APPENDIX 4-C

SAMPLING AND ANALYSIS PLAN

APPENDIX 4-C

SAMPLING AND ANALYSIS PLAN

DRAFT

GROUNDWATER POLLUTION PREVENTION, MONITORING AND RESPONSE ACTION PLAN FOR PINEDALE ANTICLINE PROJECT AREA, SUBLETTE COUNTY, WYOMING

Prepared for:

Ultra Resources, Inc.
304 Inverness Way South, Suite 295
Englewood, Colorado 80112

and

QEP Energy Company
Independence Plaza
1050 17th Street, Suite 800
Denver, Colorado 80265

Prepared by:

NewFields Companies, LLC
1120 Cedar Street
Missoula, Montana 59802

December 2014

DRAFT

TABLE OF CONTENTS

1.0 PURPOSE AND SCOPE 4C-1

2.0 BACKGROUND 4C-2

2.1 STUDY WELL INSTALLATION 4C-2
2.2 PARAMETERS IDENTIFIED FOR GROUNDWATER QUALITY MONITORING 4C-2

3.0 MONITORING AND SAMPLING PROCEDURES 4C-4

3.1 MONITORING LOCATION SELECTION 4C-4
3.2 PERMITTING REQUIREMENTS 4C-6
3.3 DRILLING AND WELL COMPLETION PROCEDURES 4C-6
3.4 WELL DEVELOPMENT PROCEDURES 4C-8
3.5 GROUNDWATER MONITORING PARAMETERS 4C-8
3.6 GROUNDWATER SAMPLING PROCEDURES 4C-11
3.6.1 Well Purging 4C-12
3.6.2 Sample Collection 4C-13
3.6.3 Sample Handling 4C-16
3.6.4 Chain-of-Custody Procedures 4C-17
3.6.5 Field Documentation 4C-17
3.6.6 Equipment Calibration 4C-18
3.6.7 Decontamination 4C-19
3.6.8 Investigation Derived Waste 4C-20
3.7 QUALITY ASSURANCE 4C-20
3.7.1 Quality Assurance (QA) Samples 4C-20
3.7.2 Data Quality Review 4C-22
3.7.2.1 Field Data Review 4C-22
3.7.2.2 Laboratory Data Review 4C-22

4.0 REFERENCES 4C-23

DRAFT

LIST OF TABLES

Table 4C-1. Existing and Proposed GMP Wells 4C-5
Table 4C-2. Laboratory Parameters, Methods, and Sample Requirements for GMP 4C-9
Table 4C-3. Action Levels for Key Petroleum Constituents 4C-12
Table 4C-4. Minimum QA/QC Samples for GMP 4C-21

LIST OF FIGURES

(figures are provided at the end of this document)

Figure 4C-1 Project Location Map
Figure 4C-2 Monitoring Regions
Figure 4C-3 PAPA Groundwater Monitoring Locations
Figure 4C-4 Wasatch HSU Monitoring Locations, North Zone
Figure 4C-5 Wasatch HSU Monitoring Locations, South Zone
Figure 4C-6 Alluvial HSU Monitoring Locations in the River Corridor Envelope
Figure 4C-7 Wasatch HSU Monitoring Locations in the River Corridor Envelope
Figure 4C-8 General 3-inch Diameter PVC Monitoring Well Construction Details
Figure 4C-9 General 5-inch Diameter Steel Monitoring Well Construction Details

LIST OF ANNEXES

Annex 4C-1 Standard Operating Procedures (SOP)
Annex 4C-2 Field Forms
Annex 4C-3 Well Completion Logs

DRAFT

1.0 PURPOSE AND SCOPE

NewFields Mining, Energy and Environmental Services, LLC (NewFields) prepared this Sampling and Analysis Plan (SAP) on behalf of Ultra Resources, Inc. (Ultra) and QEP Energy Company (QEP) for a Groundwater Pollution Prevention, Monitoring and Response Action Plan (Plan) that was developed for the Pinedale Anticline Project Area (PAPA), a natural gas development in Sublette County, Wyoming. The Plan (NewFields 2014) complies with a September 2008 Record of Decision (ROD) by the U.S. Department of Interior Bureau of Land Management (BLM) regarding the Supplemental Environmental Impact Statement (SEIS) for the Pinedale Anticline Oil and Gas Exploration and Development Project Area (i.e., PAPA). As part of the 2008 ROD, BLM approved development of the oil and gas resources within the PAPA as outlined in Alternative D of the Final SEIS (BLM 2008a), as modified in the ROD (BLM 2008b). The ROD emphasizes concentrating development, allowing for systematic development, performance based outcomes and adaptive management for reducing impacts, and cooperative monitoring with the State of Wyoming (BLM 2008b).

Besides complying with requirements of BLM's ROD, the Plan also satisfies regulations promulgated by the Wyoming Oil and Gas Conservation Commission (WOGCC). Beginning in March 2014, the WOGCC requires a groundwater baseline sampling, analysis and monitoring plan as part of the Application for Permit to Drill or Deepen a Well (WOGCC 2014; Operational Rules, Drilling Rules; Chapter 3, Section 46). WOGCC Rules allow for a master plan to cover a geographic area of development, and this Plan will serve as the master groundwater baseline sampling, analysis and monitoring plan for the PAPA.

This SAP is based on and adapted from the WOGCC groundwater baseline sampling, analysis, and monitoring program (Appendix K of WOGCC Rules). The SAP provides minimum requirements and protocols that shall be followed by oil and gas operators or their contractors per Chapter 3, Section 46 of the WOGCC Rules. This SAP also follows guidance in DEQ (2013) Fact Sheet #29 (Sampling and Analysis Plans) from the Voluntary Remediation Program (VRP).

The purpose of the SAP is to document field monitoring and sampling procedures, and laboratory methods that will be used to ensure that consistent and representative data are collected, and that a uniform method of data reporting to the agencies and Operators is established. The primary monitoring activities for the PAPA will include: installing and developing new monitoring wells; collecting water samples from existing and new monitoring wells; and measuring water levels in monitoring wells. These activities are components of the Groundwater Monitoring Program (GMP) presented in Section 4.0 of the Plan (NewFields 2014). Data Quality Objectives (DQO) for the GMP are presented in Table 4-1 of the Plan (NewFields 2014).

DRAFT

2.0 BACKGROUND

This section summarizes the 2009-2010 study well installation associated with the Hydrogeologic Data Gaps Investigation (AMEC 2012) and the process used to develop the list of monitoring parameters for this SAP (see Section 4.3 of the Plan [NewFields 2014]).

2.1 STUDY WELL INSTALLATION

BLM's 2008 ROD required Operators in the PAPA to complete additional groundwater characterization. Based on a detailed Plan of Study issued in May 2009, extensive field investigations were completed between 2009 and 2011 to fill identified data gaps. The investigation report (AMEC 2012) describes results of the hydrogeologic data gaps investigation. Thirty study wells ranging in depths from 15 to 795 feet, and 13 shallow piezometers, were installed throughout the PAPA to characterize the groundwater system.

Air-rotary, mud-rotary, and air-hammer drilling methods were used to complete the 30 study wells in 2009-2010, with potable water, foam, and/or mud used during the drilling process to facilitate removal of cuttings and maintain an open hole for casing installation (AMEC 2012). Waste drill water and cuttings were disposed off-site at selected sites where required by BLM after laboratory analysis of representative samples.

For the study wells completed in alluvium and the Wasatch Formation, well casing depths are in the following ranges:

- Alluvium (6 wells): 15 to 38 feet below ground surface (bgs); and
- Wasatch Formation (22 wells): 150 to 795 feet bgs.

In general, casing for study wells that extend to total depth consists of either 4-inch diameter PVC (alluvial and shallow Wasatch wells) or 5-inch diameter steel (deeper Wasatch wells). The 4-inch diameter Schedule-80 PVC casing (threaded-and-coupled) used for the study wells has 0.020-inch-opening factory-slotted PVC screen. The deeper study wells that were installed with 5-inch diameter black steel casing (welded) have stainless-steel factory wire-wrap screen (0.020-inch opening) sections. Lithologic and well completion logs for these wells are found in AMEC (2012).

Groundwater encountered in three the study wells located near the New Fork or East Fork rivers flowed at the surface and, therefore, were fitted with shut-in valves at the surface or packers in the well casings to prevent flowing conditions. A few study wells had measureable concentrations of lower explosive limit (LEL) vapors (e.g., methane) during drilling and groundwater sampling activities.

2.2 PARAMETERS IDENTIFIED FOR GROUNDWATER QUALITY MONITORING

Section 4.3 of the Plan (NewFields 2014) explains the process used to identify parameters for the GMP. Two flow charts (Figures 4-10 and 4-11 in NewFields 2014) show the logic used to satisfy GMP water quality-related objectives and how both a Core List and Supplemental List of parameters were developed for the GMP. Parameters selected for the Core and Supplemental Lists are listed in Table 1 of Appendix K of the WOGCC Rules. Core List and Supplemental List parameters are:

- **Core List**: chloride, total dissolved solids (TDS), barium, boron, manganese, strontium, benzene, ethylbenzene, toluene, ethylbenzene, xylenes (total), naphthalene, total petroleum hydrocarbons – diesel range organics (TPH-DRO), total petroleum hydrocarbons – gasoline range organics (TPH-GRO), and dissolved methane (gas).
- **Supplemental List**: alkalinity, bromide, calcium, potassium, and sodium.

DRAFT

3.0 MONITORING AND SAMPLING PROCEDURES

The purpose of this section is to describe the procedures used to: select monitoring locations; install and develop new monitoring wells; collect groundwater samples; handle and transport samples; and document field activities. Several annexes to this SAP contain supporting information including standard operating procedures for field activities (**Annex 4C-1**); field forms (**Annex 4C-2**); and, driller's logs for existing GMP wells (**Annex 4C-3**).

3.1 MONITORING LOCATION SELECTION

For purposes of the GMP, the PAPA well network for monitoring has been divided into three principal zones: River Corridor Envelope, North Zone, and South Zone (**Figure 4C-3**). The River Corridor Envelope is the zone designated to have the greatest environmental sensitivity and the greatest relative risk of being impacted. The bounds of the North and South Zones are designated by borders of the core natural gas development areas and the intersection with the River Corridor Envelope. A total of 41 wells are included in the GMP network: 21 existing wells and 20 new wells.

Existing Wells

The following are existing industrial or monitoring wells that are included in the groundwater monitoring network for the Plan. **Table 4C-1** lists key information for these wells, and **Annex 4C-3** contains available well logs.

- North Zone: 12 wells in the Wasatch HSU (MS 11-21; MS 11-28; MS 12-33; MS 13-5; MS 15-20; MS 3-17; MS 3-20; MS 3-22; MS 6-16; SP 14-20; SP 15-17; SP 8-32); all of these wells are industrial supply wells owned by QEP or Ultra, ranging in depth from 772 to 1,200 feet bgs. Refer to **Figure 4C-4** for North Zone wells.
- South Zone: five wells in the Wasatch HSU (AN 5-4; BO 14-32; RB 15-31; WB 11-4; WB 8-25); all of these wells are industrial supply wells owned by Ultra or Linn Energy, ranging in depth from 200 to 863 feet bgs. Refer to **Figure 4C-5** for South Zone wells.
- River Corridor Envelope: four wells in the Alluvial HSU (X-4a-A; RCE-14; RCE-15; RCE-16); these wells are on Ultra drill pads, ranging in depth from 13 to 18 feet bgs. Refer to **Figure 4C-6** for existing River Corridor Envelope wells completed in alluvium.

New Monitoring Wells

The following are new monitoring wells planned for inclusion into the GMP network (**Table 4C-1**):

- North Zone: one well in the Wasatch HSU (GMPN-01); this well has an anticipated depth of about 250-300 feet bgs. Refer to **Figure 4C-4** for North Zone wells.
- South Zone: six wells in the Wasatch HSU (GMPS-01 through GMPS-06); these wells have an anticipated depth range of 100 to 600 feet bgs. Refer to **Figure 4C-5** for South Zone wells.
- River Corridor Envelope: 13 wells in the Wasatch HSU (RCE-01 through RCE-13); these wells have an anticipated depth range of 100 to 200 feet bgs. Refer to **Figure 4C-7** for River Corridor Envelope wells proposed for completion in the Wasatch Formation.

DRAFT

Table 4C-1. Existing and Proposed GMP Wells

Well Name	Ownership / Surface Manager	HSU	Northing	Easting	Well Depth (ft bgs)	Reported Depth to Water (ft bgs)	Casing Type / Diameter (in)	Screen Interval (ft bgs)	Pump Type / Depth (ft bgs)
North Zone (12 existing wells + 1 new well)									
MS 11-21	QEP/BLM	Wasatch	15,523,864	1,950,885	910	400	Steel / 6.6	750-910	Sub / 850
MS 11-28	Ultra/BLM	Wasatch	15,517,921	1,951,565	905 / 839	550	Steel / 6.6	690-840**	Sub / 640
MS 12-33	Ultra/BLM	Wasatch	15,512,795	1,950,170	1,000	230	Steel / 6	853-979**	Sub / 800
MS 13-5	QEP/BLM	Wasatch	15,538,048	1,944,707	940	UNK	UNK	780-930	Sub / UNK
MS 15-20	QEP/BLM	Wasatch	15,522,558	1,947,624	1,120	560	Steel / 8	660-800**	Sub / 1100
MS 3-17	QEP/BLM	Wasatch	15,531,222	1,946,282	1,200	198	Steel / 8	740-1190	Sub / 1180
MS 3-20	QEP/BLM	Wasatch	15,526,279	1,946,080	940	495	Steel / 6.6	730-930	Sub / 920
MS 3-22	QEP/BLM	Wasatch	15,526,170	1,955,913	772	350	Steel / 6.6	523-772	Sub / 550
MS 6-16	QEP/State	Wasatch	15,529,939	1,951,551	1,000	400	Steel / 6.6	700-1000	Sub / 850
SP 14-20	QEP/BLM	Wasatch	15,552,193	1,937,755	1,000	350	Steel / 6.6	700-1000	Sub / 879
SP 15-17	QEP/BLM	Wasatch	15,557,192	1,938,670	940	520	Steel / 6.6	640-940	Sub / 860
SP 8-32	QEP/BLM	Wasatch	15,543,866	1,940,325	1,090	400	Steel / 8.6	810-1090	Sub / 1080
GMPN-01	Ultra/BLM	Wasatch	15,519,064	1,956,395	250-300*	NA	Steel / 5*	NA	Sub*
River Corridor Envelope (4 existing wells + 13 new wells)									
RCE-01	Road ROW	Wasatch	15,505,864	1,965,144	100-200*	NA	PVC / 3*	NA	Bladder*
RCE-02	Road ROW	Wasatch	15,504,228	1,962,891	100-200*	NA	PVC / 3*	NA	Bladder*
RCE-03	Road ROW	Wasatch	15,503,108	1,961,134	100-200*	NA	PVC / 3*	NA	Bladder*
RCE-04	Road ROW	Wasatch	15,502,442	1,958,472	100-200*	NA	PVC / 3*	NA	Bladder*
RCE-05	Road ROW	Wasatch	15,501,415	1,956,366	100-200*	NA	PVC / 3*	NA	Bladder*
RCE-06	BLM	Wasatch	15,491,554	1,946,445	100-200*	NA	PVC / 3*	NA	Bladder*
RCE-07	Road ROW	Wasatch	15,484,849	1,947,143	100-200*	NA	PVC / 3*	NA	Bladder*
RCE-08	Ultra/BLM	Wasatch	15,500,575	1,974,417	100-200*	NA	PVC / 3*	NA	Bladder*
RCE-09	Ultra/Priv.	Wasatch	15,500,028	1,968,814	100-200*	NA	PVC / 3*	NA	Bladder*
RCE-10	Ultra/Priv.	Wasatch	15,499,918	1,965,101	100-200*	NA	PVC / 3*	NA	Bladder*
RCE-11	Ultra/Priv.	Wasatch	15,498,996	1,961,819	100-200*	NA	PVC / 3*	NA	Bladder*
RCE-12	QEP/Priv.	Wasatch	15,497,644	1,957,247	100-200*	NA	PVC / 3*	NA	Bladder*
RCE-13	Ultra/Priv.	Wasatch	15,493,783	1,960,404	100-200*	NA	PVC / 3*	NA	Bladder*
RCE-14	Ultra/Priv.	Alluvial	15,500,425	1,958,285	13	5.5	PVC / 2	NA	Bladder*
RCE-15	Ultra/Priv.	Alluvial	15,502,653	1,964,758	13	3.5	PVC / 2	NA	Bladder*
RCE-16	Ultra/Priv.	Alluvial	15,503,471	1,966,973	13	6.4	PVC / 2	NA	Bladder*
X-4a-A	Ultra/Priv.	Alluvial	15,501,438	1,962,124	20 / 18	4.3	PVC / 4	NA	Bladder*
South Zone (5 existing wells + 6 new wells)									
AN 5-4	Linn/BLM	Wasatch	15,444,730	2,014,015	550	90	Steel / 6.6	430-550	Sub / 465
BO 14-32	Ultra/BLM	Wasatch	15,479,112	1,977,944	700	65	Steel / 6	380-580**	Sub / 672
RB 15-31	Linn/BLM	Wasatch	15,447,371	2,005,747	740	UNK	Steel / 6	530-698	Sub / 628
WB 11-4	Ultra/BLM	Wasatch	15,473,663	1,983,316	800	187	Steel / 6.6	570-800**	Sub / 768
WB 8-25	Ultra/BLM	Wasatch	15,455,310	2,001,889	670	290	Steel / 6.6	550-670	Sub / 640
GMPS-01	Ultra/BLM	Wasatch	15,486,528	1,971,152	100-200*	NA	Steel / 5*	NA	Sub*
GMPS-02	Ultra/BLM	Wasatch	15,481,841	1,972,550	150-250*	NA	Steel / 5*	NA	Sub*
GMPS-03	Ultra/BLM	Wasatch	15,472,189	1,988,568	300-400*	NA	Steel / 5*	NA	Sub*
GMPS-04	Ultra/BLM	Wasatch	15,468,253	1,971,107	400-500*	NA	Steel / 5*	NA	Sub*
GMPS-05	Ultra/BLM	Wasatch	15,462,303	1,992,215	500-600*	NA	Steel / 5*	NA	Sub*
GMPS-06	Ultra/BLM	Wasatch	15,458,969	1,993,604	500-600*	NA	Steel / 5*	NA	Sub*

Note: SCCD – Sublette County Conservation District; HSU – hydrostratigraphic unit; ft – feet; bgs – below ground surface; in - inches; sub – submersible pump (electric powered); bladder – bladder pump (air/gas powered); NA – not applicable; UNK – unknown or not reported; Priv. – private; Road ROW – County Road Right-of-Way; * - proposed or anticipated for new wells; ** - multiple shorter screen intervals within the reported overall interval. If two values are reported for Well Depth, the first value is depth drilled and second value is depth cased. See **Figures 4C-3** through **4C-7** for well locations.

3.2 PERMITTING REQUIREMENTS

Several permits may be required prior to completing new monitoring wells, especially those located on government-administered land. Wells located on private land also require landowner permission. Specific permits required prior to completing some of the new monitoring wells may include:

- Right-of-way permit from BLM for well sites located on BLM-managed land (not including existing gas drill pads).
- Sundry permit from BLM for well sites located on existing gas drill pads that are on BLM-managed land.
- Wildlife exception permit from BLM for wells proposed on BLM-managed land where certain wildlife restrictions may be in force.
- WOGCC permit for wells located on existing gas drill pads.
- Wyoming SEO permit for monitoring wells with casing larger than 4 inches in diameter.
- Wyoming State Lands permit for wells located on state-managed land.
- Wyoming DEQ permit-by-rule applies to wells used to characterize subsurface conditions at sites where pollution is not known to exist.
- Right-of-way permit from Sublette County for drilling within road ROW.

Based on the "Ownership / Surface Manager" column in **Table 4C-1**, a total of eight new monitoring wells would be located on BLM-managed land with Ultra or QEP leases. Six of the new monitoring wells would be located in Sublette County Road ROW, and five new wells would be on private land owned by Ultra or QEP.

3.3 DRILLING AND WELL COMPLETION PROCEDURES

The new monitoring wells for the GMP must meet the Water Well Minimum Construction Standards, where applicable, specified in the Wyoming SEO (2011) Regulations and Instructions, Part III, revised June 2011; Well Construction Standards in the Wyoming DEQ (2012b) WQD Water Quality Rules and Regulations, Chapter 26; and Wyoming DEQ/WQD Additional Recommendations for the Design, Construction, and Installation of Monitor Wells, Chapter 3, Water Quality Rules and Regulations (DEQ 2012c).

All new monitoring wells will be completed in the Wasatch Formation. New wells located in the North and South Zones are estimated to be installed to depths in the range of about 100 to 600 feet bgs, and those in the River Corridor Envelope will be completed to depths in the range of about 100 to 200 feet (**Table 4C-1**). The 13 wells to be installed in the River Corridor Envelope will be completed with 3-inch diameter Schedule-80 polyvinyl chloride (PVC; standard pipe specifications in ASTM D1785) casing (threaded-and-coupled) and 0.020-inch-opening factory-slotted PVC screen. The six wells to be installed in the North and South Zones will be completed with 5-inch diameter black steel casing (threaded-and-coupled or welded) including stainless-steel factory wire-wrap screen (0.020-inch opening) sections. All steel casing will be cleaned using a brush and detergent (e.g. Simple Green®), followed by steam cleaning inside and outside, and prior to the casing being placed in each borehole. Blank PVC casing and PVC and

DRAFT

stainless steel screens will be new and certified clean by the manufacturer. **Figures 4C-8** and **4C-9** are schematics of a typical well completion for the new PVC-cased and steel-cased monitoring wells, respectively.

Drilling will be performed using air-rotary, mud-rotary, or air-hammer methods, with potable water foam, and/or mud used during the drilling process to facilitate removal of cuttings and maintain an open hole for casing installation. Biodegradable foam and/or bentonite mud may be required during drilling to remove cuttings if water is unsuccessful. For well locations in the South Zone where dissolved methane concentrations in groundwater in excess of 1 milligram per liter is anticipated based on results of AMEC (2013), mud-rotary methods may be used to minimize the potential for explosive concentrations of methane encountered during drilling. The foam and bentonite products must be hydrocarbon-free and metal-free. Drilling compound or pipe dope used on the drill rig must be a NSF/ANSI certified biodegradable, nontoxic, metal-free, and hydrocarbon-free vegetable-based fluid.

For all new wells to be completed in the Wasatch Formation, a 20 to 40-ft length of screen will be placed adjacent to one or more zones of sandstone that are located in the uppermost part of continuously saturated Wasatch Formation. A silica-sand filter pack will be emplaced in the annulus of the borehole via tremied slurry made with potable water from the bottom of the annulus to 5 feet above the top of well screen. Bentonite chips or pellets will be installed into the borehole annulus above the sand filter pack to a depth of 5 feet above the top of the sand pack, and hydrated with potable water. Neat cement grout slurry made with potable water will be pumped into the annulus using a tremie pipe from the bottom to top of the remaining open annulus in one continuous upward operation.

Neat cement is comprised of Class A or B Portland Cement (ASTM C150 or API 10B) with a recommended water to cement ratio of 4.5 to 6.5 gallons of clean water per 94-pound sack of cement. This mixture will weigh about 15 pounds per gallon. Approximately 1-2% by weight of bentonite can be added to the cement slurry to increase set volume, reduce shrinkage, decrease density, and decrease water loss. Casing centralizers will be used on the casing and screen to ensure an even annular space in the borehole around the casing. At a minimum, centralizers will be placed at the top of the screen, at the top of the casing and at approximate 60-foot intervals on the blank well casing (**Figures 4C-8** and **4C-9**).

Monitoring wells will be finished at the surface with an above-ground metal monument equipped with a locking lid. The monument will be concreted in place. Concrete outside the monument will be graded away from the well to shed water away from the well. Top-of-casing elevation, ground surface elevation, and coordinates of the new monitoring well will be surveyed by a Wyoming-licensed professional land surveyor relative to UTM Zone 12.

Additional information on procedures for monitoring well construction includes:

- SOP-15 (**Annex 4C-1**) provides a general description of monitoring well construction procedures.
- **Figures 4C-8** and **4C-9** show schematics of a typical well completion for the new PVC-cased and steel-cased monitoring wells, respectively.

DRAFT

- **Section 3.6.8** (below) describes how investigation derived waste will be handled, including drill cuttings and water.

- Two field forms – lithologic and well completion log and monitoring well installation record – that will be used to document results of drilling and well completion are located in **Annex 4C-2**.

- A representative sample of pipe dope used on each drill rig will be collected and analyzed for the Core List of parameters, excluding dissolved methane.

Due to the potential for combustible gas concentrations in boreholes during and after drilling the new monitoring wells, a combustible gas indicator (CGI) will be used to monitor the drill site. If CGI readings are ≥20% of the lower explosive limit (LEL), drilling operations will be suspended until the source of the gas vapors is identified and mitigated. Bentonite drilling mud may be required during drilling operations to prevent the movement of explosive vapors into the borehole. The environmental consultant and drilling contractor retained by Ultra and QEP to install the monitoring wells will follow a health and safety plan that meets their safety requirements.

3.4 Well Development Procedures

Once installed, a minimum of 10 casing volumes of water will be removed by the surge-and-bail or surge-and-pump technique (SOP-18, **Annex 4C-1**) to develop each new well and remove excess fines from the screened interval. The goal is to obtain water from the aquifer adjacent to the well screen that has low turbidity (<10 nephelometric turbidity units [NTU]). Water samples will not be taken immediately after well development. The well will be allowed to equilibrate to initial static water level conditions for at least 24 hours prior to sampling. A field form for documenting well development procedures and results is included in **Annex 4C-2**. **Section 3.6.8,** below, describes how investigation derived waste will be handled, including development water.

3.5 Groundwater Monitoring Parameters

As described in **Section 2.4** and in Section 4.3.1 of the Plan (NewFields 2014), parameters identified for monitoring under the GMP were established using a rigorous assessment process, resulting in a Core List and Supplemental List of parameters. These parameters (also referred to as analytes or constituents) are listed in **Table 4C-2**, along with analytical methods, sample container and preservative requirements, filtration requirements, reporting limits, and sample holding times. In addition to the inorganic compounds and hydrocarbons listed in **Table 4C-2**, groundwater samples will also be analyzed for dissolved methane (gas).

As a result of the process used to establish GMP groundwater quality parameters, the following parameters in WOGCC's Table 1 of Appendix K (WOGCC 2014) will not be analyzed because they do not meet objectives established for the GMP: fluoride, sulfate, total phosphorus, nitrate+nitrite, iron, magnesium, selenium, iron reducing bacteria (IRB), and sulfate reducing bacteria / slime forming bacteria (SRB/SFB).

DRAFT

Table 4C-2. Laboratory Parameters, Methods, and Sample Requirements for the GMP

Analyte	CAS #	Field Method	Analytical Method	Sample Containers	Preservatives	Reporting Limit	Holding Time
Inorganic Compounds							
Alkalinity (total bicarbonate, and carbonate as $CaCO_3$)	471-34-1	Unfiltered	SM 2320b	2x 250-mL poly	Cool to 6˚C	10 mg/L	14 days
Bromide	24959-67-9		EPA 300.0 or 9056			0.1 mg/L	28 days
Chloride	16887-00-6		EPA 300.0 or 9056			0.2 mg/L	28 days
Total Dissolved Solids	---		SM 2540 C	1x 500-mL poly		10 mg/L	7 days
Barium	7440-39-3	0.45-micron (µm) filter in field	EPA 200.7/200.8 or SW 846 6010 or SW 846 6020	1x 250-mL poly	Nitric Acid (HNO_3) to pH <2 Cool to 6˚C	0.05 mg/L	180 days
Boron	7440-42-8					0.005 mg/L	
Calcium	7440-70-2					1.0 mg/L	
Manganese	7439-96-5					0.001 mg/L	
Potassium	7440-09-7					1.0 mg/L	
Sodium	7440-23-5					1.0 mg/L	
Strontium	7440-24-6					0.01 mg/L	
Hydrocarbons							
Benzene	71-43-2	Unfiltered	SW 846 8260B	3x 40-mL VOA vials (no headspace)	Hydrochloric Acid (HCL) to pH<2 Cool to 6˚C	0.001 mg/L	14 days
Ethylbenzene	100-41-4					0.001 mg/L	
Toluene	108-88-3					0.001 mg/L	
Xylenes, Total	---					0.003 mg/L	
Naphthalene	91-20-3					0.001 mg/L	
TPH-DRO	---		EPA 8015D with silica gel cleanup	2x 1000-mL glass	Sulfuric Acid (H_2SO_4) to pH<2; Cool to 6˚C	0.5 mg/L	7 days
TPH-GRO	---		EPA 5035/8015D	3x 40-mL VOA vials (no headspace)	Hydrochloric Acid (HCL) to pH <2; Cool to 6˚C	0.02 mg/L	14 days
Gases							
Dissolved Methane	74-82-8	Unfiltered	RSK175	3x 40-mL VOA vials (no headspace)	Cool to 6˚ C	0.026 mg/L	14 days
Dissolved Ethane	4-84-0						
Dissolved Propane	74-98-6						

DRAFT

Analyte	CAS #	Field Method	Analytical Method	Sample Containers	Preservatives	Reporting Limit	Holding Time
Gas Compositional Analysis (to be used only for the initial sample from a new well where dissolved methane >5 mg/L)							
Fixed Gases C1-C6	---	Dissolved Gases	RSK175	Specialized (lab supplied)	Benzoalkonium	0.026 mg/L	14 days
Stable isotropic concentration of the carbon (^{12}C and ^{13}C) and hydrogen (^{1}H and ^{2}H) in the methane	---		Laboratory Specific SOP			Variable	28 days

Notes:

TPH-DRO – Total Petroleum Hydrocarbons - Diesel Range Organics; TPH-GRO – Total Petroleum Hydrocarbons Gasoline Range Organics; VOA – Volatile Organic Analysis; mL – milliliters; mg/L – milligrams per liter; SOP – standard operating procedure; °C – degrees Celsius.

Modified from: Wyoming Oil and Gas Conservation Commission (WOGCC 2014), Table 1 in Appendix K (Sampling and Analysis Procedures for the Wyoming Oil and Gas Conservation Commission, Groundwater Baseline Sampling, Analysis, and Monitoring Program).

The following analytes were removed from WOGCC Table 1 in Appendix K due to site-specific development of the Core and Supplemental lists in Section 4 of the Plan (NewFields 2014): fluoride, sulfate, total phosphorus, nitrate+nitrite, iron, magnesium, selenium, iron reducing bacteria (IRB), and sulfate reducing bacteria/slime forming bacteria (SRB/SFB). Note that dissolved ethane gas, dissolved propane gas, fixed gases C1-C6, and stable isotopes of carbon and hydrogen are analyzed only if the dissolved methane gas concentration is >5 mg/L in the initial sample collected from a new monitoring well.

DRAFT

Core and Supplemental List parameters are:

Core List	Supplemental List
Chloride	Alkalinity
TDS	Bromide
Barium	Calcium
Boron	Potassium
Manganese	Sodium
Strontium	
Benzene	
Toluene	
Ethylbenzene	
Xylenes, total	
Naphthalene	
TPH-DRO	
TPH-GRO	
Dissolved Methane (gas)	

Note: TDS – total dissolved solids; TPH –total petroleum hydrocarbons; DRO – diesel range organics; GRO – gasoline range organics.

