

**Work Plan for an Oil Recovery Pilot Study
A27 CDP Liquid Line Release Site
Garfield and Rio Blanco Counties, Colorado
Hunter Ridge Energy Services, LLC**

Project Goals

The primary goal of this work is to determine the extent to which selected temporary monitoring wells at the Site will continuously or periodically yield oil. Additionally, the work will identify the efficacy of recovering oil from selected temporary monitoring wells using an appropriately equipped vacuum truck.

Proposed Pilot Study Approach

Vacuum Truck Extraction

An empty vacuum truck equipped with a stinger tube system will be used to lift oil and groundwater from selected temporary monitoring wells that currently contain floating free product. Proposed temporary monitoring wells selected for this pilot study include:

1. MW-08 (a four-inch diameter well); and
2. MW-S05 (a two-inch diameter well).

If time permits, testing using the vacuum truck extraction process will also be conducted at two-inch diameter wells MW-S01 and MW-09. Locations of these wells are shown on a map in Attachment A.

Well screen construction and fluid depth information for these wells are summarized in Table 1 (in Attachment B).

At each well to be tested, the depth to the top of oil and the oil/groundwater water interface will be measured to the nearest 0.01 foot using an interface probe. The field technician will then calculate the standing well volume. The stinger tube intake will then be lowered to a depth of approximately six inches below the oil/groundwater interface. The depth of the intake may be modified during the test to maximize the recovery of oil and minimize the recovery of groundwater.

The well will be sealed with the vacuum inlet at the surface and a field-determined vacuum, sufficient to lift fluids from the well, will be applied for a period of ten minutes. The stinger system will then be removed and the thickness of the product layer will be measured until it stabilizes (+/- 0.01 foot). If a recoverable thickness of oil does re-enter the well, the vacuum lifting process will be repeated, although it may be necessary to adjust the vacuum applied to the well (e.g., increased vacuum if no notable change in the product thickness is measured after the first iteration). Furthermore, it may be appropriate to extend the duration of extraction, particularly if the change in product thickness is negligible after the initial iteration.

Pilot work at a given well will be judged to be completed when:

1. oil no longer enters the well to the extent that recovery is efficient (generally less than 0.1 foot); or
2. a minimum of three iterations of extraction have been completed.

After extraction testing at each well is completed, the vacuum truck will offload the contents into drums. After allowing sufficient time for the groundwater and product to separate (during which time testing could be conducted at another well), the water and product thicknesses will be measured to calculate respective volumes recovered during the test. Following measurement, the drums will be emptied and all fluids will be transported to the Divide Road Water Treatment Facility.

As all of the temporary wells to be tested will contain oil originating from same source, extensive decontamination of down-hole equipment will not be necessary. However, the stinger tube system should be cleaned before initiation of testing and excess oil should be wiped from the tubing between each event.

The following information will be documented in a field notebook for each test:

1. Depth to the oil surface and oil/groundwater interface prior to initiation of testing and the date and time of measurement.
2. Depth of the stinger system's intake.
3. Time for initiation and termination of each extraction iteration.
4. Vacuum applied during each extraction iteration.
5. Any other relevant observations during extraction efforts.
6. Depth to the oil surface and oil/groundwater interface between and following extraction iterations.
7. Water and oil thicknesses (converted to volume) within drums following each test.

Bailer Recovery

Bailers will be used to conduct oil recovery tests at the following two-inch diameter temporary monitoring wells:

1. MW-S04;
2. MW-07; and
3. MW-S02B.

If time permits, bailing tests may also be conducted at MW-S03W, MW-22 and MW-S04B. Locations for these wells are shown on a map in Attachment A and well construction and fluid levels are summarized in Table 1 (Attachment B).

The depth to the top of oil and the oil/groundwater water interface will be measured to the nearest 0.01 foot using an interface probe prior to testing at each temporary monitoring well. The field technician will then calculate the standing well volume.

After removing a complete well volume of groundwater and oil, the well will be allowed to recover and the oil surface and groundwater/oil interface depth will be measured. Bailed groundwater and oil will be transferred into pre-calibrated five-gallon buckets, which will be transferred to the Facility Pad for oil separation and groundwater treatment.

The bailing test will continue until:

1. oil no longer re-enters the well to the extent that recovery is efficient (generally less than 0.1 foot); or
2. a minimum of three well volumes have been removed from the well.

After completion of bailing at a given well, and allowing time for phase separation to occur, the volume of groundwater and oil will be measured within the bucket(s).

