HESS BAKKEN INVESTMENTS II, LLC
3015 16th Street SW, Suite 20
Minot, ND 58701

Sent via Email

September 25, 2015

DMR Permit Manager
Oil & Gas Division
North Dakota Industrial Commission
ATTN: Todd L. Holweger
600 East Boulevard Dept. 405
Bismarck, ND 58505-0840

RE: Landowner Notification Compliance Lettter
Hess EN-Uran A Geophysical Exploration Permit # 97-0261

Dear Mr. Holweger,

The intent of this letter is to notify you that Hess Bakken Investments II, LLC has done its due diligence and provided the operator of the land and each landowner within one-half mile of the land on which geophysical exploration activities were conducted a written copy of NDCC Section 38-08.1-04.1 (Exploration Permit) and NDCC Chapter 38-11.1 (Oil and Gas Production Damage Compensation).

Please accept this letter as compliance with Paragraph #4 shown in the April 16, 2015, Hess EN-Uran A Permit letter written by you. Should you have any questions, please contact me at (701)420-7090 or wmontonye@hess.com.

Sincerely,
HESS BAKKEN INVESTMENTS II, LLC

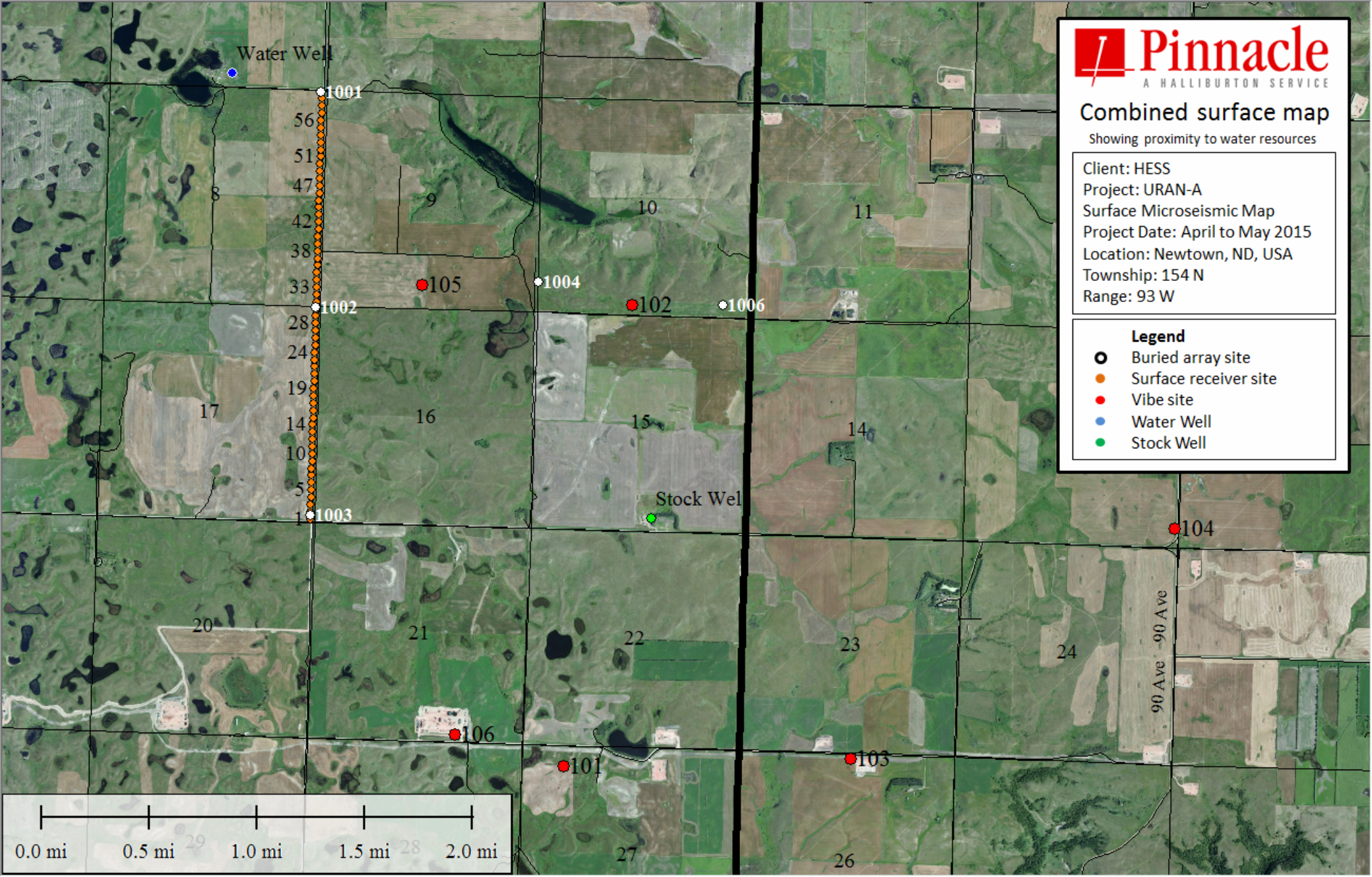
Whitney Montonye
Senior Land Negotiator

WM/jla

X	Y	LATITUDE	LONGITUDE	NAME	LAYER	NOTE
1442307	428236.5	48° 09' 13.6808" N	102° 39' 21.7155" W	1	Receiver Station	X coordinate - North Dakota North (ft international) - FIPS3301 - EPSG 2265 - NAD83
1442312	428413.4	48° 09' 15.4275" N	102° 39' 21.7163" W	2	Receiver Station	Y coordinate - North Dakota North (ft international) - FIPS3301 - EPSG 2265 - NAD83
1442317	428590.4	48° 09' 17.1742" N	102° 39' 21.7171" W	3	Receiver Station	
1442322	428767.3	48° 09' 18.9209" N	102° 39' 21.7179" W	4	Receiver Station	
1442327	428944.2	48° 09' 20.6675" N	102° 39' 21.7187" W	5	Receiver Station	
1442332	429121.1	48° 09' 22.4142" N	102° 39' 21.7195" W	6	Receiver Station	
1442337	429298.1	48° 09' 24.1609" N	102° 39' 21.7203" W	7	Receiver Station	
1442342	429475	48° 09' 25.9076" N	102° 39' 21.7211" W	8	Receiver Station	
1442347	429651.9	48° 09' 27.6542" N	102° 39' 21.7220" W	9	Receiver Station	
1442351	429828.8	48° 09' 29.4009" N	102° 39' 21.7228" W	10	Receiver Station	
1442356	430005.7	48° 09' 31.1476" N	102° 39' 21.7236" W	11	Receiver Station	
1442361	430182.7	48° 09' 32.8943" N	102° 39' 21.7244" W	12	Receiver Station	
1442366	430359.6	48° 09' 34.6410" N	102° 39' 21.7252" W	13	Receiver Station	
1442371	430536.5	48° 09' 36.3876" N	102° 39' 21.7260" W	14	Receiver Station	
1442376	430713.4	48° 09' 38.1343" N	102° 39' 21.7268" W	15	Receiver Station	
1442381	430890.3	48° 09' 39.8810" N	102° 39' 21.7276" W	16	Receiver Station	
1442386	431067.3	48° 09' 41.6277" N	102° 39' 21.7284" W	17	Receiver Station	
1442391	431244.2	48° 09' 43.3743" N	102° 39' 21.7292" W	18	Receiver Station	
1442396	431421.1	48° 09' 45.1210" N	102° 39' 21.7300" W	19	Receiver Station	
1442400	431598	48° 09' 46.8677" N	102° 39' 21.7308" W	20	Receiver Station	
1442405	431775	48° 09' 48.6144" N	102° 39' 21.7317" W	21	Receiver Station	