The 41 wells included in the GMP will be sampled annually for parameters listed on the Core List and/or Supplemental List. All wells will be analyzed for Core List parameters; whereas, wells located in the River Corridor Envelope will also be analyzed for Supplemental List parameters. In addition, for the new monitoring wells and any existing wells in the GMP that have not previously been analyzed for the inorganic compounds, hydrocarbons, and dissolved methane listed in **Table 4C-2**, the initial groundwater sample from these wells will be subject to further analysis if the dissolved methane concentration is greater than 5 milligrams per liter (mg/L); the additional analysis will include dissolved ethane and propane, fixed gases C1-C6, and stable isotopes of carbon and hydrogen in methane as shown on Figure 4-12 in NewFields (2014).

3.6 GROUNDWATER SAMPLING PROCEDURES

Most of the existing wells in the GMP network are industrial supply wells with submersible pumps installed to facilitate collection of groundwater samples; these include the 17 existing wells in the North and South Zones (**Table 4C-1**). For any existing wells without pumps, and the 20 new wells yet to be installed, it is anticipated that dedicated pumps will be installed, and that the pumps will be low-flow bladder type pumps for the wells with PVC casing, and electric submersible pumps for the wells with steel casing. Bladder pumps allow for low-flow sampling techniques whereby the intake for the pump is located in the well screen section, and the low-flow pumping rates (1.0 liter per minute (L/min) or less) withdraw formation water directly through the well screen. This low-flow method is endorsed by EPA (1996, 2002) for obtaining representative groundwater samples from a well. The intake of the bladder pump will be set in the middle of the well screen interval. Electric submersible pumps can be pumped at low to high rates depending on the pump horsepower and total pumping head. Dedicated pumps for new wells, along with associated tubing, hose, and electrical cord, will be new materials that are decontaminated in accordance with SOP-2 (**Annex 4C-1**) prior to placement in the wells.

Groundwater samples will be collected by properly trained field personnel under the supervision of a state-licensed Professional Engineer or Professional Geologist. Much of the general sampling information provided in this section is described further in EPA's "Sampler's Guide" (EPA 2014). A field form to be used for groundwater sampling is included in **Annex 4C-2**.

DRAFT

The laboratory project manager will be directed to provide notification to the Operators or Operator representative (e.g., Primary Environmental Contractor) if the preliminary analytical results indicate any of the following conditions:

1. Presence of thermogenic or mixture of thermogenic and biogenic gas;
2. Methane concentration at or above 5 mg/L; and/or
3. Benzene, toluene, ethylbenzene, and xylene (BTEX) compounds or total petroleum hydrocarbons (TPH) at or above action levels (**Table 4C-3**) in a water sample.

Table 4C-3. Action Levels for Key Petroleum Constituents

Analyte	Action Level
Benzene	0.005 mg/L
Toluene	1.0 mg/L
Ethylbenzene	0.7 mg/L
Xylenes, Total	10 mg/L
TPH-DRO	1.0 or 10 mg/L
TPH-GRO	6.6 mg/L

Note: Action levels are those specified in Section 2.3 of Appendix K (WOGCC 2014) with two exceptions: in December 2014, Wyoming DEQ (2014) lowered its groundwater cleanup level standards for TPH-GRO and TPH-GRO and these changes are reflected in **Table 4C-3**. Action levels are based on EPA (2009) Maximum Contaminant Levels (MCLs) or Wyoming DEQ (2014) Voluntary Remediation Program (VRP) groundwater cleanup levels for total petroleum hydrocarbons. TPH = total petroleum hydrocarbons; DRO = diesel-range organics; GRO = gasoline-range organics; mg/L = milligrams per liter.

3.6.1 Well Purging

Section 2.3.1 of Appendix K in the WOGCC Rules states that a groundwater sample is considered representative of the aquifer being monitored when the well has been purged to remove stagnant water prior to collection of a sample for laboratory analysis. Two of the four purging methods specified in Appendix K of the WOGCC Rules generally apply to this GMP, and were slightly adapted as follows:

1. Stabilization of Parameters Method: For the 17 existing industrial water supply wells that are included in the GMP, purging of groundwater will proceed until the field parameters have stabilized (see below), after which the sample can be collected for laboratory analysis. The field parameters should be measured every 5 minutes, with a minimum of six parameter measurements completed before stabilization is determined. Of the 17 existing water supply wells in the GMP, 13 wells have the existing submersible pumps located within the screen interval (**Table 4C-1**). For the other four wells, two wells have the pumps above and two wells have the pumps below the screen intervals. For this method, a minimum of three well screen interval volumes will be removed prior to sample collection (this criterion is in addition to the WOGCC method description). For example, 6-inch diameter well MS 11-21 has a screen interval of 750-910 feet; total volume of water in the screen interval is 240 gallons X 3 = 720 gallons. The water sample, therefore, would be collected after removal of 720 gallons and stabilization of parameters.

2. Low-Flow Sampling Method: When purging a well using low-flow sampling techniques (e.g., bladder pump), the goal is minimal drawdown (<0.3 foot) of the groundwater level during purging. A groundwater sample can be collected for laboratory analysis after at least two or three well screen interval volumes have been removed and field parameters have stabilized (see below). The goal is to exchange water residing in the well screen interval with water in the aquifer, and the low flow method consists of pumping water directly from the aquifer adjacent to the well screen (not entire well casing). It is assumed that the one casing volume criterion specified by WOGCC for sampling low-yield wells can be modified to that portion of the well with the screen interval. Typically, two to three well screen volumes are removed using the low-flow sampling method prior to sampling to achieve parameter stabilization. This method will apply to new monitoring wells for which a dedicated low-flow sampling pump (e.g., bladder pump) will be installed inside the well screen section.

Note the following well casing diameter vs. volume values: 2-inch casing = 0.163 gallon/foot (gal/ft); 3-inch casing = 0.367 gal/ft; 4-inch casing = 0.653 gal/ft; 6-inch casing = 1.47 gal/ft; and 8-inch casing = 2.61 gal/ft.

The types of pumps expected to be used for purging and sampling are listed in **Table 4C-1**. The following field parameters will be monitored on a regular basis during purging: temperature, pH, oxidation-reduction potential (ORP), specific conductance (SC), dissolved oxygen (DO), and turbidity. Water quality meters for these parameters will be calibrated at the beginning of each sampling day in accordance with manufacturer's directions and SOP-7 through SOP-10 (see **Section 3.6.6** and **Annex 4C-1**). When the field parameters have stabilized for three consecutive readings, a groundwater sample can be collected for laboratory analysis in accordance with the other conditions described above. Stabilization can be demonstrated by the following conditions:

- Temperature: ±10%;
- Turbidity: ±10% (if >10 NTU);
- DO: ±10% (if >0.5 mg/L);
- SC: ±10%;
- ORP: ±10 millivolts (mV); and
- pH: ±0.2 standard units.

During purging, field parameters will be measured in a flow-through cell equipped with applicable sensors in accordance with SOP-7, -8, -9 and -10 (**Annex 4C-1**). A field form to document well purging procedures and results is included in **Annex 4C-2**. Any purged groundwater that has a visible sheen or contains immiscible liquids (e.g., liquid phase hydrocarbons) will be containerized in an appropriately labeled 55-gallon drum, sampled, and staged pending receipt and review of laboratory results. Purged groundwater that does not have a sheen or immiscible liquids will be thin-spread on the ground surface near the GMP well, unless there are any restrictions on government-managed land.

3.6.2 Sample Collection

For this GMP, groundwater samples will be collected on an annual basis during the summer season (refer to Section 4.3.2 in NewFields 2014). Groundwater samples will be collected immediately after

DRAFT

purging each well. Groundwater sampling procedures are described in SOP-12 (**Annex 4C-1**), and a field form to document sampling information is included in **Annex 4C-2**. The parameters to be analyzed by the laboratory are listed in **Table 4C-2**, including analytical methods, sample container and preservative requirements, filtration requirements, laboratory reporting limits, and sample holding times.

Prior to collecting a groundwater sample from each well, a depth to water measurement will be obtained in accordance with SOP-5 (**Annex 4C-1**). The water level indicator tape will be decontaminated before each measurement (see SOP-2; **Annex 4C-1**). All well measuring points will be surveyed and permanently marked. Using the water level indicator, depth to water will be measured from the measuring point to the nearest hundredth of a foot. For wells that do not allow use of a water level indicator probe inside the casing (e.g., impediments for probe access due to electrical pump power cords, discharge piping, well-head access restrictions), a sonic-type water level indicator will be used. When using a sonic water level meter, depth to water readings in at least five wells with varying depths must be correlated with measurements made with a water level indicator tape. The difference between the two measurements will be linear (see AMEC 2012), and a correction factor will be calculated and applied to the water level data obtained using the sonic meter.

Water levels will also be recorded remotely in selected new monitoring wells being installed for the GMP. Solinst Leveloggers® (water pressure transducers) used by the Operators (Ultra and QEP) for the Hydrogeologic Data Gaps Investigation (AMEC 2012) will be deployed in the following new monitoring wells to measure long-term groundwater elevations in the PAPA:

- North Zone: well GMPN-01
- River Corridor Envelope: wells RCE-03, RCE-10, and X-4a-A
- South Zone: well GMPS-05

Barometric pressure sensors (Barologgers®) will be installed in well GMPN-01 in the North Zone and in well GMPS-05 in the South Zone to collect data to compensate for barometric pressure changes measured by the submerged Leveloggers throughout the PAPA. Each Levelogger and Barologger will be programmed to log data on a daily basis to evaluate potential fluctuations in groundwater elevations and barometric pressure.

Leveloggers and Barologgers will be attached to J-plugs and PVC well caps using eye-bolts and suspended below the groundwater surface using a non-stretch Kevlar® cord. Well casing caps will be left slightly loose (i.e., not air tight) or have a small hole to allow air in well casings to be in equilibrium with atmospheric pressure.

After the static water level in each well is measured manually with a water level indicator prior to sampling, the Leveloggers and Barologgers will be retrieved to download data. After data are downloaded, each transducer will be reset and re-deployed. Data will be incorporated into the Plan's data management system and used to develop long-term groundwater hydrographs for the PAPA.

For wells with existing submersible pumps (**Table 4C-1**), the sample bottles will be filled directly from the discharge faucet or port, using a low flow rate to minimize water turbulence and loss of volatile organic compounds (VOC). An attempt will be made to collect the samples as close to the well as possible and prior to holding tanks, pressure tanks, or any water treatment system (softeners, reverse

DRAFT

osmosis, etc.). If the sampling point is equipped with an aerator, the aerator will be removed prior to sampling, if possible. For existing wells without permanent power hookup, a portable generator will be connected to the pump, with the generator located away and downwind from the sampling point.

For wells to be equipped with a low-flow bladder pump or submersible pump, groundwater samples will be collected directly from the discharge tubing. The larger sample bottles for inorganic compounds and TPH-DRO will be filled first using the highest pumping rate, followed by the smaller VOA vials using a reduced pumping rate.

Unfiltered samples will be collected directly from the sampling point into clean, laboratory-provided, and preserved (if required) sample containers (**Table 4C-2**). Care will be taken when collecting the sample to minimize agitation when filling the sampling containers, and not to overfill sample containers containing preservatives. Samples collected for volatile constituents, such as BTEX and TPH-GRO, will be collected into VOA vials with no headspace. If air bubbles are observed after placing on the cap, a new sample will be collected into a fresh bottle.

For samples that require filtration (SOP-11, **Annex 4C-1**), a new disposable 0.45-micron (µm) filter will be used in the field for the seven inorganic compounds listed in **Table 4C-2**. For wells with existing submersible pumps, the filter will be inserted in-line, if possible, or from a decontaminated clean container if not possible for in-line placement. For the wells with bladder pumps, the filter will be inserted in-line for collection of the sample. The in-line filter will be connected to disposable tubing, if applicable, that is then connected to the discharge point.

Groundwater sampling will be conducted by personnel with the proper training and experience. The sampler will wear a new pair of disposable, powder-free latex gloves in order to reduce cross-contamination of the samples prior to sampling. Gloves will be changed between sampling locations.

To collect samples for dissolved methane in groundwater, a clean container (decontaminated in accordance with SOP-2, **Annex 4C-1**) of sufficient size (e.g., 5-gallon bucket) will be filled with water from the sampling location. A section of disposable tubing will be connected to the discharge point; and using a step-down valve, a short length of ¼-inch diameter disposable tubing will be connected to the valve. The flow rate through the tubing will be adjusted so that it is low. The dissolved gas sample will then be collected in accordance with procedures specified in SOP-41 (**Annex 4C-1**). If collecting the sample for gas compositional analysis (**Table 4C-2**), the benzalkonium tablet will be quickly inserted into the sample container prior to placing the cap. The filled gas sample container will be checked to be sure there are no air bubbles in the sample. If air bubbles are visible, another sample should be collected. If the water is effervescent, a gas headspace bubble in the VOA vial is acceptable, and the laboratory will be notified to analyze the gas in the vial's headspace. Once collected, dissolved gas samples will be stored and packed upside down in shipping containers

An alternate method to collect samples for dissolved methane analysis is through the use of IsoFlasks® sample containers. The IsoFlasks and sampling procedure were developed by Isotech Laboratories, Inc. (refer to: http://www.isotechlabs.com/products/isoflask/ISOFLASK_SAMPLING.pdf). The IsoFlask is designed to collect and provide proper shipment of groundwater samples for dissolved gas analysis. According to Isotech Laboratories, the unique IsoFlask design will not alter the quantity or isotopic characteristics of dissolved hydrocarbon gases, which makes it appropriate to both quantify gas concentrations and identify the source of methane, ethane, and propane present in groundwater.

Influent sample water is supplied by a pressurized system (e.g., supplied by the pump in GMP wells) with an air-tight seal between the pump tubing and IsoFlask. The IsoFlasks are provided for use under a vacuum and contain a bactericide capsule. Approximately 600-700 milliliters of sample are required to fill the IsoFlask. Sample information is recorded onto the IsoFlask with a soft-tipped permanent marker. IsoFlasks are shipped to Isotech Laboratories in a supplied protective box following chain-of-custody procedures described in **Section 3.6.4**.

Due to the potential for combustible gas concentrations inside water wells, a combustible gas indicator (CGI) will be used to survey the workspace around and in the well casing. If CGI readings are ≥20% of the LEL, sampling activities would be suspended until the source of the gas vapors is identified and mitigated (see SOP-42; **Annex 4C-1**).

3.6.3 Sample Handling

The sample containers and preservatives for each laboratory method are specified in **Table 4C-2**. Sample containers will be stored in a cool, dry location, separate from any VOC-containing materials. Sample containers containing laboratory prepared preservatives shall not be used if held on-site for an extended period of time or if exposed to extreme temperature conditions. Once opened, the sample containers will be used immediately. If the container is used for any purpose other than sample collection, it will be discarded.

Samples will be identified with a unique sample identification number (**Table 4C-1**). Sample containers will be labeled using waterproof ink and shall indicate the company, project identifier, sample ID, date, time, sampler, matrix, filtered/unfiltered, and preservative (if any) (SOP-3, **Annex 4C-1**). Sample labels from the laboratory will be used whenever possible. After labeling, samples will be placed in an insulated cooler on ice until packed for shipment to the laboratory. Sample containers will be placed in Ziploc-style baggies and then wrapped in protective packing material (bubble wrap; not foam blocks that many labs use to ship the VOA vials). Sample containers will then be placed in the insulated cooler in an up-right position (with the exception of the dissolved gas samples) and surrounded with sufficient ice to maintain a cooler temperature of ≤6 degrees Celsius (°C) during shipping. Ice will be double bagged into Ziploc-style baggies. If the cooler contains a drain outlet, it will be sealed over with tape on the inside and outside of the cooler prior to sample packing.

All groundwater samples (placed in ice-filled and sealed coolers) will be shipped to the laboratory(ies), along with all appropriate shipping forms under chain-of-custody in accordance with SOP-3 (**Annex 4C-1**). Shipping will comply with shipper, EPA, and U.S. Department of Transportation (DOT) regulations. The chain-of-custody (COC) form (see example form in **Annex 4C-2**) will be placed in a Ziploc-style bag and placed inside the sample cooler. Shipping documents will specify the laboratory analyses for each sample.

Each cooler will be secured with strapping tape and clearly display a shipping label with all appropriate laboratory information in accordance with SOP-4 (**Annex 4C-1**). A completed sample custody seal will be taped onto the outside of each sample cooler such that the seals will be broken when the cooler is opened. All samples submitted for laboratory analysis will be analyzed using standard turnaround times. Upon receipt at the laboratory, the temperature of all coolers will be measured to document proper sample preservation requirements. Therefore, a temperature blank will be placed in each cooler by the laboratory when the sample coolers are shipped to the Project site.

DRAFT

3.6.4 Chain-of-Custody Procedures

All samples will be shipped to the laboratory using proper COC procedures as outlined in SOP-3 and SOP-4 (**Annex 4C-1**) to document the custody, transfer, handling, and shipping of samples. One COC form (see example form in **Annex 4C-2**) will be completed for each cooler of samples, and will contain the following information:

- Sampler's signature
- Project number
- Date and time of collection
- Sample identification number
- Sample type
- Analyses requested
- Number of containers
- Preservatives
- Requested turn-around time
- Observations on sample condition that may be pertinent (i.e., effervescence)
- Signature of persons relinquishing custody, dates, and times
- Signature of persons accepting custody, dates, and times
- Method of shipment and shipping air bill number (if appropriate)

A sample is considered under a person's control when it is in their possession. When custody of a sample is relinquished by the sampler, the sampler will sign and date the COC form and note the time that custody was relinquished. The person responsible for delivery of the samples to the shipping company will sign the COC form, retain a copy of the COC form, document the method of shipment (shipper/airbill number) and send the original and a second copy of the COC form with the samples. The person at the laboratory receiving the samples will sign and date the COC form. Copies of the final COC forms from the laboratory documenting sample custody will be kept with the sampling information.

3.6.5 Field Documentation

Pertinent field investigation and sampling information will be recorded on a daily field log book and appropriate sampling forms to provide a continual record of activities completed each day. All field documentation will be conducted in accordance with SOP-1 (**Annex 4C-1**); field forms are included in **Annex 4C-2**. The field log book and/or data sheet will be completed using permanent ink and contain a complete record of all equipment used, activities conducted, measurements of field parameters per well casing volume produced, calculations, and observations including weather and water odor/color/clarity and effervescence. The information will be sufficient to allow the purging and sampling methods to be reconstructed in sufficient detail to evaluate adequacy of the procedures. Field notes will also include explanations of problems encountered during monitoring activities, and an explanation of any trouble-shooting techniques that were used.

DRAFT

The following specific items will be included in each day's field notes and/or field forms, where applicable to the specific groundwater monitoring activities:

- Field ID (i.e., Pinedale Anticline);
- Date and time of sample collection;
- Weather conditions;
- GPS coordinates of the available water source location;
- API Number(s) for natural gas well(s) associated with the sample location;
- Sample type (initial or subsequent);
- Description of sampling location and condition;
- Sample location ID;
- Sample matrix, number and volume of samples, and preservatives, and analysis requested;
- Health and Safety (H&S) procedures followed including Personal Protective Equipment (PPE) used during sampling, and any H&S problems encountered;
- Decontamination information;
- Equipment calibration information;
- Depth to water. Information on use of the available water source prior to sampling. The time of measurement since purging began should also be recorded;
- Depth to bottom of the well based on well construction information or on actual measurement (as appropriate);
- Calculations (casing volume, screen volume, flow rate);
- Field parameter measurements;
- Total volume and physical characteristics of the purged water, including odor, color, clarity, particulate matter, effervescence;
- Complete description of equipment used for purging, including type and capacity of pump used and pumping rate used to purge well;
- Name and affiliation of person(s) conducting purging, and any observers on site;
- Field parameter measurements for the final casing volume;
- Listing of photographs taken during sampling; and
- Landowner/Lessee/Operator comments, if any, on water quality or other related issues.

3.6.6 Equipment Calibration

All electronic field instruments (e.g., water quality meters, combustible gas indicator [CGI]) will be calibrated to ensure that each instrument is working properly, and that the results are within the range of acceptability as determined by the manufacturer's specifications. Calibration data will be recorded to maintain a record of the calibration and proof of acceptability.

Equipment used to collect field measurements will be calibrated at the start of each sampling day. More frequent calibration may be necessary, depending on the reliability and inherent stability of the

DRAFT

instrumentation, extreme field conditions (weather/climate), continuous or heavy use, or high concentrations of monitored parameters. When field calibration is performed, calibration will be verified and documented at the end of the day.

Results of calibration will be recorded in the field log book or field form referenced in the field log book (see groundwater sampling forms in **Annex 4C-2** that include equipment calibration). Calibration results outside ±5% from the standard will require the calibration procedure to be repeated.

3.6.7 Decontamination

Decontamination of sampling equipment will be performed to ensure the quality of samples collected. To prevent cross-contamination between samples, all non-disposable sampling equipment will be decontaminated on-site between sampling locations using distilled water, Alconox® detergent, and a methanol and/or nitric acid rinse in accordance with SOP-2 (**Annex 4C-1**). Decontamination procedures will be conducted at locations identified prior to sampling and at an appropriate distance from sampling activities. Disposable equipment intended for one-time use will not be decontaminated, but will be disposed as described in SOP-2. Dedicated or disposable equipment will be used whenever possible.

All non-disposable equipment (e.g. instruments, buckets, non-dedicated pumps) will be decontaminated prior to use and between sample locations by using the following procedures:

1. Remove any visible surface contamination with a brush (sludge, sediment, etc) and rinse with tap water.
2. Wash with a dilute solution of tap water and non-phosphate laboratory grade detergent such as Alconox or equivalent. Pumps and non-disposable tubing must have water pumped through them.
3. Rinse with tap water.
4. Rinse with distilled or deionized water.
5. Allow to air dry, if possible.

Decontaminated equipment should be placed on clean plastic sheeting to dry and then stored in sealed containers or wrapped in aluminum foil or plastic when not in use to prevent contamination from airborne particles.

Heavy equipment (e.g., drill rig and support vehicles) will be decontaminated in conformance with SOP-2 (**Annex 4C-1**). Steel well casing will be cleaned using a brush and detergent (e.g., Alconox® or Simple Green®), followed by steam cleaning inside and outside, and prior to the casing being placed in each borehole. Blank PVC casing and PVC and stainless steel screens will be new and certified clean by the manufacturer. All equipment will be decontaminated prior to arriving on site and before exiting a drilling location. Water for decontamination will be supplied from a potable water source (e.g., Pinedale, Wyoming municipal water supply). Decontamination should be done far enough away from the area of sampling so that rinsate generated does not affect future anticipated samples as part of the investigation. The area should also allow for the infiltration of the rinsate into the soil.

DRAFT

Decontamination procedures will be recorded daily in the field log book or field form referenced in the field log book.

3.6.8 Investigation Derived Waste

Investigation derived waste will be handled according to SOP-25 (**Annex 4C-1**). Disposable field equipment (gloves, filters, valves, tubing) shall be bagged and disposed of as municipal solid waste. Unused sampling containers and preservatives shall be returned to the laboratory, or disposed of as municipal waste. Unused preservatives requiring disposal will be diluted with water and disposed into a municipal sewer system. Preservatives should not be disposed of in concentrated form or directly onto the ground.

Unless otherwise required differently by state or federal agencies, development and purge water will be discharged onto the ground at least 20 feet from and down-gradient of the water source and in a location designated by the landowner or land manager (e.g., BLM). Decontamination water should be collected and disposed of down-gradient from the water source. Development, purge, and decontamination water, if disposed of onto the surface, shall be discharged in a location to allow for infiltration of the water.

Unless otherwise required differently by state or federal agencies, drilling fluids and water generated from new wells will be discharged to the ground surface in the vicinity of the well location for evaporation and infiltration of the water-based fluids. All surface discharge areas should be selected for infiltration capability and should not allow for migration of discharge water to a surface water body. Drill cuttings will be thin-spread on the ground surface near the well, and the drilling sites will be reclaimed to approximate pre-disturbed conditions.

3.7 QUALITY ASSURANCE

Quality Assurance/Quality Control (QA/QC) procedures will be followed in accordance with the Quality Assurance Project Plan (QAPP) in **Appendix 4-D**. Data quality will be considered adequate if sampling was conducted according to this SAP, samples were analyzed by approved analytical methods by an accredited/certified laboratory, and a thorough data quality review of field and laboratory data was conducted.

Samples will be analyzed by a laboratory or laboratories that are accredited by the National Environmental Laboratory Accreditation Program (NELAP) or American Association for Lab Accreditation (A2LA) for the analytical methods that will be used as part of the GMP. Analytical methods will conform to approved EPA test methods such as Test Methods for Evaluating Solid and Hazardous Waste (SW-846), or other approved methods such as Standard Methods (SM) for the Examination of Water and Wastewater.

3.7.1 Quality Assurance (QA) Samples

Quality control (QC) samples for this investigation will be collected in accordance with SOP-24 (**Annex 4C-1**), the QAPP (**Appendix 4-D**), and as described in this SAP. All field sampling programs require the collection of additional samples to provide quality control for the field or laboratory procedures.

DRAFT

These include field duplicates, trip blanks, and equipment rinsate blanks. A temperature blank also will be placed in each cooler by the laboratory when the sample coolers are shipped to the Project site.

A description of each of the various QC sample types is provided below. **Table 4C-4** summarizes the minimum rate at which QC samples must be collected for the GMP.

Table 4C-4. Minimum QA/QC Samples for the GMP

Medium	Duplicates[1]	Trip Blanks[2]	Equipment Rinsate Blanks[1]
Groundwater	1 duplicate in 20 natural samples	One trip blank bottle set per daily set of sample shipment containers containing VOC samples	1 per 20 decontamination procedures

[1] Duplicate and rinse blank samples are collected at the minimum rate of 1 per 20 samples. If fewer than 20 samples are collected, one duplicate sample and one rinse blank sample (if decontamination procedures are performed) must be collected.

[2] Trip blanks are prepared in the laboratory or at another off-site location from distilled or deionized water. They are never prepared on-site, or from soils or other solid material.

Field duplicate samples are independent samples of the same medium collected at the same time from the same location. Duplicate samples will be collected for analysis of all the same analytes as the parent sample. Duplicates are submitted for analysis "blind", meaning that they will not be identified to the laboratory as duplicate samples. The duplicate samples will be identified with a nonexistent sample location ID that is similar to, but different from the other sample location IDs at the site. All other labeling shall be identical to the investigative samples. The true identity of the duplicate samples shall be recorded in the field logbook, but not on the COC form or sample labels and tags that are sent to the laboratory.

Trip blanks are required only when samples are collected for analysis of VOCs (i.e., BTEX). They are prepared from analyte-free (deionized) water by the laboratory, and are transported to the sampling site with the VOC sample bottles for the investigative sampling. They are kept with the samples throughout the sampling program and are shipped for analysis with the samples. They are not opened on site, and are designed to evaluate VOC contamination encountered within the coolers during the shipping and handling procedures. Trip blanks are prepared in 40 ml VOA vials with Teflon septum lids, and must be chilled and handled in the same manner as a water sample for VOC analysis. Two trip blank vials per each daily set of shipping containers or coolers containing VOC samples are required. Trip blanks will be analyzed for BTEX.

Equipment rinsate blanks are obtained from the last rinse of analyte-free (deionized) water during decontamination of sample collection equipment. No extraordinary decontamination procedures will be followed when a rinsate blank is collected. The date and time of collection will be noted, as well as the ID number of the investigative sample collected just prior to decontamination, and the ID number of the next sample collected with the decontaminated equipment. If dedicated or disposable equipment is used, rinsate blanks need not be collected.

If contamination is detected in a rinsate blank, extensive re-sampling may be required, based on the rate of rinsate blanks collected (e.g., 20 locations re-sampled if rinsate blanks are collected at the rate of 1 per 20 samples; 10 locations resampled if rinsate blanks are collected at the rate of 1 per 10 samples). Equipment rinsate blanks will be analyzed for metals and BTEX.

DRAFT

Also as previously stated, a temperature blank will be placed in each cooler by the laboratory when the sample coolers are shipped to the Project site. Upon receipt at the laboratory, the temperature of all coolers will be measured using the temperature blanks to document proper sample preservation requirements.

Laboratory quality assurance samples (e.g., matrix spike (MS)/matrix spike duplicates (MSD); method blanks; laboratory control samples; and laboratory duplicates) will be prepared and analyzed by the laboratory. Results of the laboratory quality assurance samples will be reported with the original sample results. A narrative of any quality issues shall be included with the laboratory report from the lab.

The QAPP contained in **Appendix 4-D** provides a detailed description of the QA samples and overall QA/QC program for this GMP.

3.7.2 Data Quality Review

Data quality reviews will be conducted on all data once finalized laboratory reports have been received. Results of data quality review will be documented on a Data Quality Review Sheet and reported with the associated laboratory reports. The objective of a data quality review is to ensure that data are collected and reported properly. A data quality review includes review of both field and laboratory analytical data.

3.7.2.1 Field Data Review

Field data to be reviewed include log books and sampling sheets (forms) to confirm that this SAP was followed, that data were properly entered and recorded (transcription/spelling errors), proper field/sampling procedures were used, and that there were no conditions that occurred that could affect reliability of the data. Results of the field data review will be summarized and included in the Annual Summary Report as described in Section 4.7 of NewFields (2014)

3.7.2.2 Laboratory Data Review

Procedures to validate laboratory data are derived from the EPA's Contract Laboratory Program, National Functional Guidelines for Organic Data Review (EPA 2008); and Contract Laboratory Program, National Functional Guidelines for Inorganic Data Review (EPA 2013). Analytical reports will be checked to verify that holding times were met, proper matrix and units were reported, all requested analyses were conducted, and that proper analytical methods were used. Also, results of all laboratory internal QC samples (e.g., blanks, surrogate spikes, MS/MSDs, laboratory control samples, and target compound identification and quantitation) will be reviewed and evaluated to determine if results were within method acceptance limits.

The overall completeness of the data package will also be evaluated. Completeness checks will be administered on all data to determine whether deliverables are present. At a minimum, deliverables will include sample COC forms, analytical results, and QA/QC summaries. The reviewer will determine whether all required items are present and request copies of missing deliverables. In addition, any deficiencies in the lab reports requiring corrective action will be brought to the attention of the lab. Results of the data validation review will be summarized in a Data Validation Report for each sample report issued by the laboratory, and the reviewer shall certify if the data were collected in accordance with this SAP and is suitable for the intended use. The Data Validation Report will be appended to the Annual Summary Report described in Section 4.7 of NewFields (2014).

DRAFT

4.0 REFERENCES

AMEC Environment & Infrastructure, Inc. (AMEC). 2012. Technical Report – Hydrogeologic Data Gaps Investigation, Interim Plan, Pinedale Anticline Project Area ROD, Sublette County, Wyoming, May 2012.

_____. **2013**. Final Technical Report, Evaluation of Low-Level Petroleum Hydrocarbon Compounds Detected in Groundwater, Interim Plan. Pinedale Anticline Project Area ROD, Sublette County, Wyoming. October 2013.

BLM, see U.S. Department of the Interior, Bureau of Land Management

EPA, see U.S. Environmental Protection Agency

NewFields Mining, Energy, and Environmental Services LLC (NewFields), 2014. Draft, Groundwater Pollution Prevention, Monitoring and Response Action Plan, Pinedale Anticline Project Area, Sublette County, Wyoming. Prepared on behalf of Ultra Resources, Inc. and QEP Energy Company, for the U.S. Department of Interior Bureau of Land Management, Wyoming Oil and Gas Conservation Commission, Wyoming Department of Environmental Quality, Wyoming State Engineer's Office and U.S. Environmental Protection Agency. December.

U.S. Department of the Interior, Bureau of Land Management (BLM). 2008a. Final Supplemental Environmental Impact Statement for the Pinedale Anticline Oil and Gas Exploration and Development Project, Sublette County, Wyoming. Available on-line: http://www.blm.gov/wy/st/en/info/NEPA/documents/pfo/anticline/seis.html

_____**. 2008b**. Record of Decision. Final Supplemental Environmental Impact Statement for the Pinedale Anticline Oil and Gas Exploration and Development Project. Sept. 2008. Available on-line: http://www.blm.gov/style/medialib/blm/wy/information/NEPA/pfodocs/anticline/rod.Par.50775.File.dat/00ROD.pdf.

