913 feet above sea level.
2. The geological name of the surface formation is the Nacimiento.
3. A rotary rig will be used to drill the well to a Proposed Total Depth of 5,233' TVD/10,827' MD.
4. Estimated top of important geological markers:

Formation	Depth (TVD)(ft)	Depth (MD)(ft)
Nacimiento	Surface	Surface
Ojo Alamo	850	850
Kirtland	1,055	1,057
Fruitland	1,186	1,189
Pictured Cliffs	1,560	1,575
Chacra	2,515	2,529
Cliff House	3,076	3,233
Menefee	3,101	3,261
Point Lookout	4,001	4,242
Mancos	4,177	4,435
Mancos/Niobrara "C"	5,117	5,492

5. Estimated depth at which anticipated water, oil, gas or other mineral bearing formations are expected to be encountered:

Formation	Depth (TVD)(ft)	Water/HydroCarbon
Fruitland	1,186	Gas
Pictured Cliffs	1,540	Gas
Cliffhouse	3,076	Gas
Point Lookout	4,001	Gas
Mancos	4,177	Oil/Gas

6. All proposed casing is new and the program is as follows:

Casing	Size	Depth		Grade	Weight	Connection	PSI		x1000 lbs
		MD	TVD				Burst	Collapse	Tension
Surface	9-5/8"	0-320'	0-320'	J-55	36.00	STC	3520	2020	423
Intermediate	7"	0-5,653'	0-5,233'	J-55	23.00	LTC	4360	3270	341
Production	4-1/2"	5,503'-10,827'	5,233'-5,164'	P-110	11.60	Ultra DQX	10690	7560	279

7. Cementing Program:

   a. 12-1/4" hole x 9-5/8" casing at 320' will have cement circulated to surface with 270 sks (100% excess true hole) Class H Cement with 1.0 % $CaCl_2$, ½ #/sk Poly-E-Flake15.8 ppg, 1.17 ft^3/sk. Note: CEMENT MUST BE CIRCULATED TO SURFACE. STANDARD BOW SPRING CENTRALIZERS SHALL BE PLACED ON THE FIRST 3 (BOTTOM 3) JOINTS OF CASING (1 PER JOINT) AND 1 EVERY 3^{RD} JOINT TO SURFACE. 20 BBLS OF WATER FOLLOWED BY 20 BBLS OF MUDFLUSH AHEAD OF CEMENT AS SPACER. Test Surface Casing to 750 psi.

   a. 8-3/4" hole x 7" casing at 5,653'. Cement will be circulated to surface in a single stage with **578** sks (70% excess true hole) of HALCEM with 1.0 % CaC2. ¼ #/sk Poly-E-Flake, 5 #/sk Kol-Seal (Gilsonite) –12.3 ppg, 1.95 ft^3/sk followed by **246** sks (70% excess true hole) VARICEM with 0.15% Versaset, 0.30% HALAD-9, 1/4 #/sk Poly-E-Flake, 5 #/sk Kol-Seal – 13.5 ppg, 1.3 ft3/sk. ONE CENTRALIZER PER JOINT FOR THE FIRST 3 JOINTS, THEN EVERY OTHER JOINT TO KOP, THEN ONE EVERY 3RD JOINT TO SURFACE. 20 BBLS OF WATER FOLLOWED BY 30 BBLS OF MUDFLUSH AHEAD OF CEMENT AS SPACER Test Intermediate Casing to 1500 psi. Cement additives subject to change based on wellbore conditions and cement design criteria.

   a. **6-1/8"** hole x 4-1/2" liner at 10,827' MD in a single stage using excess of approximately 30% for TOC at **5503'**. Base slurry to consist of **391** sks EXTENDACEM -13.3 ppg, 1.36 fl3/sk. CENTRALIZERS TO BE USED AT DISCRETION IN LATERAL TO ACHIEVE 70% STAND OFF. CENTRALIZERS TO BE USED TO TIE BACK DEPTH OF 6000' TO ACHIEVE 70% STAND OFF. PACKOFF SEAL ASSEMBLY TO BE USED FOR LINER TOP ISOLATION. Cement additives subject to change based on wellbore conditions and cement design criteria. Liner to be pressure tested during completion operations.

8. Pressure Control Equipment

   a. BOPE to be installed prior to Surface Casing drillout.
   b. Pressure control equipment will be used to meet 2,000 (2M) psi specifications.
   c. BOPE working pressure of 3,000 psi.
   d. Function test and visual inspection to be done at each casing size change prior to drill out.
   e. BOP annular to be tested to 85% of working pressure.
   f. All BOP and related equipment will be tested in accordance with the requirements outlined in Onshore Order No. 2 and Notice to Operators dated May 27, 2005.
   g. BOP remote controls to be located on rig floor and readily accessible, master control on ground at accumulator will be able to function all preventors.
   h. Kill line will be 2 in min and have two kill line valves, one being a check valve.
   i. Choke line will be 2 in min and have two choke line valves, choke manifold with have two adjustable chokes, one manual and one remote. All choke lines will be as straight as possible. Any turns will be properly targeted using block and/or running tees. Choke line and manifold to be pressure tested to 1,500 psi.
   j. Float sub and TIW valve will be on the rig floor at all times.
   k. If high pressure co-flex hoses are used, they will be run as straight as possible and anchored to prevent whip.
   l. The main discharge line (panic line) will be at least 100' from the choke manifold and discharged into an appropriately sized discharge facility.