1442410	431951.9	48° 09' 50.3610" N	102° 39' 21.7325" W	22	Receiver Station	
1442415	432128.8	48° 09' 52.1077" N	102° 39' 21.7333" W	23	Receiver Station	
1442420	432305.7	48° 09' 53.8544" N	102° 39' 21.7341" W	24	Receiver Station	
1442425	432482.6	48° 09' 55.6011" N	102° 39' 21.7349" W	25	Receiver Station	
1442430	432659.6	48° 09' 57.3477" N	102° 39' 21.7357" W	26	Receiver Station	
1442435	432836.5	48° 09' 59.0944" N	102° 39' 21.7365" W	27	Receiver Station	
1442440	433013.4	48° 10' 00.8411" N	102° 39' 21.7373" W	28	Receiver Station	
1442445	433190.3	48° 10' 02.5878" N	102° 39' 21.7381" W	29	Receiver Station	
1442449	433367.2	48° 10' 04.3344" N	102° 39' 21.7389" W	30	Receiver Station	
1442454	433544.2	48° 10' 06.0811" N	102° 39' 21.7397" W	31	Receiver Station	
1442459	433721.1	48° 10' 07.8278" N	102° 39' 21.7405" W	32	Receiver Station	
1442464	433898	48° 10' 09.5745" N	102° 39' 21.7414" W	33	Receiver Station	
1442469	434074.9	48° 10' 11.3211" N	102° 39' 21.7422" W	34	Receiver Station	

1442474	434251.9	48° 10' 13.0678" N	102° 39' 21.7430" W	35	Receiver Station
1442479	434428.8	48° 10' 14.8145" N	102° 39' 21.7438" W	36	Receiver Station
1442484	434605.7	48° 10' 16.5611" N	102° 39' 21.7446" W	37	Receiver Station
1442489	434782.6	48° 10' 18.3078" N	102° 39' 21.7454" W	38	Receiver Station
1442494	434959.5	48° 10' 20.0545" N	102° 39' 21.7462" W	39	Receiver Station
1442498	435136.5	48° 10' 21.8012" N	102° 39' 21.7470" W	40	Receiver Station
1442503	435313.4	48° 10' 23.5478" N	102° 39' 21.7478" W	41	Receiver Station
1442508	435490.3	48° 10' 25.2945" N	102° 39' 21.7486" W	42	Receiver Station
1442513	435667.2	48° 10' 27.0412" N	102° 39' 21.7494" W	43	Receiver Station
1442518	435844.1	48° 10' 28.7879" N	102° 39' 21.7502" W	44	Receiver Station
1442523	436021.1	48° 10' 30.5345" N	102° 39' 21.7511" W	45	Receiver Station
1442528	436198	48° 10' 32.2812" N	102° 39' 21.7519" W	46	Receiver Station
1442533	436374.9	48° 10' 34.0279" N	102° 39' 21.7527" W	47	Receiver Station
1442538	436551.8	48° 10' 35.7745" N	102° 39' 21.7535" W	48	Receiver Station
1442543	436728.8	48° 10' 37.5212" N	102° 39' 21.7543" W	49	Receiver Station
1442547	436905.7	48° 10' 39.2679" N	102° 39' 21.7551" W	50	Receiver Station
1442552	437082.6	48° 10' 41.0145" N	102° 39' 21.7559" W	51	Receiver Station
1442557	437259.5	48° 10' 42.7612" N	102° 39' 21.7567" W	52	Receiver Station
1442562	437436.4	48° 10' 44.5079" N	102° 39' 21.7575" W	53	Receiver Station
1442567	437613.4	48° 10' 46.2546" N	102° 39' 21.7583" W	54	Receiver Station
1442572	437790.3	48° 10' 48.0012" N	102° 39' 21.7591" W	55	Receiver Station
1442577	437967.2	48° 10' 49.7479" N	102° 39' 21.7600" W	56	Receiver Station
1442582	438144.1	48° 10' 51.4946" N	102° 39' 21.7608" W	57	Receiver Station
1442587	438321	48° 10' 53.2412" N	102° 39' 21.7616" W	58	Receiver Station
1442592	438498	48° 10' 54.9879" N	102° 39' 21.7624" W	59	Receiver Station
1442597	438674.9	48° 10' 56.7346" N	102° 39' 21.7632" W	60	Receiver Station