U.S. Environmental Protection Agency (EPA). 2014. Sampler's Guide, Contract Laboratory Program Guidance for Field Samplers. OSWER 9200.2-147; EPA-540-R-014-013. October 2014.

_____**. 2013.** National Functional Guidelines for Inorganic Superfund Data Review. OSWER 9200.2-133; EPA-540-R-013-001. October 2013.

_____**. 2009**. National Primary and Secondary Drinking Water Regulations. EPA 816-F-09-004. May 2009.

_____**. 2008**. USEPA Contract Laboratory Program, National Functional Guidelines for Superfund Organic Methods Data Review. OSWER 9240.1-48; USEPA-540-R-08-01. June 2008.

_____**. 2002**. Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers. Ground Water Forum Issue Paper. By Douglas Yeskis and Bernard Zavala. EPA 542-S-02-001. May 2002.

_____**. 1996**. Ground Water Issue, Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures. By Robert W. Puls and Michael J. Barcelona. EPA/540/S-95/504. April 1996.

DRAFT

Wyoming Department of Environmental Quality (DEQ). 2014. Fact Sheet #12: Soil Cleanup Levels. Appendix A: Cleanup Levels for Total Petroleum Hydrocarbons in Soil and Groundwater. Voluntary Remediation Program (VRP). 08/27/2014 – R6. Available on-line: http:deq.state.wy.us/volremedi/index.asp.

_____**. 2013**. Fact Sheet #29: Sampling and Analysis Plans. Voluntary Remediation Program (VRP). 02/07/13 – R3. Available on-line: http://deq.state.wy.us/volremedi/index.asp.

_____**. 2012a**. Fact Sheet #13: Groundwater Cleanup Levels. Voluntary Remediation Program (VRP). 03/21/12 – R5. Available on-line: http://deq.state.wy.us/volremedi/index.asp.

_____**. 2012b**. Water Quality Rules and Regulations. Chapter 26, Well Construction Standards. Available on-line: http://deq.state.wy.us/wqd/WQDrules/Chapter_26.pdf.

_____**. 2012c**. Water Quality Rules and Regulations. Chapter 3, Regulations for Permit to Construct, Install or Modify Public Water Supplies, Wastewater Facilities, Disposal Systems, Biosolids Management Facilities, Treated Wastewater Reuse Systems and other Facilities Capable of Causing or Contributing to Pollution. Available on-line: http://deq.state.wy.us/wqd/WQDrules/Chapter_03.pdf .

_____**. 2005.** Water Quality Rules and Regulations. Chapter 8 Quality Standards for Wyoming Groundwaters. Available on-line: http://deq.state.wy.us/wqd/WQDrules/Chapter_08.pdf.

Wyoming Oil and Gas Conservation Commission (WOGCC). 2014. Wyoming Oil and Gas Conservation Rules and Regulations, Chapter 3: Operational Rules, Drilling Rules; Section 46; Appendix K. Available on-line: http://soswy.state.wy.us/Rules/RULES/9411.pdf.

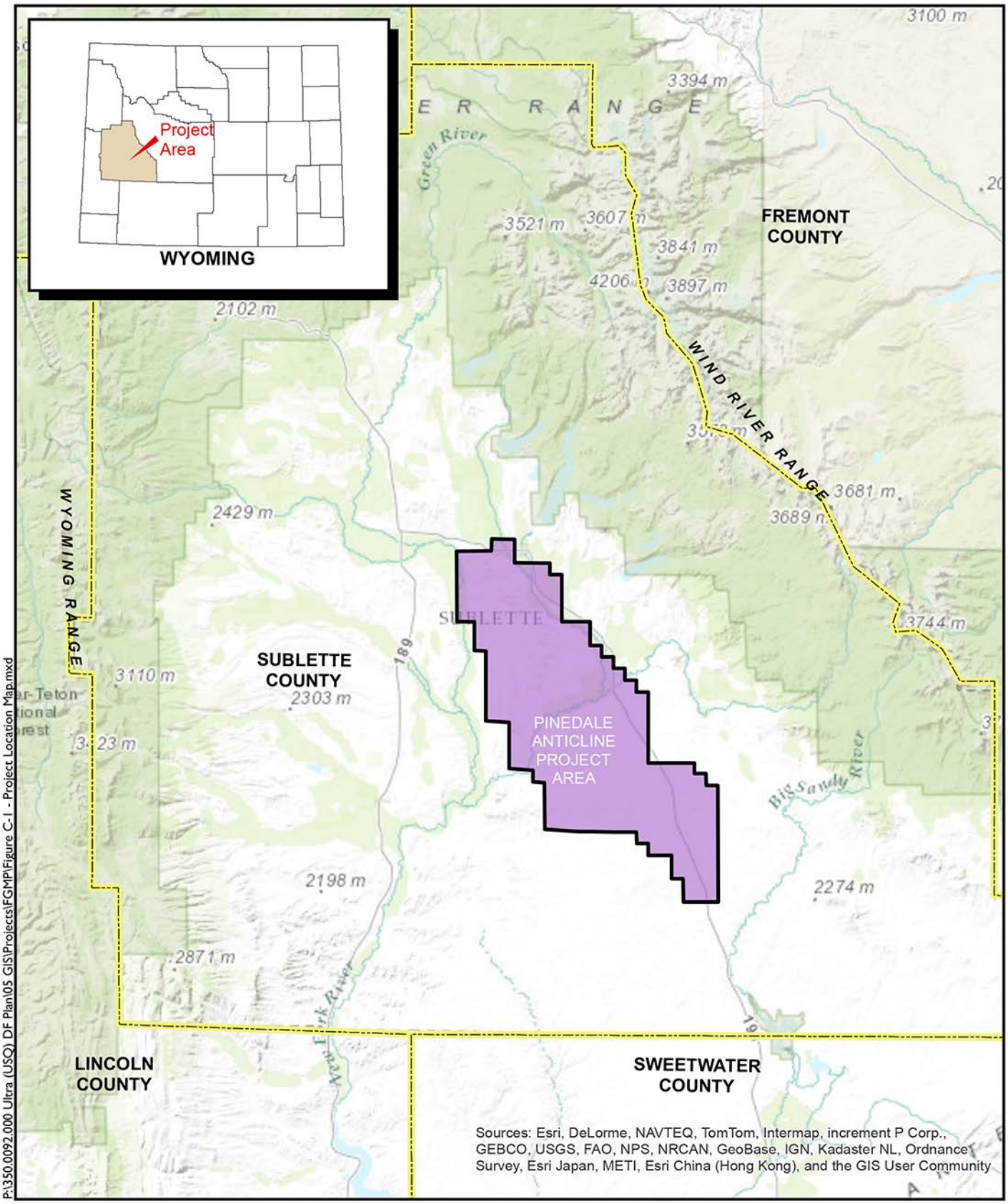
Wyoming State Engineer's Office (SEO). 2011. Water Well Minimum Construction Standards. Regulations and Instructions, Part III. Cheyenne, Wyoming. Revised June 2011.

DRAFT

FIGURES

(FOR APPENDIX 4-C)

DRAFT



P:\350.0092.000 Ultra (USQ) DF Plan\05 GIS\Projects\FGMP\Figure C-1 - Project Location Map.mxd

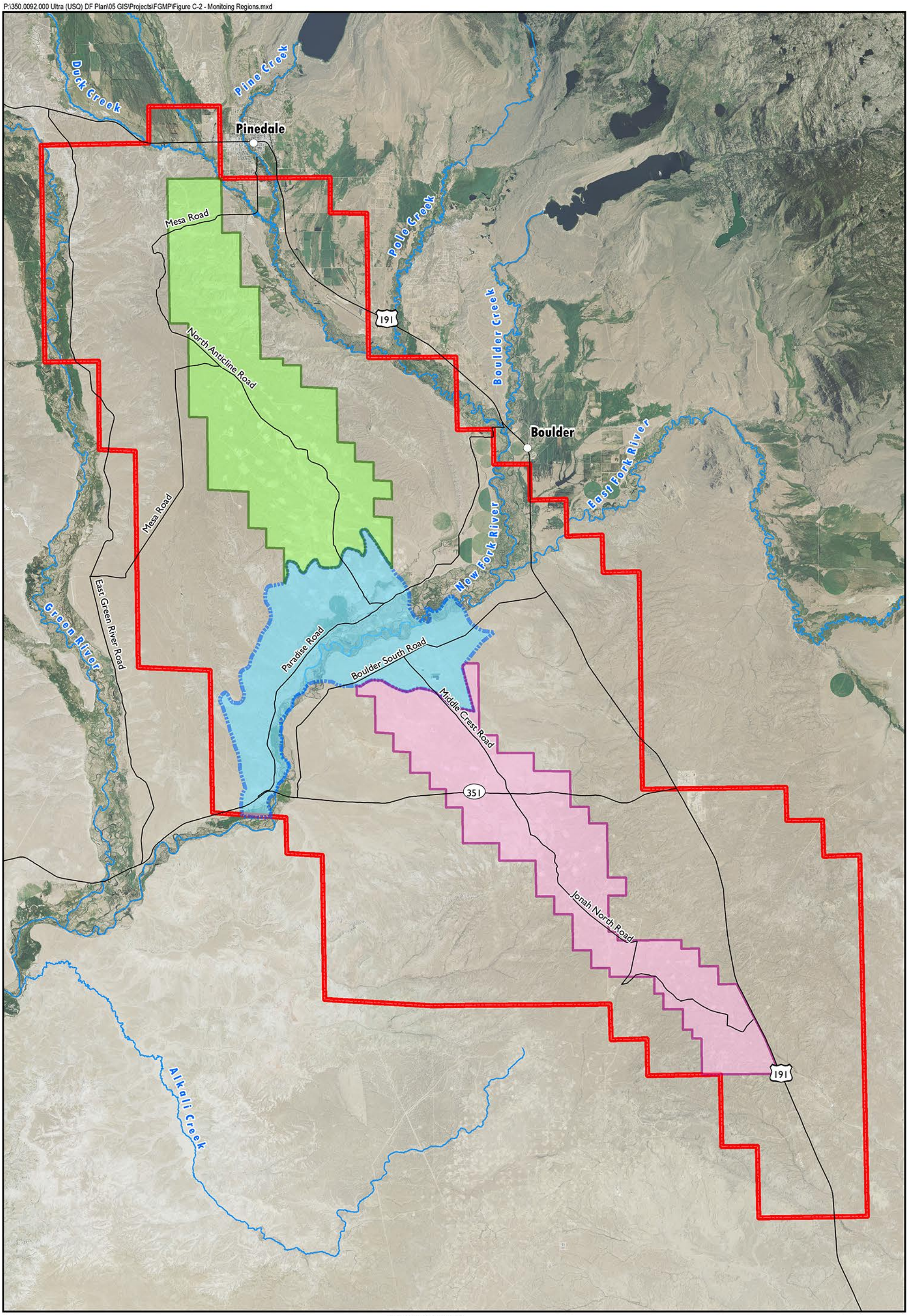
DRAFT

0 Miles 16

NewFields

Project Location Map
Pinedale Anticline Project Area
Sublette County, Wyoming
FIGURE 4C-1

P:\350.0092.000 Ultra (USQ) DF Plan\05 GIS\Projects\FGMP\Figure C-2 - Monitoing Regions.mxd



Source: 2013 NRIS

0 Miles 2.5

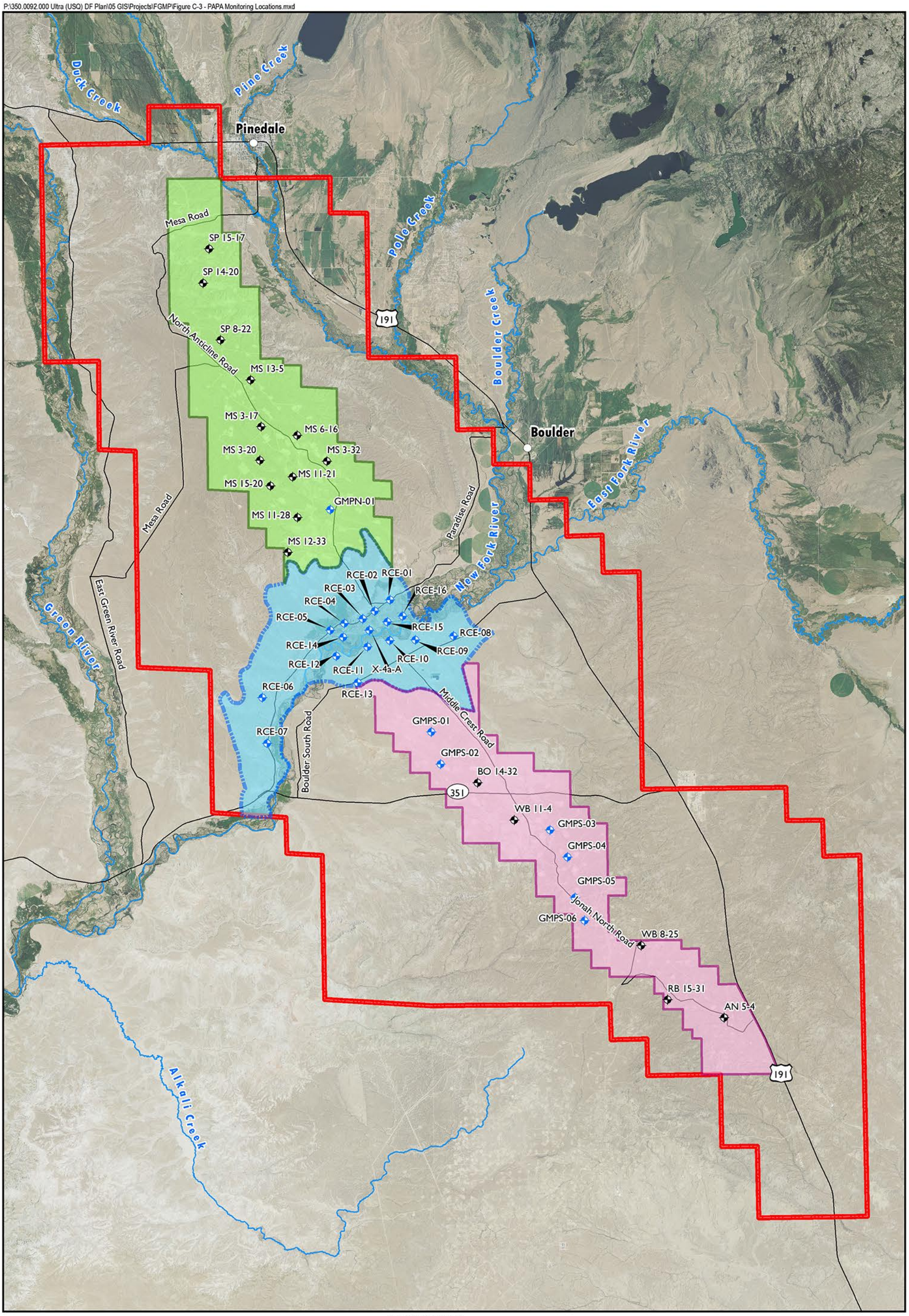
NewFields

DRAFT

North Zone
South Zone
River Corridor Envelope
Pinedale Anticline Project Area

Monitoring Regions
Pinedale Anticline Project Area
Sublette County, Wyoming
FIGURE 4C-2

P:\350.0092.000 Ultra (USQ) DF Plan\05 GIS\Projects\FGMP\Figure C-3 - PAPA Monitoring Locations.mxd



Source: 2013 NRIS

0 Miles 2.5

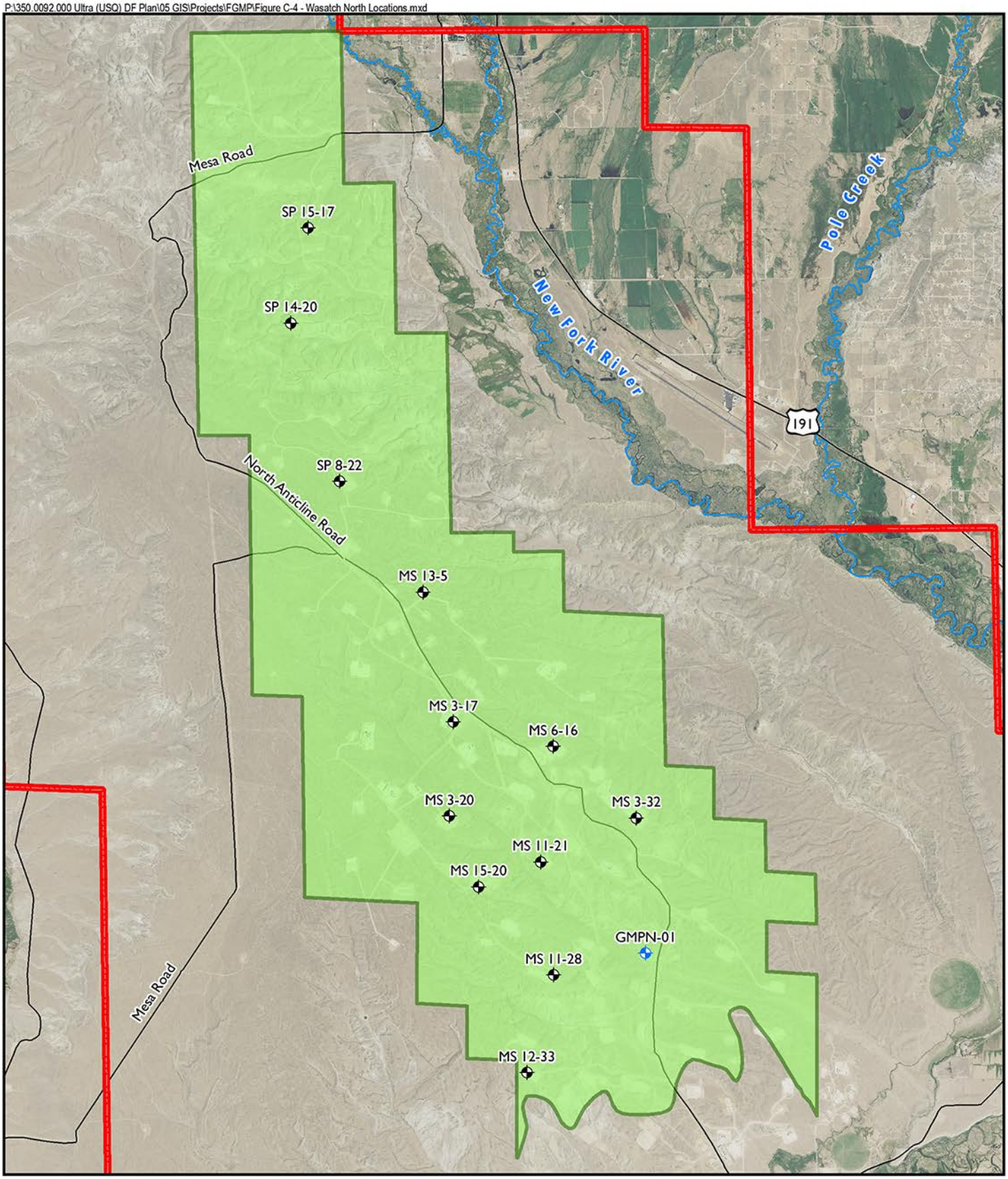
DRAFT

Monitoring Well
Industrial Water Supply Well
South Zone
North Zone
River Cooridor Envelope
Pinedale Anticline Project Area

NewFields

PAPA Groundwater Monitoring Locations
Pinedale Anticline Project Area
Sublette County, Wyoming
FIGURE 4C-3

P:\350.0092.000 Ultra (USQ) DF Plan\05 GIS\Projects\FGMP\Figure C-4 - Wasatch North Locations.mxd



Source: 2013 NRIS

DRAFT

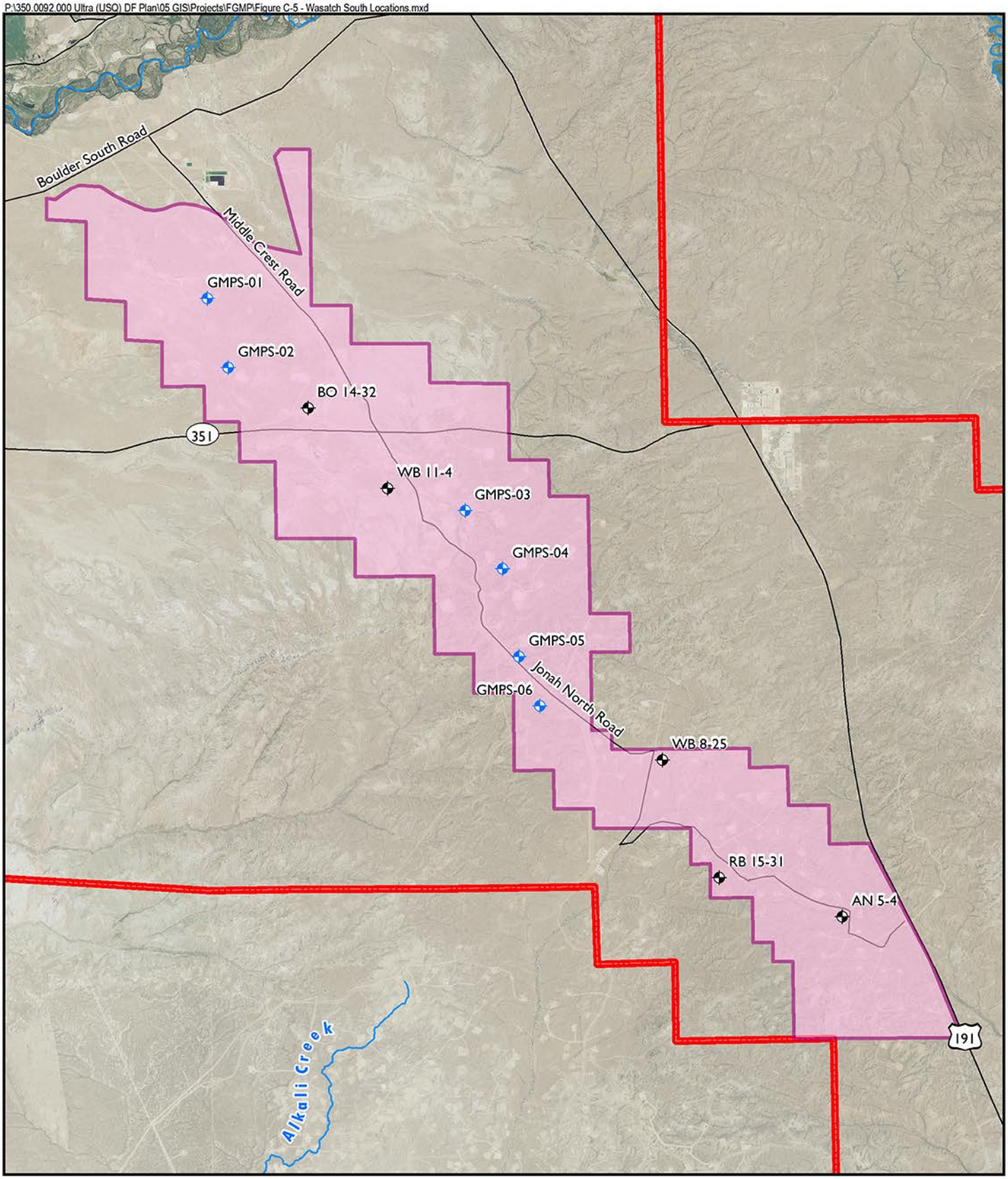
0 7,000
Feet

NewFields

Monitoring Well
Industrial Water Supply Well
North Zone
Pinedale Anticline Project Area

Wasatch HSU Monitoring Locations, North Zone
Pinedale Anticline Project Area
Sublette County, Wyoming
FIGURE 4C-4

P:\350.0092.000 Ultra (USQ) DF Plan\05 GIS\Projects\FGMP\Figure C-5 - Wasatch South Locations.mxd



Source: 2013 NRIS

0 9,000 Feet

DRAFT

Monitoring Well

Industrial Water Supply Well

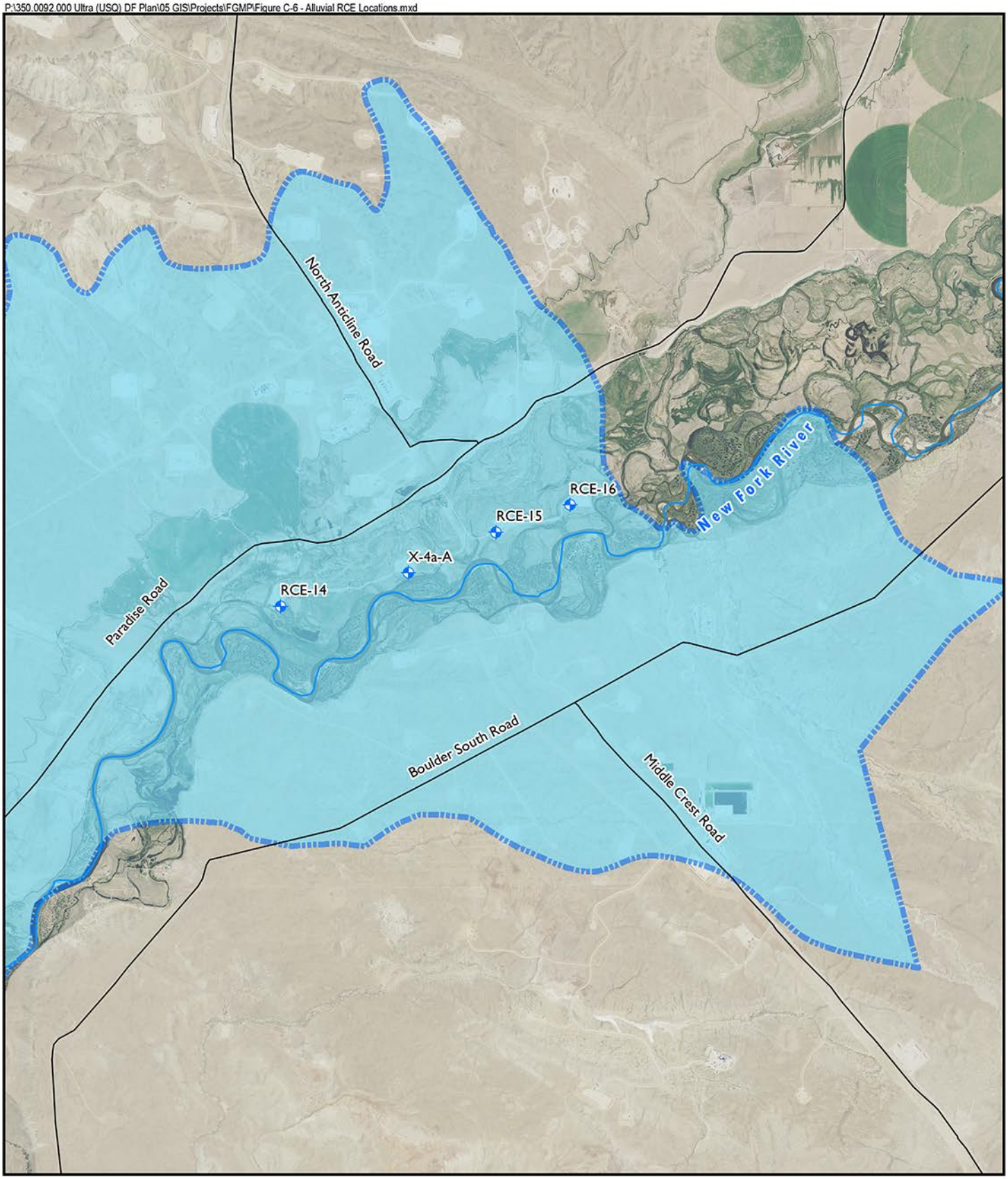
South Zone

Pinedale Anticline Project Area

NewFields

Wasatch HSU Monitoring Locations, South Zone
Pinedale Anticline Project Area
Sublette County, Wyoming
FIGURE 4C-5

P:\350.0092.000 Ultra (USQ) DF Plan\05 GIS\Projects\FGMP\Figure C-6 - Alluvial RCE Locations.mxd



Source: 2013 NRIS

DRAFT

0 4,000 Feet

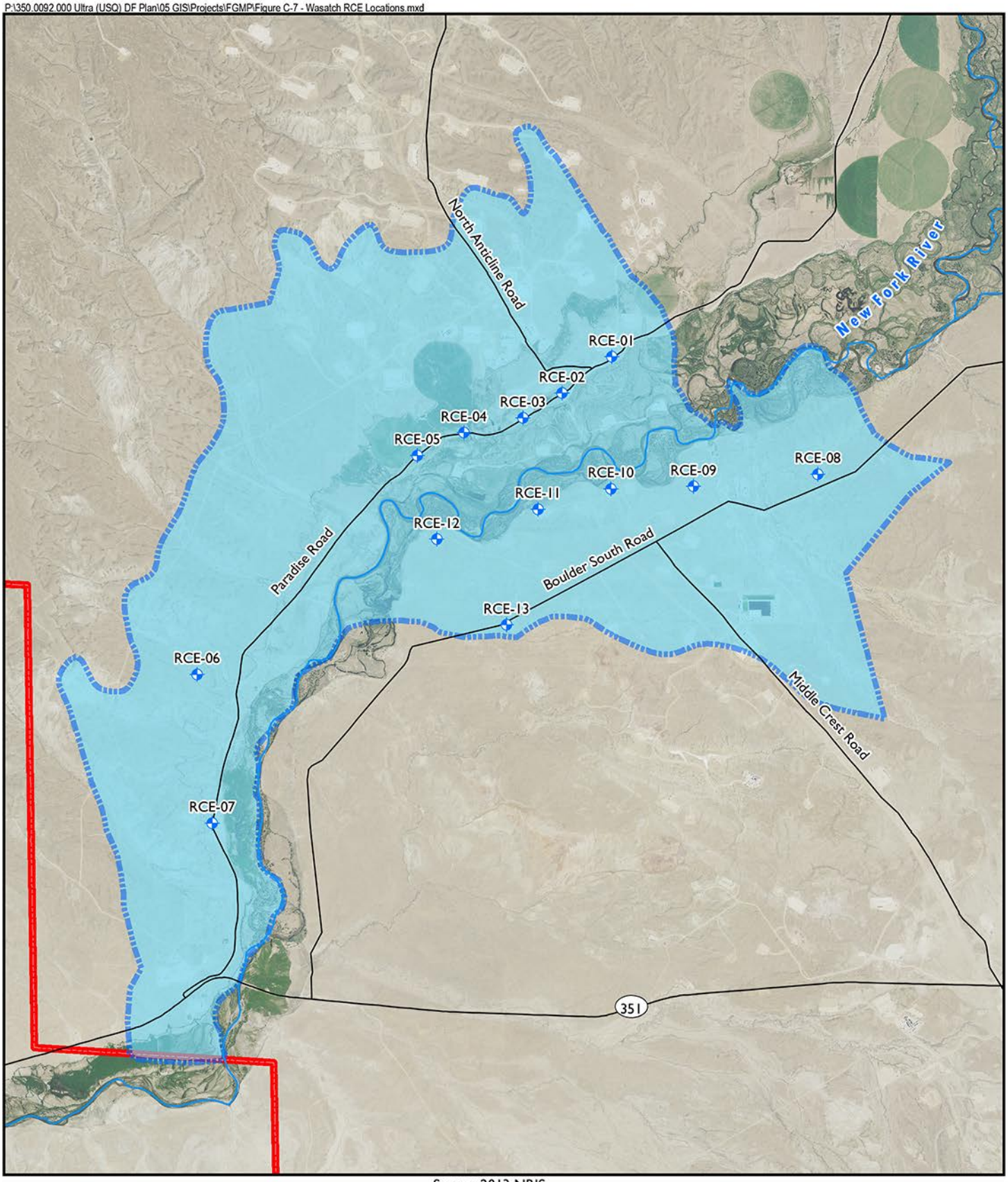
Monitoring Well

River Corridor Envelope

NewFields

Alluvial HSU Monitoring Locations in the River Corridor Envelope
Pinedale Anticline Project Area
Sublette County, Wyoming
FIGURE 4C-6

