

State of New Mexico
Energy, Minerals and Natural Resources Department

Susana Martinez
Governor

Ken McQueen
Cabinet Secretary

Matthias Sayer
Deputy Cabinet Secretary

David R. Catanach, 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: 8/7/17

Well information;

Operator LOGOS, Well Name and Number Heros 2308 O9L 3H

API# 30-045-35848, 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
 - ☐ 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.



NMOCD Approved by Signature

10-23-2017

Date

OIL CONS. DIV DIST. 3

Form 3160-3
(March 2012)

OCT 17 2017

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

APPLICATION FOR PERMIT TO DRILL OR REENTER

FORM APPROVED
OMB No. 1004-0137
Expires October 31, 20145. Lease Serial No.
NMNM18463

6. If Indian, Allottee or Tribe Name

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

8. Lease Name and Well No.
HEROS 2308 09L 3H

9. API Well No.

30-015-35848

10. Field and Pool, or Exploratory
NAGEEZI GALLUP

11. Sec., T. R. M. or Blk. and Survey or Area

SEC 9 / T23N / R8W / NMP

12. County or Parish
SAN JUAN13. State
NM1a. Type of work: ☒ DRILL☐ REENTER1b. Type of Well: ☒ Oil Well ☐ Gas Well ☐ Other☒ Single Zone ☐ Multiple Zone2. Name of Operator
LOGOS OPERATING LLC3a. Address
2010 Afton Place FARMINGTON NM 874013b. Phone No. (include area code)
(503)324-4145

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

At surface L NWSW / 1476 FSL / 270 FWL / LAT 36.238493 / LONG -107.694738

At proposed prod. zone P SESE / 315 FSL / 282 FEL / LAT 36.235252 / LONG -107.678764

14. Distance in miles and direction from nearest town or post office*
3.1 miles15. Distance from proposed*
location to nearest 270 feet
property or lease line, ft.
(Also to nearest drig. unit line, if any)16. No. of acres in lease
2243.1617. Spacing Unit dedicated to this well
20018. Distance from proposed location*
to nearest well, drilling, completed, 30 feet
applied for, on this lease, ft.19. Proposed Depth
5227 feet / 9838 feet20. BLM/BIA Bond No. on file
FED: NMB00138721. Elevations (Show whether DF, KDB, RT, GL, etc.)
6913 feet22. Approximate date work will start*
11/01/201723. 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:

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

25. Signature

(Electronic Submission)

Name (Printed/Typed)

Tamra Sessions / Ph: (505)436-3790

Date

08/07/2017

Title

REGULATORY SPECIALIST

Approved by (Signature)

Name (Printed/Typed)

Date

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)

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

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

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

NMOCDA

DISTRICT I
1825 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) 746-1883 Fax: (575) 746-9730

DISTRICT III
1000 Rio Brason Ed., 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) 476-3480 Fax: (505) 476-3482

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 30-045- 35848		² Pool Code 47540	³ Pool Name NAGEEZI GALLUP
⁴ Property Code	⁵ Property Name HEROS 2308 09L		⁶ Well Number #3H
⁷ OGRID No. 289408	⁸ Operator Name LOGOS OPERATING, LLC		⁹ Elevation 6913

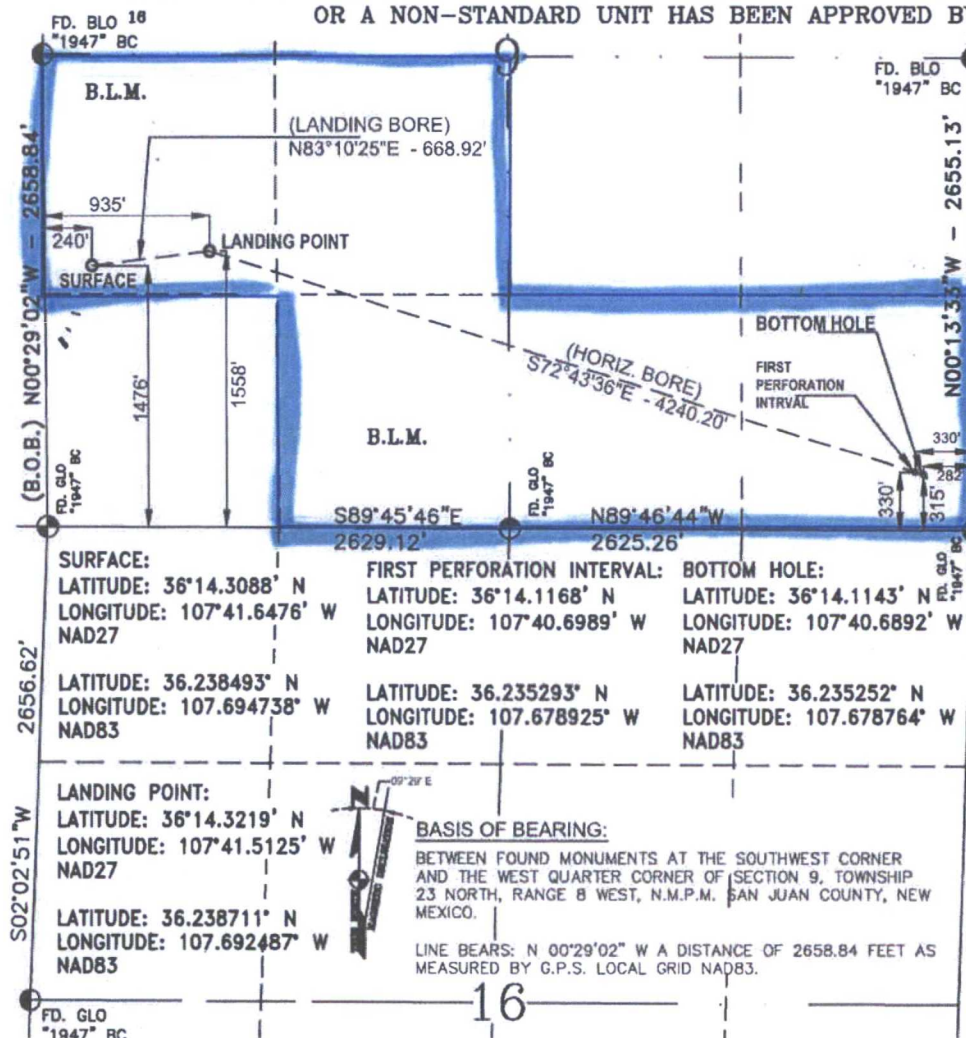
¹⁰ Surface Location

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	270	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
P	9	23-N	8-W		315	SOUTH	282	EAST	SAN JUAN
¹² Dedicated Acres Sec 9: N2SW, SESW, S2SE 200 acres			¹³ Joint or Infill		¹⁴ Consolidation Code		¹⁵ Order No.		

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.

Signature: *Tamra Sessions* Date: *7/28/17*
Printed Name: Tamra Sessions
E-mail Address: tsessions@logosresourcesllc.com

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.

Date of Survey: *JUNE 21, 2017*
Signature and Seal of Professional Surveyor: *GLEN W. RUSSELL*
Certificate Number: *15703*



Indian Surface Federal Minerals



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

Drilling Plan Data Report

08/09/2017

APD ID: 10400017851

Submission Date: 08/07/2017

Operator Name: LOGOS OPERATING LLC

Well Name: HEROS 2308 09L

Well Number: 3H

Well Type: OIL WELL

Well Work Type: Drill

Section 1 - Geologic Formations

Formation ID	Formation Name	Elevation	True Vertical Depth	Measured Depth	Lithologies	Mineral Resources	Producing Formation
18045	NACIMIENTO	6913	0	0	SHALE,SANDSTO NE	NONE	No
17119	OJO ALAMAO	6063	850	850	SHALE,SANDSTO NE	NONE	No
18047	KIRTLAND	5858	1055	1057	SHALE,SANDSTO NE	NONE	No
19404	FRUITLAND	5727	1186	1189	SHALE,SANDSTO NE,COAL	NATURAL GAS	No
16120	PICTURED CLIFFS	5353	1560	1575	SHALE,SANDSTO NE	NATURAL GAS	No
16123	CHACRA	4398	2515	2529	SANDSTONE	NONE	No
16130	CLIFFHOUSE	3837	3076	3233	SANDSTONE	NATURAL GAS	No
16127	MENEFEE	3812	3101	3261	SHALE,SANDSTO NE,COAL	NONE	No
18044	POINT LOOKOUT	2912	4001	4242	SHALE,SANDSTO NE	NATURAL GAS	No
16122	MANCOS	2736	4177	4435	SHALE,SANDSTO NE,SILTSTONE	NATURAL GAS,OIL	No
19417	NIOBRARA	1796	5117	5192	SHALE,SANDSTO NE,SILTSTONE	NATURAL GAS,OIL	Yes

Section 2 - Blowout Prevention

Pressure Rating (PSI): 2M

Rating Depth: 10000

Equipment: Per BLM regulations

Requesting Variance? NO

Variance request:

Testing Procedure: Per BLM and State regulations

Choke Diagram Attachment:

Operator Name: LOGOS OPERATING LLC

Well Name: HEROS 2308 09L

Well Number: 3H

BOP_2M_System_08-01-2017.pdf

BOP Diagram Attachment:

BOP_2M_System_08-01-2017.pdf

Section 3 - Casing

Casing ID	String Type	Hole Size	Csg Size	Condition	Standard	Tapered String	Top Set MD	Bottom Set MD	Top Set TVD	Bottom Set TVD	Top Set MSL	Bottom Set MSL	Calculated casing length MD	Grade	Weight	Joint Type	Collapse SF	Burst SF	Joint SF Type	Joint SF	Body SF Type	Body SF
1	SURFACE	12.25	9.625	NEW	API	N	0	320	0	320	1686	1366	320	J-55	36	STC	13.79	24.04	BUOY	3.85	BUOY	3.85
2	INTERMEDIATE	8.75	7.0	NEW	API	N	0	5740	0	5242	6913		5740	J-55	23	LTC	1.33	1.78	BUOY	1.67	BUOY	1.67
3	LINER	6.125	4.5	NEW	API	N	5590	9838	5242	5227			4248	P-110	11.6	OTHER	3.08	1.19	BUOY	1.83	BUOY	1.83

Casing Attachments

Casing ID: 1 String Type: SURFACE

Inspection Document:

Spec Document:

Taperd String Spec:

Casing Design Assumptions and Worksheet(s):

HEROS_3H_Casing_Assump_Surface_08-07-2017.pdf

Operator Name: LOGOS OPERATING LLC

Well Name: HEROS 2308 09L

Well Number: 3H

Casing Attachments

Casing ID: 2 String Type: INTERMEDIATE

Inspection Document:

Spec Document:

Taperd String Spec:

Casing Design Assumptions and Worksheet(s):

HEROS_3H_Casing_Assump_Interm_08-07-2017.pdf

Casing ID: 3 String Type: LINER

Inspection Document:

Spec Document:

Taperd String Spec:

Casing Design Assumptions and Worksheet(s):

HEROS_3H_Casing_Assump_Liner_08-07-2017.pdf

Section 4 - Cement

String Type	Lead/Tail	Stage Tool Depth	Top MD	Bottom MD	Quantity(sx)	Yield	Density	Cu Ft	Excess%	Cement type	Additives
SURFACE	Lead		0	320	270	1.17	15.8	315.9	100	Class H	1.0% CaCl2, 1/2#/sk Poly-E-Flake 15.8ppg, 1.17ft3/sk
INTERMEDIATE	Lead		0	5740	578	1.95	12.3	1127.1	70	Halcem	1.0% CaC2, 1/4#/sk Poly-E-Flake, 5#/sk Kol-Seal(Gilsonite
INTERMEDIATE	Tail				246	1.3	13.5	319.8	70	Varicem	0.15% Versaset, 0.3% Halad-9, 1/4#/sk Poly-E-Flake, 5#/sk Kol-Seal

Operator Name: LOGOS OPERATING LLC

Well Name: HEROS 2308 09L

Well Number: 3H

String Type	Lead/Tail	Stage Tool Depth	Top MD	Bottom MD	Quantity(sx)	Yield	Density	Cu Ft	Excess%	Cement type	Additives
LINER	Lead		5590	9838	391	1.36	13.3	531.76	30	Extendacem	N/A

Section 5 - Circulating Medium

Mud System Type: Closed

Will an air or gas system be Used? NO

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

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

Describe what will be on location to control well or mitigate other conditions: As needed Paper or LCM for losses and seepage.