9. Mud Program:

0' - 320'	Fresh water/Spud Mud. Paper for losses and seepage. 8.5 to 9.0 ppg, 32 to 75 vis, PV 3 to 5, YP 5 to 7, WL NC
320' – 5,653'	Fresh water/LSND. As needed LCM for losses and seepage. 8.5 to 9.5 ppg, pH 10, 28 to 60 vis, PV 1, YP 1, WL 8-15
5,653' – 10,827'	WBM with shale and clay stabilizers. As needed LCM for losses and seepage. 8.3 to 9.3 ppg, 15 to 35 vis, PV 4-6, YP 4-6, WL < 20

****During drilling operations, all necessary products will be sufficiently stored on location for abnormal situations. The characteristics, use, testing of drilling mud and the implementation of related drilling procedures shall be designed to prevent the loss of well control. Sufficient quantities of mud materials shall be maintained or readily accessible for the purpose of assuring well control.**
****A pH of 10 or above in the fresh water base mud system shall be maintained to control the effects corrosion has on metallurgy of equipment used.**

Operating and Maintenance

LOGOS Operating, LLC will be using all above ground steel pits for fluid and cuttings while drilling. If any tank develops a leak we will have immediate visual discovery, we would then transfer the fluid to another tank then remove any contaminated soil and dispose of it in the cuttings bins for transportation. Any leaks, spills or other undesirable events will be reported in accordance with BLM NTL 3A. Rig crews will monitor the tanks at all times. A trip/surge tank will be used to monitor returns for any "kicks" of formation fluids.

Equipment:

2-Mongoose Shale Shakers

2-3400 High Speed Centrifuges with stands and pumps

2-Roll off bins with Tracks

2-200 bbl Open top Frac tanks

1-Mud/Gas Separator and Degasser

1-Trip/Surge Tank

Electronic or Visual monitoring system to indicate lost returns

10. Testing, Logging and Coring Program:

    a. Testing Program: No drillstem tests are anticipated
    b. Electric Logging Program: TBD
    c. LWD Program: TBD
    d. Coring Program: None.
    e. CBL's and/or Temperature Surveys Will Be Performed as Needed or Required.

11. Bottom Hole Pressure expected to be 2,500 +/- psi
12. Bottom Hole Temperature expected to be 160 deg F.

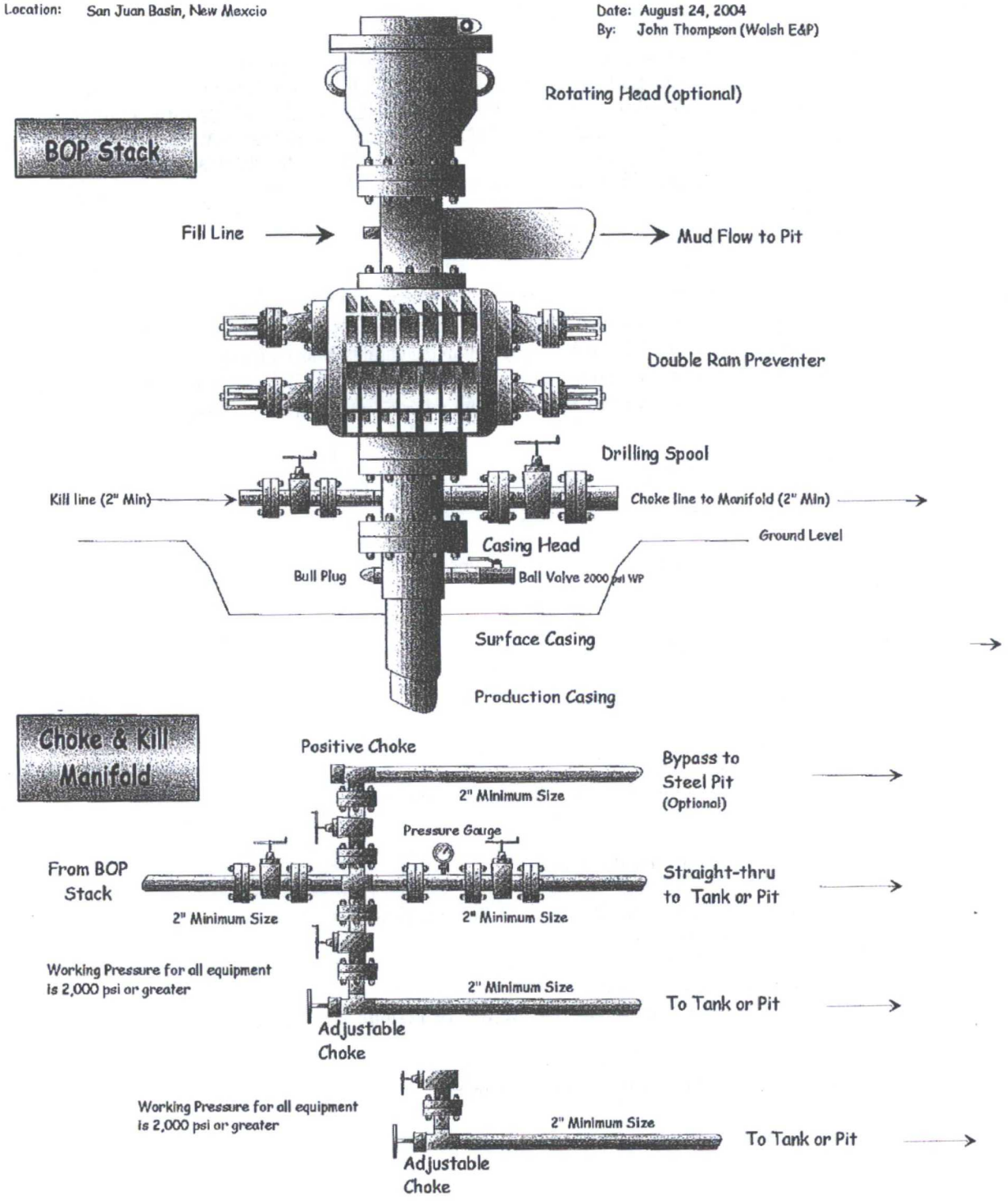
Well Control Equipment Schematic for 2M Service