P:\350.0092.000 Ultra (USQ) DF Plan\05 GIS\Projects\FGMP\Figure C-7 - Wasatch RCE Locations.mxd



Source: 2013 NRIS

DRAFT

Monitoring Well

River Corridor Envelope

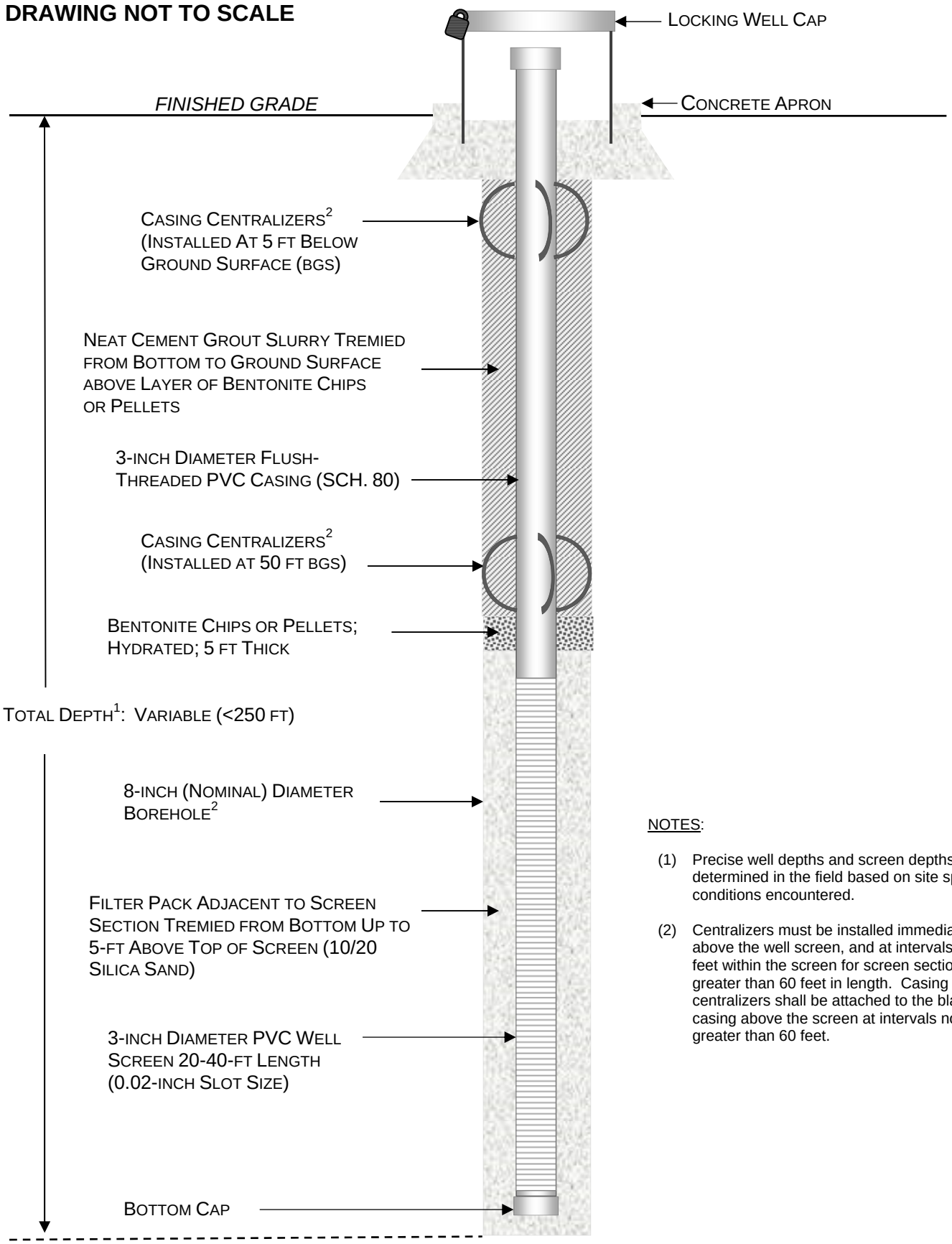
Pinedale Anticline Project Area

0 6,000 Feet

NewFields

Wasatch HSU Monitoring Locations in the River Corridor Envelope
Pinedale Anticline Project Area
Sublette County, Wyoming
FIGURE 4C-7

DRAWING NOT TO SCALE



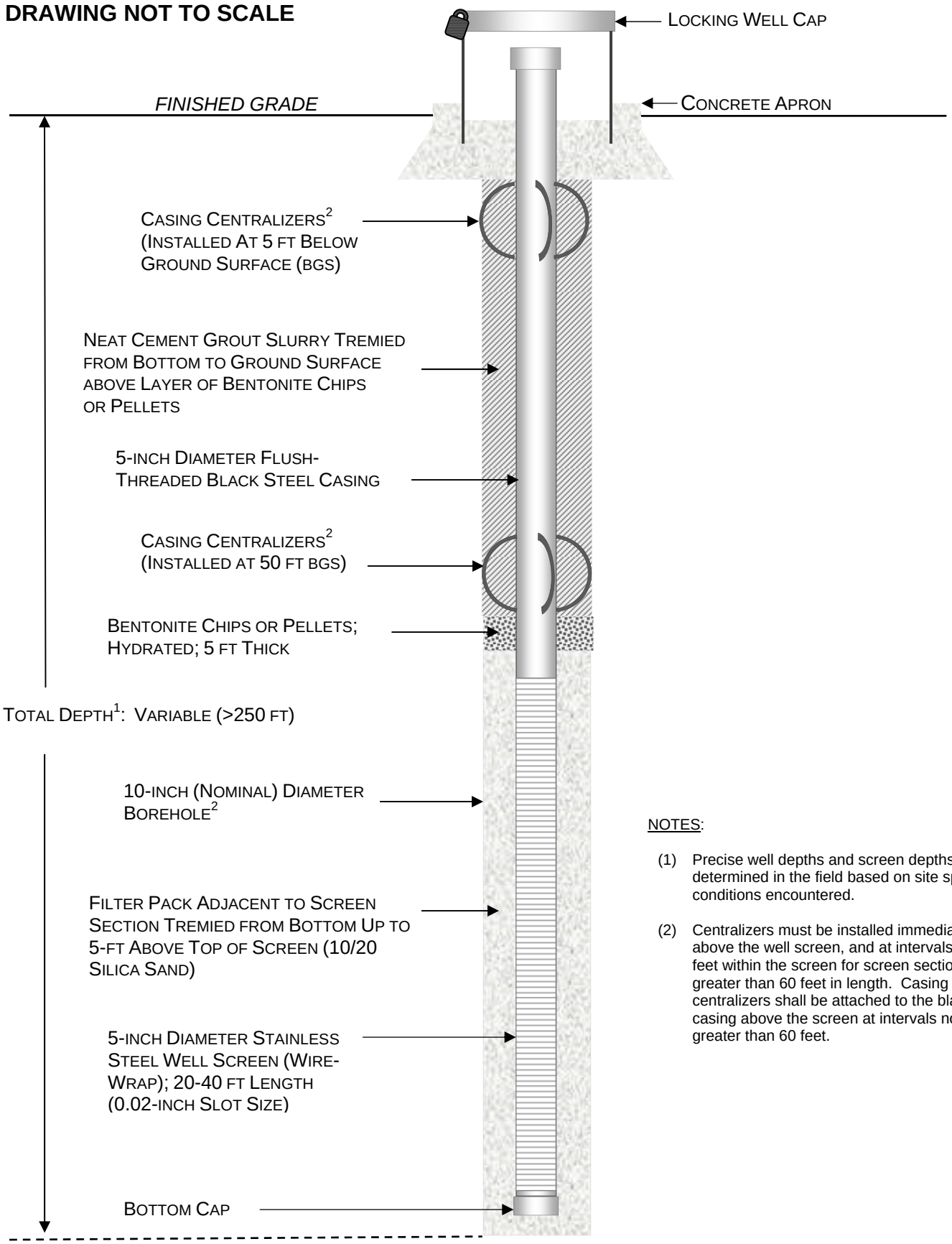
NOTES:

(1) Precise well depths and screen depths will be determined in the field based on site specific conditions encountered.

(2) Centralizers must be installed immediately above the well screen, and at intervals of 30 feet within the screen for screen sections greater than 60 feet in length. Casing centralizers shall be attached to the blank well casing above the screen at intervals not greater than 60 feet.

NewFields	GENERAL 3-INCH DIAMETER PVC MONITORING WELL CONSTRUCTION DETAILS	DATE: 12/02/2014
	Pinedale Anticline Project Area (PAPA), Wyoming	
	FIGURE 4C-8 (DRAFT)	PROJECT: 350.0092

DRAWING NOT TO SCALE



NOTES:

(1) Precise well depths and screen depths will be determined in the field based on site specific conditions encountered.

(2) Centralizers must be installed immediately above the well screen, and at intervals of 30 feet within the screen for screen sections greater than 60 feet in length. Casing centralizers shall be attached to the blank well casing above the screen at intervals not greater than 60 feet.

NewFields	GENERAL 5-INCH DIAMETER STEEL MONITORING WELL CONSTRUCTION DETAILS	DATE: 12/02/2014
	Pinedale Anticline Project Area (PAPA), Wyoming	
	FIGURE 4C-9 (DRAFT)	PROJECT: 350.0092

ANNEX 4C-1

STANDARD OPERATING PROCEDURES (SOP)

DRAFT

STANDARD OPERATING PROCEDURES TABLE OF CONTENTS	
SOP	**TITLE**
1	Field Log Book and Field Sampling Forms
2	Equipment Decontamination
3	Sample Nomenclature, Documentation, and Chain-of-Custody Procedures
4	Sample Packaging and Shipping
5	Field Measurement of Groundwater Level
7	Field Measurement of Electric or Specific Conductance
8	Field Measurement of pH
9	Field Measurement of Dissolved Oxygen
10	Field Measurement of Oxidation Reduction Potential (ORP)
11	Field Sample Filtration
12	Groundwater Sampling
15	Monitoring Well Construction
18	Monitoring Well Development
24	Quality Control Sampling
25	Management of Investigative-Derived Waste
40	Worker Responsibility to Safety
41	Groundwater Sampling for Dissolved Gases
42	Monitoring Combustible Gas in Water Well Casing

SOP-1

FIELD LOG BOOK AND FIELD SAMPLING FORMS

Pertinent field investigation and sampling information should be recorded on a daily field log book and appropriate sampling forms to provide a continual record of actions taken each day on the site. Each employee is responsible for completing a record of the day's activities in a log book and field forms of sufficient detail such that someone can reconstruct the field activities without relying on the memory of the field crew. Field Books will be bound, with consecutively numbered pages and all information must be recorded with permanent ink. If changes need to me made within the field book, a single strikethrough line will be used to mark out incorrect information. Initials of the employee making the corrections and the date of the correction must accompany the strikeout. At a minimum, daily entries on the field log book shall include, as appropriate:

Purpose

To provide guidance on how to document activities completed in the field by NewFields employees

Goal and Objective

To provide a record of our project work and the decisions made in the field

Equipment Needs

Field Note Book
Field Sampling Forms
Permanent Writing Utensils
Camera

- Project and client name
- Date, times and locations.
- Purpose of the field effort
- Names of field crew leader and team members present on the site, and other site visitors
- Description of site conditions and any unusual circumstances, including weather conditions
- Details of actual work performed, particularly any deviations from the field work plan or standard operating procedures
- Location of sample site, including map reference, if relevant
- Field observations including documentations of conditions and procedures used when collecting, handling or treating samples.
- Field measurements made (e.g., PID readings, pH, temperature) on appropriate forms.
- Date and time of initiation and cessation of work.

Specific details for each sample collected should be recorded using NewField's standardized field forms. These field forms contain blank queries to be filled in by field personnel. Items typically recorded on field sampling forms consist of the following:

- Sample name
- Time and date samples were collected
- Number and type (media; natural, duplicate, QA/QC) of samples collected
- Analysis requested
- Sample depth

- Sample preservative (if applicable) and volume
- Sampling method, particularly any deviations from standard operating procedures
- Additional field observations, including collection of field parameters
- Decontamination procedures (if applicable)
- Photo documentation; including a photo board in the photograph with details such as date, time and location or an accompanying photo log with descriptions, dates, and times.
- Signature of sampler

The field log book and field data sheet must be signed on a daily basis by the author of the entry. Upon completion of the field effort, the original field forms will be electronically scanned and both hard copies and electronic documents will be filed in their respective project file. Photocopies of the original field forms can be made and used as working documents.

SOP-2

EQUIPMENT DECONTAMINATION

Decontamination of field equipment is necessary to prevent cross contamination between sites to be investigated and sampling locations on a site. Decontamination should be performed on all non-dedicated and non-disposable sampling equipment that may contact potentially contaminated media.

The following should be done to decontaminate field sampling equipment:

- Set up a decontamination area, preferably upwind from your sampling area to reduce the potential for windborne contamination.
- Don disposal gloves while decontaminating equipment.
- Prior to initiating decontamination, visually inspect sampling equipment for evidence of contamination; use stiff brush to remove visible material.
- Once rough brushing is complete, decontaminate each piece of equipment following a sequential process of washing with Liquinox or an equivalent degreasing detergent; rinsing with distilled water; rinsing with 10% dilute nitric acid; and finally rinsing with distilled water three times. Best procedure is to set up wash tubs for each of the above processes.
- Rinse equipment with methanol instead of nitric acid if sampling for organic contamination.
- Decontaminated equipment that is used for sampling organics should be wrapped in aluminum foil or another inert material if not used immediately.

The following should be done for oversized equipment, such as drilling rigs and excavators:

- Determine whether rinsate generated during decontamination must be containerized. If so, establish a lined decontamination area and move equipment into this area prior to decontamination. If not, decontamination should be done far enough away from the area of sampling so that rinsate generated does not affect future anticipated samples as part of the investigation. The area should also allow for the infiltration of the rinsate into the soil.

- Decontaminate tracks, auger flights, wheels and excavator

Purpose

The purpose of this SOP is to describe general decontamination procedures for field equipment

Goal and Objective

To sufficiently clean field equipment to prevent cross contamination between sites and sample locations

Equipment Needs

5-gallon plastic tubs/buckets

Distilled water

10% Nitric Acid rinse (if metals are COC)

10% Methanol (if organic COC are present)

Liquinox Soap

Hard Bristle Brush

Garbage Bags

Disposable Gloves

Paper Towels

55-gallon drums (optional depending on need to containerize wash water)

Steam cleaning equipment/water truck

buckets using a high pressure washer, preferably using hot water.

All disposable items (e.g., paper towels, latex gloves) should be deposited into a garbage bag and disposed of as Class II common refuse, unless you are investigating a site known to contain hazardous wastes. Check with the project manager before initiating investigation to confirm proper handling of disposable items. Handling and disposal procedures for the rinse and wash water will depend on the likely presence and type of contaminant in the wash water. The project Field Sampling Plan should be reviewed to determine the process for handling wash water.

If equipment rinse blank samples are to be collected as part of quality control procedures, they should be collected from decontaminated sampling equipment in accordance with the project-specific Field Sampling and documented in accordance with SOP # 1.

A list of equipment for decontamination is provided above (text box). The amount of dissolved water and rinse solutions needed on site will depend on the number of samples to be collected and the sampling methods. For this reason, equipment needs should be evaluated prior to going in the field.

SOP-3

SAMPLE NOMENCLATURE, DOCUMENTATION, AND CHAIN-OF CUSTODY PROCEDURES

When completing sampling it is critical that the process used to label and transport samples to the laboratory for analysis is sufficient to demonstrate with confidence that the samples were collected from the location indicated, and that during transport to the lab no actions were taken to potentially alter the integrity of the samples. Without following strict sample labeling and chain-of-custody procedures, analytical data collected at a site has little to no value.

SAMPLE NOMENCLATURE

Samples should be labeled in such a way to allow a person unfamiliar with the site to understand where the samples were collected. Samples should be labeled sequentially as follows:

> Location initials - sampling method and site number – sample type - sample depth.

For example, the sample P3-TP1-SB-12, indicates the sample was collected in Pond 3 (P3), test pit number 1 (TP1), it was a sub-surface soil sample (SB), and that was collected at 12 feet below ground. Additional qualifiers can be added after this initial labeling such as composite or grab to identify it as a composite or grab sample.

Newly installed groundwater monitoring wells will be named by the field oversight person, and include NF for NewFields, followed by a designation of the well type (MW) for monitoring well, and a well number. An example groundwater sample name would be: NFMW1.

Prior to initiating sampling, field personnel should familiarize themselves with the Field Sampling Plan and the nomenclature to be used for the site. The character prefixes in the table below are recommended for sample types.

Purpose

To identify the specific requirements for labeling and documenting sample collection

Goal and Objective

To increase the confidence in sample locations and to submit samples to the laboratory without risk of integrity loss

Equipment Needs

Indelible ink pen

Chain-of-custody forms

Field Log Book

Field Sampling Form

SAMPLE DOCUMENTATION

In addition to the chain-of-custody forms discussed below, field person must keep a list of samples collected in the field in the field log book and on appropriate field sampling forms. This allows you to go back and verify sample locations and numbers should there be any confusion at a later time. Upon returning to the office, the field log book and forms should be kept in the project file and subsequent copies sent to the laboratory, or other designated parties, as needed.

Each person in the field is responsible for putting entries into the field log and sampling forms. Designating an individual from the sampling team for record keeping is fine, provided all field personnel come to an agreement as to who this will be, and the field crew leader is certain field personnel are familiar with the record keeping requirements. All entries on the log book and field sampling forms must be made in indelible ink.

Sampling Acronym	Label
EB	Equipment Blank
TB	Trip Blank
FB	Field Blank
MW	Monitoring Well
DW	Domestic Well
IW	Injection Well
OB	Observation Well
UST	Underground Storage Tank
VE	Vapor Extraction
AA	Ambient Air
SUMP	Sump (Water sample)
P	Pond
SPR	Spring
SE	Sediments
SW	Surface Water, Stream or River
SR	Surface Runoff
TP	Excavated Test Pit
BH	Borehole
SS	Surface Soil Sample
SB	Subsurface Soil Sample
GW	Groundwater Sample

CHAIN OF CUSTODY PROCEDURES

A chain-of-custody form must be generated for all samples collected in the field for laboratory analysis. Samples from more than one project should not be included on the same chain of custody; however, multiple samples from a specific project can be included on the same custody form.

Copies of the chain-of-custody form should be maintained in the project file. The sampler may use a NewFields' chain-of-custody form or a chain- of-custody form provided by the laboratory. Sample custody records must be maintained from the time of sample collection until the time of sample delivery to the analytical laboratory and should accompany the sample through analysis and final disposition. The information to be included on the chain-of-custody form will include, but is not limited to:

- Project number/site name
- Sampler's name and signature
- Date and time of sample collection
- Unique sample identification number or name

- Number of containers
- Sample media (e.g., soil, water, vapor, etc.)
- Sample preservative (if applicable)
- Requested analysis
- Comments or special instructions to the laboratory

Each sample must be assigned a unique sample identification number as described above. The information on the chain-of-custody form, including the sample identification number, must correspond to the information recorded by the sampler on the field forms and field log book and the label on the sample container.

A sample is considered under a person's control when it is in their possession. When custody of a sample is relinquished by the sampler, the sampler will sign and date the chain-of-custody form and note the time that custody was relinquished. The person receiving custody of the sample will also sign and date the form and note the time that the sample was accepted into custody. The goal is to provide a complete record of control of the samples. Should the chain be broken (signed by the relinquished but not receiver or vice versa), the integrity of the sample is lost and the resulting analytical data suspect. Samples must be shipped to the analytical laboratory following the procedures described in in SOP-4. If an overnight shipping service is used to transport the samples to the laboratory, custody of the samples must be relinquished to the shipping service. If possible, have the shipping service sign the chain-of-custody form prior to placing the chain of custody in the sample cooler. If this is not possible (i.e. form placed in the sealed cooler), a note should be included on the chain of custody that the shipping company has received the samples with the chain of custody inside the cooler.

SOP-4

SAMPLE PACKAGING AND SHIPPING

SAMPLE PACKAGING

Samples must be packaged to preclude breakage or damage to sample containers, and shipped under chain of custody, complying with shipper, U.S. EPA, and U.S. DOT regulations. When packaging samples:

- Chain of custody procedures must be strictly adhered to. This applies to sample collection, transportation, shipment and laboratory handling. The COC will provide documentation from collection to analysis.
- Use sample labels from the laboratory whenever possible. Place the sample label on the side of the sample container and use indelible ink when completing the label. Sample containers should be new and stored in an environment free from dust, dirt and fumes.
- Sample should never stand in the sun. After collection and preservation, place labeled sample bottles in a high quality cooler. Place the samples in an upright position inside the cooler and wrap the samples with cushioning material for protection during transport. The cooler should be able to withstand tough handling during shipment without sample breakage.
- Make sure the cooler has an adequate amount of "wet" or "blue" ice (inside sealed Ziploc bags) at all times containers or in them and make sure ice volume is sufficient and appropriate for the season in order to maintain a temperature of 4°C or less inside the cooler from the time the samples are placed in the cooler until they are received by the laboratory. When in doubt put in more ice. Ensure the cooler drain plug is taped shut.
- Fill out the appropriate chain-of-custody forms and place them in a Ziploc bag and tape it to the inside lid of the shipping container. If more than one cooler is used per chain of custody, put a photocopy in the other coolers and mark them as a copy. Commercial carriers are not required to sign the COC, but the tracking number and name of the carrier should be documented on the original cahin-of-custody.
- Close and thoroughly secure the cooler with packing tape.

Purpose

To ensure samples are properly packaged for shipment to the analytical laboratory

Goal and Objective

To have samples received by the analytical laboratory in good condition and within EPA temperature thresholds

Equipment Needs

Indelible ink pen

Chain-of-custody forms

Custody Seals

Sample Labels from Lab

Coolers and Ice

Field Sampling Form

Packing Tape

Bubble wrap/absorbent pads

- Place completed sample custody seals on the outside of the cooler such that the seals will be broken when the cooler is opened. Secure the custody seals on the cooler with clear strapping tape.
- Secure a shipping label with address, phone number, and return address on the outside of the cooler where it is clearly visible. Shipping samples should be coordinated and scheduled to prevent exceeding of hold times or temperature requirements of analytical tests. Check with the lab if there are questions regarding holding times. If Saturday delivery is necessary, confirm with the lab that they will be able to receive the sample delivery before it is shipped.

SHIPPING HAZARDOUS MATERIALS/WASTE

Transportation regulations for shipping of hazardous substances and dangerous goods are defined by the U.S. DOT in 49 CFR, Subchapter C, Part 171 (October 1, 1988); IATA and ICAO. These regulations are accepted by Federal Express and other ground and air carriers.

According to DOT regulations, environmental samples are classified as Other Regulated Substances (ORS). ORS are articles, samples, or materials that are suspected or known to contain contaminants and/or are capable of posing a risk to health, safety, or property when transported by ground or air. Samples, substances, or materials from sources other than material drums, leachate streams, or sludge, should be considered as ORS or environmental samples. Materials shipped under the classification of ORS must not meet any of the following definitions:

Class 1: Explosives; Class 2: Gases- compressed, liquefied, dissolved under pressure, or deeply refrigerated; Class 3 Flammable Liquids; Class 4: Substances susceptible to spontaneous combustion; Class 5: Oxidizing substances; Class 6: Poisonous (toxic and infectious); Class 7: Radioactive materials; Class 8: Corrosives.

If your samples might meet any of the above definitions, contact the project manager to obtain instructions on sample shipment.

SOP-5

FIELD MEASUREMENT OF GROUNDWATER LEVEL

Purpose

To ensure groundwater levels are accurately measured in the field

Goal and Objective

To accurately measure water levels in the field, and prevent cross contamination during water level measurement

Equipment Needs

Water Level Indicator

Extra set of batteries

Indelible Ink Pen

Field Sampling Form

Decontamination supplies (as necessary)

Keys (if necessary)

FIELD PROCEDURE

- Verify the water level indicator is operating correctly prior to leaving for the field by placing probe in water to test the buzzer and light. Repair as necessary. Make certain the meter and extra batteries are in the carrying case.
- Prior to collecting a measurement, decontaminate the water level indicator (see SOP-2) as appropriate. Note any repairs or modifications to water level meter measurements on field forms.
- All well measuring points should be surveyed and permanently marked. Measure and record the distance from the measuring point to ground level. If the measuring point is not marked, measure from the north side of the well and note the location on appropriate field forms. Also mark the location on the outside of the casing near the rim for future measurements.
- If free product is known or suspected to be present in a well, an oil-water level indicator or other method must be used to measure the depth to water and the thickness of free product in the well, as described in SOP-6.
- If no free product is suspected, measure the depth to water from the measuring point to the nearest hundredth of a foot.
- Record measurements on the appropriate field forms. Also record the presence/absence of free product on the field forms.
- Decontaminate the water level meter between each measurement following the procedures in SOP-2.
- Replace well caps and lids, re-lock wells (if necessary)

Notes: If air light well caps are used and pressure or a vacuum seal is noted when removing the well cap, ensure that the well has sufficient time to equilibrate before water levels are measured and recorded. If upon opening the well cover water is found in the well monument, this water must be removed prior to opening the well cap and measurement.

SOP-7

FIELD MEASUREMENT OF ELECTRIC OR SPECIFIC CONDUCTANCE

Purpose

To ensure measurement of specific conductance is done consistently and correctly in the field

Goal and Objective

To obtain accurate specific conductivity measurements in the field

Equipment Needs

Specific Conductivity Meter

Calibration Standard

Measurement container

Extra set of batteries

Indelible Ink Pen

Field Sampling Form

INSTRUMENT CALIBRATION

The conductivity meter should be inspected and calibrated prior to each sampling event following the manufacturer's recommendations. If the instrument is a multi-parameter meter, follow the instructions for measurement of electric or specific conductance from the manual.

Prior to calibrating the field meter, the expiration date on the conductivity calibration solution should be checked. If the standard has expired, it should be discarded.

During calibration the standard value and units should be recorded on the apropriate field form, in addition to the meter reading.

Prior to conducting field measurements, verify the meter automatically corrects for temperature variations. If the meter does not, apply the appropriate temperature correction to the field measurements.

FIELD MEASUREMENT PROCEDURE

Rinse a decontaminated glass container or plastic flow-through cell with sample water.

Fill the container or flow-through cell with sample water, with enough available space to insert the probe without undesired overflow of the container.

Rinse the conductivity or multi-parameter probe with deionized water and place it in the beaker of sample water. Immerse the probe in beaker and move it around to displace any air bubbles. Keep the probe tip off of the sides of the beaker. Record the conductivity reading. Be sure to recognize the units of the reading (i.e. microseimens/centimeter (µs/cm), micromhos/centimeter (µmhos/cm), or milliseimens/centimeter (ms/cm). Record the reading on the field sampling form and filed log book. If the reading is being taken in-situ or using a flow-through cell, record the reading at time intervals until the reading stabilizes and samples are collected.

Remove the probe from sample and decontaminate probe. Store the probe following the manufacturer's recommendations.

SOP-8

FIELD MEASUREMENT OF PH

INSTRUMENT CALIBRATION

The pH meter must be calibrated prior to each daily field event, or more frequently if required by the project/client. Follow the manufacturer's recommendations to calibrate. Inspect the probe daily for damages or defects. A three-point calibration should be completed (unless meter manual specifies otherwise), using pH standards 4.0, 7.0 and 10.0. If instrument is a multi-parameter meter, follow the instructions for measurement of pH from the manual.

Prior to calibrating the field meter, the expiration date of the calibration solutions should be checked. If the standard has expired, it should be discarded. During calibration the standard value and units should be recorded on the appropriate field form, in addition to the meter reading.

Periodically throughout the field day, place the probe in 7.0 pH buffer solution. If the measured value differs from the expected value by more than 0.1 pH units, recalibrate the meter according to the manufacturer's instructions.

Purpose

Provide guidelines for pH measurements in water samples

Goal and Objective

To obtain accurate pH measurements in the field

Equipment Needs

pH Meter

Calibration standards

Glass container or flow-through cell

Extra set of batteries

Indelible Ink Pen

Field Sampling Form

FIELD MEASUREMENT PROCEDURE

- Rinse a decontaminated glass beaker or plastic flow-through cell sample water three times.
- Rinse the pH probe with deionized water.
- Fill the container with sample water.
- Immerse the probe in the sample and agitate it to provide thorough mixing. Continue to agitate until the reading has stabilized. Read the pH to the nearest 0.1 s.u. and record on the field sampling form. If the reading is being taken using a flow-through cell, record the readings until they stabilize prior to sample collection. If the measurement is taken in-situ, wait until the reading has stabilized then recorded it on the field form.
- Note any problems such as erratic readings. If previous readings are available, compare the current measurement to previous reading to check that the current reading is within reasonable limits.
- Rinse probe with deionized water, decontaminate as necessary and store according to the manufacturer's instructions.

SOP-9

FIELD MEASUREMENT OF DISSOLVED OXYGEN

FIELD MEASUREMENT PROCEDURE

Before each use, clean and rinse the electrode tip with distilled water. Verify that the membrane cap has been filled with DO electrolyte in accordance with manufacturers required maintenance schedule (does not apply if measurement uses and optical DO probe). Visibly check the meter for damage or defects, and cleanliness.

Calibrate the probe and meter using the fresh water-air calibration method described in the manufacturer's manual. Correct the calibration value for temperature and altitude and adjust the meter accordingly. Record all calibration measurements and units on field forms. Note: Sensor can maintain polarization when disconnected from the meter for up to three hours.

Place probe the directly into the stream or well to be measured. If not possible, place the probe into a flow-through cell (must fill flow cell from the bottom, for accurate DO) receiving a continuous stream of water from the source being measured. Does not measure DO in a container of sample water extracted from a well. Allow sufficient time for the probe to stabilize to sample temperature and dissolved oxygen concentration. Record the dissolved oxygen value on the appropriate field forms. Decontaminate probe when measurement is complete.

If the sensor will not calibrate, becomes sluggish or erratic:

- Clean tip and refill cap with DO electrolyte in accordance with manufacturer's instructions (typically care must be taken to eliminate air bubbles from inside probe, and probe tip must be scarified using manufacturer-provided sandpaper).
- Check membrane for damage, replace if necessary.
- Check meter with test plug.
- Replace battery.

Purpose

Provide guidelines for Dissolved Oxygen measurements in water samples

Goal and Objective

To obtain accurate dissolved oxygen measurements in the field

Equipment Needs

Dissolved Oxygen Meter

Distilled water

Calibration cup

Extra set of batteries

Indelible Ink Pen

Field Sampling Form

SOP-10

FIELD MEASUREMENT OF OXIDATION REDUCTION POTENTIAL (ORP)

Purpose

Provide guidelines for Redox Potential measurements in water samples

Goal and Objective

To obtain accurate Redox Potential measurements in the field

Equipment Needs

Redox Potential Meter

Distilled water

Calibration solution with table of temperature adjustment information

Extra set of batteries

Indelible Ink Pen

Field Sampling Form

FIELD MEASUREMENT PROCEDURE

- Calibrate the meter in accordance with the manufacturer's instructions prior to each daily sampling event. Inspect the meter for damage, defects and cleanliness.
- Prior to calibrating the field meter, the expiration/preparation date of the calibration solution should be checked. If the standard has expired, it should be discarded. During calibration the standard value and units should be recorded on the appropriate field form, in addition to the meter reading. Make sure the calibration input is correct for the ORP solution and temperature by verifying it with the calibration solution manufacturers supplied table.
- If possible, obtain an in situ measurement of ORP in an effort to minimize agitation of the sample and limit exposure to oxygen. If not possible, use a flow-through cell that receives a constant stream of water from the well. If a flow-through cell is not available, ORP measurements can be taken of sample water placed in a glass container or beaker.
- All sampling equipment should be decontaminated it in accordance with SOP-2.
- If collecting a sample in-situ or in a flow through cell, place the ORP probe into the cell or the water.
- If using a beaker, rinse the ORP electrode with distilled water and then with sample water prior to inserting it into the sample beaker. Immerse the ORP electrode in the beaker and allow at least one minute for the probe to equilibrate with the water. Obtain a reading to the nearest ten millivolts.
- Record the reading on standardized field forms and the field book. Note any problems such as erratic or drifting readings.
- Decontaminate the probe following the SOP-2, store probe in accordance with manufactures specifications.