Describe the mud monitoring system utilized: PVT/MD Totco/Visual Monitoring

Circulating Medium Table

Top Depth	Bottom Depth	Mud Type	Min Weight (lbs/gal)	Max Weight (lbs/gal)	Density (lbs/cu ft)	Gel Strength (lbs/100 sqft)	PH	Viscosity (CP)	Salinity (ppm)	Filtration (cc)	Additional Characteristics
320	5740	LOW SOLIDS NON-DISPERSED (LSND)	8.5	9.5							PH 10, 28 to 60 vis, PV 1, YP 1, WL 8-15
5740	9838		8.3	9.3							15 to 35 vis, PV 4-6, YP 4-6, WL <20
0	320	SPUD MUD	8.5	9							32 to 75 vis, PV 3 to 5, YP 5 to 7, WL NC

Operator Name: LOGOS OPERATING LLC

Well Name: HEROS 2308 09L

Well Number: 3H

Section 6 - Test, Logging, Coring

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

N/A

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

CBL,DS

Coring operation description for the well:

N/A

Section 7 - Pressure

Anticipated Bottom Hole Pressure: 2500

Anticipated Surface Pressure: 1346.76

Anticipated Bottom Hole Temperature(F): 160

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

Describe:

Contingency Plans geohazards description:

Contingency Plans geohazards attachment:

Hydrogen Sulfide drilling operations plan required? NO

Hydrogen sulfide drilling operations plan:

Section 8 - Other Information

Proposed horizontal/directional/multi-lateral plan submission:

HEROS_3H_PLAN1_08-03-2017.pdf

Other proposed operations facets description:

Other proposed operations facets attachment:

Other Variance attachment:

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

Surface	Size 9.625	Weight 36	Grade K55	Conn STC	Collapse 2,020 1.125	Burst 3,520 1.000	Tension 423,000 1.200	Notes 0' - 320'
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36 ppf K55 STC

341 psi (Maximum Estimated SIP)

Collapse	Casing Depth 320	MW in 0	MW out 9	Pres in 0	Pres out 146	SF 13.79	
Burst	320	9	0	146	0	24.04	
Tension	320	Mud Wt 9 BF 0.8626	Air Wt 11,520	Bouy Wt 9,937	BW +100k 109,937	SF 3.85	100k over pull BF= 1- (MW)/65.5

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

Intermediate Interval 1	Top Interval	Btm Interval	Size	Weight	Grade	Conn	Collapse	Burst	Tension	Notes
	0	5740	7	23	J55	STC	3,270 1.125	4,360 1.000	341,000 1.200	

Collapse Interval 1	Top Interval	Btm Interval	Depth TVD	MW in	MW out	Pres in	Pres out	SF - 1.125	
23	0 J55	5740	5242	0	9	0	2453	1.33	

Burst Interval 1	Top Interval	Btm Interval	Depth TVD	MW in	MW out	Pres in	Pres out	SF - 1.0	Frac Pres
23	0 J55	5740	5242	9	0	2453 2453	0	1.78	0

Tension Interval 1	Top Interval	Btm Interval	Depth TVD	Mud Wt	Air Wt	Bouy Wt	BW +100k	SF - 1.2	
23	0 J55	5740	5242	9 BF 0.8626	120,566	104,000	204,000	1.67	

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

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

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	279,000 1.200	TD 9838', TVD 5242' - 5227'
Collapse	Casing Depth (TVD)	MW in	MW out	Pres in	Pres out	SF		
	5242	0.00	9.00	0	2453	3.08		
Burst	5242	9.00	0.00	2453 8953	0	1.19	6500	6500 psi frac pressure + no backup Burst pressure = Hyd + frac pressure
Tension		Mud Wt	Air Wt	Bouy Wt	BW +100k			100k over pull
	5242	8.80 BF 0.8656	60,807	52,638	152,638 1.83			BF= 1- (MW)/65.5



SECTION DETAILS

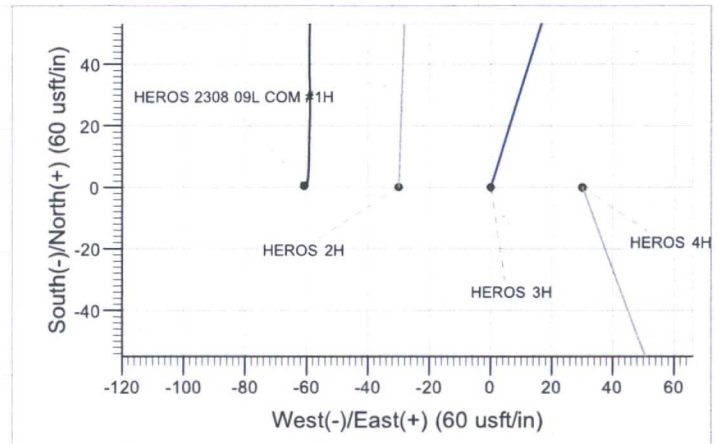
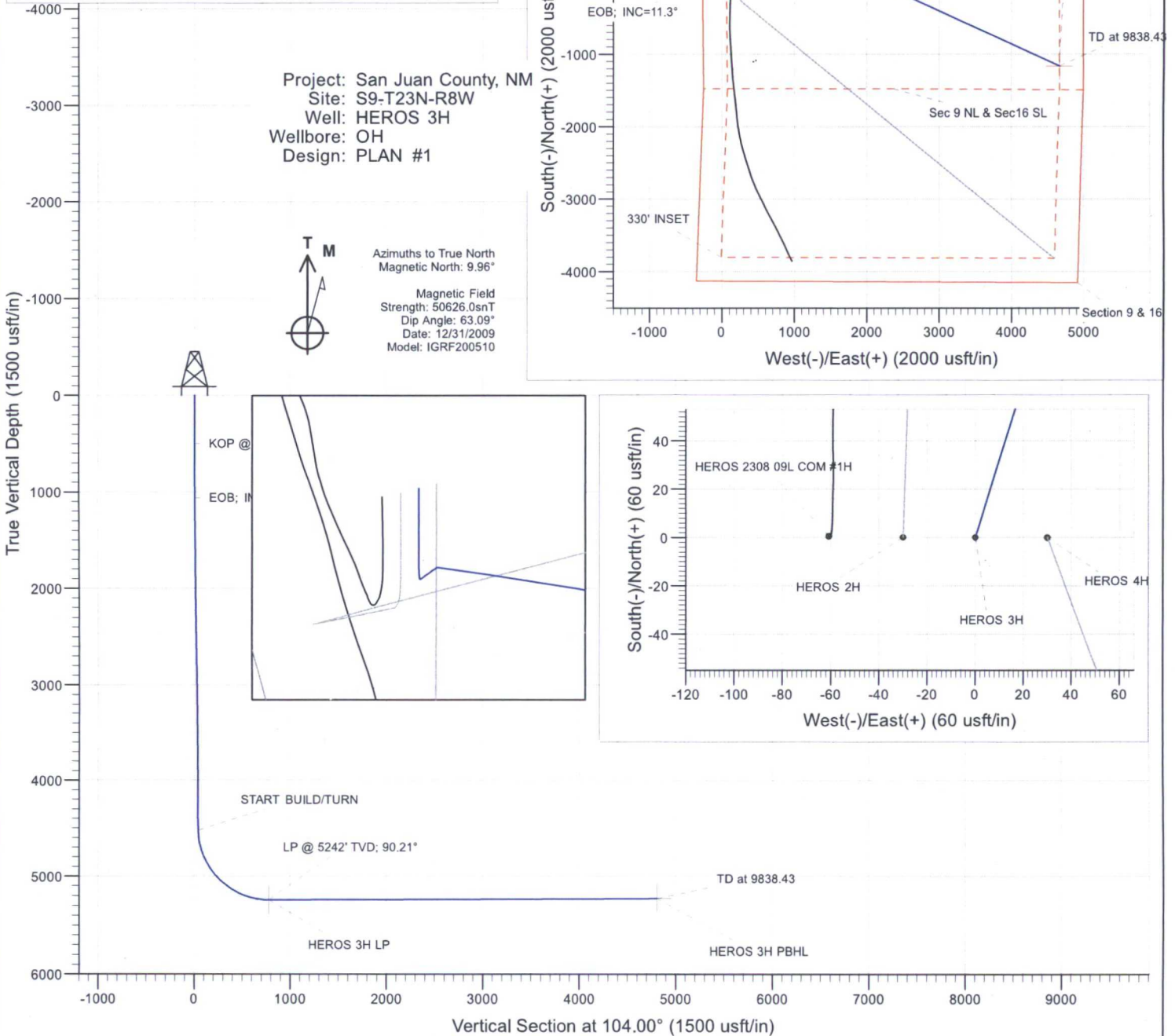
Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	VSect	Target
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2	500.00	0.00	0.00	500.00	0.00	0.00	0.00	0.00	0.00	
3	1065.09	11.30	17.36	1061.43	53.02	16.58	2.00	17.36	3.26	
4	4594.31	11.30	17.36	4522.21	713.16	222.95	0.00	0.00	43.79	
5	5739.59	90.21	114.61	5242.00	544.19	935.88	8.00	97.07	776.42	HEROS 3H LP
6	9838.43	90.21	114.61	5227.00	-1162.56	4662.45	0.00	0.00	4805.20	HEROS 3H PBHL

PLAN #1 HEROS 3H 14' KB @ 6923.00usft Ground Level @ 6909.00 North American Datum 1983 Well HEROS 3H True North									
Type	Target	Azimuth	Origin	Type	N/S	E/W	From	TVD	
TD	No Target (Freehand)	104.00	Stk	0.00	0.00	0.00	0.00	0.00	
Name		TVD	+N/-S	+E/-W	Latitude	Longitude			
HEROS 3H PBHL		5227.00	-1162.56	4662.45	36.235297	-107.679626			
HEROS 3H LP		5242.00	544.19	935.88	36.239987	-107.691562			

Project: San Juan County, NM
Site: S9-T23N-R8W
Well: HEROS 3H
Wellbore: OH
Design: PLAN #1