The following information will be documented in a field notebook for each test:

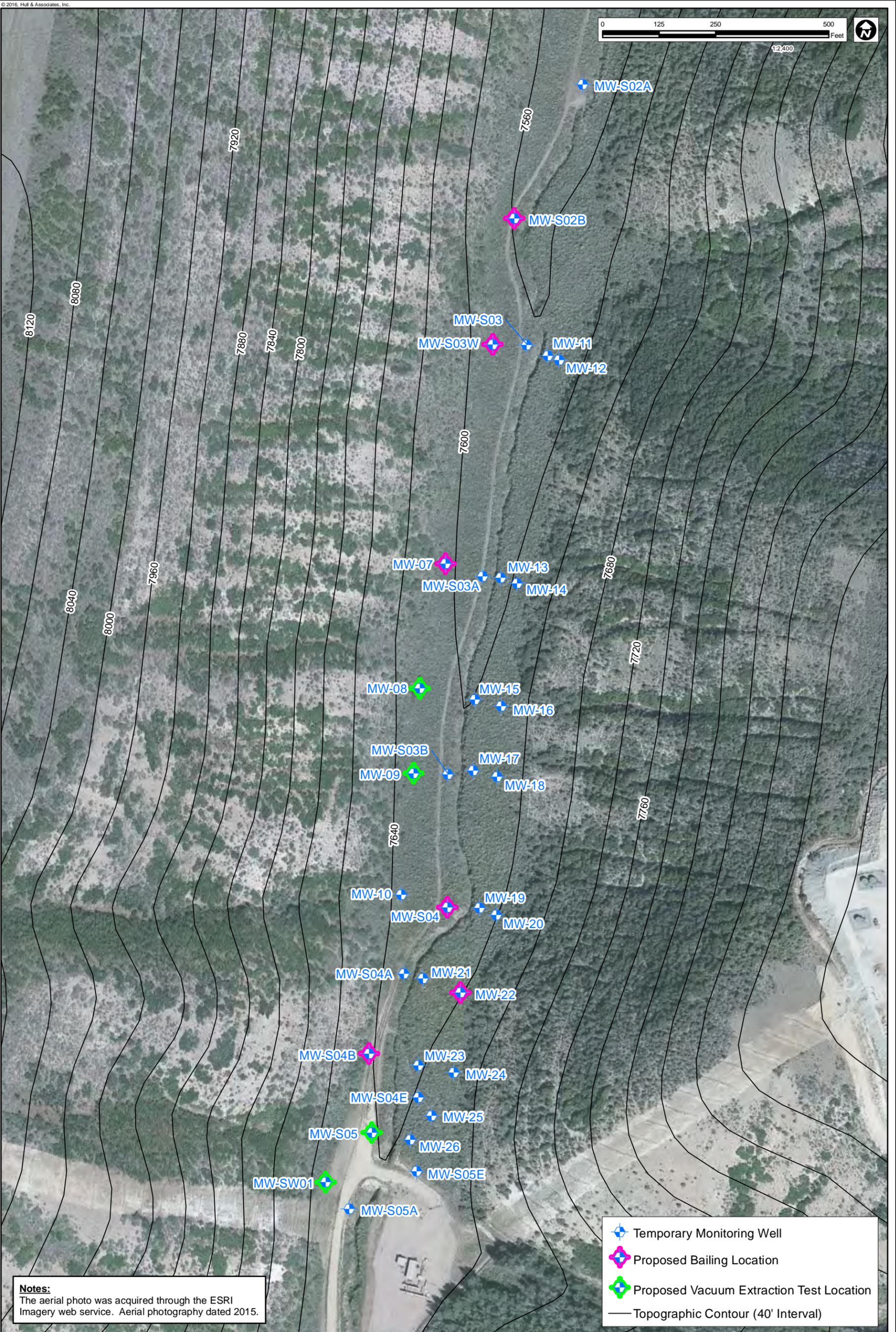
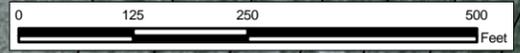
1. Depth to the oil surface and oil/groundwater interface prior to initiation of testing and the date and time of measurement.
2. The standing fluid volume within the well.
3. Any relevant observations during bailing efforts.
4. Depth to the oil surface and oil/groundwater interface between and following removal of each well volume.
5. Water and oil volumes removed from the well for each test.

Reporting

A report will be prepared that describes field activities conducted, including deviations from this Work Plan that may be necessary due to unforeseen field conditions. The report will also summarize volumes of groundwater and oil recovered from each well and oil recovery responses. Finally, the report will evaluate the efficacy of and proposed methods for ongoing oil recovery and provide a schedule for implementation and operations if such measures are determined to be effective and appropriate.

ATTACHMENT A

Locations of Temporary Monitoring Wells Proposed for Pilot Testing



Notes:
The aerial photo was acquired through the ESRI Imagery web service. Aerial photography dated 2015.