SOP-11

FIELD SAMPLE FILTRATION

FIELD PROCEDURE

- Set up a system whereby water samples can be filtered, including a disposable filter apparatus and use of a pump (peristaltic, hand-vacuum or other suitable pump) to force water under pressure through the filter.
- To avoid the need for decontamination, use disposable tubing, filters and equipment when possible.
- When collecting a grab sample of water collect the groundwater or surface water using a decontaminated bailer or similar sampling device and place water into a decontaminated vessel that can be pressurized to force the water through a disposable 0.45 micron filter.
- If a groundwater sample is being collected using a submersible pump, the submersible pump can be used to push the water through the filter.
- Filtered effluent should be placed directly into appropriate laboratory supplied sample containers and capped. Add preservative as necessary prior to capping.
- Invert sample container several times to insure complete sample-preservative mixing.
- Place sample into cooler; package and ship accordance with SOP-4 concerning shipping.
- Decontaminate, if necessary, all equipment in accordance with the SOP concerning decontamination.

  Note: If extremely turbid sample water is obtained, you may need to pre-filter the sample using 3.0 or 5.0 micron filter paper followed by 0.45 micron filtration.

Purpose

Provide guidelines for filtering water samples in the field

Goal and Objective

To employ a method of filtering samples in the field, thus removing sediment from the sample and allowing for analysis of dissolved components in the sample

Equipment Needs

0.45 micron disposable filters

3.0 and 5.0 micron disposable filter paper (if necessary)

Disposable peristaltic tubing (if using a peristaltic pump)

Pump (peristaltic or other)

Preservatives, as required

Indelible Ink Pen

Field Sampling Form

SOP-12

GROUNDWATER SAMPLING

Prior to initiating groundwater sampling, all equipment should be inspected for damage and repaired. Check with the project manager to be sure you understand what type of pump or sampling device will be used to purge and sample groundwater. Equipment to be placed down hole must be decontaminated. Always sequence groundwater sampling by beginning with the well containing the lowest level of contamination, sample wells in succession based on anticipated increasing concentrations. If the relative degree of concentrations cannot be determined, wells should be sampled in order of increasing proximity to the suspected source of contamination, preferably from the perimeter towards the source.

SAMPLING FROM TEMPORARY BOREHOLES

If samples are to be collected from temporary boreholes, a temporary well screen (PVC or stainless steel) should be placed in the borehole when feasible, and the water level should be measured prior to sampling. If it is not feasible to set temporary well screen, collect the sample initially into unpreserved, laboratory-provided ultraclean containers, then filter the sample using a 3.0 or 5.0 micron filter prior to placement in the final sample container to remove excess turbidity.

When sampling from a temporary well screen, also use either new tubing (LDPE or Teflon) with a stainless steel foot valve, or use a new/decontaminated bailer. Note the physical appearance of the sample (color and qualitative turbidity) on the field sampling form. Where feasible, avoid sampling from the bottom 1-foot of the borehole or well screen to minimize entrainment of sediment into the sample.

WELL PURGING

Purging must be performed on all wells prior to sample collection in order to obtain a representative groundwater sample.

Before purging each well, measure and record the depth to groundwater from the top of the well casing to the nearest 0.01 foot using a water level meter in accordance with SOP-5. If sampling at a site where there may be free product, wells shall be checked for the presence of free product prior to purging and

Purpose

Provide guidelines for sampling groundwater

Goal and Objective

To employ a method of collecting groundwater samples representative of the chemistry of the underlying aquifer

Equipment Needs

Five gallon bucket graduated in gallons

Purge/sampling pump(s)

Oil-Interface Probe, as necessary

Water Level Meter

pH, temperature, and conductivity meter

Filtering apparatus and pump (if filtering samples)

Sample Containers

Preservatives, as required

Field Sampling Forms

Decontamination equipment and fluids

Tubing, as needed

Generator or power supply (if necessesary)

Coolers and Ice

Stop Watch

Rope and Bailer, for backup

sampling using an oil-interface probe in accordance with SOP-6.

Determine the well casing volume. To do so, first determine the saturated thickness in the well by subtracting the total well depth from the depth to groundwater. The following equation should used to calculate well casing volume in gallons. Be sure to record all calculations on field forms or in a field book in accordance with SOP-1:

V=3.14*(r2)*d*7.48 where V= volume (gallons)
r= well radius, feet
d= depth of water in well (feet)

The radius should be the radius of the well borehole, not the well casing radius. For example, for a 2" PVC monitoring well installed in a 6" borehole, the radius is 3" or 0.25 feet.

To obtain a representative sample of groundwater, monitoring wells shall be purged of a minimum of three casing volumes and when water quality parameters (pH, temperature, and conductivity) have stabilized. Field parameters should be measured during well purging at least two times per casing volume purged and recorded on standard field forms. Stabilization is achieved when pH readings stabilize to within 0.1 and temperature and conductivity stabilize to within 5% over a casing volume, at which point samples can be collected. If water quality parameters fail to stabilize, a minimum of 6 well casing volumes should be removed. If the well purges dry (wells installed in tight clays or silts), samples should be collected after the well fully recharges to pre-sampling water elevations. At no time should a monitoring well be pumped dry if the recharge rate causes formation water to cascade down the well casing causing an accelerated loss of volatiles and change in pH.

Several general methods can be used for well purging. Well purging may be achieved using bailers, bladder pumps and submersible pumps. The specific pumping method shall be chosen based on depth to groundwater, diameter of well, site lithology, existing well configuration and contaminant(s) of concern.

All pumps and purging equipment will be examined for damage and cleanliness prior to use. Ensure all equipment is new or properly decontaminated in accordance with SOP-2 prior to putting it down a well. If wells are sampled on a regular basis, dedicated sampling equipment may be used. Use extra care when using dedicated equipment to ensure it remains correctly labeled and is not exposed to cross contamination.

Purge water must be handled in accordance with SOP-25 for investigative-derived wastes. For water that is discharged directly to the ground, attention must be given to avoid direct recharge of shallow wells with the purge water. Purge water must be discharged down gradient and at an adequate distance from the well to avoid mounding and interference.

COLLECTING GROUNDWATER QUALITY SAMPLES

Groundwater samples should be collected after field parameters have stabilized.

Label each sample container with project number, sample location, well owner, date, military time, sampler's initials, preservative, and analysis required in accordance with SOP-3.

Don clean latex or nitrile gloves immediately prior to obtaining the sample.

Obtain the sample from the well using a disposable polyethylene bailer, a decontaminated stainless steel or Teflon bailer, or pump and tubing (submersible, bladder, peristaltic, etc.), as appropriate. The pump to be used should be determined by the contaminants of concern, so check with the project specific field sampling plan or the project manager. If using an bladder pump or hydrosleve to obtain groundwater samples, please see the Hydrosleve and Bladder Pump specific SOP. The pump or bailer intake should generally be placed at the midpoint of the saturated thickness in the casing for sampling (within the screened interval). If the well is pumped dry during the purge, the pumping rate shall be reduced to match well yield if possible and a note made on the sampling form. When using a bailer, take care to minimize degassing or contamination of the sample by submerging and withdrawing the bailer slowly to avoid splashing. Do not place the bailer on the ground.

When sampling a monitoring well, add preservatives to the sample container prior to sample collection (this is often done by the analytical laboratory). Remove water from the well and transfer sample water directly into sample bottles or filter apparatus (should filtering be necessary see SOP-11), maintaining a slow linear flow with as little agitation as possible. For volatile analyses, fill container vials at the rate of 100 milliliters per minute (24 seconds for 40 milliliter vial) or less. Fill each sample vial completely so the water forms a convex meniscus at the top to ensure no air space exists in the vial after it has been capped. After filling, immediately cap, invert, and gently tap the vial to check for trapped air. If air bubbles are present, un-cap vial, add more sample water and repeat procedure. If air bubbles are still present, discard the vial.

When sampling a domestic well connect a hose to the outside fixture to direct water away from the home to an area where the water can soak into the ground. Turn on the faucet and let it run for 60 minutes. Turn flow rate down and collect a water sample in appropriate containers, as described above. Make sure to add preservatives to the sample containers prior to filling them, in accordance with the table below.

Samples should be preserved as described in the table below.

Parameter	Number	Container	Preservation	Maximum Holding Time Extraction/ Analysis
VOCs	2	40 ml glass	4°C & HCL	14 days to analysis
SVOCs	1	1 liter glass	4°C	7 days/40days from extraction to analysis
Metals	1	500 ml HDPE	4°C & HNO_3	6 months to analysis,, Hg 28 days to analysis
Nutrients	1	500 ml HDPE	4°C & H_2SO_4	Varies – contact laboratory for additional information
Common Ions	1	1 liter HDPE	4°C	7 days/40 days from extraction to analysis

Be sure to properly cap and lock the well when sampling is complete.

Be sure to complete the necessary shipping and handling paperwork in accordance SOP-04, and record all pertinent information on Field Sampling Forms, SOP-1. Samples should be maintained under Chain of Custody record at all time from sample collection to lab analysis.

SOP-15

MONITORING WELL CONSTRUCTION

Monitoring well construction specifications may differ from those listed in this SOP. The site specific Fields Sampling Plan (FSP) should be consulted prior to any well installation to ensure objectives are met.

MONITORING WELL CONSTRUCTION

- Arrive on site with the appropriate decontaminated drilling equipment and materials for site conditions. Be sure to review the FSP to determine anticipated lithology. Drilling method, filter pack and well-screen slotting should be predetermined and based on the site lithology.
- Ensure that the driller has properly decontaminated all drilling equipment and materials prior to arrival on site, in accordance with SOP-2.
- Many states now require certification and licensing for monitoring well drillers. Verify the driller is licensed in the State (if required) prior to beginning fieldwork.
- Safety equipment required drilling is mandatory. All Newfields personnel must comply with the site-specific HASP and SOP-40.
- Acceptable drilling techniques for the installation of monitoring wells include air- rotary, cable tool, and hollow-stem auger. If unconsolidated material is encountered, it may be necessary to drive steel casing during drilling to maintain borehole integrity.
- Appropriate decontamination of drilling equipment between well installations is required and should be completed in accordance with SOP-2. Cross contamination of water bearing zones by drilling must be avoided.
- Drilling mud or drilling solutions of any kind are not to be used during drilling activities in conjunction with monitoring well construction.
- Investigation derived waste protocols outlined in the FSP must be followed.
- Subsurface samples shall be collected by the driller at intervals specified in the FSP. Down-hole soil samples should be collected in accordance with SOP-14.
- A detailed lithologic boring log must be completed by field staff during drilling activities on standard lithologic field forms with additional notes detailed in the field book (SOP-1). Soils

Purpose

Provide guidelines for installing monitoring wells in the field

Goal and Objective

To employ a standard method of installation monitoring wells, which will allow for collection of representative groundwater samples

Equipment Needs

Drilling system

Well completion material (screen, filter pack, borehole seal, and surface seal) consistent with anticipated lithology

Hand lens (10) power

USGS Soil Classification Chart and Munsel color book

Latex or Nitrile gloves

Boring Log and field book

Field forms and field book

should be described on the log according to the procedures outlined in the United Soil Classification System (USCS; method ASTM D2487) or the Soil Conservation Service (SCS) classification system. Soil texture should be classified by either the USCS or the U.S. Department of Agriculture (USDA) classification, if necessary. Water bearing characteristics of the formations should also be noted on the log. In addition, details of monitoring well construction should be described on the well log including total depth, perforated interval, sizes, depths, and types of construction materials, etc.

- When completing the well, install factory slotted well screen (size dependent on lithology, length is dependent on site conditions) and blank flush threaded PVC well casing unless other specified in the FSP. Thickness of PVC (schedule 40 vs schedule 80) will be dependent on depth of well instillation, and as defined in the FSP.
- After borehole is drilled and well is positioned in the borehole by the driller, emplace chemically inert silica sand in the annular space from well depth to a minimum of 2 feet above the perforated screening of the casing. Measure placement of sand with a tag line to ensure property placement. The silica sand or filter pack should be sized based on the screen slot size and aquifer characteristics.
- Above the filter pack the well must be sealed with bentonite to a minimum thickness of 3 feet from ground surface, and hydrated with clean, potable water. Backfill remaining well annulus with bentonite slurry (cement grout with bentonite) or grout to the ground surface.
- Develop the well (SOP-18) prior to collecting groundwater samples (SOP-12).
- Place locking protective well monument (stick-up or flush-mount) over well casing(s) after outer steel casing has been removed from the borehole. Grout cover in place and lock with high quality lock.
- Mark groundwater depth measuring point on north side of well casing with permanent marker.
- Well location and top of casing elevation should be surveyed to 0.01 ft.

BOREHOLE ABANDONMENT IN EVENT WELL CANNOT BE COMPLETED

- If for some reasons attempts to install a well fail, the borehole must be properly abandoned. To abandon a borehole, bentonite pellets or bentonite grout or slurry should be introduced into the borehole as the auger flights or well casing is extracted. If bentonite pellets are used, at periodic intervals of not less the every 3 feet of casing extraction, the bentonite should be hydrated with potable water. Bentonite pellets or slurry should be placed in the boreole to ground surface.

SOP-18

MONITORING WELL DEVELOPMENT

FIELD PROCEDURE

After well installation and prior to sampling of a monitoring well, the well must be developed to remove excess fines and set the filter pack installed during well construction. Multiple techniques exist for development of a well, but the goal should be to extract enough groundwater from the well until clean (non-turbid) water is produced from the well. General steps to well development are discussed below.

Purpose

Provide guidelines for developing monitoring wells

Goal and Objective

To ensure wells are sufficiently developed prior to sampling

Equipment Needs

Decontamination equipment and fluids

Latex or Nitrile gloves

Well Development Form

Multi parameter meters

Surge block/bailer/pump

Air compressor/air line

- Visually inspect all well development equipment for damage and repair, as necessary.
- Decontaminate all stingers, air hoses, surge blocks that will be placed downhole following SOP-2.
- Generally a minimum of ten casing volumes is needed to properly develop a well. A well is considered developed when field parameters (pH, temperature and conductivity) have stabilized and the turbidity has dropped below 10 NTU.
- Turbidity readings and field parameters should be recoded periodically throughout the development process. Clarity of water (turbidity and color) after development and volume of water removed during development of the well should be recorded on well development forms (SOP-1).
- Report field observations on well development form including:
  1. Volume of water removed during purge
  2. Date and time (duration) of development
  3. Depth to water, pre and post development
  4. Pumping depth
  5. Yield and field parameters collected at set time intervals.
- Evacuated water should be disposed of following to the process defined in the FSP for derived wastes and may need to be treated as investigation derived wastes (SOP-25).

PURGING UTILIZING DRILLING EQUIPMENT-COMPRESSED AIR

- If using a compressed air method for well development, verify the compressor utilized does not produce air laden with hydraulic fluid for lubricating purposes. This may affect the integrity of the monitoring well for producing viable water quality data.

SURGING AND PUMP TECHNIQUES

- Monitoring wells can be effectively developed using surging and pump techniques. A surge block or bailer is commonly used to remove entrained sediment and set the well casing followed by evacuation of water and sediment using a pump or bailer. To employ this method, place the surge block or bailer in the well and lower to bottom. Move the surge block or bailer up and down over the entire length of the well screen several times. Remove the surge block and bailer and evacuate water from the well. Repeat this procedure until evacuated water is visibly clean and free of sediment.

SOP-24

QUALITY CONTROL SAMPLING

Quality Control (QC) samples must be submitted along with natural samples to provide supporting laboratory data to validate laboratory results. In general, field equipment and field replicate samples should be collected for every sampling event. Always check the SAP before going to the field to understand what QC samples are required for the sampling event, and at what frequency samples should be collected.

With the exception of trip blank, QC samples will be collected in the field following sample collection procedures (SOP-3, SOP-4). Trip blanks are supplied by the laboratory and will accompany each sample cooler containing samples for analysis of volatile organic compounds. Trip blanks provide data to evaluate whether the samples were affected by organic compounds during transport to the lab.

The most common QC samples are shown in the table below.

Purpose

To outline the quality control samples to be collected in the field

Goal and Objective

To ensure quality control samples are collected along with natural samples to validate laboratory results

Equipment Needs

Field Forms and field book

Chain-of-custody

Most Common QC Samples		
SP	Split Sample	A portion of a natural sample collected for independent analysis; used in calculating laboratory precision
R	Replicate Sample	Two samples taken from the same media under similar conditions; used to evaluate precision
FB	Field Blank	Deionized water collected in sample bottle; used to detect contamination introduced during the sampling process.
ERB	Equipment Rinsate Blank	Deionized water run through or over decontaminated equipment; used to verify the effectiveness of equipment decontamination procedures
MS/MSD	Matrix Spike/ Matrix Spike Duplicate	Certified materials of known concentration; used to assess laboratory precision and accuracy
TB	Trip Blank	Inert material (deionized water or diatomaceous earth) included in sample cooler; sent by the lab, the sample is used to detect any contamination or cross-contamination during handling and transportation.

Typical QC sample collection frequencies are presented in the table below. Consult the SAP for variations based on site specific objectives. Each field crew leader will be responsible for all QC samples

prepared by that crew.

QC Sample	Purpose	Collection Frequency
Field Replicate Samples	Measure analytical precision.	1 per every 20 samples
Matrix Spike/Matrix Spike Duplicate	Measure analytical accuracy.	1 per every 20 samples
Equipment rinse blanks	Evaluate effectiveness of equipment decontamination and sample handling procedures.	1 per sampling event per media
Field Blank	Assess possible cross-contamination of samples due to ambient conditions during sample collection.	1 per sampling event
Trip Blanks	Evaluate sample preservation, packing, shipping, and storage.	1 per sampling event with volatile constituents

SOP-25

MANAGEMENT OF INVESTIGATIVE-DERIVED WASTE

Prior to the field sampling event, review the Sampling and Analysis Plan to understand how wastes generated during the investigation should be handled. This standard operating procedure is applicable to non-hazardous wastes. If hazardous wastes may be generated, please consult with the project manager and the project specific SAP.

Purpose

To outline the procedure for handling wastes generated during site investigation

Goal and Objective

To employ a method for appropriate handling investigative-derived wastes that limits contamination of the environment

Equipment Needs

PID

Field Forms and field book

DOT approved 55-gallon drums

Drum wrench

SOIL

Whenever possible, soils excavated from test pits should be placed back in the test pit in the reverse order that it was excavated.

To determine appropriate methods for handing of drill cuttings from soil borings or monitoring well installation, soils exhumed from the borehole should be monitored for staining and field screened for VOCs using a PID in accordance with standard operating procedures. Based on the PID screening, cuttings with organic vapor concentrations greater than 100 ppm should be containerized in labeled 55-gallon drums (or roll-off containers if large volumes of cuttings are anticipated) pending further characterization. Alternatively, project personnel may elect to containerize all drill cuttings based on the presence of known contamination and anticipated contaminant concentrations. Containerized soil must be properly labeled, documented and disposed of in accordance with state and federal regulations based on of soil analytical results.

Soil that does not appear to be contaminated based on observations by field personnel and PID screening may be spread on the ground near the point of origin.

GROUNDWATER

Groundwater purged from a well during development or sampling that has a sheen or contains free product must be containerized in an appropriately labeled 55-gallon drums or tank pending receipt of analytical results. A drum should be dedicated to each well sampled so that the analytical results of the groundwater sample from the well can be used to characterize the water in the drum. If groundwater from several wells is placed in a drum, the water in the drum should be sampled for adequate characterization. The containerized water must be disposed of in accordance with state and federal regulations based on the analytical results. Groundwater that does not have a sheen or contain free product or other know contamination may be discharged to the ground surface in the vicinity of the well location for evaporation and infiltration. All surface discharge areas should not allow for migration

of discharge water to a surface water body.

RINSEATE WATER ORIGINATING FROM DECONTAMINATION

All source water for sampling equipment decontamination purposes will be distilled water. For larger equipment when power washing procedures are used for decontamination, potable water will be used. Decontamination will be conducted in a specified area that limits the spread of decontamination water. Decontamination water will be discharged to the ground in the vicinity of the source of dirt and mud to evaporate and infiltrate.

SOP-40

WORKER RESPONSIBILITY TO SAFETY

This SOP establishes general guidelines for NewFields personnel to follow to complete field investigations in a safe manner. All NewFields personnel involved in field work must:

1. Review and sign the site-specific Health and Safety Plan (HASP). In addition to this SOP, there are numerous other SOPs that identify specific requirements for maintaining a safe work environment, appropriate safety communication and reporting of a safety incident. NewFields employees must become familiar with these SOPs prior to initiation of field work and follow them during field work.

2. Prevent visitor access to a site unless they have reviewed the HASP and signed site entry form in the HASP. Visitors should never be allowed access to a work zone, as defined in the HASP.

3. Take personal responsibility for maintaining a safe working environment throughout the entirety of the field work. While NewFields personnel are not responsible for the safety of other contractors on the site, NewFields personnel that witness unsafe conditions should immediately report this to the NewFields Health & Safety Officer (HSO) and Project Manager (PM). If while working on a site you feel something is being done in an unsafe manner, do not continue to participate in the activity and call the HSO and PM.

4. Maintain and wear appropriate personal protective equipment (PPE), as described in the HASP.

5. Facilitate or participate in daily health and safety meetings, preferably at the beginning of each work day. The meeting should be facilitated by the NewFields field lead. At these meetings, safety issues anticipated for the upcoming work day including potential contaminant exposure, appropriate PPE, traffic safety, and any potential on site hazards should be discussed with all workers. If drilling or excavation is planned, applicable safety issues such as utility clearance, creation of work zones, heavy equipment hazards, adequate sloping of excavations, excavation setbacks, potential shoring requirements, and means of communications in a noisy environment should be discussed. In addition, protocols to follow in the event of a hazardous incident should be discussed at daily safety meetings, including what defines and incident and where personnel should congregate in the event of an incident.

6. Report all safety incidents, in accordance with the HASP.

7. Confirm prior to the start of each work day that NewFields and drilling and excavation contractors have appropriate safety equipment and PPE on site. At a minimum, this shall include a hardhat, safety glasses, steel toed boots, gloves, first aid kit, fire extinguisher and a copy of the HASP.

SOP-41

GROUNDWATER SAMPLING FOR DISSOLVED GASES

Prior to initiating groundwater sampling, all equipment should be inspected for damage and repaired. Check with the project manager to be sure you understand what type of pump or sampling device will be used to purge and sample groundwater. Equipment to be placed down hole must be decontaminated. Always sequence groundwater sampling by beginning with the well containing the lowest level of contamination, sample wells in succession based on anticipated increasing concentrations.

COLLECT SAMPLE FOR DISSOLVED GASES

Refer to SOP-12 for procedures to be used to collect groundwater samples. To collect a sample for dissolved gases, fill a clean container (5-gallon bucket) with groundwater from the well. Connect a section of disposable tubing to the discharge point, and using a step-down valve, connect a short length of ¼-inch diameter disposable tubing to the valve. Adjust flow through the tubing so that the rate is low.

Submerge the closed sample container for dissolved gas provided by the laboratory to the bottom of the 5-gallon bucket. While under water, open the sample container and place the sampling tubing with a slow flow rate into the bottom of the sample container. Monitor the time to allow enough water volume to flow through the sample container to flush the container for at least twice its volume.

Slowly remove the sample tubing while maintaining the sample bottle beneath the surface of the water. Place the cap on the sample container while submerged in order to maintain the pressure head of the water. If collecting the sample for compositional analysis, quickly insert the benzalkonium tablet into the container prior to capping.

Remove the sample container from the bucket of water and check to be sure there are no air bubbles in the sample. If air bubbles are visible, collect another sample. If the water is effervescent, a gas headspace bubble in the VOA vial is acceptable, but the laboratory must be notified to analyze the gas headspace. Dissolved gas samples shall be stored and packed upside down.

Purpose

Provide guidelines for sampling dissolved gases in groundwater

Goal and Objective

To employ a method of collecting dissolved gases in groundwater samples representative of the underlying aquifer

Equipment Needs

Five gallon bucket

Sample Containers

Preservatives, as required

Field Sampling Forms

Tubing, disposable

Step-down valves

Coolers and Ice

See SOP-12 for additional equipment for collecting groundwater samples.

New sampling tubing and step-down valves shall be used at each sampling location.

All pumps and purging equipment will be examined for damage and cleanliness prior to use. Ensure all pumping equipment is new or properly decontaminated in accordance with SOP-2 prior to putting it down a well. If wells are sampled on a regular basis, dedicated sampling equipment may be used. Use extra care when using dedicated equipment to ensure it remains correctly labeled and is not exposed to cross contamination.

Purge water must be handled in accordance with SOP-25 for investigative-derived wastes. For water that is discharged directly to the ground, attention must be given to avoid direct recharge of shallow wells with the purge water. Purge water must be discharged down gradient and at an adequate distance from the well to avoid mounding and interference.

Label each sample container with project number, sample location, well owner, date, military time, sampler's initials, preservative, and analysis required in accordance with SOP-3.

Wear clean latex or nitrile gloves during the sample collection procedure.

Be sure to properly cap and lock the well when sampling is complete.

Be sure to complete the necessary shipping and handling paperwork in accordance SOP-4, and record all pertinent information on Field Sampling Forms per SOP-1. Samples should be maintained under Chain of Custody record at all time from sample collection to lab analysis.

SOP-42

MONITORING COMBUSTIBLE GAS IN WATER WELL CASING

At some locations, especially in oil and gas production fields, combustible gas may be present in wells that are subject to groundwater sampling. If such gas concentrations are >20% of the lower explosive limit (LEL), then sampling should be avoided until mitigation measures are implemented and the gas concentrations are reduced to safe levels. This SOP assumes that a groundwater sample is being collected using a bailer; however, other sampling devices can be used under safe conditions.

PROCEDURE

Survey workspace in and around the well-head with a combustible gas indicator (CGI). If readings are >20% of the LEL, additional sampling activities should not be performed until the source of combustible gas vapors is identified and mitigated.

Install well cap fitted with monitoring/sampling ports and polyethylene (PE) drop tubing on the wellhead. Prior to installation, suspend a disposable PE bailer attached to nylon cord from the underside of the cap by passing the bailer cord through the 5/8-inch diameter access port in the cap.

After installing the well cap, survey the work space around the wellhead for potentially explosive conditions. While it is safe to proceed if CGI readings are <20% LEL, the source of CGI readings in the 1-20% range should be investigated and mitigated, if possible.

Connect the CGI to the monitoring port on the cap with 5-ft long flexible tubing, and measure for potentially explosive conditions within the well casing. Allow sufficient running time for the tubing to be completely purged to ensure the atmosphere within the well casing is being monitored.

Connect the air pump to the sampling port and purge the 10-ft long sample tubing for sufficient period of time to purge air from the tubing. Purge time will depend on the pumping rate.

Disconnect the air pump and connect Summa canisters to sample port if collecting gas sample. Collect gas sample in accordance with laboratory instructions that provided the canister.

Purpose

Provide guidelines for sampling dissolved gases in groundwater

Goal and Objective

To employ a method of collecting dissolved gases in groundwater samples representative of the underlying aquifer

Equipment Needs

Combustible Gas Indicator (CGI)

See equipment list on pages 2 & 3 of this SOP

If conditions within the well casing measured through the monitoring port are <20% LEL, proceed with collecting a groundwater sample by lowering the bailer via the nylon cord passing through the 5/8-inch access port in the well cap.

If conditions within the well casing, as indicated by readings from the CGI attached to the monitoring port, are >20% LEL, STOP WORK. The well casing will have to be inerted before a groundwater sample can be safely collected.

Remove the well cap to allow vapors to dissipate as the well is being inerted. Discharge nitrogen or carbon dioxide gas from a hose as it is being lowered into the well to a depth of approximately 30 feet. After inerting is completed, remove the hose from the well and reinstall the well cap. Monitor continuously for potentially explosive conditions with the CGI. Proceed with groundwater sampling once CGI readings remain <20% LEL for at least 10 minutes.

Monitor the well casing continuously with the CGI during groundwater sample collection to ensure readings remain <20% LEL. If necessary, repeat the inerting process.

Depth to water measurements can be made after sampling by inserting an electric water level meter probe through the 5/8-inch port, provided that CGI readings remain <20% LEL.

EQUIPMENT

1. Well cap (PVC, expandable j-plug, or similar) sized to form an airtight seal with the well casing and fitted with:

    - Monitoring port for a CGI with 5-ft length of polyethylene (PE) tubing affixed to the inside, for the purpose of monitoring explosive conditions inside well casing;

    - Sampling port with 10-ft length of PE tubing affixed to the inside, for the purpose of collecting vapor samples from within the well casing; and

    - A 5/8-inch diameter port through which a water level meter and nylon bailer cord can pass.

2. Nylon cord

3. Disposable PE bailer or similar grab sampler

4. Combustible gas indicator (CGI) and oxygen concentration meter (the type that accommodates a sampling line or probe is necessary) that is calibrated at the beginning of each work shift in accordance with manufacturer's instructions (calibrated for both flammable gas and oxygen concentrations).

5. Summa canisters for collecting gas samples, if required

6. Intrinsically-safe air pump to evacuate PE tubing

7. Flexible tubing to connect CGI and Summa canisters to monitoring/sampling ports

8. Compressed nitrogen or carbon dioxide gas cylinders (standard K-size), regulator, and air hose (enough to reach a depth of 30 feet or within 10 feet of static water level in well)

ANNEX 4C-2

FIELD FORMS

DRAFT

NewFields
Perspective. Vision. Solutions.

WELL LITHOLOGIC AND COMPLETION LOG

JOB NO: _____ **WELL NO:** _____

PROJECT: _____ *STATE:* _____ COUNTY: _____ LOGGED BY: _____

LEGAL LOCATION:
T R S TRACT _____

DESCRIPTIVE LOCATION: _____

DATE STARTED: _____ DATE COMPLETED: _____ DRILLING CO/ DRILLER: _____

DRILLING METHOD _____ BOREHOLE DIAM (IN): _____ DRILL FLUIDS USED: _____

TOTAL DEPTH DRILLED: _____ TOTAL DEPTH CASED: _____ INTERVAL PERFORATED FROM OR SCREENED (FT:) _____ DIAMETER: _____ CASING TYPE: _____

METHOD OF PERFORATION:
- _____ Open Hole
- _____ Open Bottom
- _____ Saw Slotted
- _____ Factory ___ (size)
- _____ Other: Roller Perf tool 1/2" x 1"; 4 rows

DURING WELL CONSTRUCTION WAS/WERE:

	YES	NO
Well Developed		
Well Pumped		
Water Samples Collected		
Material Samples Collected		

ANNULAR COMPLETION CHARACTERISTICS

WELL PROTECTOR: LENGTH: _____ DIAM: _____

LOCK NO: _____

SURFACE SEAL TYPE: _____ FROM: TO:
BACKFILL MATERIAL: _____ FROM: TO:
HOLE PLUG: _____ FROM: TO:
FILTER PACK TYPE: _____ FROM: TO:

STATIC WATER LEVEL: _____ DATE: _____ MEASURING POINT DESCRIPTION/ ELEVATION: _____ MEASURING POINT RELATIVE TO GROUND SURFACE (+/-) _____

REMARKS: _____

INTERVAL(FT) below ground surface	**LITHOLOGIC DESCRIPTION USCS NAME (USCS symbol): color, moist, % by weight, plasticity, consistency, structure, cementation, geology**	**REMARKS**

NewFields
Perspective. Vision. Solutions.