Attachment to Drilling Technical Program

Exhibit #1
Typical BOP setup

Location: San Juan Basin, New Mexcio

Date: August 24, 2004
By: John Thompson (Walsh E&P)



Cathedral Energy Services

Planning Report

Database:	USA EDM 5000 Multi Users DB	**Local Co-ordinate Reference:**	Well HEROS 4H
Company:	LOGOS Operating LLC	**TVD Reference:**	14' KB @ 6923.00usft
Project:	San Juan County, NM	**MD Reference:**	14' KB @ 6923.00usft
Site:	S9-T23N-R8W	**North Reference:**	True
Well:	HEROS 4H	**Survey Calculation Method:**	Minimum Curvature
Wellbore:	OH		
Design:	PLAN #2		

Project	San Juan County, NM		
Map System:	US State Plane 1983	**System Datum:**	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	New Mexico Western Zone		

Site	S9-T23N-R8W				
Site Position:		**Northing:**	1,906,138.83 usft	**Latitude:**	36.238493
From:	Map	**Easting:**	2,763,902.48 usft	**Longitude:**	-107.694942
Position Uncertainty:	0.00 usft	**Slot Radius:**	13-3/16"	**Grid Convergence:**	0.08 °

Well	HEROS 4H					
Well Position	**+N/-S**	0.00 usft	**Northing:**	1,906,138.43 usft	**Latitude:**	36.238492
	+E/-W	0.00 usft	**Easting:**	2,763,993.22 usft	**Longitude:**	-107.694634
Position Uncertainty		0.00 usft	**Wellhead Elevation:**	usft	**Ground Level:**	6,909.00 usft

Wellbore	OH			
Magnetics	**Model Name**	**Sample Date**	**Declination (°)**	**Dip Angle (°)**	**Field Strength (nT)**
	HDGM	6/6/2017	8.98	62.88	49,669.20000000

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	129.93	

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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2,100.00	0.00	0.00	2,100.00	0.00	0.00	0.00	0.00	0.00	0.00	
2,208.12	2.16	159.16	2,208.09	-1.91	0.73	2.00	2.00	0.00	159.16	
4,542.13	2.16	159.16	4,540.44	-84.21	32.05	0.00	0.00	0.00	0.00	
5,653.14	90.76	129.38	5,233.00	-554.51	584.34	8.00	7.97	-2.68	-29.79	HEROS 4H LP
6,999.93	90.76	129.38	5,215.20	-1,408.85	1,625.32	0.00	0.00	0.00	0.00	HEROS 4H TGT
7,562.29	90.77	135.00	5,207.70	-1,786.32	2,041.79	1.00	0.00	1.00	89.83	
9,062.29	90.77	135.00	5,187.54	-2,846.89	3,102.35	0.00	0.00	0.00	0.00	
10,710.53	90.74	113.74	5,165.52	-3,771.92	4,454.95	1.29	0.00	-1.29	-89.93	
10,827.43	90.74	113.74	5,164.00	-3,818.97	4,561.96	0.00	0.00	0.00	0.00	HEROS 4H PBHL

Database:	USA EDM 5000 Multi Users DB	**Local Co-ordinate Reference:**	Well HEROS 4H
Company:	LOGOS Operating LLC	**TVD Reference:**	14' KB @ 6923.00usft
Project:	San Juan County, NM	**MD Reference:**	14' KB @ 6923.00usft
Site:	S9-T23N-R8W	**North Reference:**	True
Well:	HEROS 4H	**Survey Calculation Method:**	Minimum Curvature
Wellbore:	OH		
Design:	PLAN #2		