Azimuths to True North
Magnetic North: 9.96°
Magnetic Field
Strength: 50626.0snT
Dip Angle: 63.09°
Date: 12/31/2009
Model: IGRF200510



WELL DETAILS: HEROS 3H

+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
0.00	0.00	1906138.43	2763963.22	36.238492	-107.694736



Cathedral Energy Services

Planning Report

Database: USA EDM 5000 Multi Users DB
Company: LOGOS Operating LLC
Project: San Juan County, NM
Site: S9-T23N-R8W
Well: HEROS 3H
Wellbore: OH
Design: PLAN #1

Local Co-ordinate Reference: Well HEROS 3H
TVD Reference: 14' KB @ 6923.00usft
MD Reference: 14' KB @ 6923.00usft
North Reference: True
Survey Calculation Method: Minimum Curvature

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 3H

Well Position +N/-S 0.00 usft Northing: 1,906,138.43 usft Latitude: 36.238492
+E/-W 0.00 usft Easting: 2,763,963.22 usft Longitude: -107.694736
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)
	IGRF200510	12/31/2009	9.97	63.09	50,626.04703205

Design PLAN #1

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	104.00

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	
500.00	0.00	0.00	500.00	0.00	0.00	0.00	0.00	0.00	0.00	
1,065.09	11.30	17.36	1,061.43	53.02	16.58	2.00	2.00	0.00	17.36	
4,594.31	11.30	17.36	4,522.21	713.16	222.95	0.00	0.00	0.00	0.00	
5,739.59	90.21	114.61	5,242.00	544.19	935.88	8.00	6.89	8.49	97.07	HEROS 3H LP
9,838.43	90.21	114.61	5,227.00	-1,162.56	4,662.45	0.00	0.00	0.00	0.00	HEROS 3H PBHL

Cathedral Energy Services

Planning Report

Database: USA EDM 5000 Multi Users DB
Company: LOGOS Operating LLC
Project: San Juan County, NM
Site: S9-T23N-R8W
Well: HEROS 3H
Wellbore: OH
Design: PLAN #1

Local Co-ordinate Reference:
TVD Reference: 14' KB @ 6923.00usft
MD Reference: 14' KB @ 6923.00usft
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 (°/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	KOP @ 500'
600.00	2.00	17.36	599.98	1.67	0.52	0.10	2.00	2.00	
700.00	4.00	17.36	699.84	6.66	2.08	0.41	2.00	2.00	
800.00	6.00	17.36	799.45	14.98	4.68	0.92	2.00	2.00	
900.00	8.00	17.36	898.70	26.61	8.32	1.63	2.00	2.00	
1,000.00	10.00	17.36	997.47	41.54	12.99	2.55	2.00	2.00	
1,065.09	11.30	17.36	1,061.43	53.02	16.58	3.26	2.00	2.00	EOB; INC=11.3°
1,100.00	11.30	17.36	1,095.67	59.55	18.62	3.66	0.00	0.00	
1,200.00	11.30	17.36	1,193.73	78.26	24.46	4.80	0.00	0.00	
1,300.00	11.30	17.36	1,291.79	96.96	30.31	5.95	0.00	0.00	
1,400.00	11.30	17.36	1,389.85	115.67	36.16	7.10	0.00	0.00	
1,500.00	11.30	17.36	1,487.91	134.37	42.01	8.25	0.00	0.00	
1,600.00	11.30	17.36	1,585.97	153.08	47.86	9.40	0.00	0.00	
1,700.00	11.30	17.36	1,684.03	171.78	53.70	10.55	0.00	0.00	
1,800.00	11.30	17.36	1,782.09	190.49	59.55	11.70	0.00	0.00	
1,900.00	11.30	17.36	1,880.15	209.19	65.40	12.84	0.00	0.00	
2,000.00	11.30	17.36	1,978.21	227.90	71.25	13.99	0.00	0.00	
2,100.00	11.30	17.36	2,076.27	246.60	77.09	15.14	0.00	0.00	
2,200.00	11.30	17.36	2,174.33	265.31	82.94	16.29	0.00	0.00	
2,300.00	11.30	17.36	2,272.40	284.01	88.79	17.44	0.00	0.00	
2,400.00	11.30	17.36	2,370.46	302.72	94.64	18.59	0.00	0.00	
2,500.00	11.30	17.36	2,468.52	321.42	100.48	19.73	0.00	0.00	
2,600.00	11.30	17.36	2,566.58	340.13	106.33	20.88	0.00	0.00	
2,700.00	11.30	17.36	2,664.64	358.83	112.18	22.03	0.00	0.00	
2,800.00	11.30	17.36	2,762.70	377.54	118.03	23.18	0.00	0.00	
2,900.00	11.30	17.36	2,860.76	396.24	123.87	24.33	0.00	0.00	
3,000.00	11.30	17.36	2,958.82	414.95	129.72	25.48	0.00	0.00	
3,100.00	11.30	17.36	3,056.88	433.65	135.57	26.62	0.00	0.00	
3,200.00	11.30	17.36	3,154.94	452.36	141.42	27.77	0.00	0.00	
3,300.00	11.30	17.36	3,253.00	471.06	147.26	28.92	0.00	0.00	
3,400.00	11.30	17.36	3,351.07	489.77	153.11	30.07	0.00	0.00	
3,500.00	11.30	17.36	3,449.13	508.47	158.96	31.22	0.00	0.00	
3,600.00	11.30	17.36	3,547.19	527.18	164.81	32.37	0.00	0.00	
3,700.00	11.30	17.36	3,645.25	545.88	170.65	33.52	0.00	0.00	
3,800.00	11.30	17.36	3,743.31	564.59	176.50	34.66	0.00	0.00	
3,900.00	11.30	17.36	3,841.37	583.29	182.35	35.81	0.00	0.00	
4,000.00	11.30	17.36	3,939.43	602.00	188.20	36.96	0.00	0.00	
4,100.00	11.30	17.36	4,037.49	620.70	194.04	38.11	0.00	0.00	
4,200.00	11.30	17.36	4,135.55	639.41	199.89	39.26	0.00	0.00	
4,300.00	11.30	17.36	4,233.61	658.11	205.74	40.41	0.00	0.00	
4,400.00	11.30	17.36	4,331.67	676.82	211.59	41.55	0.00	0.00	
4,500.00	11.30	17.36	4,429.73	695.52	217.43	42.70	0.00	0.00	
4,594.31	11.30	17.36	4,522.21	713.16	222.95	43.79	0.00	0.00	START BUILD/TURN
4,600.00	11.25	19.68	4,527.80	714.22	223.30	43.87	8.00	-0.83	
4,700.00	13.22	57.01	4,625.67	729.66	236.20	52.65	8.00	1.97	
4,800.00	18.69	78.68	4,721.86	739.04	261.54	74.97	8.00	5.47	
4,900.00	25.50	90.00	4,814.51	742.19	298.84	110.39	8.00	6.81	

Cathedral Energy Services

Planning Report

Database:	USA EDM 5000 Multi Users DB	Local Co-ordinate Reference:	Well HEROS 3H
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 3H	Survey Calculation Method:	Minimum Curvature
Wellbore:	OH		
Design:	PLAN #1		

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	32.82	96.66	4,901.80	739.05	347.35	158.23	8.00	7.32	
5,100.00	40.38	101.08	4,982.04	729.66	406.15	217.55	8.00	7.56	
5,200.00	48.06	104.30	5,053.67	714.22	474.09	287.20	8.00	7.68	
5,300.00	55.81	106.82	5,115.28	693.03	549.83	365.83	8.00	7.75	
5,400.00	63.60	108.92	5,165.69	666.50	631.92	451.90	8.00	7.79	
5,500.00	71.42	110.74	5,203.92	635.14	718.75	543.74	8.00	7.82	
5,600.00	79.26	112.41	5,229.21	599.56	808.63	639.55	8.00	7.84	
5,700.00	87.10	113.99	5,241.07	560.47	899.82	737.49	8.00	7.84	
5,739.59	90.21	114.61	5,242.00	544.19	935.88	776.42	8.00	7.85	LP @ 5242' TVD; 90.21°
5,800.00	90.21	114.61	5,241.78	519.03	990.81	835.80	0.00	0.00	
5,900.00	90.21	114.61	5,241.41	477.39	1,081.73	934.09	0.00	0.00	
6,000.00	90.21	114.61	5,241.05	435.75	1,172.64	1,032.38	0.00	0.00	
6,100.00	90.21	114.61	5,240.68	394.11	1,263.56	1,130.67	0.00	0.00	
6,200.00	90.21	114.61	5,240.32	352.47	1,354.48	1,228.96	0.00	0.00	
6,300.00	90.21	114.61	5,239.95	310.83	1,445.40	1,327.26	0.00	0.00	
6,400.00	90.21	114.61	5,239.58	269.19	1,536.32	1,425.55	0.00	0.00	
6,500.00	90.21	114.61	5,239.22	227.55	1,627.23	1,523.84	0.00	0.00	
6,600.00	90.21	114.61	5,238.85	185.91	1,718.15	1,622.13	0.00	0.00	
6,700.00	90.21	114.61	5,238.49	144.27	1,809.07	1,720.42	0.00	0.00	
6,800.00	90.21	114.61	5,238.12	102.63	1,899.99	1,818.71	0.00	0.00	
6,900.00	90.21	114.61	5,237.75	60.99	1,990.90	1,917.00	0.00	0.00	
7,000.00	90.21	114.61	5,237.39	19.35	2,081.82	2,015.29	0.00	0.00	
7,100.00	90.21	114.61	5,237.02	-22.29	2,172.74	2,113.58	0.00	0.00	
7,200.00	90.21	114.61	5,236.66	-63.93	2,263.66	2,211.87	0.00	0.00	
7,300.00	90.21	114.61	5,236.29	-105.57	2,354.57	2,310.16	0.00	0.00	
7,400.00	90.21	114.61	5,235.92	-147.21	2,445.49	2,408.45	0.00	0.00	
7,500.00	90.21	114.61	5,235.56	-188.85	2,536.41	2,506.74	0.00	0.00	
7,600.00	90.21	114.61	5,235.19	-230.49	2,627.33	2,605.04	0.00	0.00	
7,700.00	90.21	114.61	5,234.83	-272.13	2,718.24	2,703.33	0.00	0.00	
7,800.00	90.21	114.61	5,234.46	-313.76	2,809.16	2,801.62	0.00	0.00	
7,900.00	90.21	114.61	5,234.09	-355.40	2,900.08	2,899.91	0.00	0.00	
8,000.00	90.21	114.61	5,233.73	-397.04	2,991.00	2,998.20	0.00	0.00	
8,100.00	90.21	114.61	5,233.36	-438.68	3,081.91	3,096.49	0.00	0.00	
8,200.00	90.21	114.61	5,233.00	-480.32	3,172.83	3,194.78	0.00	0.00	
8,300.00	90.21	114.61	5,232.63	-521.96	3,263.75	3,293.07	0.00	0.00	
8,400.00	90.21	114.61	5,232.26	-563.60	3,354.67	3,391.36	0.00	0.00	
8,500.00	90.21	114.61	5,231.90	-605.24	3,445.58	3,489.65	0.00	0.00	
8,600.00	90.21	114.61	5,231.53	-646.88	3,536.50	3,587.94	0.00	0.00	
8,700.00	90.21	114.61	5,231.17	-688.52	3,627.42	3,686.23	0.00	0.00	
8,800.00	90.21	114.61	5,230.80	-730.16	3,718.34	3,784.52	0.00	0.00	
8,900.00	90.21	114.61	5,230.43	-771.80	3,809.25	3,882.82	0.00	0.00	
9,000.00	90.21	114.61	5,230.07	-813.44	3,900.17	3,981.11	0.00	0.00	
9,100.00	90.21	114.61	5,229.70	-855.08	3,991.09	4,079.40	0.00	0.00	
9,200.00	90.21	114.61	5,229.34	-896.72	4,082.01	4,177.69	0.00	0.00	
9,300.00	90.21	114.61	5,228.97	-938.36	4,172.92	4,275.98	0.00	0.00	
9,400.00	90.21	114.61	5,228.60	-980.00	4,263.84	4,374.27	0.00	0.00	
9,500.00	90.21	114.61	5,228.24	-1,021.64	4,354.76	4,472.56	0.00	0.00	
9,600.00	90.21	114.61	5,227.87	-1,063.28	4,445.68	4,570.85	0.00	0.00	
9,700.00	90.21	114.61	5,227.51	-1,104.92	4,536.59	4,669.14	0.00	0.00	
9,800.00	90.21	114.61	5,227.14	-1,146.56	4,627.51	4,767.43	0.00	0.00	
9,838.43	90.21	114.61	5,227.00	-1,162.56	4,662.45	4,805.20	0.00	0.00	TD at 9838.43