WELL LITHOLOGIC AND COMPLETION LOG

JOB NO: _____ **WELL NO:** [ ]

PROJECT: _____ *STATE:* _____ COUNTY: _____ LOGGED BY: _____

INTERVAL(FT) below ground surface	**LITHOLOGIC DESCRIPTION USCS NAME (USCS symbol): color, moist, % by weight, plasticity, consistency, structure, cementation, geology**	**REMARKS**

Classification of Granular Materials and Approximate Slot Size for Naturally Developed Wells

Name	Milliameters	Inches	Sieve Size	Slot Size (inches)	Slot Size (mm)
Boulders	>300	>11.8	>12”	>0.100	>2.5
Cobbles	300 - 75	11.8 - 2.9	12” - 3”	>0.100	>2.5
Gravel - coarse	75 -19	2.90 - .075	3” - 3/4”	>0.100	>2.5
Gravel - fine	19 - 4.8	.075 - 0.19	3/4” - 4	>0.100	>2.5
Sand - coarse	4.8 - 2.0	0.19 - 0.08	4 - 10	0.100	2.5
Sand - coarse to med	3.3 - 1.8	0.13 - 0.07	6 - 12	0.090	2.3
Sand - medium	2.2 - 1.3	0.09 - 0.05	8 - 16	0.070	1.8
Sand - medium	1.8 - 1.0	0.07 - 0.04	12 - 20	0.050	1.3
Sand - medium	1.3 - 0.5	0.05 - 0.02	16 - 30	0.030	0.8
Sand - fine	0.5 - 0.2	0.02 - 0.008	30 - 70	0.015	0.4
Sand - fine	0.2 - 0.08	0.008 - 0.003	30 - 200	0.007	0.2
Slits and Clays	<0.08	<0.003	<200	NA	NA

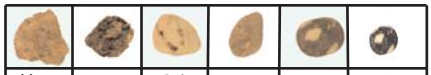
Grain size classification is based on USCS and slot selection is based on well construction using natural development and average grain sizes.

Screen Slot Gauge in/mm

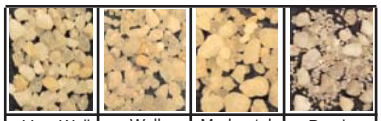
in	mm
0.100	2.54
0.080	2.03
0.060	1.52
0.050	1.27
0.040	1.00
0.030	0.76
0.020	0.51
0.010	0.25

Sand / Slot Size Gauge

Gauge	Name	Natural Development Slot		Filter Pack	Filter Pack Slot	
		Inches	mm	sieve	Inches	mm
	Gravel	0.125	3.2	3/8” - 3/4”	0.250	6.4
	Sand - Coarse	0.100	2.5	4 - 3/8”	0.160	4
		0.080	2	3 - 6	.0120	3.0
	Sand - Medium	0.060	1.5	4 - 8	0.090	2.3
		0.040	1	6 - 12	0.070	1.8
	Sand - Fine	0.020	0.5	10 - 20	0.040	1.0
		0.007	0.2	20 - 40	0.018	0.45

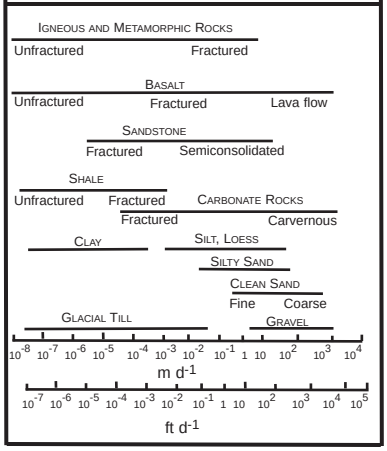


Very Angular	Angular	Sub Angular	Sub Rounded	Rounded	Well Rounded



Very Well Sorted	Well Sorted	Moderately Sorted	Poorly Sorted

Range of Hydraulic Conductivites



Moderate red 5R 4/6

Dark yellowish orange 10YR 6/6

Yellowish gray 5Y 8/1

Light gray N7

Pale blue 5B 6/2

Grayish green 10G 4/2

Dark gray N3

1-800-VEE-WIRE
1-800-833-9473
www.johnsonscreens.com

Johnson screens®
A Weatherford Company

© 2004 Weatherford JS-BR7200-1204

8x6changed.qxd 11/1/2004 10:47 AM Page 2

Field Guide for Logging Water-Well Boreholes

Thomas M. Hanna, 2004

Descriptor	Log Entry	Field Test / Definition
Aquifer / Formation Name	Aquifer / Formation Name	Published name of aquifer / formation
Aquifer / Formation Category	Unconsolidated	Alluvial / unconsolidated materials (e.g., glacial, fluvial, soils, etc.)
	Bedrock	Bedrock / consolidated materials
Alluvial / Unconsolidated Type	Clay	Can be rolled into a rope ¼-in diameter
	Silt	Can not be rolled into a rope
	Sand with Clay / Silt	20% of formation is clay/silt
	Sand, fine-med	Fine (<0.5mm-2mm)
	Sand, med-coarse	Medium - Coarse (2.2-5mm)
	Sand and Gravel	20% or more of formation is sand
	Gravel	Fine (5-19mm), Coarse (19-75mm)
Bedrock Type / Unconsolidated	Siltstone/Shale	Consolidated Formations/Bedrock
	Sandstone	
	Limestone	
	Conglomerate	
	Coal	
	Granite	
	Volcanic	
	Basalt	
	Other	
Hardness	Very hard	Difficult to break with hammer
	Hard	Easy to break with Hammer / >30 blows/ft
	Dense / Stiff	Can break in hand / 10-30 blows/ft
	Loose	Unconsolidated / < 10 blows/ft
Color	Moderate Red	Color of washed samples
	Dark Yellowish Orange	
	Yellowish Gray (Tan)	
	Very Light Grey	
	Pale Blue	
	Greyish Green	
	Dark Grey	
Water Content	Dry	Moisture absent
	Moist	Damp no visible water
	Wet	Visible water
	High Production	Fracture or zone of significant production
	Lost Circulation	Significant loss of drilling fluids
Other	Other Information	Any comments on drilling conditions or hydrogeology

Logging Procedure

1 Depth interval on log for the sample description.
2 Formation or aquifer name.
3 Alluvial/unconsolidated formation or bedrock formation.
4 Alluvial or bedrock type. If rock type is not present, select other type.
5 Rock hardness based on description. Typically unconsolidated alluvial formations are loose.
6 Color of washed samples.
7 Information for moisture content, fractures and water bearing zones.
8 Any other comments.

Example of Water-Well Borehole Log

Depth (from/ to in ft)	Formation /Aquifer	Bedrock / Unconsolidated	Type	Hardness	Color	Water Content	Other
0 - 20		Unconsolidated	Sand with Clay/Slit	Loose	Light Grey	Dry	Poorly sorted
20 - 40	Denver	Bedrock	Sandstone	Dense/Stiff	Yellowish Orange	Wet	Carbonate cement

1-800-VEE-WIRE
1-800-833-9473
www.johnsonscreens.com
Thomas M. Hanna, 2004

Johnson screens®
A Weatherford Company

MONITORING WELL INSTALLATION RECORD

MONITORING WELL

MONITORING WELL NO.: _____
PROJECT: _____
SITE: _____
BOREHOLE NO.: _____
WELL PERMIT NO.: _____
TOC TO BOTTOM OF WELL: _____

DRILLING INFORMATION

DRILLING BEGAN:
DATE: _____ TIME: _____
WELL INSTALLATION BEGAN:
DATE: _____ TIME: _____
WELL INSTALLATION FINISHED:
DATE: _____ TIME: _____
DRILLING CO.: _____
DRILLER: _____
LICENSE: _____
DRILL RIG: _____
DRILLING METHOD:
☐ HOLLOW STEM AUGER
☐ AIR ROTARY
☐ OTHER: _____
DIAMETER OF AUGERS:
ID: _____ OD: _____

WELL CASING

☐ SCHEDULE 40 PVC
☐ OTHER: _____
PRODUCT: _____
MFG. BY: _____
CASING DIAMETER:
ID: _____ OD: _____
LENGTH OF CASING (TOTAL): _____

**NOTE: IF CASING SEGMENTS OF VARYING LENGTH ARE USED, RECORD ALL SEGMENT LEGTHS ON BACK*

WELL SCREEN

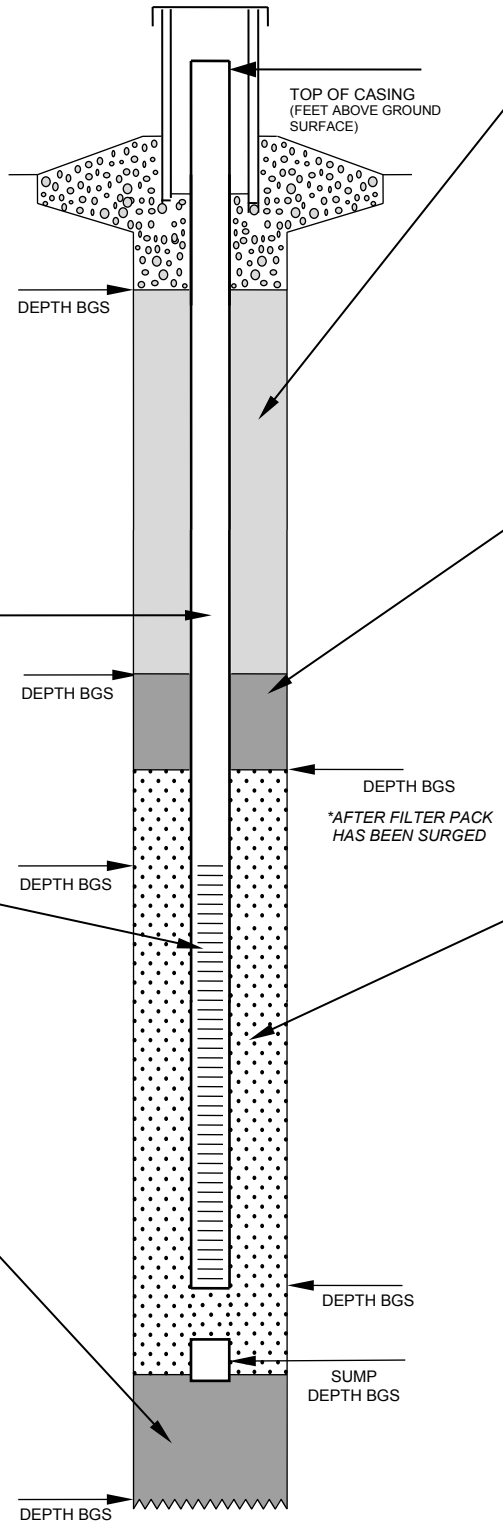
☐ SCHEDULE 40 PVC
☐ OTHER: _____
PRODUCT: _____
MFG. BY: _____
CASING DIAMETER:
ID: _____ OD: _____
SLOT SIZE: _____
LENGTH OF SCREEN: _____

BOREHOLE BACKFILL

AMOUNT CALCULATED: _____
AMOUNT USED: _____
❑ BENTONITE CHIPS, SIZE: _____
❑ BENTONITE PELLETS, SIZE: _____
❑ SLURRY: _____
❑ FORMATION COLLAPSE: _____
❑ OTHER: _____
PRODUCT: _____
MFG. BY: _____
METHOD INSTALLED:
❑ POURED ❑ TREMIE
❑ OTHER: _____

SURFACE COMPLETION

❑ FLUSH MOUNT
❑ ABOVE GROUND WITH BUMPER POST
❑ CONCRETE ❑ ASPHALT



SURVEY INFORMATION

TOC ELEVATION: _____
GROUND SURFACE ELEVATION: _____
NORTHING: _____
EASTING: _____
DATE SURVEYED: _____
SURVEY CO.: _____

ANNULAR SEAL

VOLUME CALCULATED: _____
AMOUNT USED: _____
❑ GROUT FORMULA (PERCENTAGES)
PORTLAND CEMENT: _____
BENTONITE: _____
WATER: _____
❑ PREPARED MIX
PRODUCT: _____
MFG. BY: _____
METHOD INSTALLED:
❑ POURED ❑ TREMIE
❑ OTHER: _____

BENTONITE SEAL

VOLUME CALCULATED: _____
AMOUNT USED: _____
☐ PELLETS, SIZE: _____
☐ CHIPS, SIZE: _____
☐ OTHER: _____
PRODUCT: _____
MFG. BY: _____
METHOD INSTALLED:
☐ POURED ☐ TREMIE
☐ OTHER: _____
AMOUNT OF WATER USED: _____

FILTER PACK

❑ PREPACKED FILTER
VOLUME CALCULATED: _____
AMOUNT USED: _____
❑ SAND, SIZE: _____
PRODUCT: _____
MFG. BY: _____
METHOD INSTALLED:
❑ POURED ❑ TREMIE
❑ OTHER: _____
WATER LEVEL: _____
(BTOC AFTER WELL INSTALLATION)

CENTRALIZERS USED?

❑ YES ❑ NO;
CENTRALIZER DEPTHS: _____ _____ _____
_____ _____ _____ _____ _____
_____ _____ _____ _____ _____

BGS – BELOW GROUND SURFACE
BTOC – BELOW TOP OF CASING
N/A – NOT APPLIC ABLE
NR – NOT RECORDED
TOC – TOP OF CASING

NewFields

NewFields Perspective. Vision. Solutions.	Project:	Personnel:
	Project #	
	Date/Time:	

Groundwater Sampling and/or Development Field Form

Well ID/Sample Location:		Measuring Point (mp)	(+GS)
Well Type:	Total Depth: (bgs / bmp)	Casing Type:	
SWL before purging: (bgs / bmp)	SWL post purge: (bgs / bmp)	Well Diameter: ( )	
Well Locked: Y / N	Cap/lid: Y / N	Photos taken: Y / N	Monument Type:

Purge & Sampling Equipment

Pump Type:	Pump Depth: ( ) bgs / bmp	
Purging Method:	Sampling Method:	$1ft^3 = 7.48$ gal
1 Casing Vol:	3 Casing Vol:	Total Vol. Removed:

Instrument Calibration

	Model/Unit #	Buffer Soln 1	Buffer Soln 2	Field Temp. (°C)	Instrument Rdg.	Comments
pH						
Specific Cond.						
Redox						
ORP						
DO		Salinity %:	Pressure (mmHg):			

Well Evacuation & Monitoring Data

Time	DTW (bmp)	Purge Rate (L/min)	Purge Vol. (L)	Temp (°C)	pH	SC (µS/cm)	DO (mg/L)	ORP (mV)	Turb (NTU)	Comments

Sampling Data

Bottle Label	Sample Time	Sampling Parameter(s)	Preservative	Method	Other
Samples Analyzed by:	Lab Name:				

Monitoring Well Sampling Log (Low Flow)

MWO#: _____ **Project/Site Name:** _____ **Date:** _____ **Well ID:** _____

Well Data:

Casing Diameter: _____
Borehole Diameter: _____
Depth of Casing (ft bTOC): _____
Screen Interval (ft bTOC): _____
Pump Intake (ft bTOC): _____
Well Condition (Comments): _____
_____
Weather (temp/pressure/wind): _____
_____

Initial Measurements & Calculations:

Initial PID Reading at TOC (ppm): _____
Depth to Product (ft bTOC; NA if none): _____
Product Thickness (ft bTOC): _____
Static Depth to Water (ft bTOC): _____
Standing Water Column (ft): _____
a) One Pump Volume (mL): 300 mL
b) One Tube Volume (mL): ft x (9.7 ml/ft)= mL
c) One Purge Volume (=a+b): _____ mL
Minimum Volume to be Purged (=2xc): _____ mL

Equipment Documentation:

Water Level Meter: _____
Product Probe/Sampler (NA if none): _____
Multi-Parameter Meter: _____
PID: _____
Purge/Sample Pumps: _____
Control Box Settings:
Pressure (psi): _____
Fill Cycle (sec): _____
Pump Cycle (sec): _____

All measurements taken from the surveyor mark at top of casing, or north side if no mark exists.

Time	Amount Purged (mL)	Field Parameters Measured										Comments (field observations, odor, color, problems, well performance, etc.)	Field Tech.
		Temp. (ºC)	Salinity (%)	pH	S.C. (mS/cm)	Turbidity (NTU)	D.O. (mg/L)	ORP (mV)	PID Breathing Zone / TOC	Depth to Water (ft bTOC)	Flow Rate (mL/min)		
												(flow reduced to ____ ml/min prior to VOC collection)	
Sample													

Purge Information:

Purge Method (circle one): Marshalk System / Aquarious / Bladder Pump
Time Purging Began: _____
Total Milliliters Purged: _____
Total Pump/Tubing Volumes Purged: _____
Time Purging Completed: _____

Sampling Information:

Sampling QA/QC Requirements (circle one): NA Dup/Split MS/MSD
Sampling Method: _____
Time Sampling Began: _____
Filter Type (size/brand): NA / QEC (0.45 micron) / Other: _____
Amount Flushed Through Filter (well water in mL): _____
Time Sampling Completed: _____

NewFields

Well Sampling or Development Record

Site Name:
Project Number:
Field Personnel:

NewFields
Perspective. Vision. Solutions.

Well ID _____ Depth to Water (DTW) prior to sampling, ft. _____ Intake Depth _____
Date _____ DTW after sampling, ft. _____

Time	Purge Rate (Lpm)	Purge Vol. (L)	DTW	EC, µS/cm	DO, mg/L	ORP, mV	pH	Temp., ^{0}C	Comments

Pace Analytical®
www.pacelabs.com

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: of

1628866

Section A **Required** Client Information:	Section B **Required** Project Information:	Section C Invoice Information:
Company:	Report To:	Attention:
Address:	Copy To:	Company Name:
		Address:
Email To:	Purchase Order No.:	Pace Quote Reference:
Phone: Fax:	Project Name:	Pace Project Manager:
Requested Due Date/TAT:	Project Number:	Pace Profile #:

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER _____

Site Location
STATE: _____

Section D
Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Matrix Codes
MATRIX / CODE

Drinking Water	DW
Water	WT
Waste Water	WW
Product	P
Soil/Solid	SL
Oil	OL
Wipe	WP
Air	AR
Tissue	TS
Other	OT

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED: COMPOSITE START DATE	COLLECTED: COMPOSITE START TIME	COLLECTED: COMPOSITE END/GRAB DATE	COLLECTED: COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test (Y/N)	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				
11																				
12																				

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			

ORIGINAL

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

SIGNATURE of SAMPLER: **DATE Signed (MM/DD/YY):**

Temp in °C | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N) | Samples Intact (Y/N)

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

ANNEX 4C-3

WELL COMPLETION LOGS

DRAFT

ANNEX 4C-3

WELL COMPLETION LOGS
FOR RIVER CORRIDOR ENVELOPE

RCE-14

Well Completion Log

NewFields

PROJECT NUMBER	BORING NUMBER			
350.0045.00	JN 15-10 MW-1	SHEET	1	OF 1

WELL LITHOLOGIC AND COMPLETION LOG

PROJECT: Jensen 11 Soil Assessment
WELL ID: JN15-10 MW-1
DRILLER NAME: Mark Taggart
DRILLING CONTRACTOR: Earth Probe
DRILLING METHOD AND EQUIPMENT: Geo Probe Direct Push
WATER LEVEL:
DATE START: March 22, 2013
DATE FINISH: March 22, 2013
LOGGER: MDW
WELL LOCATION: 1118207.963 N, 2696333.692 E
TOC ELEVATION: 6884.16 Feet

DEPETH BE(LOW SURFACE (FT)	SAMPLE: INTERVAL RECOVERY (%)	SAMPLE: SAMPLE DEPTH INTERVAL (ft bgs)	SAMPLE: INTERVAL ID #	PID Screen (ppm)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: OBSERVATIONS (ODOR, STAINING, DRILLING RATE, DRILLING ISSUES, ETC.)
0-6					Cleared by hydrovac; no recovery; water present at bottom of hole.	Water at approx. 5.5 feet bgs in hole.
6-10	50	7.0		0.8	Gravelly sand; sub-angular; matrix moderate yellowish brown; medium- to coarse-grained; gravel to 1-inch diameter; few fines; saturated.	No odor
10-13	50				As above; saturated.	No odor
					Hole caved to 6 feet while building well.	
					Well installed to 13 feet bgs with 10-feet of 2-inch diameter 0.010-inch slot PVC well screen.	
					5 bags of 10/20 silica sand poured into borehole annulus 0.5 feet above well screen.	
					3 bags of bentonite chips added to borehole annulus above filter pack and then saturated.	
					Well is secured inside a steel monument with locking lid (key # 2043). The steel monument is set in place with a sloping cement pad. K-rails are places around surface completion for additional protection	

RCE-15

Well Completion Log

NewFields

PROJECT NUMBER	BORING NUMBER	
350.0045.00	VB 8-11 MW-1	SHEET 1 OF 1

WELL LITHOLOGIC AND COMPLETION LOG

PROJECT: Vible 8-11 | WELL ID: VB 8-11 MW-1

DRILLER NAME: Mark Taggart | DRILLING CONTRACTOR: Earth Probe

DRILLING METHOD AND EQUIPMENT: Geo Probe Direct Push

WATER LEVEL: 6.55 feet btoc | DATE START: March 25, 2013 | DATE FINISH: March 25, 2013 | LOGGER: MDW

WELL LOCATION: 1119984.045 N, 2702616.008 E | TOC ELEVATION: 6892.19 Feet

DEPETH BE(LOW SURFACE (FT)	SAMPLE: INTERVAL RECOVERY (%)	SAMPLE: SAMPLE DEPTH INTERVAL (ft bgs)	SAMPLE: INTERVAL ID #	PID Screen (ppm)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: OBSERVATIONS (ODOR, STAINING, DRILLING RATE, DRILLING ISSUES, ETC.)
0-4.5					Cleared by hydrovac; no recovery; water borehole.	
4.5-6.5	50	5-6		0.4	Sandy silt; reddish brown; sand fine-grained; soft; saturated.	No odor/staining
6.5-9.5	50				Sandy gravel; matrix reddish brown; sub-angular to sub-rounded; sand is coarse-grained; gravel to 2-inches in diameter; saturated.	No odor/staining
9.5-13					Gravelly sand; matrix reddish brown; sub-rounded to sub-angular; coarse-grained gravel to 0.5-inches diameter; saturated.	No odor/staining
					Well installed to 13 feet bgs with 10-feet of 2-inch diameter 0.010-inch slot PVC well screen. 4 bags of 10/20 silica sand poured in borehole annulus to 0.5 feet above well screen. 2 bags of bentonite chips added in borehole annulus above filter pack and then saturated. Casing stickup = 3.0 feet Well is secured inside a steel monument with locking lid (key # 2043). The steel monument is set in place with a sloping cement pad. K-rails are places around surface completion for additional protection.	

RCE-16

Well Completion Log

PROJECT NUMBER	BORING NUMBER	
350.0045.00	VB 3-12 MW-1	SHEET 1 OF 1

WELL LITHOLOGIC AND COMPLETION LOG

PROJECT: Vible 3-12 Shallow Groundwater Characterization
WELL ID: VB 3-12 MW-1
DRILLER NAME: Mark Taggart
DRILLING CONTRACTOR: Earth Probe
DRILLING METHOD AND EQUIPMENT: Geo Probe Direct Push
WATER LEVEL: 6.38 feet bgs (3/21/2013)
DATE START: March 21, 2013
DATE FINISH: March 21, 2013
LOGGER: L. McKay
WELL LOCATION: 1120809.896 N, 2704850.783 E
TOC ELEVATION: 6897.53 Feet

DEPETH BE(LOW SURFACE (FT)	SAMPLE: INTERVAL RECOVERY (%)	SAMPLE: SAMPLE DEPTH INTERVAL (ft bgs)	SAMPLE: INTERVAL ID #	PID Screen (ppm)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: OBSERVATIONS (ODOR, STAINING, DRILLING RATE, DRILLING ISSUES, ETC.)
0-6					Cleared by hydrovac from 0-6 feet below ground surface; no recovery; begin drilling @ bottom of borehole.	
6-8.2	90	6-10		1.6	Well graded to poorly graded sand (SW-SP); moderate yellowish brown; ~80 to 60% medium-grained sand (sub-rounded, arkosic); ~20 to 60% coarse-grained sand; trace sand; very soft; rare organics; saturated; no odor.	No odor or staining
8.2-13	100	10-13		1.7	Poorly graded to well graded sand w/gravel (SW-SP); light grayish brown; from 8.2 to 11 feet below ground surface: sand as above [6-8.2 feet below ground surface]; 11-depth: very poorly sorted; ~70% angular to sub-rounded arkosic sand; ~30% medium-grained sand; trace fines; sub-rounded to rounded gravel @ 11 and 12 feet below ground surface; saturated; no odor.	No odor or staining

2-inch diameter 0.010-inch slot PVC well screen set from 13 to 3.0 feet below ground surface.

4 bags of 10/20 silica sand poured in borehole annulus to 2.5 feet (0.5 feet above the top of the well screen).

2 bags of bentonite chips added in borehole annulus above filter pack and were then saturated.

Casing stickup = 2.83 feet.

Well is secured inside a steel monument with locking lid (key # 2043). The steel monument is set in place with a sloping cement pad. K-rails are places around surface completion for additional protection.

X-4a-A

Well Completion Log

AMEC Geomatrix

WELL LITHOLOGIC AND COMPLETION LOG

JOB NO: 013655.006.0 T4

WELL NO: X-4a-A

PROJECT: Pinedale Anticline Project Area: Hydro Data Gaps

STATE: WY

COUNTY: Sublette

LOGGED BY: D. Holman

LEGAL LOCATION: T 31N R 109W S 11 TRACT NE, SW

DESCRIPTIVE LOCATION: Jensen 11 pad (Shell); well located at southern end of pad near east road entrance. Well is between X-4-RW and X-4-SW.

DATE STARTED: 7/14/2010

DATE COMPLETED: 7/14/2010

DRILLING CO/ DRILLER: Thomas Drilling/ Bob Thomas

DRILLING METHOD: Air rotary/casing hammer

BOREHOLE DIAM (IN): 9"

DRILL FLUIDS USED: Air with foam as needed

TOTAL DEPTH DRILLED: 20'

TOTAL DEPTH CASED: 18'

INTERVAL PERFORATED FROM OR SCREENED (FT:) 8' 18'

DIAMETER: 4"

CASING TYPE: Sch 80 PVC

METHOD OF PERFORATION:

	Open Hole
	Open Bottom
	Saw Slotted
X	Factory 0.020 (size)
	Other: Roller Perf tool 1/2" x 1"; 4 rows

DURING WELL CONSTRUCTION WAS/WERE:

	YES	NO
Well Developed		X
Well Pumped		X
Water Samples Collected		X
Material Samples Collected		X

ANNULAR COMPLETION CHARACTERISTICS

WELL PROTECTOR: LENGTH: DIAM:

LOCK NO: Geomatrix Master Lock #2190

SURFACE SEAL TYPE:	N/A	FROM:	TO:
BACKFILL MATERIAL:	N/A	FROM:	TO:
HOLE PLUG:	Bentonite chips	FROM: 0'	TO: 5'
FILTER PACK TYPE:	10/20 silica sand	FROM: 5'	TO: 18'

Hole Plug and filter pack material poured in and installed w/ tremie pipe

SURVEYED LOCATION (m): Northing: 15501437.54 Easting: 1962124.32

SURVEYED DATUM: HORIZONTAL: UTM Zone 12 North, NAD83

WELL CASING ELEV. (ft): 6890.26'

VERTICAL: NAVD88

GROUND SURFACE ELEV.(ft): 6888.34'

STATIC WATER LEVEL: 6.18 ft

DATE: 7/14/2010

MEASURING POINT DESCRIPTION/ ELEVATION: Top well casing

MEASURING POINT RELATIVE TO GROUND SURFACE (+/-) +1.92

REMARKS:

INTERVAL(FT) below ground surface	LITHOLOGIC DESCRIPTION USCS NAME (USCS symbol): color, moist, % by weight, plasticity, consistency, structure, cementation, geology	REMARKS
0 - 3	Gravel, sand [fill]	
3 - 12	Gravel	
12 - 18	Sand; minor clay cement; gravelly	
18 - 20	Sandstone; medium grained; wet; subrounded to subangular; qtz	

ANNEX 4C-3

WELL COMPLETION LOGS
FOR NORTH ZONE

MS 11-21

Well Completion Log

FORM U.W. 5
Rev. 6/07
FILING FEE SCHEDULE
ON REVERSE SIDE

SCO 39065
50.00
9/17/08

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E CHEYENNE, WYOMING 82002
(307) 777-6163

APPLICATION FOR PERMIT TO APPROPRIATE GROUND WATER

APPLICATION FOR WELLS AND SPRINGS

Note: Only springs flowing 25 gallons per minute or less, where the proposed use is domestic and /or stock watering, will be considered as ground water appropriations.

Temporary Filing No. U.W. 41-3-275

FOR OFFICE USE ONLY

PERMIT NO. U.W. 188900
WATER DIVISION NO. 4 DISTRICT 7
U.W. DISTRICT Sublette Co.

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.
ALL ITEMS MUST BE COMPLETED BEFORE APPLICATION IS ACCEPTABLE

NAME AND NUMBER OF WELL or SPRING Mesa 11-21 WSW

1. Name of applicant(s) 1- Questar Exploration and Production Company
2- Bureau of Land Management Phone: 303-308-3068
2. Address of applicant(s) 1- 1050 17th Street, Suite 500 Denver, CO 80265
2- P.O. Box 768, Pinedale, WY 82941
(MAILING ADDRESS) (CITY) (STATE) (ZIP)

3. Name & address of agent to receive correspondence and notices Debra K. Stanberry, Supervisor, Regulatory Affairs
1050 17th Street, Suite 500 Denver, CO 80265 Phone: 303-308-3068
(MAILING ADDRESS) (CITY) (STATE) (ZIP)

4. Use to which the water will be applied:

	Domestic:	Use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totaling one acre or less. Number of houses served?____.
	Stock Watering:	Normal livestock use at four tanks or less within one mile of well or spring. Stockwatering pipelines and commercial feedlots are a miscellaneous use. Number of stock tanks?____.
	Irrigation:	Watering of any lands for agricultural purposes not covered by the definition of domestic use (large-scale lawn watering of golf courses, cemeteries, recreation areas, etc., is miscellaneous use).
	Municipal:	Use of water in incorporated Towns and Cities. Note 1: use of water in unincorporated towns, sub-divisions, improvement districts, mobile home parks, etc. is classified as miscellaneous use. Note 2: a permit may be required by the Wyoming Department of Environmental Quality (WDEQ) if the well will be classified as a public water supply under the WDEQ's rules and regulations.
	Industrial:	Long term use of water for the manufacture of a product or production of oil/gas or other minerals (oil field water flood operations, power plant water supply, etc.). (Describe in REMARKS)
X	Miscellaneous:	Any use of water not defined under previous definitions such as stock water pipelines, subdivisions, mine dewatering, mineral/oil exploration drilling, potable supplies in office, etc. (Describe in Remarks). Note: a permit may be required by the WDEQ if the well will be classified as a public water supply under the WDEQ's rules and regulations. rd maintenance, dust abatement, well work-overs/ repairs and reclamation per corresp. Recd 10/22/08
	Coalbed Methane	Water produced in the production of coal bed methane gas. Note: wells used in the production of coal bed methane gas will require a permit from the Wyoming Oil and Gas Conservation Commission.
	Monitor, Observation	Note: a WDEQ permit may be required ☐ Test Well: (Describe in REMARKS)

5. Location of the well or spring: (NOTE: Quarter-quarter (40 acre subdivision) MUST be shown. EXAMPLE: SE 1/4 NW 1/4 of Sec. 12, Township 14 North, Range 68 West.) Sublette County, NE 1/4 SW 1/4 of Sec. 21, T. 32 N., R. 109 W. of the 6th P.M. (W.R.M.), Wyoming. If located in a platted subdivision, also provide Lot/Tract ___ Block ___ of the ____ Subdivision (or Add'n) of ____. Resurvey Location: Tract ____, (or Lot) ____
Per U.W.G. Permit No. U.W. 147528

6. Estimated depth of the well or spring is 910 feet. Estimated production interval is ~~220~~ 750 ft to ~~948~~ 910 ft.

7. (a) MAXIMUM instantaneous flow of water to be developed and beneficially used: 125 gallons per minute. NOTE: if for domestic and / or stock use, this application will be processed for a maximum of 25 gallons per minute. For a spring, after approval of this application, some type of artificial diversion or improvement must be constructed to qualify for a water right.