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft	Build Rate (°/100u	Comments / Formations
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
100.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	
200.00	0.00	0.00	200.00	0.00	0.00	0.00	0.00	0.00	
300.00	0.00	0.00	300.00	0.00	0.00	0.00	0.00	0.00	
400.00	0.00	0.00	400.00	0.00	0.00	0.00	0.00	0.00	
500.00	0.00	0.00	500.00	0.00	0.00	0.00	0.00	0.00	
600.00	0.00	0.00	600.00	0.00	0.00	0.00	0.00	0.00	
700.00	0.00	0.00	700.00	0.00	0.00	0.00	0.00	0.00	
800.00	0.00	0.00	800.00	0.00	0.00	0.00	0.00	0.00	
900.00	0.00	0.00	900.00	0.00	0.00	0.00	0.00	0.00	
1,000.00	0.00	0.00	1,000.00	0.00	0.00	0.00	0.00	0.00	
1,100.00	0.00	0.00	1,100.00	0.00	0.00	0.00	0.00	0.00	
1,200.00	0.00	0.00	1,200.00	0.00	0.00	0.00	0.00	0.00	
1,300.00	0.00	0.00	1,300.00	0.00	0.00	0.00	0.00	0.00	
1,400.00	0.00	0.00	1,400.00	0.00	0.00	0.00	0.00	0.00	
1,500.00	0.00	0.00	1,500.00	0.00	0.00	0.00	0.00	0.00	
1,600.00	0.00	0.00	1,600.00	0.00	0.00	0.00	0.00	0.00	
1,700.00	0.00	0.00	1,700.00	0.00	0.00	0.00	0.00	0.00	
1,800.00	0.00	0.00	1,800.00	0.00	0.00	0.00	0.00	0.00	
1,900.00	0.00	0.00	1,900.00	0.00	0.00	0.00	0.00	0.00	
2,000.00	0.00	0.00	2,000.00	0.00	0.00	0.00	0.00	0.00	
2,100.00	0.00	0.00	2,100.00	0.00	0.00	0.00	0.00	0.00	KOP @ 2100'
2,200.00	2.00	159.16	2,199.98	-1.63	0.62	1.52	2.00	2.00	
2,208.12	2.16	159.16	2,208.09	-1.91	0.73	1.78	2.00	2.00	EOB; INC=2.16°
2,300.00	2.16	159.16	2,299.91	-5.15	1.96	4.81	0.00	0.00	
2,400.00	2.16	159.16	2,399.84	-8.67	3.30	8.10	0.00	0.00	
2,500.00	2.16	159.16	2,499.77	-12.20	4.64	11.39	0.00	0.00	
2,600.00	2.16	159.16	2,599.70	-15.73	5.99	14.68	0.00	0.00	
2,700.00	2.16	159.16	2,699.62	-19.25	7.33	17.98	0.00	0.00	
2,800.00	2.16	159.16	2,799.55	-22.78	8.67	21.27	0.00	0.00	
2,900.00	2.16	159.16	2,899.48	-26.31	10.01	24.56	0.00	0.00	
3,000.00	2.16	159.16	2,999.41	-29.83	11.35	27.86	0.00	0.00	
3,100.00	2.16	159.16	3,099.34	-33.36	12.70	31.15	0.00	0.00	
3,200.00	2.16	159.16	3,199.27	-36.88	14.04	34.44	0.00	0.00	
3,300.00	2.16	159.16	3,299.20	-40.41	15.38	37.73	0.00	0.00	
3,400.00	2.16	159.16	3,399.13	-43.94	16.72	41.03	0.00	0.00	
3,500.00	2.16	159.16	3,499.05	-47.46	18.07	44.32	0.00	0.00	
3,600.00	2.16	159.16	3,598.98	-50.99	19.41	47.61	0.00	0.00	
3,700.00	2.16	159.16	3,698.91	-54.52	20.75	50.90	0.00	0.00	
3,800.00	2.16	159.16	3,798.84	-58.04	22.09	54.20	0.00	0.00	
3,900.00	2.16	159.16	3,898.77	-61.57	23.43	57.49	0.00	0.00	
4,000.00	2.16	159.16	3,998.70	-65.10	24.78	60.78	0.00	0.00	
4,100.00	2.16	159.16	4,098.63	-68.62	26.12	64.08	0.00	0.00	
4,200.00	2.16	159.16	4,198.56	-72.15	27.46	67.37	0.00	0.00	
4,300.00	2.16	159.16	4,298.48	-75.67	28.80	70.66	0.00	0.00	
4,400.00	2.16	159.16	4,398.41	-79.20	30.15	73.95	0.00	0.00	
4,500.00	2.16	159.16	4,498.34	-82.73	31.49	77.25	0.00	0.00	
4,542.13	2.16	159.16	4,540.44	-84.21	32.05	78.63	0.00	0.00	START BUILD/TURN
4,600.00	6.59	138.72	4,598.13	-87.73	34.63	82.87	8.00	7.66	
4,700.00	14.55	133.53	4,696.36	-100.72	47.55	101.11	8.00	7.95	
4,800.00	22.53	131.98	4,791.09	-122.22	70.93	132.84	8.00	7.99	
4,900.00	30.52	131.21	4,880.49	-151.81	104.33	177.45	8.00	7.99	

Cathedral Energy Services

Planning Report

Database:	USA EDM 5000 Multi Users DB	**Local Co-ordinate Reference:**	Well HEROS 4H
Company:	LOGOS Operating LLC	**TVD Reference:**	14' KB @ 6923.00usft
Project:	San Juan County, NM	**MD Reference:**	14' KB @ 6923.00usft
Site:	S9-T23N-R8W	**North Reference:**	True
Well:	HEROS 4H	**Survey Calculation Method:**	Minimum Curvature
Wellbore:	OH		
Design:	PLAN #2		