Cathedral Energy Services

Planning Report

Database: USA EDM 5000 Multi Users DB
 Company: LOGOS Operating LLC
 Project: San Juan County, NM
 Site: S9-T23N-R8W
 Well: HEROS 3H
 Wellbore: OH
 Design: PLAN #1

Local Co-ordinate Reference: Well HEROS 3H
 TVD Reference: 14' KB @ 6923.00usft
 MD Reference: 14' KB @ 6923.00usft
 North Reference: True
 Survey Calculation Method: Minimum Curvature

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 3H PBHL - plan hits target center - Point	0.00	0.00	5,227.00	-1,162.56	4,662.45	1,904,982.54	2,768,627.32	36.235297	-107.678926
HEROS 3H LP - plan hits target center - Point	0.00	0.00	5,242.00	544.19	935.88	1,906,683.95	2,764,898.32	36.239987	-107.691562

Plan Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
+N/-S (usft)	+E/-W (usft)			
500.00	500.00	0.00	0.00	KOP @ 500'
1,065.09	1,061.43	53.02	16.58	EOB; INC=11.3°
4,594.31	4,522.21	713.16	222.95	START BUILD/TURN
5,739.59	5,242.00	544.19	935.88	LP @ 5242' TVD; 90.21°
9,838.43	5,227.00	-1,162.56	4,662.45	TD at 9838.43



LOGOS Operating LLC

San Juan County, NM

S9-T23N-R8W

HEROS 3H

OH

PLAN #1

Anticollision Report

12 June, 2017

Cathedral Energy Services

Anticollision Report

Company:	LOGOS Operating LLC	Local Co-ordinate Reference:	Well HEROS 3H
Project:	San Juan County, NM	TVD Reference:	14' KB @ 6923.00usft
Reference Site:	S9-T23N-R8W	MD Reference:	14' KB @ 6923.00usft
Site Error:	0.00usft	North Reference:	True
Reference Well:	HEROS 3H	Survey Calculation Method:	Minimum Curvature
Well Error:	0.00usft	Output errors are at	2.00 sigma
Reference Wellbore	OH	Database:	USA EDM 5000 Multi Users DB
Reference Design:	PLAN #1	Offset TVD Reference:	Offset Datum

Reference	PLAN #1		
Filter type:	NO GLOBAL FILTER: Using user defined selection & filtering criteria		
Interpolation Method:	MD Interval 100.00usft	Error Model:	ISCWSA
Depth Range:	Unlimited	Scan Method:	Closest Approach 3D
Results Limited by:	Maximum center-center distance of 1,195.88usft	Error Surface:	Pedal Curve
Warning Levels Evaluated at:	2.00 Sigma		

Survey Tool Program	Date 6/12/2017			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description
0.00	9,838.43	PLAN #1 (OH)	MWD+HDGM	OWSG MWD + HDGM

Summary						
Site Name	Reference	Offset	Distance		Separation	Warning
	Measured	Measured	Between	Between		
Offset Well - Wellbore - Design	Depth	Depth	Centres	Ellipses	Factor	
	(usft)	(usft)	(usft)	(usft)		
S9-T23N-R8W						
HEROS 2308 09L COM #1H - OH - SURVEYS	426.47	433.69	59.96	57.89	28.898	CC
HEROS 2308 09L COM #1H - OH - SURVEYS	600.00	607.17	60.47	57.13	18.079	ES
HEROS 2308 09L COM #1H - OH - SURVEYS	1,700.00	1,709.16	101.31	89.18	8.353	SF
HEROS 2H - OH - PLAN #1	500.00	500.00	30.00	26.82	9.446	CC
HEROS 2H - OH - PLAN #1	600.00	600.02	30.56	26.67	7.853	ES
HEROS 2H - OH - PLAN #1	5,400.00	5,584.93	130.09	84.28	2.840	SF
HEROS 4H - OH - PLAN #1	726.01	725.77	28.65	23.85	5.975	CC, ES
HEROS 4H - OH - PLAN #1	800.00	800.55	29.44	24.11	5.523	SF
W Lybrook Unit 701H - OH - NO SURVEYS	0.00	5.00	1,178.72			
W Lybrook Unit 701H - OH - NO SURVEYS	100.00	5.00	1,183.12	1,182.17	1,247.937	SF
W Lybrook Unit 702H - OH - NO SURVEYS	0.00	5.00	1,185.27			
W Lybrook Unit 702H - OH - NO SURVEYS	100.00	5.00	1,189.64	1,188.70	1,261.042	SF

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

Cathedral Energy Services

Anticollision Report

Company:	LOGOS Operating LLC	Local Co-ordinate Reference:	Well HEROS 3H
Project:	San Juan County, NM	TVD Reference:	14' KB @ 6923.00usft
Reference Site:	S9-T23N-R8W	MD Reference:	14' KB @ 6923.00usft
Site Error:	0.00usft	North Reference:	True
Reference Well:	HEROS 3H	Survey Calculation Method:	Minimum Curvature
Well Error:	0.00usft	Output errors are at	2.00 sigma
Reference Wellbore	OH	Database:	USA EDM 5000 Multi Users DB
Reference Design:	PLAN #1	Offset TVD Reference:	Offset Datum

Offset Design S9-T23N-R8W - HEROS 2308 09L COM #1H - OH - SURVEYS														Offset Site Error:	0.00 usft
Survey Program: 404-MWD+HDGM														Offset Well Error:	0.00 usft
Reference		Offset		Semi Major Axis		Highside Toolface (°)	Distance		Total Uncertainty Axis	Separation Factor	Warning				
Measured Depth (usft)	Vertical Depth (usft)	Measured Depth (usft)	Vertical Depth (usft)	Reference (usft)	Offset (usft)		Offset Wellbore Centre +N/-S (usft)	+E/-W (usft)							
0.00	0.00	7.00	7.00	0.00	0.01	-89.55	0.48	-60.74	60.74						
100.00	100.00	107.05	107.05	0.15	0.19	-89.58	0.45	-60.69	60.69	60.35	0.34	178.797			
200.00	200.00	207.10	207.10	0.51	0.36	-89.65	0.37	-60.56	60.56	59.69	0.87	69.525			
300.00	300.00	307.15	307.15	0.87	0.53	-89.76	0.25	-60.35	60.35	58.95	1.40	43.024			
400.00	400.00	407.20	407.20	1.23	0.70	-89.93	0.08	-60.06	60.06	58.12	1.93	31.048			
426.47	426.47	433.69	433.68	1.32	0.75	-89.98	0.03	-59.96	59.96	57.89	2.08	28.898 CC			
500.00	500.00	506.97	506.97	1.59	1.05	-89.89	0.12	-60.04	60.04	57.40	2.64	22.743			
600.00	599.98	607.17	607.17	1.95	1.40	-108.68	0.27	-59.93	60.47	57.13	3.34	18.079 ES			
700.00	699.84	707.43	707.38	2.31	1.75	-110.60	3.16	-59.49	61.68	57.63	4.05	15.224			
800.00	799.45	807.25	806.99	2.67	2.10	-112.09	9.62	-59.27	64.18	59.42	4.76	13.471			
900.00	898.70	907.42	906.73	3.04	2.46	-113.92	18.76	-58.94	67.73	62.24	5.49	12.335			
1,000.00	997.47	1,006.90	1,005.65	3.41	2.82	-116.80	29.33	-58.83	72.86	66.63	6.23	11.693			
1,100.00	1,095.67	1,107.19	1,105.18	3.80	3.20	-120.20	41.59	-59.06	79.77	72.78	6.99	11.412			
1,200.00	1,193.73	1,207.60	1,204.40	4.21	3.59	-121.58	56.99	-58.92	86.14	78.37	7.77	11.092			
1,300.00	1,291.79	1,309.58	1,304.43	4.62	4.00	-120.29	76.78	-58.42	91.17	82.60	8.57	10.634			
1,400.00	1,389.85	1,411.86	1,403.99	5.04	4.43	-117.31	100.02	-55.94	93.69	84.28	9.41	9.954			
1,500.00	1,487.91	1,512.75	1,501.27	5.46	4.88	-112.50	126.45	-51.89	94.45	84.16	10.29	9.178			
1,600.00	1,585.97	1,610.87	1,595.11	5.88	5.34	-106.21	154.92	-48.72	96.61	85.41	11.20	8.627			
1,700.00	1,684.03	1,709.16	1,687.66	6.31	5.84	-97.68	187.88	-46.26	101.31	89.18	12.13	8.353 SF			
1,800.00	1,782.09	1,806.53	1,777.85	6.74	6.36	-87.95	224.46	-43.38	108.97	95.95	13.02	8.367			
1,900.00	1,880.15	1,903.23	1,866.90	7.17	6.91	-79.24	262.10	-41.12	120.65	106.79	13.85	8.709			
2,000.00	1,978.21	1,997.96	1,954.04	7.60	7.45	-72.50	299.22	-40.23	135.96	121.35	14.61	9.307			
2,100.00	2,076.27	2,091.80	2,039.26	8.03	8.02	-66.61	338.51	-40.25	155.42	140.10	15.32	10.146			
2,200.00	2,174.33	2,185.25	2,122.75	8.47	8.61	-61.14	380.47	-39.60	178.08	162.08	16.00	11.131			
2,300.00	2,272.40	2,278.12	2,205.00	8.90	9.23	-56.70	423.59	-39.40	203.59	186.92	16.67	12.210			
2,400.00	2,370.46	2,381.69	2,296.81	9.34	9.92	-52.68	471.49	-38.04	229.33	211.75	17.58	13.047			
2,500.00	2,468.52	2,478.08	2,382.83	9.78	10.56	-49.40	514.82	-34.29	253.30	234.97	18.33	13.818			
2,600.00	2,566.58	2,579.15	2,472.51	10.21	11.24	-46.15	561.08	-28.67	277.96	258.80	19.16	14.506			
2,700.00	2,664.64	2,687.84	2,570.40	10.65	11.95	-43.23	607.61	-20.63	299.63	279.53	20.10	14.909			
2,800.00	2,762.70	2,792.99	2,666.57	11.09	12.62	-41.15	649.46	-13.28	319.10	298.12	20.98	15.212			
2,900.00	2,860.76	2,888.75	2,755.25	11.53	13.20	-39.96	685.30	-8.63	337.30	315.54	21.75	15.506			
3,000.00	2,958.82	2,984.49	2,843.53	11.97	13.80	-39.00	722.18	-5.07	357.10	334.56	22.54	15.845			
3,100.00	3,056.88	3,092.29	2,943.90	12.41	14.45	-38.36	761.39	-2.33	375.26	351.79	23.48	15.984			
3,200.00	3,154.94	3,191.69	3,037.17	12.85	15.03	-38.07	795.72	-0.88	392.06	367.74	24.32	16.119			
3,300.00	3,253.00	3,279.89	3,119.41	13.28	15.56	-37.81	827.56	0.09	410.51	385.47	25.04	16.396			
3,400.00	3,351.07	3,372.92	3,205.55	13.72	16.13	-37.44	862.68	1.37	430.53	404.72	25.81	16.683			
3,500.00	3,449.13	3,460.89	3,286.34	14.16	16.70	-36.99	897.44	2.98	452.16	425.66	26.51	17.057			
3,600.00	3,547.19	3,556.18	3,372.87	14.61	17.32	-36.28	937.23	6.21	475.57	448.28	27.30	17.421			
3,700.00	3,645.25	3,660.53	3,467.93	15.05	18.00	-35.62	980.13	9.63	498.47	470.26	28.21	17.670			
3,800.00	3,743.31	3,764.59	3,563.75	15.49	18.66	-35.18	1,020.62	12.28	519.36	490.25	29.12	17.837			
3,900.00	3,841.37	3,857.49	3,649.18	15.93	19.25	-34.77	1,056.99	15.12	540.40	510.51	29.89	18.082			
4,000.00	3,939.43	3,955.17	3,738.78	16.37	19.88	-34.34	1,095.78	18.27	561.98	531.26	30.71	18.298			
4,100.00	4,037.49	4,048.87	3,824.52	16.81	20.48	-33.99	1,133.47	20.65	584.28	552.78	31.50	18.551			
4,200.00	4,135.55	4,150.38	3,917.77	17.25	21.13	-33.76	1,173.55	22.27	606.12	573.74	32.38	18.718			
4,300.00	4,233.61	4,242.07	4,002.01	17.69	21.72	-33.55	1,209.71	23.97	627.88	594.73	33.15	18.942			
4,400.00	4,331.67	4,327.92	4,080.04	18.13	22.29	-33.18	1,245.38	27.04	651.32	617.49	33.83	19.251			
4,500.00	4,429.73	4,427.87	4,169.97	18.57	22.97	-32.50	1,288.53	33.35	675.80	641.12	34.68	19.487			
4,600.00	4,527.80	4,528.15	4,257.38	19.02	24.58	-44.04	1,214.90	61.18	656.57	629.42	27.15	24.180			
4,700.00	4,625.67	4,618.92	4,349.22	19.45	24.48	-88.48	1,165.95	68.23	589.18	561.48	27.69	21.276			
4,800.00	4,721.86	4,688.51	4,441.57	19.86	24.27	-124.64	1,050.53	78.30	528.56	502.68	25.88	20.425			
4,900.00	4,814.51	4,687.76	4,521.44	20.24	24.01	-158.83	880.88	89.85	467.00	441.22	25.78	18.113			
5,000.00	4,901.80	4,807.90	4,542.49	20.60	23.89	179.36	764.19	94.24	419.58	388.31	31.27	13.417			