(b) MAXIMUM volumetric quantity of water to be developed and beneficially used per calendar year: 15 acre feet. Circle appropriate units: (Gallons) (Acre Feet) A four person family utilizes approximately one (1) acre-foot of water per year or 325,000 gallons.

8. Mark the point(s) or area(s) of use in the tabulation box below. Note: Upper row refers to the quarter of the section. Next row refers to the quarter of the quarter section.

TABULATION BOX

TWP	RNG	SEC	NE¼				NW¼				SW¼				SE¼				TOTAL
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	
32	109	21									X	X	X	X					

SEE REVERSE SIDE

Permit No. U.W. 188900 Book No. 1364 Page No. 150

9. If for irrigation use:
   a. Describe MAXIMUM acreage to be irrigated in each 40 acre subdivision in the tabulation box above.
   b. [ ] Land will be irrigated from this well only.
   c. [ ] Land is irrigated from existing water right(s) with water from this well to be additional supply. Describe existing water right(s) under REMARKS.

10. If for irrigation use, describe method of irrigation, i.e. center pivot sprinkler, flood, etc.: _____

11. The well or spring is to be constructed on lands owned by Bureau of Land Management
(The granting of a permit does not constitute the granting of a right-of-way. If any easement or right-of-way is necessary in connection with this application, it should be understood that the responsibility is the applicant's. A copy of the agreement should accompany this application, if the land is privately owned and the owner is not the co-applicant.)

12. The water is to be used on lands owned by Bureau of Land Management
(If the landowner is not the applicant, a copy of the agreement relating to the usage of the appropriated water on the land should be submitted to this office. If the landowner is included as co-applicant on the application, this procedure need not be followed.) NOTE: Water rights attach to the area(s) and/or point(s) of use.

Per Corresp Rec'd 10/23/08

REMARKS: Drilling of oil and gas wells, rd maintenance, dust abatement, well work-overs/repair & reclamation
Refile of cancelled permit #147528

Under penalties of perjury, I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete.

Signature of Applicant or Authorized Agent — September 10, 2008 (Date)

Debra K. Stanberry, Supervisor, Regulatory Affairs

THE LEGALLY REQUIRED FILING FEE MUST ACCOMPANY THIS APPLICATION

DOMESTIC AND/OR STOCK WATERING USES (Domestic use is defined as use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totalling one acre or less.)	$25.00
IRRIGATION, MUNICIPAL, INDUSTRIAL, MISCELLANEOUS, COAL BED METHANE	$50.00
MONITOR (For water level measurements or chemical quality sampling) or TEST WELL	No Fee

IF WELL WILL SERVE MULTIPLE USES, SUBMIT ONLY ONE (THE HIGHER) FILING FEE.

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

THE STATE OF WYOMING)
) ss.
STATE ENGINEER'S OFFICE)

This instrument was received and filed for record on the 17th day of September, A.D. 2008, at 9:36 o'clock A M.

Permit No. U.W. 188900

for State Engineer

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This application is approved subject to the condition that the proposed use shall not interfere with any existing rights to ground water from the same source of supply and is subject to regulation and correlation with surface water rights, if the ground and surface waters are interconnected. The use of water hereunder is subject to the further provisions of Chapter 169, Session Laws of Wyoming, 1957, and any subsequent amendments thereto.

Granting of a permit does not guarantee the right to have the water level or artesian pressure in the well maintained at any specific level. The well should be constructed to a depth adequate to allow for the maximum development and beneficial use of ground water in the source of supply.

If the well is a flowing artesian well, it shall be so constructed and equipped that the flow may be shut off when not in use without loss of water into sub-surface formations or at the land surface.

Coal Bed Methane wells have Additional Conditions and Limitations on attachment sheet.

FOR ADDITIONAL CONDITIONS AND LIMITATIONS SEE ATTACHED STATUS SHEET.

This permit and accompanying notices serve to register an existing well and establish a valid water right for the same. Time limit for Completion of Construction and Completion of Beneficial Use is waived.

~~Approval of this application may be considered as authorization to proceed with construction of the proposed well or spring. A Statement of Completion will be filed within thirty (30) days of completion of construction, including pump installation.~~

~~Completion of construction and completion of the beneficial use of water for the purposes specified in Item 4 of this application will be made by December 31, 20____.~~

~~The amount of appropriation shall be limited to the quantity to which permittee is entitled as determined at time of proof of application of water to beneficial use.~~

Witness my hand this 29th day of Oct., A.D. 20 08.

for PATRICK T. TYRRELL, State Engineer

PERMIT NO. U.W. 138900
T.F. No. U.W. 41 - 3 - 275

PERMIT STATUS

Priority Date September 17th, 2008 **Approval Date** OCT 29 2008

ADDITIONAL CONDITIONS AND LIMITATIONS:

1. The right to the use of ground water granted under this permit is restricted to the point (s) of use shown. The State Engineer is to be notified in writing at least five (5) days prior to utilizing water under this permit at any additional points of use. The written notification shall contain location of the point of use by 40 acre legal subdivision and approximate length of time the water will be used at additional point of use. A copy of the written notification shall be mailed to the field personnel designated below.

2. The right to the use of ground water granted under this permit is for **oil and gas drilling, road maintenance, dust abatement, well work-overs/repairs and reclamation** shall extend until **December 31, 2013**. At that time the permit will be automatically cancelled unless a written request for an extension of time has been received by the State Engineer prior to **December 31, 2013**.

3. If this well is to be drilled on the main portion of the geographic region called "The Mesa", and the surface elevation of the well site is at an altitude greater than 7,250 feet above sea level, this well shall be cased with new or new-like quality blank unperforated casing from the land surface to a depth of at least 500 feet below land surface. Said casing shall be grouted in place utilizing one or more of the following materials, neat cement, cement/bentonite mixed grout, bentonite pellets/chips, or bentonite slurry, from the land surface to the bottom of the blank unperforated casing, interval specified above.

4. If this well is to be located in portions of the Pinedale Anticline Project Area that are not specific to "The Mesa" region as outlined in Condition 3, and, the well is to be situated within 1,000 feet of an existing domestic or stock watering well, the top of the production zone (perforated interval) utilized by this well shall be located at least 200 feet below that of the bottom of the deepest production zone utilized by existing domestic or stock watering wells located within 1,000 feet of this water supply well. In this case, this well shall be cased with new or new-like quality blank unperforated casing from the land surface to the top of the production zone of this well. Said casing shall be grouted in place utilizing one or more of the following materials, neat cement, cement/bentonite mixed grout, bentonite pellets/chips, or bentonite slurry, from the land surface to the bottom of the blank unperforated casing, interval specified above.

5. If this well is to be located in portions of the Pinedale Anticline Project Area that are not specific to "The Mesa" region as outlined in Condition 3, and, this well is not situated within 1,000 feet of an existing domestic or stock watering well, as outlined in Condition 4, this well shall be cased with new or new-like blank unperforated casing from the land surface to a depth of at least 200 feet below land surface. Said casing shall be grouted in place utilizing one or more of the following materials, neat cement, cement/bentonite mixed grout, bentonite pellets/chips, or bentonite slurry, from the land surface to the bottom of the blank unperforated casing, interval specified above

6. The water delivery system from this well shall be equipped with a functional backflow prevention device to eliminate the possibility of fluids or other matter entering the well during use.

7. Part I of the final Proof of Appropriation is required for this permit; however, Parts II and III are waived.

8. The State Engineer may, upon written request, waive all or any portion of these conditions and limitations.

10/29/2008
Date of Approval

for PATRICK T. TYRRELL, State Engineer

COPY OF THIS PERMIT MAILED TO:
Jade Henderson –Superintendent
P.O. Box 277
Cokeville, WY 83114

September 17, 2008 - Statement of Completion on November 14, 2002 received.
September 17, 2008 - Proof of Beneficial Use on September 4, 2008 received.

FORM U.W 6
Rev. 1/07

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E
CHEYENNE, WYOMING 82002

(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

NOTE: Do not fold this form. Use typewriter or print neatly with black pen.

PERMIT NO. U.W. 188900 NAME OF WELL/SPRING Mesa 11-21 Water Source Well

1. NAME OF OWNER 1- Questar Exploration and Production Company 2-Bureau of Land Management

2. ADDRESS 1-1050 17th Street, Suite 500 2-P.O.Box 768
   ☐ Please check if address has changed from that shown on permit
   City 1- Denver 2- Pinedale State 1- Colorado 2- Wyoming Zip Code 1-80265 2-82941 Phone No. 303-308-3068

3. USE OF WATER ☐ Domestic ☐ Stock Watering ☐ Irrigation ☐ Municipal ☐ Industrial ☒ Miscellaneous
   ☐ Monitor or Test ☐ Coal Bed Methane Explain proposed use (Example: One single family dwelling)
   Oil & Gas Well Drilling

4. LOCATION OF WELL/SPRING NE 1/4 SW 1/4 of Section 21 T. 32 N.,R. 109 W., of the 6th P.M. (or W.R.M.)
   Subdivision Name _____ Lot _____ Block _____
   Resurvey Location Tract _____ or Lot _____ Datum ☐ NAD27 ☐ NAD83
   Geographic Coordinates: Latitude _____ N Longitude _____ W (degrees, minutes, seconds)
   UTM: Zone _____ Northing _____ Easting _____ (meters)
   State Plane Coordinates: Zone _____ Northing 4731686 Easting 594626 (feet)
   Land surface elevation (ft. above mean sea level) 7319 Datum ☐ NAVD29 ☐ NAVD88
   Source ☒ GPS ☐ Map ☐ Survey Unkown ☐ Other ☐ Altimeter (for elevation only)

5. TYPE OF CONSTRUCTION ☒ Drilled Rotary ☐ Dug ☐ Driven ☐ Other
   Describe _____

6. CONSTRUCTION Total depth of well/spring 910 ft.
   Depth of static water level 400 ft. (below land surface) Casing height 0 ft. above ground
   a. Diameter of borehole (bit size) 9 7/8 inches
   b. Casing schedule ☒ New ☐ Used Joint type ☐ Threaded ☐ Glued ☒ Welded
   6 5/8 diameter from 0 ft. to 910 ft. Material Steel Gage 0.188
   _____ diameter from _____ ft. to _____ ft. Material _____ Gage _____
   c. Cemented/grouted interval, from 0 ft. to 500 ft.
   Amount of cement/grout used 130 Sacks (example: 10 sacks) type Portland (example: bentonite pellets)
   d. Type of completion ☒ Customized perforations ☐ Open hole ☐ Factory screen
   Type of perforator used Torch Cut Slotted
   Size of perforations 12 inches by 1/8 inches.
   Number of perforations and depths where perforated
   250 perforations from 750 ft. to 910 ft.
   _____ perforations from _____ ft. to _____ ft.
   Open hole from _____ ft. to _____ ft.
   Well screen details
   Diameter _____ slot size _____ set from _____ ft. to _____ ft.
   Diameter _____ slot size _____ set from _____ ft. to _____ ft.
   e. Well development method Rotary How long was well developed? _____
   f. Was a filter/gravel pack installed? ☒ Yes ☐ No Size of sand/gravel Pea Gravel 3/8" Washed
   Filter/gravel pack installed from _____ ft. to _____ ft.
   g. Was surface casing used? ☒ Yes ☐ No Was it cemented in place? ☐ Yes ☒ No
   Surface casing installed from _____ ft. to _____ ft.

7. NAME AND ADDRESS OF DRILLING COMPANY Searle Bros., 149 Pollux Drive, Rock Springs, WY 82901

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) 11/14/2002

9. PUMP INFORMATION Manufacturer Grundfoss Type Submersible
   Source of power Generator Horsepower 30 Depth of pump setting or intake 850 ft.
   Amount of water being pumped 80 gal./min.* (For springs or flowing wells, see item 10)
   Total volumetric quantity used per calendar year.* 15 acre feet
   *If these amounts exceed permitted amount an enlargement is required.

10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
    If artesian flow or spring, yield is _____ gal./min. *Surface pressure is _____ lb./sq.inch. or _____ feet of water.
    The flow is controlled by ☐ Valve ☐ Cap ☐ Plug
    Does well leak around casing? ☐ Yes ☐ No

Permit No. U.W. 188900 Book No. 1364 Page No. 150

SEE REVERSE SIDE

11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion, i.e., spring box, cribbing, etc., is necessary to qualify for a water right) _____

12. PUMP TEST Was a pump test conducted? ☐ Yes ☒ No
If so, by whom _____
Yield _____ gal./min. with _____ ft. drawdown after _____ hours
Yield _____ gal./min. with _____ ft. drawdown after _____ hours

13. LOG OF WELL Total depth drilled 910 ft.
Depth of completed well 910 ft. Diameter of well 9 7/8 inches
Depth to first water bearing formation 220 ft.
Depth to principal water bearing formation Top 805 ft. to Bottom 835 ft.

DRILL CUTTINGS DESCRIPTION

From Feet	To Feet	Rock Type or Description	Formation	Water Bearing? (Yes or no)
Surface	35	Tan Shale		No
35	45	Grey Shale		No
45	60	Sand Stone		No
60	75	Green Shale		No
82	220	Green Blue Red Grey Shale		No
220	224	Broken Sandstone		Yes
224	447	Red Blue and Grey Shale		No
447	456	Sandstone		Yes
456	567	Red and Grey Shale		No
567	572	Sandstone		Yes
572	761	Grey and Blue Shale, Red Clay		No
761	782	Sandstone		Yes
782	805	Blue Shale		No
805	835	Sandstone		No
835	848	Sandstone with Grey Shale		Yes
848	910	Grey Shale		No

14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM? ☐ Yes ☒ No

Note: Perforations from 750'to 910'

15. QUALITY OF WATER INFORMATION

Does a chemical and/or bacteriological water quality analysis accompany this form? ☐ Yes ☒ No
It is recommended that chemical and bacteriologic water quality analyses be performed and that the report(s) be filed with the records of this well (contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984).
If not, do you consider the water as Good ☒ Acceptable ☐ Poor Unusable

REMARKS _____

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct, and complete.

Signature of Owner or Authorized Agent

Debra K. Stanberry, Supervisor, Regulatory Affairs

September 10, 20 08
Date

FOR STATE ENGINEER'S USE ONLY

Permit No. U.W. 188900

Date of Receipt SEP 17 2008, 20____

Date of Priorty _____, 20____

Date of Approval 10/29, 20 08

for State Engineer

MS 11-28

Well Completion Log

FORM U.W.6
Rev. 7/05

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E
CHEYENNE, WYOMING 82002

(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

NOTE: Do not fold this form. Use typewriter or print neatly with black pen.

PERMIT NO. U.W. 182109 NAME OF WELL/SPRING Mesa 11-28-32-109

1. NAME OF OWNER Shell Rocky Mountain Prodcution, LLC & Bureau of Land Management
2. ADDRESS 1.) P O Box 1666, Pinedale WY 82941-1666
2.) P O BOx 1828, Cheyenne WY 82001 1828
☐ Please check if address has changed from that shown on permit

City _____ State _____ Zip Code _____ Phone No. 307-367-7904

3. USE OF WATER ☐ Domestic ☐ Stock Watering ☐ Irrigation ☐ Municipal ☐ Industrial ☒ Miscellaneous
☐ Monitor or Test ☐ Coal Bed Methane Explain proposed use (Example: One single family dwelling) _____

4. LOCATION OF WELL/SPRING NE 1/4 SW 1/4 of Section 28 T. 32 N.,R. 109 W., of the 6th P.M. (or W.R.M.)
GPS Coordinates UTM Zone _____ Easting _____ Northing _____
Subdivision Name _____ Lot _____ Block _____
If surveyed, bearing, distance and reference point _____
Longitude (degrees, minutes, seconds) 109°50' 31" Latitude (degrees, minutes, seconds) 42° 4' 56"
Datum ☐ 1927 ☐ 1983 Source: ☒ GPS ☐ Map ☐ Survey

5. TYPE OF CONSTRUCTION ☒ Drilled Air Rotary (Type of rig, and fluid used, if any) ☐ Dug ☐ Driven ☒ Other
Describe Drilled

6. CONSTRUCTION Total depth of well/spring 905 ft.
Depth of static water level 550 ft. (below land surface) Casing height 20 ft. above ground
a. Diameter of borehole (bit size) 9 7/8 inches
b. Casing schedule ☒ New ☐ Used Joint type ☐ Threaded ☐ Glued ☒ Welded
10" diameter from 0 ft. to 26 ft. Material Steel Gage 8
6 5/8" diameter from 0 ft. to 839 ft. Material Steel Gage 8
c. Cemented/grouted interval, from 0 ft. to 500 ft.
Amount of cement/grout used 102 sacks (example: 10 sacks) type Class G Cement & Clacium Chloride (example: bentonite pellets)
d. Type of completion ☐ Factory screen ☐ Open hole ☒ Customized perforations
Type of perforator used Slotted
Size of perforations 1/8 inches by 6 inches.
Number of perforations and depths where perforated
6" perforations from 690 ft. to 710 ft.
6" perforations from 800 ft. to 840 ft.
Open hole from _____ ft. to _____ ft.
Well screen details
Diameter _____ slot size _____ set from _____ ft. to _____ ft.
Diameter _____ slot size _____ set from _____ ft. to _____ ft.
e. Well development method _____ How long was well developed? _____
f. Was a filter/gravel pack installed? ☒ Yes ☐ No Size of sand/gravel Pea
Filter/gravel pack installed from _____ ft. to _____ ft.
g. Was surface casing used? ☒ Yes ☐ No Was it cemented in place? ☒ Yes ☐ No
Surface casing installed from _____ ft. to _____ ft.

RECEIVED
JUN 21
STATE ENGINEER
CHEYENNE, WY

7. NAME AND ADDRESS OF DRILLING COMPANY Excel Drilling;POB 267; Rock Springs WY 82902
8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) May 4, 2001
9. PUMP INFORMATION Manufacturer Grundfos Type Submersible
Source of power Generator Horsepower 30 Depth of pump setting or intake 640' ft.
Amount of water being pumped 115 gal./min. (For springs or flowing wells, see item 10)
Total volumetric quantity used per calendar year. ~~1,764,000~~ OUT 3 Ac.-Ft./Yr. Per U.W. 5 IN
10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
If artesian flow or spring, yield is _____ gal./min. Surface pressure is _____ lb./sq.inch, or _____ feet of water.
The flow is controlled by: ☐ Valve ☐ Cap ☐ Plug
Does well leak around casing? ☐ Yes ☐ No

Permit No. U.W. 182109 Book No. 1319 Page No. 109

SEE REVERSE SIDE

11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion, i.e., spring box, cribbing, etc., is necessary to quality for a water right)

12. PUMP TEST Was a pump test conducted? ☐ Yes ☐ No

If so, by whom

Yield gal./min. with ft. drawdown after hours

Yield gal./min. with ft. drawdown after hours

13. LOG OF WELL Total depth drilled ~~865~~ 905 ft. Per Item 6, JH

Depth of completed well ~~865~~ 905 ft. Diameter of well 6 inches

Depth to first water bearing formation 550 ft.

Depth to principal water bearing formation Top 690 ft. to Bottom 840 ft.

Land surface elevation (ft. above mean sea level) 7420.7' Datum ☐ 1929 ☐ 1988

How determined ☒ Map ☐ Altimeter ☐ Survey ☐ Other

DRILL CUTTINGS DESCRIPTION

From Feet	To Feet	Rock Type or Description	Formation	Water Bearing? (Yes or no)
Surface				
		See attached		

14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM? ☐ Yes ☒ No

15. QUALITY OF WATER INFORMATION

Does a chemical and/or bacteriological water quality analysis accompany this form? ☐ Yes ☒ No

It is recommended that chemical and bacteriologic water quality analyses be performed and that the report(s) be filed with the records of this well (contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984).

If not, do you consider the water as ☒ Good ☐ Acceptable ☐ Poor ☐ Unusable

REMARKS

Good for drilling, completions and dust control

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct, and complete.

Signature of Owner or Authorized Agent

May 1 ,20 07
Date

FOR STATE ENGINEER'S USE ONLY

Permit No. U.W. 182109

Date of Receipt JUN 21 2007 , 20

Date of Priorty , 20

Date of Approval 8/1 , 20 07

for State Engineer

Attachment for Statement of Completion Form U.W. 182109

Attachment for the Mesa 11-28-32-109 Water Well

Cuttings Description Continued for the

From Feet	To Feet	Rock Type Texture, color	Perforations	Water Zone	Perforated casing Location
0	17	Gravel and Sand			
17	85	Blue and Green Shale			
85	98	Sandstone			
98	210	Blue and Green Shale			
210	220	Sandstone		x	
220	350	Blue & Green Shale			
350	365	Sandstone			
365	550	Brown Shale			
550	590	Green Shale			
590	620	Sandstone		x	
620	690	Green Shale			
690	710	Sandstone	x	x	
910	750	Brown Shale			
750	760	Sandstone			
760	800	Brown Shale			
800	840	Sandstone	x	x	
840	867	Green Shale			
867	875	Sandstone			
875	892	Blue and Green Shale			
892	905	Sandstone			
Well Completion Log					

MS 12-33

Well Completion Log

FORM U.W.6
Rev. 7/05

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E
CHEYENNE, WYOMING 82002

(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

NOTE: Do not fold this form. Use typewriter or print neatly with black pen.

PERMIT NO. U.W. 181278 NAME OF WELL/SPRING Mesa 12-33

1. NAME OF OWNER 1.) Shell Rocky Mountain Production, LLC 2.) Bureau oof Land Management

2 ADDRESS 1.) P O Box 1666, Pinedale WY 82941-1666 2.) P O Box 1828, Cheyenne WY 82001-1828

☐ Please check if address has changed from that shown on permit

City____ State____ Zip Code____ Phone No. 307-367-7904

3. USE OF WATER ☐ Domestic ☐ Stock Watering ☐ Irrigation ☐ Municipal ☐ Industrial ☒ Miscellaneous
☐ Monitor or Test ☐ Coal Bed Methane Explain proposed use (Example: One single family dwelling) ____

4. LOCATION OF WELL/SPRING NW 1/4 SW 1/4 of Section 33 T. 32 N., R. 109 W., of the 6th P.M. (or W.R.M.)
GPS Coordinates UTM Zone____ Easting____ Northing____
Subdivision Name____ Lot____ Block____
If surveyed, bearing, distance and reference point ____
Longitude (degrees, minutes, seconds) 108° 50.881 Latitude (degrees, minutes, seconds) 42° 42.090
Datum ☐ 1927 ☐ 1983 Source: ☒ GPS ☐ Map ☐ Survey

5. TYPE OF CONSTRUCTION ☒ Drilled Rotary (Type of rig, and fluid used, if any) ☐ Dug ☐ Driven ☐ Other
Describe ____

6. CONSTRUCTION Total depth of well/spring 1,000 ft.
Depth of static water level 230 ft. (below land surface) Casing height 20 1.5 ft. above ground
a. Diameter of borehole (bit size) 10 5/8 inches
b. Casing schedule ☒ New ☐ Used Joint type ☐ Threaded ☐ Glued ☒ Welded
20" diameter from 0 ft. to 12 ft. Material____ Gage____
6" diameter from 12 ft. to 1000 ft. Material____ Gage____
c. Cemented/grouted interval, from 0 ft. to 500 ft.
Amount of cement/grout used____ (example: 10 sacks) type Pumped Bentonite Grout (example: bentonite pellets)
d. Type of completion ☐ Factory screen ☐ Open hole ☒ Customized perforations
Type of perforator used ____
Size of perforations 6 inches by 1/8 inches.
Number of perforations and depths where perforated
300 perforations from 853 ft. to 895 ft.
____ perforations from 937 ft. to 979 ft.
Open hole from ____ ft. to ____ ft.
Well screen details
Diameter ____ slot size____ set from ____ ft. to ____ ft.
Diameter ____ slot size____ set from ____ ft. to ____ ft.
e. Well development method____ How long was well developed? ____
f. Was a filter/gravel pack installed? ☒ Yes ☐ No Size of sand/gravel Pea 3/8"
Filter/gravel pack installed from ____ ft. to ____ ft.
g. Was surface casing used? ☐ Yes ☐ No Was it cemented in place? ☐ Yes ☐ No
Surface casing installed from ____ ft. to ____ ft.

RECEIVED STATE ENGINEER CHEYENNE, WY

7. NAME AND ADDRESS OF DRILLING COMPANY Excel Drilling: POB 267, Rock Springs WY 82902

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) 05-07-2004

9. PUMP INFORMATION Manufacturer Graunfause Type Submersable
Source of power Generator Horsepower 30 Depth of pump setting or intake 800' ft.
Amount of water being pumped 110 gal./min. (For springs or flowing wells, see item 10)
Total volumetric quantity used per calendar year. 8 AF/YR

10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
If artesian flow or spring, yield is ____ gal./min. Surface pressure is ____ lb./sq.inch, or ____ feet of water.
The flow is controlled by: ☐ Valve ☐ Cap ☐ Plug
Does well leak around casing? ☐ Yes ☐ No

Permit No. U.W. 181278 Book No. 1314 Page No. 28

SEE REVERSE SIDE

11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion, i.e., spring box, cribbing, etc., is necessary to quality for a water right)_____

12. PUMP TEST Was a pump test conducted? ☒ Yes ☐ No
If so, by whom Premeir Pumps: P O Box 129: Farson, WY 83932
Yield 100 gal./min. with 430 ft. drawdown after 8 hours
Yield ____ gal./min. with ____ ft. drawdown after ____ hours

13. LOG OF WELL Total depth drilled 1,000 ft.
Depth of completed well 975 ft. Diameter of well 6 inches
Depth to first water bearing formation 230 ft.
Depth to principal water bearing formation Top 950 ft. to Bottom 975 ft.

Land surface elevation (ft. above mean sea level)____ Datum ☐ 1929 ☐ 1988
How determined ☐ Map ☐ Altimeter ☐ Survey ☐ Other

DRILL CUTTINGS DESCRIPTION

From Feet	To Feet	Rock Type or Description	Formation	Water Bearing? (Yes or no)
Surface				
		See attached		

14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM? ☐ Yes ☐ No

15. QUALITY OF WATER INFORMATION

Does a chemical and/or bacteriological water quality analysis accompany this form? ☐ Yes ☒ No
It is recommended that chemical and bacteriologic water quality analyses be performed and that the report(s) be filed with the records of this well (contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984).
If not, do you consider the water as ☐ Good ☒ Acceptable ☐ Poor ☐ Unusable

REMARKS _____

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct, and complete.

Signature of Owner or Authorized Agent

4/20/07, 20____
Date

FOR STATE ENGINEER'S USE ONLY

Permit No. U.W. 181278

Date of Receipt April 27, 20 07

Date of Priorty ____, 20____

Date of Approval May 11, 20 07

for State Engineer

UW 181278

Attachment for the Mesa 12-33 Water Well

Cuttings Description Continued for the

From Feet	To Feet	Rock Type Texture, color	Perforations	Water Bearing Formations (Yes or No)	Perforated casing Location
0	16	Gravel and Sand			
16	35	Green Shale			
35	80	Sandstone			
80	120	Green Shale			
120	170	Blue Shale			
170	200	Brown Shale			
200	230	Blue Shale			
230	240	Sandstone		X	
240	560	Blue and Brown Shale			
560	575	Sandstone			
575	655	Blue and Brown Shale			
655	670	Sandstone			
670	720	Blue and Brown Shale			
720	730	Sandstone			
730	850	Blue and Brown Shale			
850	890	Sandstone	X	X	
890	950	Blue and Brown Shale			
950	975	Sandstone	X	X	
975	1000	Blue and Brown Shale			
Well Completion Log					

RECEIVED
STATE ENGINEER
CHEYENNE, WY

Form U.W. 8
Rev. 1-05

NOTE: Do not fold this form. Use typewriter or print neatly with black ink

RECEIVED
STATE ENGINEER
CHEYENNE, WY

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER

PROOF OF APPROPRIATION AND BENEFICIAL USE OF GROUND WATER

The Owner Responsible for Submitting Parts I and II of this form. Part III will be prepared by a State Engineer representative at time of inspection.

PART I

WATER DIVISION 4(7)

U.W. DISTRICT Sublette

PERMIT NO. U.W. 181278

DATE OF PRIORITY October 4, 2002

NAME OF WELL Mesa 12-33

LOCATION NW ¼ SW ¼ of Section 33

T. 32 N., R. 109 W.

1. Name of Claimant(s) Shell Rocky Mountain Production, LLC / BLM

2. Address P O Box 1666, Pinedale WY 82941-1666 Zip Code

3. For What Purpose(s) is Water Used? Use: Oil and gas developement dust abatement, construction of pads & roads, reclamation MISC Date First Used:

Use: Date First Used: Use: Date First Used: May 7, 2004

If use is for irrigation, give date irrigation was completed on all lands under this Permit:

PART II

For Irrigation, Industrial, Municipal, and Miscellaneous Wells

A plat which has been certified by a licensed professional engineer or land surveyor shall be submitted to accompany this form. The plat shall be in accordance with W.S. § 33-29-139 or Chapters V and VI, State Engineers Office Regulations and Instructions (Minimum scale shall be 2" = 1 mile). The map shall be prepared with waterproof black ink on tracing linen or an acceptable equivalent and shall show on a suitable scale the legal subdivisions, the accurate location of the well or wells, storage facilities, main canals, streams, highways and other important cultural features. Land ownership shall be shown, if there is more than one owner under the permit.

IRRIGATION WELLS

Acreage irrigated under terms of this permit will be clearly shown with a distinctive pattern and a distinction clearly made between lands having an original supply and those provided an additional supply. Where use is for additional supply for lands with a right from another source, indicate the priority or permit number of the source, the source of supply and the name of the ditch, pipe line, or other well. Conveyance system will be shown and described. Indicate method of irrigation being used.

INDUSTRIAL WELLS

In addition to the information outlined above, industrial users will locate and describe conveyance facilities to the point(s) of use, giving as accurately as possible the location of the point(s) of use. Permits for other sources of water must be identified.

MUNICIPAL WELLS

The plat will show the area of use and show and describe the means of conveyance of the water from the well to the connection with the municipal water system distribution network.

MISCELLANEOUS WELLS

(1) The linen plat for wells where the use is described as miscellaneous and where the yield or flow of the well exceeds twenty-five (25) gallons per minute must show the area of use and describe and show the means of conveyance from the well to the distribution system and/or point(s) of use.

(2) The plat for wells where the use is described as miscellaneous and where the yield or flow is twenty-five (25) gallons per minute or less may be a 7½ minute United States Geological Survey Quadrangle map in lieu of a linen tracing, provided that the Quadrangle map is in compliance with the following conditions:

(a) The entire Quadrangle map must be submitted to the State Engineer's Office.