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft	Build Rate (°/100u	Comments / Formations
5,000.00	38.52	130.74	4,962.82	-188.93	147.10	234.06	8.00	8.00	
5,100.00	46.52	130.41	5,036.47	-232.84	198.40	301.59	8.00	8.00	
5,200.00	54.51	130.16	5,100.00	-282.69	257.23	378.70	8.00	8.00	
5,300.00	62.51	129.95	5,152.19	-337.51	322.46	463.91	8.00	8.00	
5,400.00	70.51	129.77	5,192.02	-396.24	392.80	555.55	8.00	8.00	
5,500.00	78.51	129.61	5,218.70	-457.73	466.90	651.83	8.00	8.00	
5,600.00	86.51	129.46	5,231.73	-520.79	543.31	750.90	8.00	8.00	
5,653.14	90.76	129.38	5,233.00	-554.51	584.34	804.01	8.00	8.00	LP @ 5233' TVD; 90.7°
5,700.00	90.76	129.38	5,232.38	-584.24	620.56	850.86	0.00	0.00	
5,800.00	90.76	129.38	5,231.06	-647.67	697.85	950.85	0.00	0.00	
5,900.00	90.76	129.38	5,229.74	-711.11	775.15	1,050.83	0.00	0.00	
6,000.00	90.76	129.38	5,228.42	-774.54	852.44	1,150.82	0.00	0.00	
6,100.00	90.76	129.38	5,227.09	-837.98	929.73	1,250.81	0.00	0.00	
6,200.00	90.76	129.38	5,225.77	-901.41	1,007.03	1,350.79	0.00	0.00	
6,300.00	90.76	129.38	5,224.45	-964.85	1,084.32	1,450.78	0.00	0.00	
6,400.00	90.76	129.38	5,223.13	-1,028.28	1,161.61	1,550.77	0.00	0.00	
6,500.00	90.76	129.38	5,221.81	-1,091.72	1,238.91	1,650.75	0.00	0.00	
6,600.00	90.76	129.38	5,220.49	-1,155.15	1,316.20	1,750.74	0.00	0.00	
6,700.00	90.76	129.38	5,219.16	-1,218.59	1,393.49	1,850.73	0.00	0.00	
6,800.00	90.76	129.38	5,217.84	-1,282.02	1,470.79	1,950.71	0.00	0.00	
6,900.00	90.76	129.38	5,216.52	-1,345.46	1,548.08	2,050.70	0.00	0.00	
6,999.93	90.76	129.38	5,215.20	-1,408.85	1,625.32	2,150.62	0.00	0.00	START TURN
7,000.00	90.76	129.38	5,215.20	-1,408.89	1,625.37	2,150.69	0.00	0.00	
7,100.00	90.76	130.38	5,213.87	-1,473.00	1,702.11	2,250.68	1.00	0.00	
7,200.00	90.76	131.38	5,212.55	-1,538.44	1,777.71	2,350.65	1.00	0.00	
7,300.00	90.76	132.38	5,211.21	-1,605.18	1,852.16	2,450.58	1.00	0.00	
7,400.00	90.77	133.38	5,209.88	-1,673.22	1,925.44	2,550.44	1.00	0.00	
7,500.00	90.77	134.38	5,208.54	-1,742.52	1,997.51	2,650.20	1.00	0.00	
7,562.29	90.77	135.00	5,207.70	-1,786.32	2,041.79	2,712.26	1.00	0.00	END OF TURN
7,600.00	90.77	135.00	5,207.19	-1,812.99	2,068.46	2,749.82	0.00	0.00	
7,700.00	90.77	135.00	5,205.85	-1,883.69	2,139.16	2,849.42	0.00	0.00	
7,800.00	90.77	135.00	5,204.50	-1,954.40	2,209.86	2,949.02	0.00	0.00	
7,900.00	90.77	135.00	5,203.16	-2,025.10	2,280.57	3,048.63	0.00	0.00	
8,000.00	90.77	135.00	5,201.82	-2,095.80	2,351.27	3,148.23	0.00	0.00	
8,100.00	90.77	135.00	5,200.47	-2,166.51	2,421.98	3,247.83	0.00	0.00	
8,200.00	90.77	135.00	5,199.13	-2,237.21	2,492.68	3,347.43	0.00	0.00	
8,300.00	90.77	135.00	5,197.79	-2,307.92	2,563.39	3,447.03	0.00	0.00	
8,400.00	90.77	135.00	5,196.44	-2,378.62	2,634.09	3,546.63	0.00	0.00	
8,500.00	90.77	135.00	5,195.10	-2,449.33	2,704.79	3,646.23	0.00	0.00	
8,600.00	90.77	135.00	5,193.75	-2,520.03	2,775.50	3,745.83	0.00	0.00	
8,700.00	90.77	135.00	5,192.41	-2,590.73	2,846.20	3,845.43	0.00	0.00	
8,800.00	90.77	135.00	5,191.07	-2,661.44	2,916.91	3,945.03	0.00	0.00	
8,900.00	90.77	135.00	5,189.72	-2,732.14	2,987.61	4,044.63	0.00	0.00	
9,000.00	90.77	135.00	5,188.38	-2,802.85	3,058.32	4,144.23	0.00	0.00	
9,062.29	90.77	135.00	5,187.54	-2,846.89	3,102.35	4,206.27	0.00	0.00	START TURN
9,100.00	90.77	134.51	5,187.03	-2,873.44	3,129.13	4,243.84	1.29	0.00	
9,200.00	90.77	133.22	5,185.69	-2,942.73	3,201.22	4,343.60	1.29	0.00	
9,300.00	90.77	131.93	5,184.34	-3,010.38	3,274.84	4,443.48	1.29	0.00	
9,400.00	90.77	130.64	5,182.99	-3,076.36	3,349.98	4,543.44	1.29	0.00	
9,500.00	90.77	129.35	5,181.64	-3,140.63	3,426.57	4,643.43	1.29	0.00	
9,600.00	90.77	128.06	5,180.29	-3,203.16	3,504.60	4,743.39	1.29	0.00	
9,700.00	90.77	126.77	5,178.94	-3,263.91	3,584.01	4,843.29	1.29	0.00	

Database:	USA EDM 5000 Multi Users DB	**Local Co-ordinate Reference:**	Well HEROS 4H
Company:	LOGOS Operating LLC	**TVD Reference:**	14' KB @ 6923.00usft
Project:	San Juan County, NM	**MD Reference:**	14' KB @ 6923.00usft
Site:	S9-T23N-R8W	**North Reference:**	True
Well:	HEROS 4H	**Survey Calculation Method:**	Minimum Curvature
Wellbore:	OH		
Design:	PLAN #2		