X	Y	LATITUDE	LONGITUDE	NAME	NOTES
1442574.777	438665.907	48° 10' 56.6400" N	102° 39' 22.0800" W	1001	X coordinate - North Dakota North (ft international) - FIPS3301 - EPSG 2265 - NAD83
1442439.725	433408.631	48° 10' 04.7400" N	102° 39' 21.9000" W	1002	Y coordinate - North Dakota North (ft international) - FIPS3301 - EPSG 2265 - NAD83
1442305.721	428333.805	48° 09' 14.6400" N	102° 39' 21.7800" W	1003	There is no 1005
1447864.124	434029.906	48° 10' 12.3600" N	102° 38' 02.1600" W	1004	
1452388.671	433454.951	48° 10' 07.9200" N	102° 36' 55.2000" W	1006	


Pinnacle
A HALLIBURTON SERVICE
Combined surface map
Showing proximity to water resources
Client: HESS
Project: URAN-A
Surface Microseismic Map
Project Date: April to May 2015
Location: Newtown, ND, USA
Township: 154 N
Range: 93 W
Legend
Buried array site
Surface receiver site
Vibe site
Water Well
Stock Well
Water Well
Stock Wel
1001
1002
1003
1004
1006
105
102
104
106
101
103
56
51
47
42
38
33
28
24
19
14
10
5
1
8
9
10
11
17
16
15
14
20
21
22
23
24
27
26
90 Ave
0.0 mi
0.5 mi
1.0 mi
1.5 mi
2.0 mi

GEOPHYSICAL EXPLORATION AFFIDAVIT OF COMPLETION REPORT - FORM GE 6B

INDUSTRIAL COMMISSION OF NORTH DAKOTA
OIL AND GAS DIVISION
600 EAST BOULEVARD DEPT 405
BISMARCK, ND 58505-0840
SFN 51456 (03-2011)

PERMIT NAME (Required): Hess EIV-Uran A

PERMIT NUMBER: 97-0261

AFFIDAVIT OF COMPLETION (GEOPHYSICAL CONTRACTOR)

STATE OF Colorado)
)
COUNTY OF Denver)

Before me, PAMELA M. JOHNSON, a Notary Public in and for the said County and State, this day personally appeared BEN BAGHERIAN who being first duly sworn, deposes and says that (s)he is employed by Halliburton Energy Services, that (s)he has read North Dakota Century Code Section 38-08.1, that the foregoing seismic project has been completed in accordance with North Dakota Administrative Code Rule 43-02-12 and that the statements on the reverse side of this document are true.

BEN BAGHERIAN
Geophysical Contractor Representative

Subscribed in my presence and sworn before me this 24th day of July, 2015.

PAMELA M. JOHNSON
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 19874101186
MY COMMISSION EXPIRES MAY 01, 2018

Notary Public Pamela M. Johnson

My Commission Expires May 01, 2018

GEOPHYSICAL EXPLORATION COMPLETION REPORT - FORM GE 6A

INDUSTRIAL COMMISSION OF NORTH DAKOTA
OIL AND GAS DIVISION
600 EAST BOULEVARD DEPT 405
BISMARCK, ND 58505-0840
SFN 51456 (03-2011)

Permit No. 97 - 0261	
Shot Hole Operations	*Non-Explosive Operations 300 ft Non-Explosive, other

SECTION 1

Geophysical Contractor Halliburton	
Project Name and Number Hess EN-Uran A	County(s) Mountrail County
Township(s) 154	Range(s) 93
Drilling and Plugging Contractors SKS Drilling	
Date Commenced April 20, 2015	Date Completed May 8, 2015

SECTION 2

First S.P. #	Last S.P. #

Loaded Holes (Undetonated Shot Points)

S.P.#'s													
Charge Size													
Depth													

Reasons Holes Were Not Shot

SECTION 3

Flowing Holes and/or Blowouts
S.P.#'s

Procedure for Plugging Flowing Holes and/or Blowouts

Include a 7.5 minute USGS topographic quadrangle map or a computer generated post-plot facsimile of the approximate scale displaying each individual shot hole, SP #, line #, and legal location.