- Temporary Monitoring Well
- Proposed Bailing Location
- Proposed Vacuum Extraction Test Location
- Topographic Contour (40' Interval)



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October 2016

A27 CDP Liquid Line Release Project
Remediation Plan

**Oil Recovery Pilot
Test Locations**

Garfield and Rio Blanco Counties, Colorado

Figure

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ATTACHMENT B

Construction and Fluid Levels of Temporary Monitoring Wells to be Employed for Pilot Testing

**A27 CDP LIQUID LINE RELEASE SITE
WORK PLAN FOR AN OIL RECOVERY PILOT STUDY
TABLE 1
WELL CONSTRUCTION AND LIQUIDS LEVEL SUMMARY
GARFIELD AND RIO BLANCO COUNTIES, COLORADO
HUNTER RIDGE ENERGY SERVICES LLC**

Temporary Monitoring Well Designation	Type of Pilot Test	Top of Screen Depth (feet below ground surface)	Base of Screen Depth (feet below ground surface)	Ground Elev. (feet)	TOC Elev. (feet)	Date Well Gauged	DTW TOC (feet)	Groundwater Elev. (feet)	DTP (feet)	Product Thickness (feet)	TD TOC (feet)	Hydraulic Conductivity (cm/sec.)
MW-S02B	Bailing	10	40	7,561.25	7,563.75	8/9/2016	26.20	7,537.55	NA	NA	40.57	NT
						8/19/2016	26.80	7,536.95	NA	NA		
						9/29/2016	27.30	7,536.45	NA	NA		
						10/28/2016	29.30	7,534.45	28.94	0.36		
MW-S03W	Bailing	25	45	7,580.98	7,582.59	7/1/2016	42.48	7,540.11	42.18	0.30	46.45	NT
						7/5/2016	42.25	7,540.34	42.01	0.24		
						7/6/2016	42.29	7,540.30	42.01	0.28		
						8/9/2016	42.57	7,540.02	42.30	0.27		
						8/19/2016	42.62	7,539.97	42.35	0.27		
						9/29/2016	42.78	7,539.81	42.53	0.25		
						10/28/2016	42.84	7,539.75	42.60	0.24		
MW-S04	Bailing	10	30	7,627.10	7,629.55	6/29/2016	25.00	7,604.55	24.90	0.10	32.49	3.259E-05
						7/5/2016	27.18	7,602.37	NA	NA		
						7/6/2016	27.21	7,602.34	NA	NA		
						8/9/2016	27.71	7,601.84	NA	NA		
						8/18/2016	27.85	7,601.70	NA	NA		
						9/29/2016	28.67	7,600.88	28.36	0.31		
						10/28/2016	28.97	7,600.58	28.63	0.34		
MW-S04B	Bailing	29	49	7,644.21	7,646.36	8/16/2016	43.66	7,602.70	NA	NA	50.97	NT
						8/19/2016	44.55	7,601.81	44.25	0.30	51.71	
						9/29/2016	45.08	7,601.28	44.82	0.26	51.25	
						10/28/2016	45.19	7,601.17	45.00	0.19	53.50	
						6/30/2016	45.27	7,611.92	45.26	0.01		
MW-S05	Vacuum Truck	25	55	7,654.73	7,657.19	7/5/2016	50.37	7,606.82	47.41	2.96	56.48	NT
						7/6/2016	49.81	7,607.38	47.45	2.36		
						8/9/2016	52.59	7,604.60	48.82	3.77		
						8/16/2016	49.52	7,607.67	NA	NA		
						8/19/2016	50.20	7,606.99	49.15	1.05		
						9/29/2016	52.79	7,604.40	49.74	3.05		
						10/28/2016	52.21	7,604.98	50.80	1.41		
						6/30/2016	38.58	7,632.77	38.56	0.02		
MW-SW01	Vacuum Truck	15	45	7,668.90	7,671.35	7/5/2016	38.85	7,632.50	38.28	0.57	47.78	NT
						7/6/2016	38.83	7,632.52	38.26	0.57		
						8/9/2016	38.66	7,632.69	38.17	0.49		
						8/19/2016	38.57	7,632.78	38.15	0.42		
						9/29/2016	38.85	7,632.50	38.33	0.52		
						10/28/2016	38.85	7,632.50	38.32	0.53		
						6/30/2016	48.35	7,551.56	48.03	0.32		
MW-07	Bailing	28	58	7,597.53	7,599.91	10/28/2016	48.35	7,551.56	48.03	0.32	61.12	NT
MW-08	Vacuum Truck	33	63	7,613.70	7,616.01	10/28/2016	56.55	7,559.46	55.98	0.57	64.75	NT
MW-09	Vacuum Truck	29	59	7,621.21	7,623.66	10/28/2016	57.94	7,565.72	57.57	0.37	61.65	NT
MW-22	Bailing	16	46	7,633.11	7,635.68	10/28/2016	34.83	7,600.85	34.64	0.19	47.78	NT

Notes:
DTW - Depth to Water
DTP - Depth to Product
TOC - Top of Casing