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

Cathedral Energy Services

Anticollision Report

Company:	LOGOS Operating LLC	Local Co-ordinate Reference:	Well HEROS 3H
Project:	San Juan County, NM	TVD Reference:	14' KB @ 6923.00usft
Reference Site:	S9-T23N-R8W	MD Reference:	14' KB @ 6923.00usft
Site Error:	0.00usft	North Reference:	True
Reference Well:	HEROS 3H	Survey Calculation Method:	Minimum Curvature
Well Error:	0.00usft	Output errors are at	2.00 sigma
Reference Wellbore	OH	Database:	USA EDM 5000 Multi Users DB
Reference Design:	PLAN #1	Offset TVD Reference:	Offset Datum

Offset Design S9-T23N-R8W - HEROS 2308 09L COM #1H - OH - SURVEYS													Offset Site Error:	0.00 usft
Survey Program: 404-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)	Total Uncertainty Axis	Separation Factor		
5,098.80	4,981.13	5,836.04	5,246.12	20.95	23.88	172.48	736.38	96.55	402.47	365.41	37.06	10.859		
5,100.00	4,982.04	5,836.40	5,246.17	20.95	23.88	172.40	736.03	96.58	402.48	365.35	37.13	10.840		
5,200.00	5,053.67	5,862.54	5,249.34	21.33	23.87	165.83	710.16	98.64	420.20	378.75	41.46	10.135		
5,300.00	5,115.28	5,883.51	5,251.60	21.79	23.87	159.00	689.35	99.79	468.27	424.58	43.69	10.719		
5,400.00	5,165.69	5,903.64	5,253.33	22.47	23.87	150.19	669.29	100.15	537.86	493.36	44.50	12.087		
5,500.00	5,203.92	5,937.35	5,255.78	23.47	23.87	136.07	635.67	100.32	620.06	575.40	44.66	13.884		
5,600.00	5,229.21	5,979.44	5,258.21	24.82	23.89	117.47	593.66	100.54	708.46	663.81	44.65	15.866		
5,700.00	5,241.07	6,029.48	5,260.23	26.45	23.94	98.15	543.67	101.36	798.73	754.03	44.70	17.870		
5,800.00	5,241.78	6,066.49	5,261.92	28.27	23.99	91.53	506.70	101.98	889.01	844.18	44.84	19.827		
5,900.00	5,241.41	6,116.72	5,265.28	30.26	24.08	91.83	456.59	102.82	979.27	934.15	45.12	21.705		
6,000.00	5,241.05	6,166.75	5,269.38	32.40	24.20	92.17	406.75	104.19	1,069.06	1,023.54	45.52	23.484		
6,100.00	5,240.68	6,238.52	5,273.43	34.66	24.42	92.35	335.15	106.81	1,158.54	1,112.29	46.25	25.050		

Cathedral Energy Services

Anticollision Report

Company: LOGOS Operating LLC
Project: San Juan County, NM
Reference Site: S9-T23N-R8W
Site Error: 0.00usft
Reference Well: HEROS 3H
Well Error: 0.00usft
Reference Wellbore: OH
Reference Design: PLAN #1

Local Co-ordinate Reference: Well HEROS 3H
TVD Reference: 14' KB @ 6923.00usft
MD Reference: 14' KB @ 6923.00usft
North Reference: True
Survey Calculation Method: Minimum Curvature
Output errors are at 2.00 sigma
Database: USA EDM 5000 Multi Users DB
Offset TVD Reference: Offset Datum