***Non-Explosive Operations - Complete Section 1 and Affidavit (Form GE 6B).**

GEOPHYSICAL EXPLORATION SUNDRY NOTICE - FORM GE 4

INDUSTRIAL COMMISSION OF NORTH DAKOTA
OIL AND GAS DIVISION
600 EAST BOULEVARD DEPT 405
BISMARCK, ND 58505-0840
SFN 51458 (03-2011)

APR 2015 RECEIVED ND OIL & GAS DIVISION

PERMIT # 97-0261

Project Name	Hess EN-Uran A
County	Mountrail

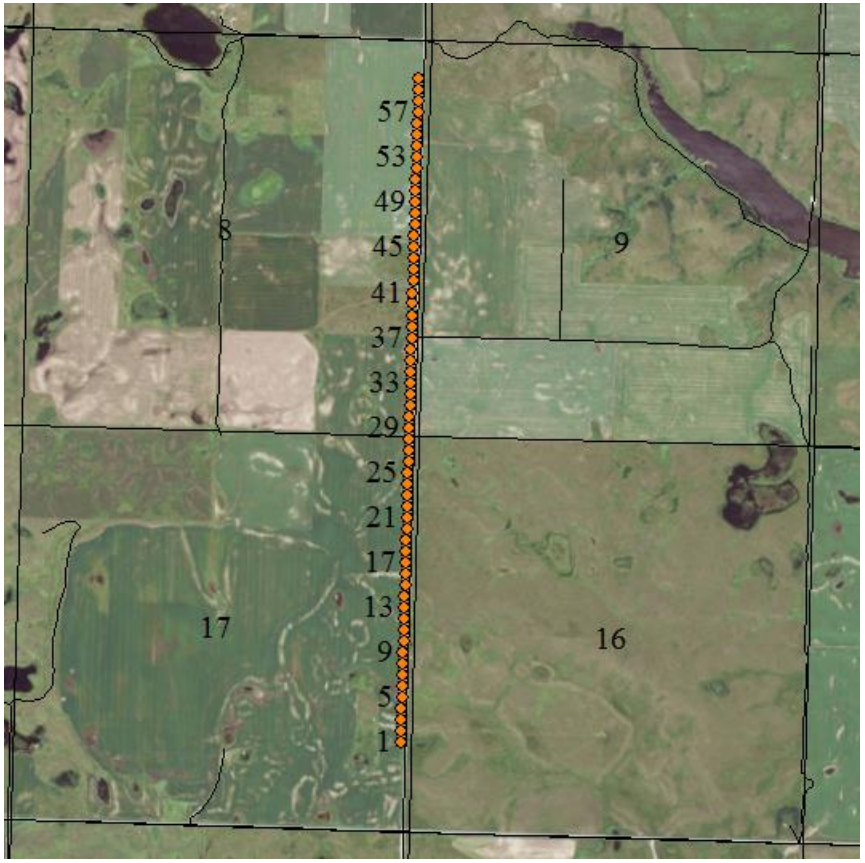
Supplemental Information

We respectfully request to make two corrections:
1) Correct "Location of Proposed Project - County" - it should be Mountrail, not McKenzie.
2) Extend, slightly, the length of the surface seismic line from 1.7 miles to 1.98 miles. The BOL/EOL will remain within the same quarter-section, but will simply run up-to (but not across) the section boundary. Previously, the BOL/EOL were inset from the section boundary by 500 and 1100 ft respectively.

Company: Halliburton			Telephone Number: 720-593-7077
Address: 1125 17th Stree, Suite 1900			
City: Denver		State: CO	Zip Code: 80202
Signature	Printed Name: Price Stark		
Title: Pinnacle Team Lead	Date: April 19, 2015		
Email Address: Price.Stark@halliburton.com			

FOR STATE USE ONLY

☐ Received	☒ Approved
Date: 4/20/15	
By: [signature]	
Title: Mineral Resources Permit Manager	



Original

Updated

Surface Receiver Stations. 4/20/2015. (Passive Array Line)

Station number	Longitude (decimal degrees)	Latitude (decimal degrees)
1	-102.6560321	48.15380023
2	-102.6560323	48.15428542
3	-102.6560325	48.15477060
4	-102.6560328	48.15525579
5	-102.6560330	48.15574098
6	-102.6560332	48.15622617
7	-102.6560334	48.15671136
8	-102.6560337	48.15719655
9	-102.6560339	48.15768173
10	-102.6560341	48.15816692
11	-102.6560343	48.15865211
12	-102.6560345	48.15913730
13	-102.6560348	48.15962249
14	-102.6560350	48.16010767
15	-102.6560352	48.16059286
16	-102.6560354	48.16107805
17	-102.6560357	48.16156324
18	-102.6560359	48.16204843
19	-102.6560361	48.16253361
20	-102.6560363	48.16301880
21	-102.6560366	48.16350399
22	-102.6560368	48.16398918
23	-102.6560370	48.16447436
24	-102.6560372	48.16495955
25	-102.6560375	48.16544474
26	-102.6560377	48.16592993
27	-102.6560379	48.16641511
28	-102.6560381	48.16690030
29	-102.6560384	48.16738549
30	-102.6560386	48.16787068
31	-102.6560388	48.16835586
32	-102.6560390	48.16884105
33	-102.6560393	48.16932624
34	-102.6560395	48.16981142
35	-102.6560397	48.17029661
36	-102.6560399	48.17078180
37	-102.6560402	48.17126699
38	-102.6560404	48.17175217
39	-102.6560406	48.17223736
40	-102.6560408	48.17272255
41	-102.6560411	48.17320773
42	-102.6560413	48.17369292
43	-102.6560415	48.17417811
44	-102.6560417	48.17466329
45	-102.6560420	48.17514848