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft	Build Rate (°/100u	Comments / Formations
9,800.00	90.77	125.48	5,177.60	-3,322.86	3,664.78	4,943.05	1.29	0.00	
9,900.00	90.77	124.19	5,176.25	-3,379.98	3,746.84	5,042.65	1.29	0.00	
10,000.00	90.77	122.90	5,174.91	-3,435.24	3,830.18	5,142.02	1.29	0.00	
10,100.00	90.77	121.61	5,173.57	-3,488.61	3,914.73	5,241.11	1.29	0.00	
10,200.00	90.76	120.32	5,172.24	-3,540.06	4,000.47	5,339.88	1.29	0.00	
10,300.00	90.76	119.03	5,170.91	-3,589.56	4,087.34	5,438.27	1.29	0.00	
10,400.00	90.76	117.74	5,169.58	-3,637.10	4,175.31	5,536.23	1.29	0.00	
10,500.00	90.75	116.45	5,168.27	-3,682.64	4,264.32	5,633.72	1.29	0.00	
10,600.00	90.75	115.16	5,166.96	-3,726.17	4,354.34	5,730.69	1.29	0.00	
10,700.00	90.74	113.87	5,165.65	-3,767.66	4,445.32	5,827.08	1.29	0.00	
10,710.53	90.74	113.74	5,165.52	-3,771.92	4,454.95	5,837.20	1.29	0.00	END OF TURN
10,800.00	90.74	113.74	5,164.36	-3,807.92	4,536.84	5,923.11	0.00	0.00	
10,827.43	90.74	113.74	5,164.00	-3,818.97	4,561.96	5,949.45	0.00	0.00	TD at 10827.43

Targets

Target Name - hit/miss target - Shape	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
HEROS 4H PBHL - plan hits target center - Point	0.00	0.00	5,164.00	-3,818.97	4,561.96	1,902,326.00	2,768,560.63	36.228000	-107.679167
HEROS 4H TGT - plan hits target center - Point	0.00	0.00	5,215.20	-1,408.85	1,625.32	1,904,731.91	2,765,620.55	36.234621	-107.689123
HEROS 4H LP - plan hits target center - Point	0.00	0.00	5,233.00	-554.51	584.34	1,905,584.76	2,764,578.35	36.236968	-107.692653

Plan Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates +N/-S (usft)	Local Coordinates +E/-W (usft)	Comment
2,100.00	2,100.00	0.00	0.00	KOP @ 2100'
2,208.12	2,208.09	-1.91	0.73	EOB; INC=2.16°
4,542.13	4,540.44	-84.21	32.05	START BUILD/TURN
5,653.14	5,233.00	-554.51	584.34	LP @ 5233' TVD; 90.7°
6,999.93	5,215.20	-1,408.85	1,625.32	START TURN
7,562.29	5,207.70	-1,786.32	2,041.79	END OF TURN
9,062.29	5,187.54	-2,846.89	3,102.35	START TURN
10,710.53	5,165.52	-3,771.92	4,454.95	END OF TURN
10,827.43	5,164.00	-3,818.97	4,561.96	TD at 10827.43

LOGOS RESOURCES LLC

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	VSect	Target
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2	2100.00	0.00	0.00	2100.00	0.00	0.00	0.00	0.00	0.00	
3	2208.12	2.16	159.16	2208.09	-1.91	0.73	2.00	159.16	1.78	
4	4542.13	2.16	159.16	4540.44	-84.21	32.05	0.00	0.00	78.63	
5	5653.14	90.76	129.38	5233.00	-554.51	584.34	8.00	-29.79	804.01	HEROS 4H LP
6	6999.93	90.76	129.38	5215.20	-1408.85	1625.32	0.00	0.00	2150.62	HEROS 4H TGT
7	7562.29	90.77	135.00	5207.70	-1786.32	2041.79	1.00	89.83	2712.26	
8	9062.29	90.77	135.00	5187.54	-2846.89	3102.35	0.00	0.00	4206.27	
9	10710.53	90.74	113.74	5165.52	-3771.92	4454.95	1.29	-89.93	5837.20	
10	10827.43	90.74	113.74	5164.00	-3818.97	4561.96	0.00	0.00	5949.45	HEROS 4H PBHL

PLAN #2
HEROS 4H
14' KB @ 6923.00usft
Ground Level @ 6909.00
North American Datum 1983
Well HEROS 4H, True North

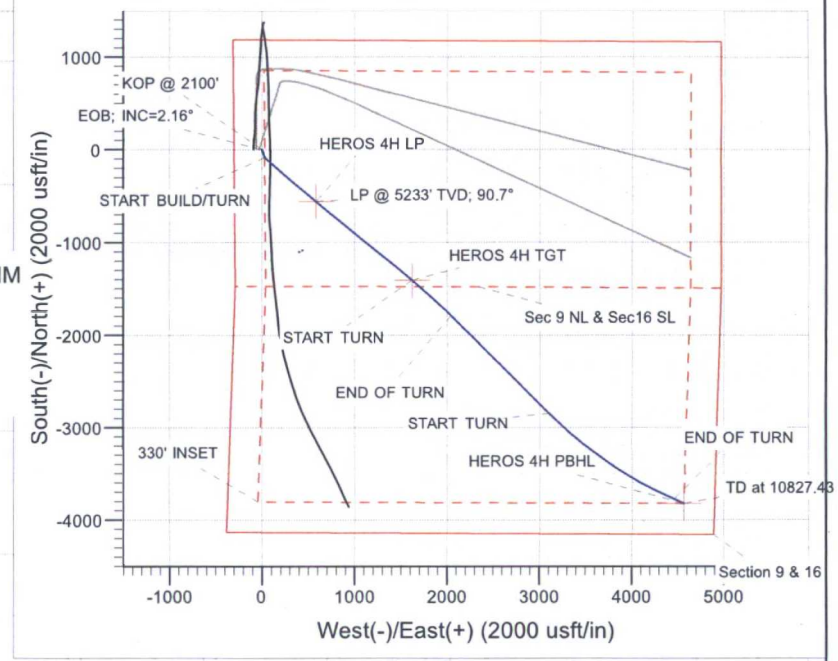
Type	Target	Azimuth	Origin Type	N/S	E/W	From TVD
TD	No Target (Freehand)	129.93	Slot	0.00	0.00	0.00