Offset Design S9-T23N-R8W - HEROS 2H - OH - PLAN #1													Offset Site Error: 0.00 usft
Survey Program: 0-MWD+HDGM													Offset Well Error: 0.00 usft
Reference	Offset	Semi Major Axis		Distance		Total		Separation		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)	Uncertainty Axis	Factor	
0.00	0.00	0.00	0.00	0.00	0.00	-89.92	0.04	-30.00	30.00				
100.00	100.00	100.00	100.00	0.15	0.15	-89.92	0.04	-30.00	30.00	29.69	0.31	97.312	
200.00	200.00	200.00	200.00	0.51	0.51	-89.92	0.04	-30.00	30.00	28.97	1.03	29.262	
300.00	300.00	300.00	300.00	0.87	0.87	-89.92	0.04	-30.00	30.00	28.26	1.74	17.220	
400.00	400.00	400.00	400.00	1.23	1.23	-89.92	0.04	-30.00	30.00	27.54	2.46	12.200	
500.00	500.00	500.00	500.00	1.59	1.59	-89.92	0.04	-30.00	30.00	26.82	3.18	9.446 CC	
600.00	599.98	600.02	599.98	1.95	1.95	-110.39	0.04	-30.00	30.56	26.67	3.89	7.853 ES	
700.00	699.84	699.84	699.84	2.31	2.30	-118.96	0.04	-30.00	32.76	28.15	4.61	7.108	
800.00	799.45	799.98	799.95	2.67	2.66	-128.13	1.79	-29.94	37.05	31.73	5.33	6.955	
900.00	898.70	900.33	900.17	3.04	3.03	-134.48	7.04	-29.75	42.83	36.78	6.05	7.080	
1,000.00	997.47	1,000.89	1,000.33	3.41	3.39	-138.53	15.82	-29.44	49.70	42.92	6.78	7.334	
1,100.00	1,095.67	1,101.65	1,100.33	3.80	3.76	-140.81	28.14	-29.01	57.24	49.73	7.51	7.620	
1,200.00	1,193.73	1,202.70	1,200.13	4.21	4.13	-140.46	44.01	-28.45	63.35	55.09	8.26	7.670	
1,300.00	1,291.79	1,303.01	1,298.71	4.62	4.52	-138.26	62.49	-27.79	67.92	58.89	9.03	7.519	
1,400.00	1,389.85	1,402.87	1,396.83	5.04	4.91	-136.21	81.08	-27.14	72.47	62.64	9.82	7.378	
1,500.00	1,487.91	1,502.74	1,494.94	5.46	5.31	-134.41	99.68	-26.48	77.09	66.47	10.62	7.258	
1,600.00	1,585.97	1,602.60	1,593.06	5.88	5.72	-132.81	118.28	-25.82	81.79	70.36	11.43	7.155	
1,700.00	1,684.03	1,702.47	1,691.18	6.31	6.13	-131.38	136.87	-25.17	86.54	74.29	12.25	7.065	
1,800.00	1,782.09	1,802.33	1,789.29	6.74	6.54	-130.11	155.47	-24.51	91.35	78.27	13.07	6.987	
1,900.00	1,880.15	1,902.20	1,887.41	7.17	6.95	-128.96	174.07	-23.85	96.19	82.28	13.90	6.918	
2,000.00	1,978.21	2,002.06	1,985.52	7.60	7.37	-127.92	192.67	-23.20	101.06	86.32	14.74	6.857	
2,100.00	2,076.27	2,101.93	2,083.64	8.03	7.79	-126.98	211.26	-22.54	105.97	90.39	15.58	6.802	
2,200.00	2,174.33	2,201.79	2,181.76	8.47	8.21	-126.12	229.86	-21.88	110.90	94.48	16.42	6.754	
2,300.00	2,272.40	2,301.66	2,279.87	8.90	8.64	-125.34	248.46	-21.22	115.86	98.59	17.27	6.710	
2,400.00	2,370.46	2,401.52	2,377.99	9.34	9.06	-124.62	267.05	-20.57	120.83	102.72	18.11	6.670	
2,500.00	2,468.52	2,501.39	2,476.10	9.78	9.48	-123.96	285.65	-19.91	125.82	106.86	18.97	6.635	
2,600.00	2,566.58	2,601.25	2,574.22	10.21	9.91	-123.34	304.25	-19.25	130.83	111.02	19.82	6.602	
2,700.00	2,664.64	2,701.12	2,672.34	10.65	10.34	-122.78	322.84	-18.60	135.85	115.18	20.67	6.572	
2,800.00	2,762.70	2,800.98	2,770.45	11.09	10.76	-122.25	341.44	-17.94	140.89	119.36	21.53	6.545	
2,900.00	2,860.76	2,900.85	2,868.57	11.53	11.19	-121.76	360.04	-17.28	145.93	123.55	22.38	6.520	
3,000.00	2,958.82	3,000.71	2,966.68	11.97	11.62	-121.30	378.64	-16.63	150.99	127.75	23.24	6.496	
3,100.00	3,056.88	3,100.58	3,064.80	12.41	12.05	-120.87	397.23	-15.97	156.05	131.95	24.10	6.475	
3,200.00	3,154.94	3,200.44	3,162.92	12.85	12.48	-120.47	415.83	-15.31	161.13	136.16	24.96	6.455	
3,300.00	3,253.00	3,300.31	3,261.03	13.28	12.91	-120.10	434.43	-14.65	166.21	140.38	25.82	6.437	
3,400.00	3,351.07	3,400.17	3,359.15	13.72	13.34	-119.74	453.02	-14.00	171.29	144.61	26.68	6.419	
3,500.00	3,449.13	3,500.04	3,457.26	14.16	13.77	-119.41	471.62	-13.34	176.38	148.84	27.55	6.403	
3,600.00	3,547.19	3,600.10	3,555.38	14.61	14.20	-119.09	490.22	-12.68	181.48	153.07	28.41	6.388	
3,700.00	3,645.25	3,700.23	3,653.50	15.05	14.63	-118.80	508.82	-12.03	186.59	157.31	29.27	6.374	
3,800.00	3,743.31	3,800.37	3,751.61	15.49	15.06	-118.51	527.41	-11.37	191.69	161.55	30.14	6.360	
3,900.00	3,841.37	3,900.50	3,849.73	15.93	15.49	-118.25	546.01	-10.71	196.81	165.80	31.01	6.347	
4,000.00	3,939.43	4,000.64	3,947.84	16.37	15.93	-117.99	564.61	-10.06	201.92	170.05	31.87	6.336	
4,100.00	4,037.49	4,100.77	4,045.96	16.81	16.36	-117.75	583.20	-9.40	207.04	174.31	32.74	6.324	
4,200.00	4,135.55	4,200.91	4,144.08	17.25	16.79	-117.52	601.80	-8.74	212.17	178.56	33.60	6.314	
4,300.00	4,233.61	4,298.96	4,242.19	17.69	17.22	-117.30	620.40	-8.09	217.29	182.83	34.46	6.305	
4,400.00	4,331.67	4,401.17	4,340.31	18.13	17.66	-117.09	638.99	-7.43	222.42	187.09	35.34	6.294	
4,500.00	4,429.73	4,498.69	4,438.42	18.57	18.08	-116.90	657.59	-6.77	227.56	191.36	36.20	6.287	
4,600.00	4,527.80	4,622.75	4,560.15	19.02	18.62	-116.90	680.65	-6.11	229.98	192.95	37.04	6.210	
4,700.00	4,625.67	4,767.30	4,698.72	19.45	19.22	-116.68	706.79	-5.45	231.15	194.35	37.80	6.010	
4,800.00	4,721.86	4,906.79	4,824.13	19.86	19.77	-116.49	730.35	-4.82	230.63	193.31	38.51	5.794	
4,900.00	4,814.51	5,039.06	4,931.15	20.24	20.29	-117.35	750.33	-4.21	229.04	191.15	39.19	5.535	
5,000.00	4,901.80	5,163.11	5,017.67	20.60	20.84	-117.10	766.39	-3.60	227.02	188.97	40.00	5.191	
5,100.00	4,982.04	5,278.92	5,084.02	20.95	21.55	-116.86	778.59	-3.00	224.78	186.55	41.00	4.634	

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

Cathedral Energy Services

Anticollision Report

Company:	LOGOS Operating LLC	Local Co-ordinate Reference:	Well HEROS 3H
Project:	San Juan County, NM	TVD Reference:	14' KB @ 6923.00usft
Reference Site:	S9-T23N-R8W	MD Reference:	14' KB @ 6923.00usft
Site Error:	0.00usft	North Reference:	True
Reference Well:	HEROS 3H	Survey Calculation Method:	Minimum Curvature
Well Error:	0.00usft	Output errors are at	2.00 sigma
Reference Wellbore	OH	Database:	USA EDM 5000 Multi Users DB
Reference Design:	PLAN #1	Offset TVD Reference:	Offset Datum

Offset Design S9-T23N-R8W - HEROS 2H - OH - PLAN #1													Offset Site Error:	0.00 usft
Survey Program: 0-MWD+HDGM													Offset Well Error:	0.00 usft
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)	Total Uncertainty Axis	Separation Factor	Warning	
5,200.00	5,053.67	5,387.15	5,131.83	21.33	22.55	-146.79	787.27	437.10	113.19	82.34	30.86	3.668		
5,257.04	5,090.12	5,445.86	5,151.61	21.58	23.26	-134.81	790.80	492.24	110.03	74.93	35.10	3.135		
5,300.00	5,115.28	5,488.79	5,163.24	21.79	23.85	-125.46	792.84	533.50	111.93	73.14	38.79	2.885		
5,400.00	5,165.69	5,584.93	5,180.34	22.47	25.38	-105.44	795.70	627.99	130.09	84.28	45.81	2.840 SF		
5,500.00	5,203.92	5,676.50	5,185.01	23.47	27.03	-90.03	796.22	719.38	162.19	112.31	49.88	3.251		
5,600.00	5,229.21	5,766.54	5,185.10	24.82	28.82	-80.78	795.88	809.42	201.21	148.23	52.99	3.797		
5,700.00	5,241.07	5,857.88	5,185.19	26.45	30.75	-76.66	795.54	900.77	241.62	185.11	56.50	4.276		
5,800.00	5,241.78	5,949.03	5,185.29	28.27	32.80	-77.25	795.19	991.92	281.88	221.38	60.50	4.659		
5,900.00	5,241.41	6,040.11	5,185.38	30.26	34.93	-78.94	794.84	1,082.99	322.36	257.70	64.66	4.986		
6,000.00	5,241.05	6,131.18	5,185.47	32.40	37.13	-80.26	794.50	1,174.06	363.03	294.07	68.96	5.264		
6,100.00	5,240.68	6,222.25	5,185.56	34.66	39.39	-81.31	794.15	1,265.14	403.82	330.43	73.39	5.503		
6,200.00	5,240.32	6,313.33	5,185.66	37.01	41.70	-82.16	793.81	1,356.21	444.71	366.79	77.92	5.707		
6,300.00	5,239.95	6,404.40	5,185.75	39.43	44.06	-82.88	793.46	1,447.28	485.67	403.12	82.55	5.883		
6,400.00	5,239.58	6,504.52	5,185.84	41.92	46.69	-83.48	793.11	1,538.36	526.68	439.18	87.50	6.019		
6,500.00	5,239.22	6,586.55	5,185.93	44.45	48.88	-84.00	792.77	1,629.43	567.73	475.70	92.03	6.169		
6,600.00	5,238.85	6,677.63	5,186.02	47.04	51.33	-84.44	792.42	1,720.51	608.81	511.95	96.86	6.285		
6,700.00	5,238.49	6,768.70	5,186.12	49.65	53.80	-84.83	792.08	1,811.58	649.92	548.18	101.74	6.388		
6,800.00	5,238.12	6,859.78	5,186.21	52.30	56.29	-85.18	791.73	1,902.65	691.06	584.39	106.67	6.479		
6,900.00	5,237.75	6,950.85	5,186.30	54.97	58.80	-85.48	791.39	1,993.73	732.21	620.58	111.63	6.559		
7,000.00	5,237.39	7,041.93	5,186.39	57.67	61.33	-85.76	791.04	2,084.80	773.38	656.75	116.62	6.631		
7,100.00	5,237.02	7,133.00	5,186.49	60.39	63.86	-86.00	790.69	2,175.88	814.56	692.91	121.65	6.696		
7,200.00	5,236.66	7,224.07	5,186.58	63.12	66.41	-86.22	790.35	2,266.95	855.75	729.05	126.69	6.754		
7,300.00	5,236.29	7,315.15	5,186.67	65.87	68.97	-86.42	790.00	2,358.02	896.95	765.19	131.76	6.807		
7,400.00	5,235.92	7,406.22	5,186.76	68.63	71.54	-86.61	789.66	2,449.10	938.16	801.30	136.85	6.855		
7,500.00	5,235.56	7,502.70	5,186.86	71.40	74.27	-86.78	789.31	2,540.17	979.38	837.26	142.12	6.891		
7,600.00	5,235.19	7,588.37	5,186.95	74.19	76.70	-86.93	788.97	2,631.24	1,020.60	873.51	147.09	6.939		
7,700.00	5,234.83	7,679.45	5,187.04	76.98	79.29	-87.07	788.62	2,722.32	1,061.83	909.60	152.22	6.975		
7,800.00	5,234.46	7,770.52	5,187.13	79.78	81.88	-87.21	788.27	2,813.39	1,103.06	945.69	157.38	7.009		
7,900.00	5,234.09	7,861.60	5,187.23	82.59	84.48	-87.33	787.93	2,904.47	1,144.30	981.76	162.54	7.040		
8,000.00	5,233.73	7,952.67	5,187.32	85.40	87.09	-87.44	787.58	2,995.54	1,185.54	1,017.83	167.71	7.069		

Cathedral Energy Services

Anticollision Report

Company:	LOGOS Operating LLC	Local Co-ordinate Reference:	Well HEROS 3H
Project:	San Juan County, NM	TVD Reference:	14' KB @ 6923.00usft
Reference Site:	S9-T23N-R8W	MD Reference:	14' KB @ 6923.00usft
Site Error:	0.00usft	North Reference:	True
Reference Well:	HEROS 3H	Survey Calculation Method:	Minimum Curvature
Well Error:	0.00usft	Output errors are at	2.00 sigma
Reference Wellbore	OH	Database:	USA EDM 5000 Multi Users DB
Reference Design:	PLAN #1	Offset TVD Reference:	Offset Datum