46	-102.6560422	48.17563367
47	-102.6560424	48.17611885
48	-102.6560426	48.17660404
49	-102.6560429	48.17708922
50	-102.6560431	48.17757441
51	-102.6560433	48.17805960
52	-102.6560435	48.17854478
53	-102.6560438	48.17902997
54	-102.6560440	48.17951516
55	-102.6560442	48.18000034
56	-102.6560444	48.18048553
57	-102.6560447	48.18097071
58	-102.6560449	48.18145590
59	-102.6560451	48.18194109
60	-102.6560453	48.18242627

NORTH DAKOTA
OIL AND GAS DIVISION

Oil and Gas Division

Lynn D. Helms - Director Bruce E. Hicks - Assistant Director
Department of Mineral Resources
Lynn D. Helms - Director
North Dakota Industrial Commission
www.dmr.nd.gov/oilgas/

April 16, 2015

MR. PRICE STARK
PROJECT MANAGER
HALLIBURTON SERVICE
1125 17th STREET
SUITE 1900
DENVER, CO 80202

RE: ***County Correction***
HESS EN-URAN A
GEOPHYSICAL EXPLORATION PERMIT # 97-0261
MOUNTRAIL COUNTY
NON EXPLOSIVE METHOD

Dear MR. STARK:

Please be advised that we are in receipt of your Geophysical Exploration permit application and it is conditionally approved; effective for one year from April 16, 2015. **PURSUANT TO NDAC 43-02-12-05 (DISTANCE RESTRICTION) non-explosive exploration method may not be conducted not less than 300 feet from a water well, building, underground cistern, pipelines, and flowing spring.** Review the following conditions for your permit:

1. A pre-program meeting with state seismic inspector Tom Torstenson is required. You must contact him at 701-290-1546 (cell) or 701-227-7436 at least 24 hours prior to any exploration operations. Also, a copy of the entire permit is required for all contractors at the pre-program meeting.
2. All variances for distance restrictions are to be furnished, and a pre-plot map displaying any source points that do not comply with the distance restriction rule must be supplied to the inspector.
3. The following information must be submitted within 30 days of the completion of the project by the Geophysical Company:
    a. Completion Report,
    b. Completion Affidavit,
    c. Post Plot Map. It must show all water wells, buildings, underground cisterns, pipelines, and flowing springs that fall within the program area and within one half mile of the perimeter of the program.
    d. An Image file (.img) on an SD card or email: ttorstenson@nd.gov with all source and receiver points,

e. Letter stating that the Geophysical Company has given all surface owner's a copy of the Section and Chapter of the NDCC as stated in paragraph 5.

4. It is required that within seven days of initial contact between the permitting agent and the operator of the land, the permitting agent shall provide the operator of the land and each landowner owning land within one-half mile of the land on which geophysical exploration activities are to be conducted a written copy of NDCC Section 38-08.1-04.1 (Exploration Permit) and NDCC Chapter 38-11.1 (Oil and Gas Production Damage Compensation). The permitting agent shall file an affidavit with this office confirming compliance with such notification. For your convenience, a copy of both Sections are enclosed.
5. The permit agent shall notify the operator of the land at least seven days before commencement of any geophysical exploration activity, unless waived by mutual agreement of both parties. The notice must include the approximate time schedule and the location of the planned activity.
6. Information regarding the location of water wells, springs, etc.; refer to the following ND State Water Commission Mapservice website, at: http://mapservice.swc.state.nd.us/
7. The entire permit can be viewed, as well as the status of various seismic projects in the state, at: https://www.dmr.nd.gov/oilgas/seismic/seismicstats.asp

Should you have any questions regarding this matter, feel free to contact me at 701-328-8020, or Tom Torstenson at the number listed in paragraph 1.

Sincerely,

Todd L. Holweger
DMR Permit Manager

GEOPHYSICAL EXPLORATION PERMIT - FORM GE 1

INDUSTRIAL COMMISSION OF NORTH DAKOTA
OIL AND GAS DIVISION
600 EAST BOULEVARD DEPT 405
BISMARCK, ND 58505-0840
SFN 51459 (03-2011)

APR 2015 RECEIVED ND DIVISION

1) a. Company **Halliburton**	Address **1125 17th Street, Suite 1900**	
Contact **Price Stark**	Telephone **720-593-7077**	Fax **303-766-4306**
Surety Company **Westchester Fire Insurance Company**	Bond Amount **$25,000.00**	Bond Number **K08358977**
2) a Subcontractor(s) S & S Drilling	Address 5030 133 Ave NW, Williston	Telephone 701-570-8730
b. Subcontractor(s)	Address	Telephone
3) Party Manager **Jeff Keller**	Address (local)	Telephone (local) **720-468-2785**

4) Project Name or Line Numbers
Hess EN-Uran A

5) Exploration Method (Shot Hole, Non-Explosive, 2D, 3D, Other)
Non-explosive, Other

6) Distance Restrictions (Must check all that apply)

- [x] 300 feet - NonExplosive - Distance setbacks apply to water wells, buildings, underground cisterns, pipelines, and flowing springs.
- [ ] 660 feet - Shot Hole - Distance setbacks apply to water wells, buildings, underground cisterns, pipelines, and flowing springs.