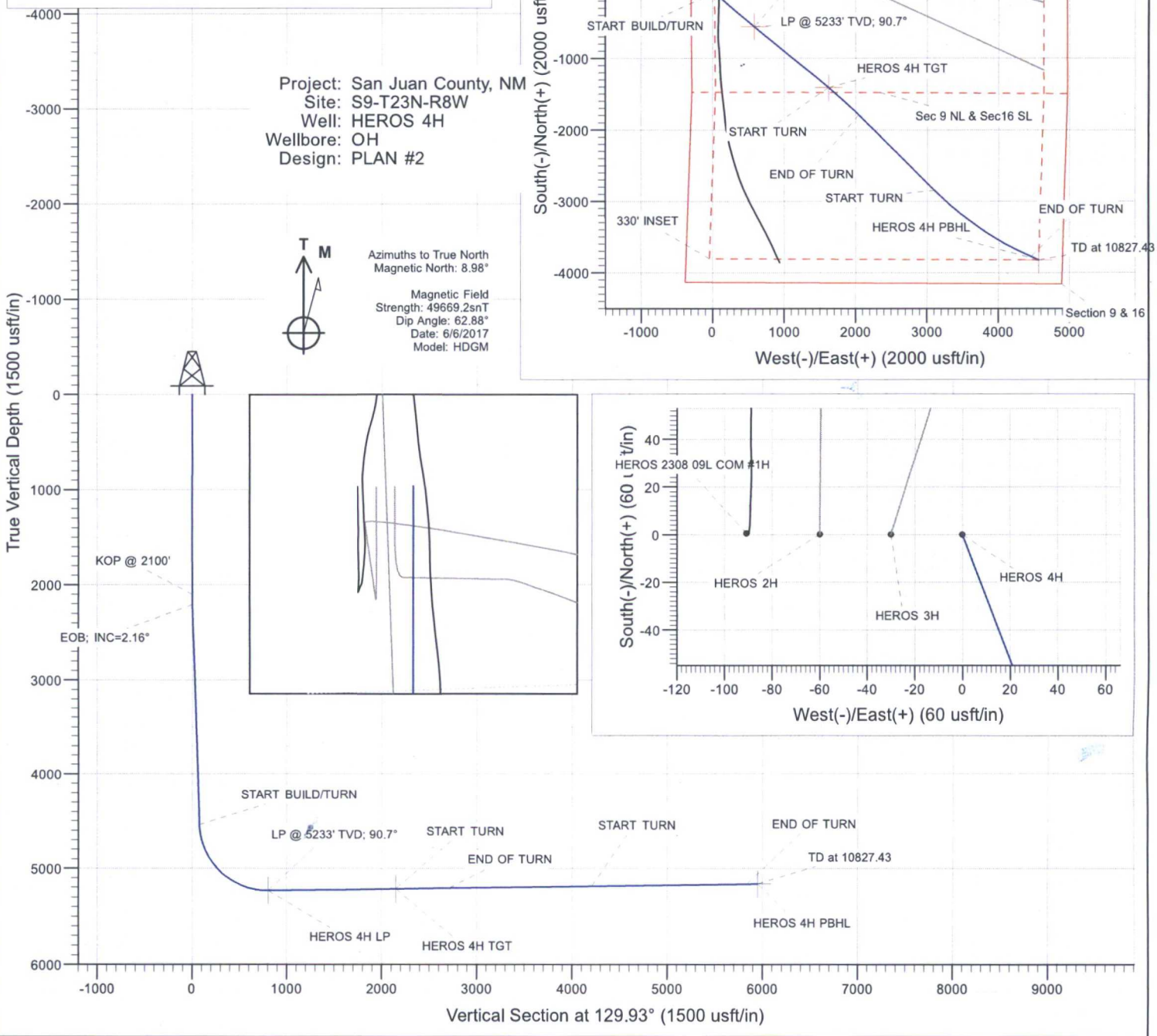
Name	TVD	+N/-S	+E/-W	Latitude	Longitude
HEROS 4H PBHL	5164.00	-3818.97	4561.96	36.228000	-107.679167
HEROS 4H TGT	5215.20	-1408.85	1625.32	36.234621	-107.689123
HEROS 4H LP	5233.00	-554.51	584.34	36.236968	-107.692653

Project: San Juan County, NM
Site: S9-T23N-R8W
Well: HEROS 4H
Wellbore: OH
Design: PLAN #2

Azimuths to True North
Magnetic North: 8.98°

Magnetic Field
Strength: 49669.2snT
Dip Angle: 62.88°
Date: 6/6/2017
Model: HDGM





WELL DETAILS: HEROS 4H

6909.00

+N/-S	+E/-W	Northing	Easting	Latittude	Longitude
0.00	0.00	1906138.43	2763993.22	36.238492	-107.694634

CATHEDRAL

Produced water from nearby existing gas wells will also be utilized for completions operations if such activity proves practicable.

The water hauler(s) will access the proposed well pad via the roads described in Section A: *Existing Access Roads* and Section B: New or Reconstructed Access Roads.

No water supply well will be drilled on this lease.