Offset Design S9-T23N-R8W - HEROS 4H - OH - PLAN #1													Offset Site Error:	0.00 usft
Survey Program: 0-MWD+HDGM													Offset Well Error:	0.00 usft
Measured Depth (usft)	Vertical Depth (usft)	Measured Depth (usft)	Vertical Depth (usft)	Reference (usft)	Offset (usft)	Semi Major Axis (usft)	Highside Toolface (°)	Offset Wellbore Centre +N/-S (usft)	+E/-W (usft)	Between Centres (usft)	Between Ellipses (usft)	Total Uncertainty Axis	Separation Factor	Warning
0.00	0.00	0.00	0.00	0.00	0.00	90.08		-0.04	30.00	30.00				
100.00	100.00	100.00	100.00	0.15	0.15	90.08		-0.04	30.00	30.00	29.69	0.31	97.312	
200.00	200.00	200.00	200.00	0.51	0.51	90.08		-0.04	30.00	30.00	28.97	1.03	29.262	
300.00	300.00	300.00	300.00	0.87	0.87	90.08		-0.04	30.00	30.00	28.26	1.74	17.220	
400.00	400.00	400.00	400.00	1.23	1.23	90.08		-0.04	30.00	30.00	27.54	2.46	12.200	
500.00	500.00	500.00	500.00	1.59	1.59	90.08		-0.04	30.00	30.00	26.82	3.18	9.446	
600.00	599.98	600.02	599.98	1.95	1.95	75.96		-0.04	30.00	29.53	25.64	3.89	7.587	
700.00	699.84	700.16	699.84	2.31	2.31	86.15		-0.04	30.00	28.71	24.10	4.61	6.230	
726.01	725.77	725.77	725.77	2.40	2.40	90.00		-0.04	30.00	28.65	23.85	4.79	5.975 CC, ES	
800.00	799.45	800.55	799.45	2.67	2.67	103.25		-0.04	30.00	29.44	24.11	5.33	5.523 SF	
900.00	898.70	901.30	898.70	3.04	3.03	123.26		-0.04	30.00	34.36	28.30	6.06	5.669	
1,000.00	997.47	1,002.53	997.47	3.41	3.39	139.96		-0.04	30.00	44.93	38.13	6.80	6.611	
1,100.00	1,095.67	1,104.33	1,095.67	3.80	3.75	151.36		-0.04	30.00	60.67	53.14	7.53	8.053	
1,200.00	1,193.73	1,206.27	1,193.73	4.21	4.12	158.21		-0.04	30.00	78.50	70.23	8.26	9.499	
1,300.00	1,291.79	1,308.21	1,291.79	4.62	4.49	162.51		-0.04	30.00	97.01	88.01	8.99	10.787	
1,400.00	1,389.85	1,389.85	1,389.85	5.04	4.78	165.42		-0.04	30.00	115.87	106.22	9.65	12.006	
1,500.00	1,487.91	1,487.91	1,487.91	5.46	5.13	167.51		-0.04	30.00	134.95	124.58	10.37	13.014	
1,600.00	1,585.97	1,585.97	1,585.97	5.88	5.48	169.08		-0.04	30.00	154.16	143.07	11.09	13.902	
1,700.00	1,684.03	1,684.03	1,684.03	6.31	5.83	170.31		-0.04	30.00	173.45	161.64	11.81	14.687	
1,800.00	1,782.09	1,782.09	1,782.09	6.74	6.18	171.29		-0.04	30.00	192.81	180.28	12.53	15.385	
1,900.00	1,880.15	1,880.15	1,880.15	7.17	6.54	172.09		-0.04	30.00	212.21	198.95	13.25	16.010	
2,000.00	1,978.21	1,978.21	1,978.21	7.60	6.89	172.76		-0.04	30.00	231.64	217.66	13.98	16.572	
2,100.00	2,076.27	2,070.95	2,070.94	8.03	7.21	173.19		-0.87	30.31	251.91	237.25	14.65	17.192	
2,200.00	2,174.33	2,165.92	2,165.85	8.47	7.52	173.30		-3.91	31.45	274.23	258.90	15.33	17.890	
2,300.00	2,272.40	2,263.35	2,263.23	8.90	7.84	173.38		-7.21	32.69	296.72	280.70	16.02	18.522	
2,400.00	2,370.46	2,360.79	2,360.60	9.34	8.16	173.44		-10.52	33.93	319.22	302.50	16.71	19.099	
2,500.00	2,468.52	2,458.23	2,457.97	9.78	8.49	173.50		-13.82	35.17	341.71	324.30	17.41	19.626	
2,600.00	2,566.58	2,555.66	2,555.34	10.21	8.81	173.55		-17.13	36.41	364.21	346.09	18.11	20.110	
2,700.00	2,664.64	2,653.10	2,652.72	10.65	9.14	173.60		-20.43	37.65	386.70	367.89	18.81	20.556	
2,800.00	2,762.70	2,750.54	2,750.09	11.09	9.47	173.64		-23.74	38.89	409.20	389.68	19.52	20.967	
2,900.00	2,860.76	2,847.97	2,847.46	11.53	9.80	173.67		-27.04	40.13	431.69	411.47	20.22	21.349	
3,000.00	2,958.82	2,945.41	2,944.84	11.97	10.14	173.70		-30.35	41.37	454.19	433.26	20.93	21.703	
3,100.00	3,056.88	3,042.85	3,042.21	12.41	10.47	173.73		-33.65	42.61	476.68	455.05	21.64	22.032	
3,200.00	3,154.94	3,140.28	3,139.58	12.85	10.81	173.76		-36.95	43.85	499.18	476.83	22.35	22.340	
3,300.00	3,253.00	3,237.72	3,236.95	13.28	11.15	173.78		-40.26	45.09	521.68	498.62	23.06	22.627	
3,400.00	3,351.07	3,335.16	3,334.33	13.72	11.48	173.81		-43.56	46.33	544.17	520.40	23.77	22.896	
3,500.00	3,449.13	3,432.59	3,431.70	14.16	11.82	173.83		-46.87	47.57	566.67	542.19	24.48	23.148	
3,600.00	3,547.19	3,530.03	3,529.07	14.61	12.16	173.84		-50.17	48.80	589.16	563.97	25.19	23.386	
3,700.00	3,645.25	3,627.47	3,626.44	15.05	12.50	173.86		-53.48	50.04	611.66	585.75	25.91	23.609	
3,800.00	3,743.31	3,724.90	3,723.82	15.49	12.84	173.88		-56.78	51.28	634.16	607.53	26.62	23.820	
3,900.00	3,841.37	3,822.34	3,821.19	15.93	13.19	173.89		-60.08	52.52	656.65	629.32	27.34	24.020	
4,000.00	3,939.43	3,919.78	3,918.56	16.37	13.53	173.91		-63.39	53.76	679.15	651.10	28.05	24.208	
4,100.00	4,037.49	4,017.21	4,015.93	16.81	13.87	173.92		-66.69	55.00	701.65	672.88	28.77	24.387	
4,200.00	4,135.55	4,114.65	4,113.31	17.25	14.22	173.93		-70.00	56.24	724.14	694.65	29.49	24.556	
4,300.00	4,233.61	4,212.09	4,210.68	17.69	14.56	173.95		-73.30	57.48	746.64	716.43	30.21	24.717	
4,400.00	4,331.67	4,309.52	4,308.05	18.13	14.90	173.96		-76.61	58.72	769.14	738.21	30.93	24.870	
4,500.00	4,429.73	4,406.96	4,405.42	18.57	15.25	173.97		-79.91	59.96	791.63	759.99	31.64	25.016	
4,600.00	4,527.80	4,504.40	4,502.80	19.02	15.60	171.61		-83.22	61.20	814.13	781.76	32.36	25.155	
4,700.00	4,625.67	4,580.59	4,578.89	19.45	15.87	133.67		-86.49	63.01	835.63	802.71	32.92	25.385	
4,800.00	4,721.86	4,643.52	4,641.25	19.86	16.10	111.61		-92.56	68.62	857.49	824.15	33.34	25.720	
4,900.00	4,814.51	4,706.03	4,702.26	20.24	16.33	100.12		-101.99	78.37	879.69	845.96	33.74	26.076	
5,000.00	4,901.80	4,768.31	4,761.62	20.60	16.57	93.51		-114.70	92.14	902.03	867.88	34.15	26.415	

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

Cathedral Energy Services

Anticollision Report

Company:	LOGOS Operating LLC	Local Co-ordinate Reference:	Well HEROS 3H
Project:	San Juan County, NM	TVD Reference:	14' KB @ 6923.00usft
Reference Site:	S9-T23N-R8W	MD Reference:	14' KB @ 6923.00usft
Site Error:	0.00usft	North Reference:	True
Reference Well:	HEROS 3H	Survey Calculation Method:	Minimum Curvature
Well Error:	0.00usft	Output errors are at	2.00 sigma
Reference Wellbore	OH	Database:	USA EDM 5000 Multi Users DB
Reference Design:	PLAN #1	Offset TVD Reference:	Offset Datum

Offset Design S9-T23N-R8W - HEROS 4H - OH - PLAN #1													Offset Site Error:	0.00 usft
Survey Program: 0-MWD+HDGM													Offset Well Error:	0.00 usft
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)	Total Uncertainty Axis	Separation Factor	Warning	
5,100.00	4,982.04	4,830.51	4,819.08	20.95	16.81	89.36	-130.58	109.84	924.32	889.69	34.63	26.689		
5,200.00	5,053.67	4,892.86	4,874.38	21.33	17.08	86.64	-149.59	131.41	946.44	911.17	35.26	26.838		
5,300.00	5,115.28	4,955.60	4,927.30	21.79	17.36	84.86	-171.69	156.81	968.27	932.14	36.13	26.803		
5,400.00	5,165.69	5,019.04	4,977.61	22.47	17.69	83.74	-196.89	186.06	989.75	952.46	37.29	26.542		
5,500.00	5,203.92	5,083.51	5,025.03	23.47	18.06	83.15	-225.25	219.24	1,010.83	972.03	38.80	26.051		
5,600.00	5,229.21	5,150.00	5,069.63	24.82	18.52	83.03	-257.15	256.81	1,031.47	990.79	40.68	25.356		
5,700.00	5,241.07	5,217.46	5,110.00	26.45	19.07	83.28	-291.98	298.09	1,051.64	1,008.75	42.88	24.522		
5,800.00	5,241.78	5,289.18	5,147.16	28.27	19.76	84.77	-331.41	345.04	1,072.02	1,026.62	45.40	23.613		
5,900.00	5,241.41	5,369.19	5,181.14	30.26	20.68	86.70	-377.82	400.59	1,094.97	1,046.70	48.27	22.684		
6,000.00	5,241.05	5,457.28	5,208.97	32.40	21.88	88.25	-431.21	464.82	1,119.68	1,068.14	51.53	21.727		
6,100.00	5,240.68	5,551.75	5,227.18	34.66	23.36	89.25	-490.25	536.19	1,145.14	1,089.94	55.19	20.748		
6,200.00	5,240.32	5,649.75	5,233.04	37.01	25.06	89.58	-552.36	611.67	1,170.70	1,111.53	59.17	19.785		

Cathedral Energy Services

Anticollision Report

Company:	LOGOS Operating LLC	Local Co-ordinate Reference:	Well HEROS 3H
Project:	San Juan County, NM	TVD Reference:	14' KB @ 6923.00usft
Reference Site:	S9-T23N-R8W	MD Reference:	14' KB @ 6923.00usft
Site Error:	0.00usft	North Reference:	True
Reference Well:	HEROS 3H	Survey Calculation Method:	Minimum Curvature
Well Error:	0.00usft	Output errors are at	2.00 sigma
Reference Wellbore	OH	Database:	USA EDM 5000 Multi Users DB
Reference Design:	PLAN #1	Offset TVD Reference:	Offset Datum