7) Size of Hole	Amt of Charge	Depth	Source points per sq. mi.	No. of sq. mi.
3-D				
Size of Hole	Amt of Charge	Depth	Source points ~~per ln. mi.~~	No. of ln. mi.
2-D			7	

8) Approximate Start Date	Approximate Completion Date
May 7th, 2015	**August 30th, 2015**

THE COMMISSION MUST BE NOTIFIED AT LEAST 24 HOURS IN ADVANCE OF COMMENCEMENT OF GEOPHYSICAL OPERATIONS

9) Location of Proposed Project - County
~~McKenzie~~ Mountrail

Section(s), Township(s) & Range(s)	Section	T.	R.
	27	154	93
	10	154	93
	26	154	93
	13	154	93
	9	154	93
	21, 22	154	93

I hereby swear or affirm that the information provided is true, complete and correct as determined from all available records. Date **March 23, 2015**

Signature	Printed Name	Title
	Price Stark	**Pinnacle Team Lead**

Email Address(es)
price.stark@halliburton.com

(This space for State office use)

Permit No. 97-0261	Approval Date 4/16/15
Approved by	
Title **Mineral Resources Permit Manager**	

Permit Conditions

* Permit in hand required at pre-program meeting with field inspector and be aware of all NDIC Rules and Regulations (i.e. distance restrictions).
* See attached letter.

*See Instructions On Reverse Side

Oil and Gas Division

Lynn D. Helms - Director Bruce E. Hicks - Assistant Director

Department of Mineral Resources

Lynn D. Helms - Director

North Dakota Industrial Commission

www.dmr.nd.gov/oilgas/

April 16, 2015

The Honorable Stephanie Pappa
Mountrail County Auditor
P.O. Box 69
Stanley, ND 58784-0069

RE: Geophysical Exploration
Permit #97-0261

Dear Ms. Pappa:

Pursuant to Section 38-08.1-04.2 of the North Dakota Century Code, please be advised that Halliburton Energy Services was issued the above captioned permit on April 16, 2015 and will remain in effect for a period of one year. The entire permit can be viewed on our website at: https://www.dmr.nd.gov/oilgas/seismic/seismicstats.asp

Should you have any questions, please contact our office.

Sincerely,

Todd L. Holweger
DMR Permit manager

600 E Boulevard Ave - Dept 405, Bismarck, North Dakota 58505-0840 Phone (701)328-8020 Fax (701)328-8022

Price Stark
Pinnacle, A Halliburton Service
1125 17th Street, No. 1900
Denver, CO 80202
Phone: 720.593.7077
www.pinntech.com

Jeff Keller
Pinnacle, A Halliburton Service
1125 17th Street, No. 1900
Denver, CO 80202
Phone: 720.468.2785
www.pinntech.com

3/23/2015

Mr. Todd Holweger
NDIC
tholweger@nd.gov

Pinnacle will be performing a series of geophysical exploration services for the upcoming treatment of the Hess EN-Uran A lateral well pad in McKenzie County, ND (S22, T145N, R93W). The expected timeframe for this operation is May 7th through August 30th 2015.

The services being provided for the Hess Corporation to map the treatment of the well are Downhole Microseismic, Surface Microseismic, and a Surface Buried Array. These services include three kinds of geophone deployments including wireline deployed geophones, surface geophones, and buried geophones (shallow 300 ft. wells). Additional detail on the deployment of each geophone service is provided in the following sections. Locations of the different geophone deployments are shown in Figure 1 and located in Table 1 through Table 3.

Figure 1 Map View of Project Location and Vibe Positions

Project Objectives

The arrays will be used to map the upcoming hydraulic fracture treatment of the Hess EN-Uran A Pad. It will also serve as a pilot study to determine the viability of a buried microseismic array to monitor a hydraulic fracture treatment in the surrounding region. We plan to measure the fidelity of the

signal from well treatment and determine the effect of attenuation of the glacial till layer. We also plan to compare the number and quality of surface array events, buried array events, and downhole microseismic events. This study will help guide future microseismic data acquisition in the region with the aim to obtain the highest value information while reducing the impact to landowners and natural areas.

Downhole Microseismic

Deployment

Pinnacle will tractor-deploy a geophone toolstring in the nearby EN-Uran A-H-6 lateral observation well from a surface wireline logging unit. This deployment is comparable to any wireline deployed toolstring. The geophone toolstring will be periodically repositioned in the lateral well during the fracture treatment and will be withdrawn upon its completion.

These geophones require a known signal source to orient themselves to the physical world around them which will be accomplished using surface vibroseis signals.

This orientation process will involve the use of a mini-vibroseis unit to perform a series of 5, 12-second sweeps at several locations in the surrounding area. An image of the vibroseis unit is provided in Figure 2. For the purposes of this project all vibe locations are on existing well pads or access roads owned by Hess Corporation. These vibe locations and their relative positions to the treatment and observation wells are provided below in Appendix A, Table 1.

Due to the unknown nature of field operations the vibroseis orientation may need to be repeated during the fracture treatment if mechanical issues force the geophone toolstring to be replaced. This will involve a repeat of the same 12 second vibroseis sweeps at the same locations.

Figure 2 Halliburton Mini-Vibroseis Unit

Surface Microseismic

Description

Pinnacle will deploy a surface geophone line approximately 1.7 miles long and will consist of 60 surface geophone stations distributed along its length. Data will be recorded on the surface array string for approximately two months and then it will be completely removed.

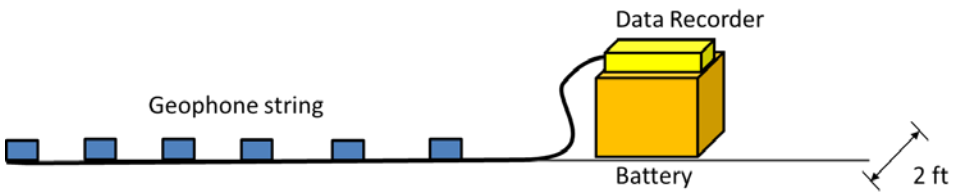


Figure 3 Surface Receiver Line – Single Station Schematic (not to scale)

Deployment

The surface geophone line will utilize 60 geophones stations. Each station is comprised of six to twelve geophones strung together in a "geophone string". Geophones each have a 2" spike, and the geophones will be pressed into the soil, see Figure 3. The spike will penetrate into the soil to keep the geophone firmly positioned. The expected ground disturbance from geophone installation is minimal, and comparable to the impact of playing lawn darts.