F. Construction Plan and Materials

The BLM-FFO (505-564-7600) will be notified at least 48 hours prior to the start of construction activities; approximately 3-6 weeks of construction will be required for the construction phase of the proposed project.

The well pad will be leveled with heavy equipment to provide space and a level surface for vehicles and equipment. All native excavated material will be used on the well pad. Excavated materials from the cuts will be used for fill in order to level the proposed well pad. Approximately 11.6 feet of cut and 13.1 feet of fill will be needed to create a level well pad. No additional materials will be required for construction of the proposed well pad.

Activity will cease when construction equipment cause ruts in the soil 6 inches in depth and/or when equipment can no longer move or operate under its own power on access road surfaces.

Construction plats are provided in the APD and permit package.

G. Methods for Handling Waste

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

Energen will 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 will be used.

All refuse will be placed in metal trash basket and will be hauled off site and properly disposed in an approved landfill.

Portable toilets will be provided and maintained during all construction, drilling and completion operations.

H. Ancillary Facilities

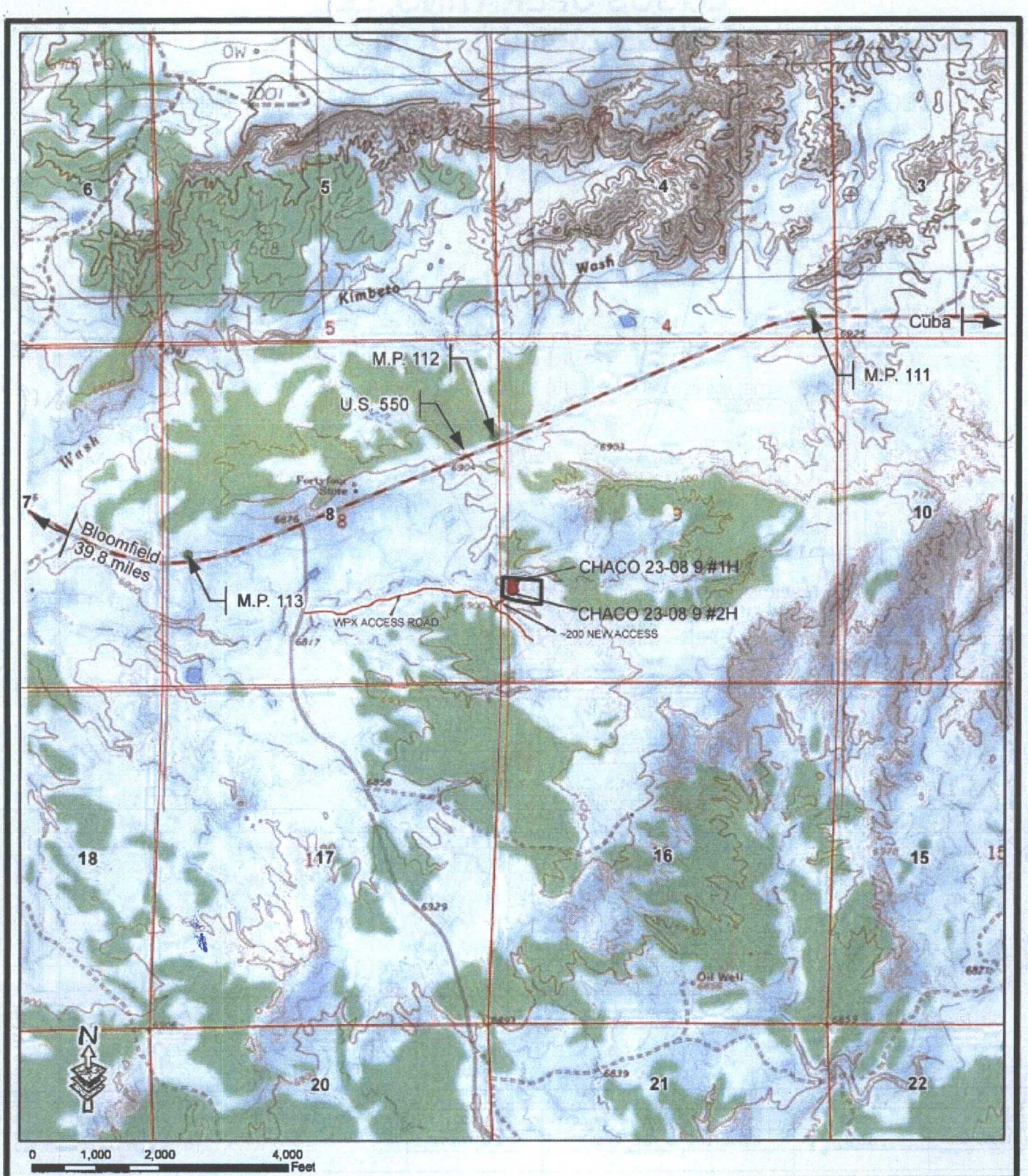
No ancillary facilities will be associated with the well pad.

I. Well Site Layout

The approximate cuts, fills, and orientation for the proposed well pad are depicted on the construction plats in the APD package. The location of drilling equipment, rig orientation, and the location of topsoil stockpiles are provided in Appendix C.

J. Plans for Surface Reclamation

Please see Appendix A: *Reclamation Plan.*



CHACO 23-8 9 #1H & #2H	
Cartography By: MJW	**ENERGEN RESOURCES CORPORATION**
Checked by: JS	**CHACO 23-08 9 #1H & #2H**
Date: 5/14/2015 Time: 3:34:24 PM	**SEC. 9, T-23-N, R-8-W, N.M.P.M., SAN JUAN CO, NM**

tegre
integrity - respect - responsibility