Offset Design S9-T23N-R8W - W Lybrook Unit 701H - OH - NO SURVEYS													Offset Site Error:	0.00 usft
Survey Program: 5-MWD+HDGM													Offset Well Error:	0.00 usft
Reference		Offset		Semi Major Axis		Highside Toolface (°)	Distance		Total Uncertainty Axis	Separation Factor	Warning			
Measured Depth (usft)	Vertical Depth (usft)	Measured Depth (usft)	Vertical Depth (usft)	Reference (usft)	Offset (usft)		Between Centres (usft)	Between Ellipses (usft)						
0.00	0.00	5.00	5.00	0.00	0.01	156.73	-1,082.83	465.67	1,178.72					
100.00	100.00	5.00	5.00	0.15	0.01	156.73	-1,082.83	465.67	1,183.12	1,182.17	0.95	1,247.937 SF		

Cathedral Energy Services

Anticollision Report

Company:	LOGOS Operating LLC	Local Co-ordinate Reference:	Well HEROS 3H
Project:	San Juan County, NM	TVD Reference:	14' KB @ 6923.00usft
Reference Site:	S9-T23N-R8W	MD Reference:	14' KB @ 6923.00usft
Site Error:	0.00usft	North Reference:	True
Reference Well:	HEROS 3H	Survey Calculation Method:	Minimum Curvature
Well Error:	0.00usft	Output errors are at	2.00 sigma
Reference Wellbore	OH	Database:	USA EDM 5000 Multi Users DB
Reference Design:	PLAN #1	Offset TVD Reference:	Offset Datum

Offset Design S9-T23N-R8W - W Lybrook Unit 702H - OH - NO SURVEYS												Offset Site Error:	0.00 usft
Survey Program: S-MWD+HDGM												Offset Well Error:	0.00 usft
Reference		Offset		Semi Major Axis		Highside Toolface (°)	Distance		Total Uncertainty Axis	Separation Factor	Warning		
Measured Depth (usft)	Vertical Depth (usft)	Measured Depth (usft)	Vertical Depth (usft)	Reference (usft)	Offset (usft)		Offset Wellbore +N/-S (usft)	Centre +E/-W (usft)					
0.00	0.00	5.00	5.00	0.00	0.01	158.65	-1,103.94	431.46	1,185.27				
100.00	100.00	5.00	5.00	0.15	0.01	158.65	-1,103.94	431.46	1,189.64	1,188.70	0.94	1,261.042 SF	

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

Cathedral Energy Services

Anticollision Report

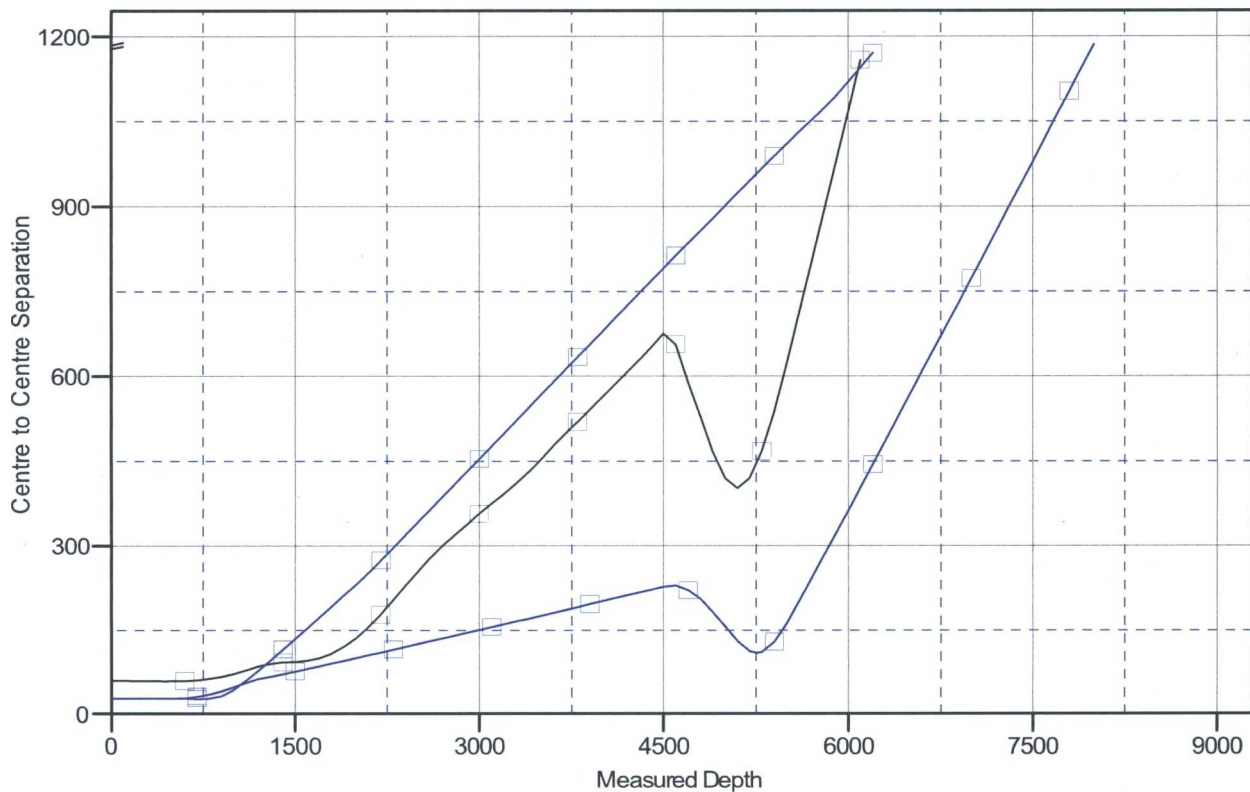
Company: LOGOS Operating LLC
 Project: San Juan County, NM .
 Reference Site: S9-T23N-R8W
 Site Error: 0.00usft
 Reference Well: HEROS 3H
 Well Error: 0.00usft
 Reference Wellbore: OH
 Reference Design: PLAN #1

Local Co-ordinate Reference: Well HEROS 3H
 TVD Reference: 14' KB @ 6923.00usft
 MD Reference: 14' KB @ 6923.00usft
 North Reference: True
 Survey Calculation Method: Minimum Curvature
 Output errors are at: 2.00 sigma
 Database: USA EDM 5000 Multi Users DB
 Offset TVD Reference: Offset Datum

Reference Depths are relative to 14' KB @ 6923.00usft
 Offset Depths are relative to Offset Datum
 Central Meridian is -107.833333 °

Coordinates are relative to: HEROS 3H
 Coordinate System is US State Plane 1983, New Mexico Western Zone
 Grid Convergence at Surface is: 0.08°

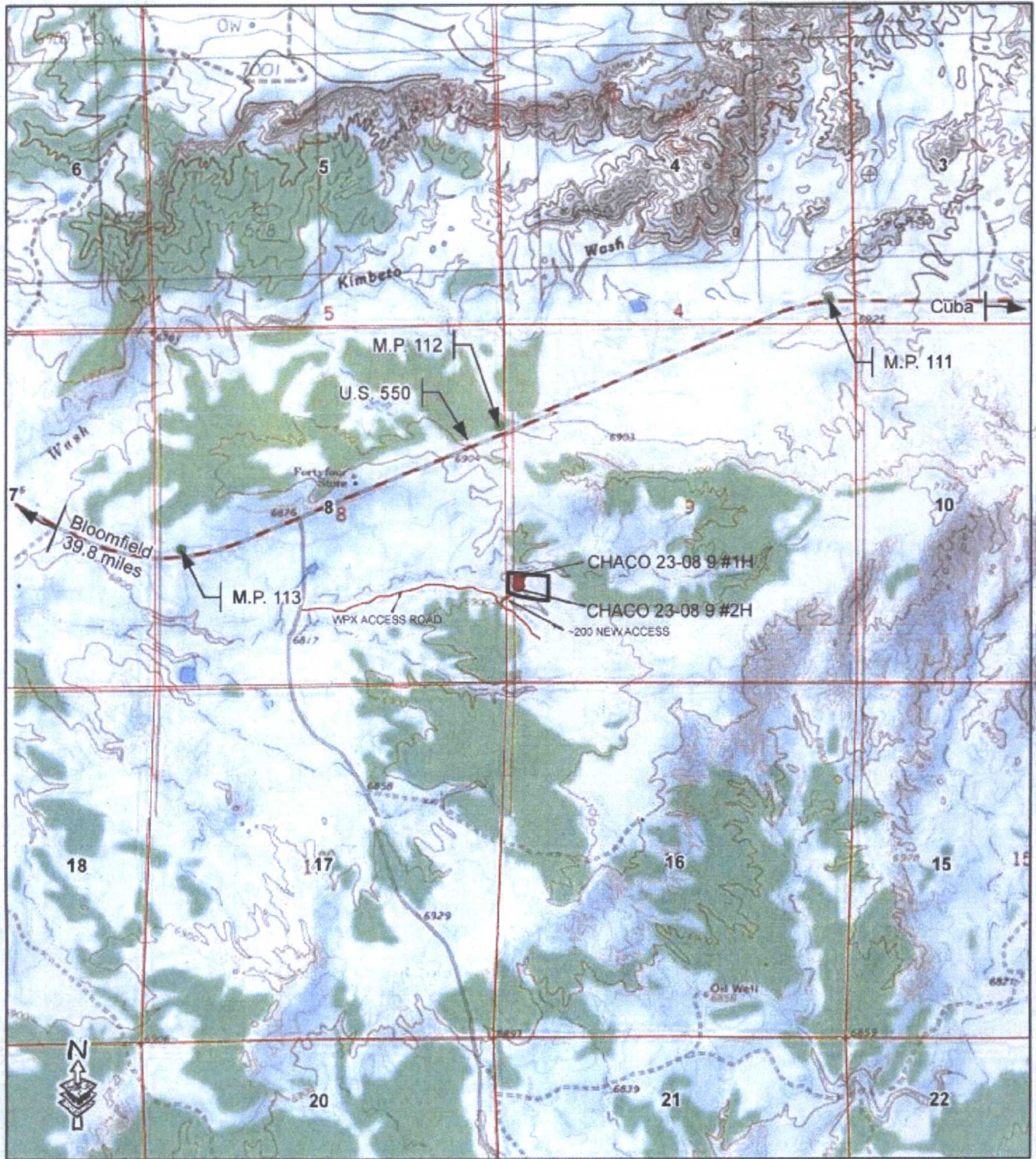
Ladder Plot



LEGEND

WLybrookUnit702H, OH, NO SURVEYS V0
 WLybrookUnit701H, OH, NO SURVEYS V0
 HEROS 2H, OH, PLAN#1 V0

HEROS 2308 09L COM#1H, OH, SURVEYS V0
 HEROS 4H, OH, PLAN#1 V0



0 1,000 2,000 4,000 Feet



CHACO 23-8 9 #1H & #2H

Cartography By: MJW

Checked by: JS

Date: 5/14/2015 Time: 3:34:24 PM

ENERGEN RESOURCES CORPORATION
CHACO 23-08 9 #1H & #2H
SEC. 9, T-23-N, R-8-W, N.M.P.M., SAN JUAN CO, NM

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*.

Well Control Equipment Schematic for 2M Service

Attachment to Drilling Technical Program

Exhibit #1 Typical BOP setup

Location: San Juan Basin, New Mexico

Date: August 24, 2004

By: John Thompson (Walsh E&P)