The surface line will be laid out prior to the hydraulic well treatment and picked up immediately after hydraulic well treatment. Since this seismic line is located beside a roadway, we do not expect to have to drive vehicles off-road to access the seismic line. Planned locations for the geophones in the surface string are provided in Table 2. All equipment will be hand-carried. There will be light-weight cable placed on the ground between many of the stations. Based on our understanding of the roadways in the area, we do not foresee any need to cross roadways with cables. During data acquisition, the surface string will be connected to an autonomous data acquisition unit, at various points, used to record the geophone signals. Each data acquisition unit is approximately 10x10x4 inches in size. The units are powered by12 volt external batteries.

Buried Array

Description

Pinnacle will deploy an array of four geophones in a group of six shallow (300 ft.) borehole. Locations for the six boreholes are provided in Table 3. These geophones installations are commonly referred to as a "buried array." Borehole locations will be approved by landowners and care will be taken to locate them where they will be easily accessible by

Pinnacle/Halliburton staff and situated so they will not conflict with any sensitive wildlife, archeological resources, or farming and ranching operations. The buried array sites will be invisible from surface and are designed to remain operational for many years. Our intent is to record on the buried array for approximately two months and then leave the sights disconnected until they may be required again in the future.

Deployment

A 300 ft. borehole will be excavated using a conventional water-well drill rig at predetermined locations approved by land owners. The geophone array will be attached to a 1" PVC pipe and lowered into the borehole. The geophones will be placed at depths of 300 ft., 212 ft., 126 ft. and 40 ft. below ground level, Figure 4.

Once the geophones are installed, they will be cemented in-place using a cement grout. The grout will be pumped through a PVC trimie pipe. The cement will be allowed to cure and settle for 24 hrs. A 5ft column of sand will be added to assist with attenuating surface noise. Bentonite chips will be used to plug the remaining open section of the borehole to the surface. A non-metallic vault will be installed to protect the geophone leads. All drill cuttings will be removed and disposed of according to state regulations.

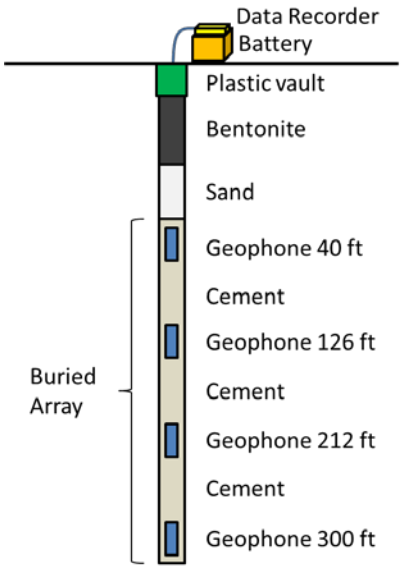


Figure 4 Buried Array Schematic Diagram – Not to Scale

The surface completion will consist of a small vault that contains the geophone leads at each buried array station. The vault is installed so that it is flush with ground level. Each vault will have Pinnacle's contact information and client name.

During data acquisition, each station will be connected to an autonomous data acquisition unit used to record the geophone signals. Each data acquisition unit is approximately 10x10x4 inches in size. The units are powered by12 volt external batteries.

Project Completion

At the completion of the fracture treatment, surface data acquisition units will be removed from the six buried-array locations. The buried array cables will be placed fully underground within the plastic vaults. The surface line, as well as any garbage will be picked up completely. The landowners will be paid pursuant to the permit agreement.

Related Documents

The NDIC oil & Gas Division will be provided:

- A post plot map showing actual monitoring locations that will include latitude and longitude of each location.
- Coordinates of all buried-array wells
- Coordinates of all surface line stations
- Coordinates of all vibroseis locations

If there are any questions or concerns please contact either Price Stark or Jeff Keller.

Sincerely,

Price Stark
Team Lead
Pinnacle – a Halliburton Service
O: 720-593-7077
price.stark@pinntech.com

Sincerely,

Jeff Keller
Account Representative
Pinnacle – a Halliburton Service
O: 720.468.2785
jeff.keller@pinntech.com

APPENDIX A SITE LOCATION TABLES

Table 1 Vibe Locations

Location	Sec	Twn	Rng	Latitude	Longitude
101	27	154N	93W	48.13829	-102.62152
102	10	154N	93W	48.13925	-102.61860
103	26	154N	93W	48.14152	-102.64277
104	13	154N	93W	48.13785	-102.60196
105	09	154N	93W	48.15584	-102.57140
106	21	154N	93W	48.16823	-102.64543
107	22	154N	93W	48.13925	-102.61860

Table 2 Surface Line Locations (Planned)

Station Number	Sec	Twn	Rng	Easting	Northing	Latitude	Longitude
1	9	154N	93W	1442406	428390	48.15423	-102.65565
2	9	154N	93W	1442410	428540	48.15464	-102.65565
3	9	154N	93W	1442414	428690	48.15505	-102.65565
4	9	154N	93W	1442418	428839	48.15546	-102.65565
5	9	154N	93W	1442422	428989	48.15587	-102.65565
6	9	154N	93W	1442427	429140	48.15628	-102.65565
7	9	154N	93W	1442431	429290	48.15670	-102.65565
8	9	154N	93W	1442435	429440	48.15711	-102.65565
9	9	154N	93W	1442439	429589	48.15752	-102.65565
10	9	154N	93W	1442443	429739	48.15793	-102.65565
11	9	154N	93W	1442448	429889	48.15834	-102.65565
12	9	154N	93W	1442450	430040	48.15875	-102.65565
13	9	154N	93W	1442454	430189	48.15916	-102.65565
14	9	154N	93W	1442458	430339	48.15957	-102.65565
15	9	154N	93W	1442463	430489	48.15998	-102.65565
16	9	154N	93W	1442467	430639	48.16040	-102.65565
17	9	154N	93W	1442471	430789	48.16081	-102.65565
18	9	154N	93W	1442475	430938	48.16122	-102.65565
19	9	154N	93W	1442479	431089	48.16163	-102.65565
20	9	154N	93W	1442484	431239	48.16204	-102.65565
21	9	154N	93W	1442488	431389	48.16245	-102.65565
22	9	154N	93W	1442492	431539	48.16286	-102.65565
23	9	154N	93W	1442496	431688	48.16327	-102.65565
24	9	154N	93W	1442498	431838	48.16368	-102.65566
25	9	154N	93W	1442503	431989	48.16410	-102.65566
26	9	154N	93W	1442507	432139	48.16451	-102.65566
27	9	154N	93W	1442511	432288	48.16492	-102.65566

28	9	154N	93W	1442515	432438	48.16533	-102.65566
29	9	154N	93W	1442519	432588	48.16574	-102.65566
30	9	154N	93W	1442524	432738	48.16615	-102.65566
31	9	154N	93W	1442528	432889	48.16656	-102.65566
32	9	154N	93W	1442532	433037	48.16697	-102.65566
33	9	154N	93W	1442536	433188	48.16739	-102.65566
34	9	154N	93W	1442540	433338	48.16780	-102.65566
35	9	154N	93W	1442543	433488	48.16821	-102.65567
36	16	154N	93W	1442547	433638	48.16862	-102.65567
37	16	154N	93W	1442551	433787	48.16903	-102.65567
38	16	154N	93W	1442555	433937	48.16944	-102.65567
39	16	154N	93W	1442560	434088	48.16985	-102.65567
40	16	154N	93W	1442564	434238	48.17027	-102.65567
41	16	154N	93W	1442568	434387	48.17067	-102.65567
42	16	154N	93W	1442572	434537	48.17109	-102.65567
43	16	154N	93W	1442576	434687	48.17150	-102.65567
44	16	154N	93W	1442581	434837	48.17191	-102.65567
45	16	154N	93W	1442585	434988	48.17232	-102.65567
46	16	154N	93W	1442589	435136	48.17273	-102.65567
47	16	154N	93W	1442591	435287	48.17314	-102.65568
48	16	154N	93W	1442596	435437	48.17355	-102.65568
49	16	154N	93W	1442600	435587	48.17397	-102.65568
50	16	154N	93W	1442604	435737	48.17438	-102.65568
51	16	154N	93W	1442608	435886	48.17479	-102.65568
52	16	154N	93W	1442612	436036	48.17520	-102.65568
53	16	154N	93W	1442617	436187	48.17561	-102.65568
54	16	154N	93W	1442621	436337	48.17602	-102.65568
55	16	154N	93W	1442625	436487	48.17643	-102.65568
56	16	154N	93W	1442629	436636	48.17684	-102.65568
57	16	154N	93W	1442633	436786	48.17725	-102.65568
58	16	154N	93W	1442638	436936	48.17767	-102.65568
59	16	154N	93W	1442640	437087	48.17808	-102.65569
60	16	154N	93W	1442644	437236	48.17849	-102.65569

Table 3 Buried Array Station Locations

Station Number	Sec	Twn	Rng	Easting	Northing	Latitude	Longitude
1001	9	154N	93W	1442623	438252	48.16708	-102.65587
1002	16	154N	93W	1442482	433079	48.16064	-102.61286
1003	16	154N	93W	1442377	429349	48.13863	-102.63381
1004	15	154N	93W	1447695	427963	48.15346	-102.63394
1005	27	154N	93W	1447576	422554	48.15685	-102.65587

1006	15	154N	93W	1452910	430438	48.18127	-102.65589

APPENDIX B VIBE LOCATION IMAGES

Figure 5 Map View of Vibe Position 1

Figure 6 Map View of Vibe Position 2

Figure 7 Map View of Vibe Position 3

Figure 8 Map View of Vibe Position 4

Figure 9 Map View of Vibe Position 5

Figure 10 Map View of Vibe Position 6

Figure 11 Map View of Vibe Position 7

Todd,

Here is our tentative schedule.

April 17 to May 2 -Drill and install buried array.

April 24 to April 26-Layout Surface Array

April 28 to May 20 Vibe and Collect Seismic Data using Downhole, Buried and Surface Arrays

May 20 -Release Vibe truck or sooner

May 21 to May 25- Pickup Surface Array and Buried Array Readout equipment

Jeff Keller P.G.
Business Development
1125 17th Street
Suite 1900
Denver, Colorado 80202
Cell: 720-468-2785
Jeffrey.keller@pinntech.com

Pinnacle
A HALLIBURTON SERVICE

Learn about ISD for Unconventionals: www.Halliburton.com/ISD