(b) The scale on said Quadrangle map must be one to twenty-four thousand.

(c) An identified section corner or quarter-corner must be shown on said Quadrangle map along with the Section, Township, and Range.

(d) The section in which the well is located and the section(s) where the area(s) or point(s) of use are located must be subdivided into forty (40) acre tracts and the well location and area(s) or point(s) of use clearly labeled and described.

(e) Said Quadrangle map showing the well location and area(s) or points(s) of use must be certified by a professional engineer or land surveyor licensed to practice within the State of Wyoming.

SEE REVERSE SIDE

MS 13-5

Well Completion Log

State Engineer's Office

HERSCHLER BUILDING, 4-E CHEYENNE, WYOMING 82002
(307) 777-7354 FAX (307) 777-5451
seoleg@seo.wyo.gov

DAVE FREUDENTHAL
GOVERNOR

PATRICK TYRRELL
STATE ENGINEER

June 1, 2009

1)WEXPRO COMPANY 2)BLM
1050 17TH ST., STE 500
Denver, CO 80265
ATTN: DEBRA STANBERRY

Dear Applicant or Agent:

You are advised that the State Engineer approved the following application(s) to appropriate ground water for **MIS** on **May 27, 2009**. A copy of each permit is enclosed. Also enclosed are forms and instructions for submitting data to the State Engineer relating to the completion of the well and the beneficial use of the water, as required by law.

PERMIT NUMBER - WELL NAME
U.W. 190128 - MESA 13-5 WSW
WELL LOCATION - SWSW 5-32-109

Not Completed or in Full Beneficial Use - dr

By statute the well must be completed and the water beneficially utilized by December 31, 2010. ***IF THE REQUIRED NOTICES ARE NOT RETURNED TO THIS OFFICE WITHIN THE STATUTORY TIME LIMITS SET FORTH, THE PERMIT(S) WILL BE SUBJECT TO CANCELLATION, WHICH ACTS AS A FORFEITURE OF THE WATER RIGHT GRANTED BY THIS PERMIT.***

An extension of time may be requested for completion of work when good reason is provided. A request for such extension must be received in the State Engineer's Office prior to the expiration date shown on the permit. Requests for extension of time must indicate due diligence on the part of the applicant to comply with the time limits imposed by this permit. ***(PLEASE NOTE: The conditions and limitations of your permit may NOT allow an extension of time.)***

Sincerely,

Lisa Lindemann

Lisa Lindemann, Administrator
Ground Water Division

LL:CL
xc: DIV 4 (7)

(4) ON

09-25-08 RCVD 0017

FORM U.W. 5
Rev. 6/07
FILING FEE SCHEDULE
ON REVERSE SIDE

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E CHEYENNE, WYOMING 82002
(307) 777-6163

SEO 3 9142
50.00
9/25/08

APPLICATION FOR PERMIT TO APPROPRIATE GROUND WATER

APPLICATION FOR WELLS AND SPRINGS

Note: Only springs flowing 25 gallons per minute or less, where the proposed use is domestic and /or stock watering, will be considered as ground water appropriations.

Temporary Filing No. U.W. 41-60-283

FOR OFFICE USE ONLY

PERMIT NO. U.W. 190128
WATER DIVISION NO. 4 DISTRICT 7
U.W. DISTRICT Sublette Co.

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.
ALL ITEMS MUST BE COMPLETED BEFORE APPLICATION IS ACCEPTABLE

NAME AND NUMBER OF WELL or SPRING Mesa 13-5 WSW

1. Name of applicant(s) 1- Wexpro Company 2- Bureau of Land Management Phone: 303-308-3068
2. Address of applicant(s) 1- 1050 17th Street, Suite 500 Denver, CO 80265 2- P.O. Box 768, Pinedale, WY 82941
   (MAILING ADDRESS) (CITY) (STATE) (ZIP)
3. Name & address of agent to receive correspondence and notices Debra K. Stanberry, Supervisor, Regulatory Affairs
   1050 17th Street, Suite 500 Denver, CO 80265 Phone: 303-308-3068
   (MAILING ADDRESS) (CITY) (STATE) (ZIP)
4. Use to which the water will be applied:

	Domestic:	Use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totaling one acre or less. Number of houses served?____.
X	Stock Watering:	Normal livestock use at four tanks or less within one mile of well or spring. Stockwatering pipelines and commercial feedlots are a miscellaneous use. Number of stock tanks? 1.
	Irrigation:	Watering of any lands for agricultural purposes not covered by the definition of domestic use (large-scale lawn watering of golf courses, cemeteries, recreation areas, etc., is miscellaneous use).
	Municipal:	Use of water in incorporated Towns and Cities. Note 1: use of water in unincorporated towns, subdivisions, improvement districts, mobile home parks, etc. is classified as miscellaneous use. Note 2: a permit may be required by the Wyoming Department of Environmental Quality (WDEQ) if the well will be classified as a public water supply under the WDEQ's rules and regulations.
	Industrial:	Long term use of water for the manufacture of a product or production of oil/gas or other minerals (oil field water flood operations, power plant water supply, etc.). (Describe in REMARKS)
X	Miscellaneous:	Any use of water not defined under previous definitions such as stock water pipelines, subdivisions, mine dewatering, mineral/oil exploration drilling, potable supplies in office, etc. (Describe in Remarks). Note: a permit may be required by the WDEQ if the well will be classified as a public water supply under the WDEQ's rules and regulations.
	Coalbed Methane	Water produced in the production of coal bed methane gas. Note: wells used in the production of coal bed methane gas will require a permit from the Wyoming Oil and Gas Conservation Commission.
	Monitor, Observation	Note: a WDEQ permit may be required ☐ Test Well: (Describe in REMARKS)

5. Location of the well or spring: (NOTE: Quarter-quarter (40 acre subdivision) MUST be shown. EXAMPLE: SE 1/4 NW 1/4 of Sec. 12, Township 14 North, Range 68 West.) Sublette County, SW 1/4 SW 1/4 of Sec. 5, T. 32 N., R. 109 W. of the 6th P.M. (W.R.M.), Wyoming. If located in a platted subdivision, also provide Lot/Tract ___ Block ___ of the ___ Subdivision (or Add'n) of ___. Resurvey Location: Tract ___, (or Lot) ___ Per U.W. 6, U.W. 126625 JH
6. Estimated depth of the well or spring is ~~950~~ 940 feet. Estimated production interval is ~~335~~ 780 ft. to ~~940~~ 930 ft.
7. (a) MAXIMUM instantaneous flow of water to be developed and beneficially used: 125 gallons per minute. NOTE: if for domestic and / or stock use, this application will be processed for a maximum of 25 gallons per minute. For a spring, after approval of this application, some type of artificial diversion or improvement must be constructed to qualify for a water right.

   (b) MAXIMUM volumetric quantity of water to be developed and beneficially used per calendar year: 5 acre feet. Circle appropriate units: (Gallons) (Acre Feet) A four person family utilizes approximately one (1) acre-foot of water per year or 325,000 gallons.
8. Mark the point(s) or area(s) of use in the tabulation box below. Note: Upper row refers to the quarter of the section. Next row refers to the quarter of the quarter section.

TABULATION BOX

TWP	RNG	SEC	NE¼				NW¼				SW¼				SE¼				TOTAL
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	
32	109	5							X	X			X						
32	109	6								X									
32	109	8						X	X			X			X				
32	109	4								X - Location of Stock Tank									

SEE REVERSE SIDE

Permit No. U.W. 190128 Book No. 1373 Page No. 28

9. If for irrigation use:
   a. Describe MAXIMUM acreage to be irrigated in each 40 acre subdivision in the tabulation box above.
   b. [ ] Land will be irrigated from this well only.
   c. [ ] Land is irrigated from existing water right(s) with water from this well to be additional supply. Describe existing water right(s) under REMARKS.

10. If for irrigation use, describe method of irrigation, i.e. center pivot sprinkler, flood, etc.: _____

11. The well or spring is to be constructed on lands owned by Bureau of Land Management
(The granting of a permit does not constitute the granting of a right-of-way. If any easement or right-of-way is necessary in connection with this application, it should be understood that the responsibility is the applicant's. A copy of the agreement should accompany this application, if the land is privately owned and the owner is not the co-applicant.)

12. The water is to be used on lands owned by Bureau of Land Management
(If the landowner is not the applicant, a copy of the agreement relating to the usage of the appropriated water on the land should be submitted to this office. If the landowner is included as co-applicant on the application, this procedure need not be followed.) NOTE: Water rights attach to the area(s) and/or point(s) of use.

REMARKS: Drilling of oil and gas wells
Refile of cancelled permit #126625

Under penalties of perjury, I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete.

Signature of Applicant or Authorized Agent — September 19, 20 08
Date

Debra K. Stanberry, Supervisor, Regulatory Affairs

THE LEGALLY REQUIRED FILING FEE MUST ACCOMPANY THIS APPLICATION

DOMESTIC AND/OR STOCK WATERING USES (Domestic use is defined as use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totalling one acre or less.)	$25.00
IRRIGATION, MUNICIPAL, INDUSTRIAL, MISCELLANEOUS, COAL BED METHANE	$50.00
MONITOR (For water level measurements or chemical quality sampling) or TEST WELL	No Fee

IF WELL WILL SERVE MULTIPLE USES, SUBMIT ONLY ONE (THE HIGHER) FILING FEE.

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

THE STATE OF WYOMING)
) ss.
STATE ENGINEER'S OFFICE)

This instrument was received and filed for record on the 25th day of September, A.D. 20 08, at 9:17 o'clock A M.

Permit No. U.W. 190128

for State Engineer

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This application is approved subject to the condition that the proposed use shall not interfere with any existing rights to ground water from the same source of supply and is subject to regulation and correlation with surface water rights, if the ground and surface waters are interconnected. The use of water hereunder is subject to the further provisions of Chapter 169, Session Laws of Wyoming, 1957, and any subsequent amendments thereto.

Granting of a permit does not guarantee the right to have the water level or artesian pressure in the well maintained at any specific level. The well should be constructed to a depth adequate to allow for the maximum development and beneficial use of ground water in the source of supply.

If the well is a flowing artesian well, it shall be so constructed and equipped that the flow may be shut off when not in use without loss of water into sub-surface formations or at the land surface.

Coal Bed Methane wells have Additional Conditions and Limitations on attachment sheet.

FOR ADDITIONAL CONDITIONS AND LIMITATIONS SEE ATTACHED STATUS SHEET.

Approval of this application may be considered as authorization to proceed with construction of the proposed well or spring. A Statement of Completion will be filed within thirty (30) days of completion of construction, including pump installation.

Completion of construction and completion of the beneficial use of water for the purposes specified in Item 4 of this application will be made by December 31, 20 10.

The amount of appropriation shall be limited to the quantity to which permittee is entitled as determined at time of proof of application of water to beneficial use.

Witness my hand this 27TH day of May, A.D. 20 09.

PATRICK T. TYRRELL, State Engineer

Revised 11/2/2004

PERMIT NO. U.W. 190128

T.F. No. U.W. 41-6-283

PERMIT STATUS

Priority Date September 25, 2008 **Approval Date** MAY 27 2009

This well is a water supply well to supply water for oil/gas well drilling and associated operations within the Pinedale Anticline Project Area (PAPA).

The Additional Conditions and Limitations attached to permits issued by this office for water supply wells in the PAPA are reflective of the requirements for these types of wells listed in the 2000 Record of Decision for the Pinedale Anticline Project, and are designed to insure a level of protection for the users of the shallow sandstone aquifers in the PAPA by limiting the ability of the water supply wells associated with the project to utilize the same resource targeted by the existing stock and/or domestic wells in the PAPA.

The Additional Condition and Limitation attached to permits issued by this office for water supply wells in this location, located on "The Mesa", normally requires that the well must be cased with un-perforated casing to a depth of 500 feet and that the casing must be fully cemented/grouted in the borehole to that depth. However, due to the variability of the geology of the area, this office is aware that the same level of protection of the shallow sandstone aquifers can be achieved by somewhat less than the 500 foot cemented interval in some cases.

A review of the Statement of Completion and Description of Well form submitted with this application indicates that the well has not been constructed in a manner in which the 500 foot cemented interval Condition described above can be satisfied. A review of the well log associated with the Completion form indicates, however, that an effective seal has been emplaced between the un-perforated well casing and the well bore to eliminate the production of water from any of the shallow sandstone aquifers present between the land surface and 500 feet below land surface in the immediate area. As such, the intent of the Condition, the isolation and protection of the shallow sandstone aquifers, has been achieved in this instance. **Therefore, this permit is approved, as this well is constructed, subject to the following ADDITIONAL CONDITIONS AND LIMITATIONS:**

ADDITIONAL CONDITIONS AND LIMITATIONS:

1. The right to the use of ground water granted under this permit is restricted to the point (s) of use shown. The State Engineer is to be notified in writing at least five (5) days prior to utilizing water under this permit at any additional points of use. The written notification shall contain location of the point of use by 40 acre legal subdivision and approximate length of time the water will be used at the additional point of use. A copy of the written notification shall be mailed to the field personnel designated below.

2. The right to the use of ground water granted under this permit is for **livestock watering, road maintenance, dust abatement, and reclamation** and shall extend until **December 31, 2010**. At that time the permit will be automatically cancelled unless a written request for an extension of time has been received by the State Engineer prior to **December 31, 2010**.

3. **The water delivery system from this well shall be equipped with a functional backflow prevention device to eliminate the possibility of fluids or other matter entering the well during use.**

4. **The approval of this permit does not obligate the State Engineer to issue any permits for the use of water from this well for any purpose from this point forward, beyond what is authorized by this permit.**

5. Part I of the final Proof of Appropriation is required for this permit; however, Parts II and III are waived.

6. The State Engineer may, upon written request, waive all or any portion of these conditions and limitations.

May 27, 2009
Date of Approval

PATRICK T. TYRRELL, State Engineer

COPY OF THIS PERMIT MAILED TO:
Jade Henderson –Superintendent
P.O. Box 277
Cokeville, WY 83114

MS 15-20

Well Completion Log

FORM U.W. 5
Rev. 6/07
FILING FEE SCHEDULE
ON REVERSE SIDE

S6039063
50.00
9/17/08

STATE OF WYOMING

09-17-08 RCVD 0036

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E CHEYENNE, WYOMING 82002
(307) 777-6163

APPLICATION FOR PERMIT TO APPROPRIATE GROUND WATER

APPLICATION FOR WELLS AND SPRINGS

Note: Only springs flowing 25 gallons per minute or less, where the proposed use is domestic and /or stock watering, will be considered as ground water appropriations.

Temporary Filing No. U.W. 41-1-275

FOR OFFICE USE ONLY

PERMIT NO. U.W. 138898
WATER DIVISION NO. 4 DISTRICT 7
U.W. DISTRICT Sublette Co.

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.
ALL ITEMS MUST BE COMPLETED BEFORE APPLICATION IS ACCEPTABLE

NAME AND NUMBER OF WELL or SPRING Mesa 15-20 WSW

1. Name of applicant(s) 1- Questar Exploration and Production Company
2- Bureau of Land Management Phone: 303-308-3068

2. Address of applicant(s) 1- 1050 17th Street, Suite 500 Denver, CO 80265
2- P.O. Box 768, Pinedale, WY 82941
(MAILING ADDRESS) (CITY) (STATE) (ZIP)

3. Name & address of agent to receive correspondence and notices Debra K. Stanberry, Supervisor, Regulatory Affairs
1050 17th Street, Suite 500 Denver, CO 80265 Phone: 303-308-3068
(MAILING ADDRESS) (CITY) (STATE) (ZIP)

4. Use to which the water will be applied:

	Domestic:	Use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totaling one acre or less. Number of houses served?____.
	Stock Watering:	Normal livestock use at four tanks or less within one mile of well or spring. Stockwatering pipelines and commercial feedlots are a miscellaneous use. Number of stock tanks?____.
	Irrigation:	Watering of any lands for agricultural purposes not covered by the definition of domestic use (large-scale lawn watering of golf courses, cemeteries, recreation areas, etc., is miscellaneous use).
	Municipal:	Use of water in incorporated Towns and Cities. Note 1: use of water in unincorporated towns, subdivisions, improvement districts, mobile home parks, etc. is classified as miscellaneous use. Note 2: a permit may be required by the Wyoming Department of Environmental Quality (WDEQ) if the well will be classified as a public water supply under the WDEQ's rules and regulations.
	Industrial:	Long term use of water for the manufacture of a product or production of oil/gas or other minerals (oil field water flood operations, power plant water supply, etc.). (Describe in REMARKS)
X	Miscellaneous:	Any use of water not defined under previous definitions such as stock water pipelines, subdivisions, mine dewatering, mineral/oil exploration drilling, potable supplies in office, etc. (Describe in Remarks). Note: a permit may be required by the WDEQ if the well will be classified as a public water supply under the WDEQ's rules and regulations. Road maintenance, dust abatement, well work-overs/repairs and reclamation. Per Corr. Rec'd 10/22/08
	Coalbed Methane	Water produced in the production of coal bed methane gas. Note: wells used in the production of coal bed methane gas will require a permit from the Wyoming Oil and Gas Conservation Commission.
	Monitor, Observation	Note: a WDEQ permit may be required ☐ Test Well: (Describe in REMARKS)

5. Location of the well or spring: (NOTE: Quarter-quarter (40 acre subdivision) MUST be shown. EXAMPLE: SE 1/4 NW 1/4 of Sec 12, Township 14 North, Range 68 West.) SW 1/4 SE 1/4 of Sec. 20, T. 32 N., R. 109 W. of the 6th P.M. (W.R.M.), Sublette County, Wyoming. If located in a platted subdivision, also provide Lot/Tract ___ Block ___ of the ___ Subdivision (or Add'n) of ___. Resurvey Location: Tract ___, (or Lot) ___.

6. Estimated depth of the well or spring is 1000 feet. Estimated production interval is 650 ft. to 950 ft.

7. (a) MAXIMUM instantaneous flow of water to be developed and beneficially used: 125 gallons per minute. NOTE: if for domestic and / or stock use, this application will be processed for a maximum of 25 gallons per minute. For a spring, after approval of this application, some type of artificial diversion or improvement must be constructed to qualify for a water right.

(b) MAXIMUM volumetric quantity of water to be developed and beneficially used per calendar year: 15 acre feet. Circle appropriate units: (Gallons) (Acre Feet) A four person family utilizes approximately one (1) acre-foot of water per year or 325,000 gallons.

8. Mark the point(s) or area(s) of use in the tabulation box below. Note: Upper row refers to the quarter of the section. Next row refers to the quarter of the quarter section.

Per corresp. Rec'd 10/22/08

TABULATION BOX

TWP	RNG	SEC	NE¼				NW¼				SW¼				SE¼				TOTAL
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	
32	109	20			X					X	X	X	X	X	X	X	X	X	
32	109	21					X	X	X	X			X						

SEE REVERSE SIDE

Permit No. U.W. 138898 Book No. 1364 Page No. 148

9. If for irrigation use:
   a. Describe MAXIMUM acreage to be irrigated in each 40 acre subdivision in the tabulation box above.
   b. ☐ Land will be irrigated from this well only.
   c. ☐ Land is irrigated from existing water right(s) with water from this well to be additional supply. Describe existing water right(s) under REMARKS.

10. If for irrigation use, describe method of irrigation, i.e. center pivot sprinkler, flood, etc.: _____

11. The well or spring is to be constructed on lands owned by Bureau of Land Management
(The granting of a permit does not constitute the granting of a right-of-way. If any easement or right-of-way is necessary in connection with this application, it should be understood that the responsibility is the applicant's. A copy of the agreement should accompany this application, if the land is privately owned and the owner is not the co-applicant.)

12. The water is to be used on lands owned by Bureau of Land Management
(If the landowner is not the applicant, a copy of the agreement relating to the usage of the appropriated water on the land should be submitted to this office. If the landowner is included as co-applicant on the application, this procedure need not be followed.) NOTE: Water rights attach to the area(s) and/or point(s) of use.

REMARKS: Drilling of oil and gas wells, road maintenance, dust abatement, well work-overs/repairs and reclamation Refile of cancelled permit #162526

Under penalties of perjury, I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete.

Signature of Applicant or Authorized Agent — Date: September 10, 20 08

Debra K. Stanberry, Supervisor, Regulatory Affairs

THE LEGALLY REQUIRED FILING FEE MUST ACCOMPANY THIS APPLICATION

DOMESTIC AND/OR STOCK WATERING USES (Domestic use is defined as use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totalling one acre or less.)	$25.00
IRRIGATION, MUNICIPAL, INDUSTRIAL, MISCELLANEOUS, COAL BED METHANE	$50.00
MONITOR (For water level measurements or chemical quality sampling) or TEST WELL	No Fee

IF WELL WILL SERVE MULTIPLE USES, SUBMIT ONLY ONE (THE HIGHER) FILING FEE.

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

THE STATE OF WYOMING)
) ss.
STATE ENGINEER'S OFFICE)

This instrument was received and filed for record on the 17th day of September, A.D. 20 08, at 9:36 o'clock A M.

Permit No. U.W. 188898

for State Engineer

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This application is approved subject to the condition that the proposed use shall not interfere with any existing rights to ground water from the same source of supply and is subject to regulation and correlation with surface water rights, if the ground and surface waters are interconnected. The use of water hereunder is subject to the further provisions of Chapter 169, Session Laws of Wyoming, 1957, and any subsequent amendments thereto.

Granting of a permit does not guarantee the right to have the water level or artesian pressure in the well maintained at any specific level. The well should be constructed to a depth adequate to allow for the maximum development and beneficial use of ground water in the source of supply.

If the well is a flowing artesian well, it shall be so constructed and equipped that the flow may be shut off when not in use without loss of water into sub-surface formations or at the land surface.

Coal Bed Methane wells have Additional Conditions and Limitations on attachment sheet.

FOR ADDITIONAL CONDITIONS AND LIMITATIONS SEE ATTACHED STATUS SHEET.

This permit and accompanying notices serve to register an existing well and establish a valid water right for the same. Time limit for Completion of Construction and Completion of Beneficial Use is waived.

~~Approval of this application may be considered as authorization to proceed with construction of the proposed well or spring. A Statement of Completion will be filed within thirty (30) days of completion of construction, including pump installation.~~

~~Completion of construction and completion of the beneficial use of water for the purposes specified in Item 4 of this application will be made by December 31, 20____.~~

~~The amount of appropriation shall be limited to the quantity to which permittee is entitled as determined at time of proof of application of water to beneficial use.~~

Witness my hand this 29th day of Oct., A.D. 20 08.

for PATRICK T. TYRRELL, State Engineer

PERMIT NO. U.W. 138898
T.F. No. U.W. 41 - 1 - 275

PERMIT STATUS

Priority Date September 17th, 2008 **Approval Date** OCT 29 2008

ADDITIONAL CONDITIONS AND LIMITATIONS:

1. The right to the use of ground water granted under this permit is restricted to the point (s) of use shown. The State Engineer is to be notified in writing at least five (5) days prior to utilizing water under this permit at any additional points of use. The written notification shall contain location of the point of use by 40 acre legal subdivision and approximate length of time the water will be used at additional point of use. A copy of the written notification shall be mailed to the field personnel designated below.

2. The right to the use of ground water granted under this permit is for **oil and gas drilling, road maintenance, dust abatement, well work-overs/repairs and reclamation** shall extend until **December 31, 2013**. At that time the permit will be automatically cancelled unless a written request for an extension of time has been received by the State Engineer prior to **December 31, 2013**.

3. If this well is to be drilled on the main portion of the geographic region called "The Mesa", and the surface elevation of the well site is at an altitude greater than 7,250 feet above sea level, this well shall be cased with new or new-like quality blank unperforated casing from the land surface to a depth of at least 500 feet below land surface. Said casing shall be grouted in place utilizing one or more of the following materials, neat cement, cement/bentonite mixed grout, bentonite pellets/chips, or bentonite slurry, from the land surface to the bottom of the blank unperforated casing, interval specified above.

4. If this well is to be located in portions of the Pinedale Anticline Project Area that are not specific to "The Mesa" region as outlined in Condition 3, and, the well is to be situated within 1,000 feet of an existing domestic or stock watering well, the top of the production zone (perforated interval) utilized by this well shall be located at least 200 feet below that of the bottom of the deepest production zone utilized by existing domestic or stock watering wells located within 1,000 feet of this water supply well. In this case, this well shall be cased with new or new-like quality blank unperforated casing from the land surface to the top of the production zone of this well. Said casing shall be grouted in place utilizing one or more of the following materials, neat cement, cement/bentonite mixed grout, bentonite pellets/chips, or bentonite slurry, from the land surface to the bottom of the blank unperforated casing, interval specified above.

5. If this well is to be located in portions of the Pinedale Anticline Project Area that are not specific to "The Mesa" region as outlined in Condition 3, and, this well is not situated within 1,000 feet of an existing domestic or stock watering well, as outlined in Condition 4, this well shall be cased with new or new-like blank unperforated casing from the land surface to a depth of at least 200 feet below land surface. Said casing shall be grouted in place utilizing one or more of the following materials, neat cement, cement/bentonite mixed grout, bentonite pellets/chips, or bentonite slurry, from the land surface to the bottom of the blank unperforated casing, interval specified above

6. The water delivery system from this well shall be equipped with a functional backflow prevention device to eliminate the possibility of fluids or other matter entering the well during use.

7. Part I of the final Proof of Appropriation is required for this permit; however, Parts II and III are waived.

8. The State Engineer may, upon written request, waive all or any portion of these conditions and limitations.

10/27/2008
Date of Approval

for John R. Hall
PATRICK T. TYRRELL, State Engineer

COPY OF THIS PERMIT MAILED TO:
Jade Henderson –Superintendent
P.O. Box 277
Cokeville, WY 83114

September 17, 2008 - Statement of Completion on October 18, 2005 received.

September 17, 2008 - Proof of Beneficial Use on August 16, 2008 received.

FORM U.W.6
Rev. 1/07

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E
CHEYENNE, WYOMING 82002

(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

NOTE: Do not fold this form. Use typewriter or print neatly with black pen.

PERMIT NO. U.W. 188898 NAME OF WELL/SPRING Mesa 15-20 Water Source Well

1. NAME OF OWNER 1- Questar Exploration and Production Company 2-Bureau of Land Management

2. ADDRESS 1-1050 17th Street, Suite 500 2-P.O.Box 768
☐ Please check if address has changed from that shown on permit
City 1- Denver 2- Pinedale State 1- Colorado 2- Wyoming Zip Code 1-80265 2-82941 Phone No. 303-308-3068

3. USE OF WATER ☐ Domestic ☐ Stock Watering ☐ Irrigation ☐ Municipal ☐ Industrial ☒ Miscellaneous
☐ Monitor or Test ☐ Coal Bed Methane Explain proposed use (Example: One single family dwelling)
Oil & Gas Well Drilling, Rd Maintenance, dust abatement, well work-overs/repairs and reclamation

4. LOCATION OF WELL/SPRING SW 1/4 SE 1/4 of Section 20 T. 32 N.,R. 109 W., of the 6th P.M. (or W.R.M.)
Subdivision Name _____ Lot _____ Block _____
Resurvey Location Tract _____ or Lot _____ Datum ☐ NAD27 ☐ NAD83
Geographic Coordinates: ~~Latitude~~ Long: -109° 51' 22.339" N ~~Longitude~~ Lat: 42° 43' 42.012" W (degrees, minutes, seconds)
UTM Zone 12 Northing ? Easting ? (meters) JH
State Plane Coordinates: Zone _____ Northing 4731282 Easting 593639 (feet)
Land surface elevation (ft. above mean sea level) 7455 Datum ☐ NAVD29 ☐ NAVD88
Source ☒ GPS ☐ Map ☐ Survey ☐ Unkown ☐ Other ☐ Altimeter (for elevation only)

5. TYPE OF CONSTRUCTION ☒ Drilled Rotary ☐ Dug ☐ Driven ☐ Other
Describe _____

6. CONSTRUCTION Total depth of well/spring 1120 ft.
Depth of static water level 560 ft. (below land surface) Casing height 18" ft. above ground
a. Diameter of borehole (bit size) 13 3/8 inches
b. Casing schedule ☒ New ☐ Used Joint type ☐ Threaded ☐ Glued ☒ Welded
16 diameter from 0 ft. to 20 ft. Material Steel Gage 1/4 .250
8 diameter from 0 ft. to 1120 ft. Material Steel Gage 1/4 .250
c. Cemented/grouted interval, from 500 ft. to Surface ft.
Amount of cement/grout used 125 Sacks (example: 10 sacks) type Cement neat & plug gel (example: bentonite pellets)
d. Type of completion ☒ Customized perforations ☐ Open hole ☐ Factory screen
Type of perforator used Air Perforator
Size of perforations 1/8 inches by 1 1/2 inches.
Number of perforations and depths where perforated
320 perforations from 660 ft. to 690 ft.
480 perforations from 760 ft. to 800 ft.
Open hole from _____ ft. to _____ ft.
80 perforations from 840' to 850'
480 perforations from 930' to 970'
480 perforations from 980' to 1060'
160 perforations from 1080' to 1100'
Well screen details
Diameter _____ slot size _____ set from _____ ft. to _____ ft.
Diameter _____ slot size _____ set from _____ ft. to _____ ft.
e. Well development method Rotary How long was well developed? 36 Hours
f. Was a filter/gravel pack installed? ☒ Yes ☐ No Size of sand/gravel 1/4 Minus
Filter/gravel pack installed from 500 ft. to 1120 ft.
g. Was surface casing used? ☒ Yes ☐ No Was it cemented in place? ☐ Yes ☒ No
Surface casing installed from 0 ft. to 20 ft.

7. NAME AND ADDRESS OF DRILLING COMPANY White Mountain Drilling Co. P.O.Box 2353 Pinedale, WY 82941

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) 10/18/2005

9. PUMP INFORMATION Manufacturer Grundfoss Type Submersible
Source of power Generator Horsepower 50 Depth of pump setting or intake 1100 ft.
Amount of water being pumped 100 gal./min.* (For springs or flowing wells, see item 10)
Total volumetric quantity used per calendar year.* 15 acre feet
*If these amounts exceed permitted amount an enlargement is required.

10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
If artesian flow or spring, yield is _____ gal./min. *Surface pressure is _____ lb./sq.inch. or _____ feet of water.
The flow is controlled by ☒ Valve ☐ Cap ☐ Plug
Does well leak around casing? ☐ Yes ☒ No

SEP 1 2006

Permit No. U.W 188898 Book No 1364 Page No 148

SEE REVERSE SIDE

11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion. i.e., spring box, cribbing, etc.. is necessary to qualify for a water right) _____

12. PUMP TEST Was a pump test conducted? ☐ Yes ☒ No

If so, by whom _____

Yield _____ gal./min. with _____ ft. drawdown after _____ hours

Yield _____ gal./min. with _____ ft. drawdown after _____ hours

13. LOG OF WELL Total depth drilled 1120 ft.

Depth of completed well 1120 ft. Diameter of well 8 inches

Depth to first water bearing formation 460 ft.

Depth to principal water bearing formation Top 660 ft. to Bottom 1120 ft.

DRILL CUTTINGS DESCRIPTION

From Feet	To Feet	Rock Type or Description	Formation	Water Bearing? (Yes or no)
Surface	460	Shale, Grey		
460	500	Sandstone, Light Grey		
500	660	Shale, Blue Grey		
660	700	Sandstone, Grey		
700	760	Shale, Tan		
760	800	Sandstone, Grey		
800	840	Shale		
840	850	Sandstone		
850	930	Shale, Green		
930	970	Sandstone, Light Grey	Note: Perforations from	
970	990	Shale, Grey	660' to 1100'	
990	1030	Sandstone, Grey		
1050	1120	Shale		

14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM? ☐ Yes ☒ No

15. QUALITY OF WATER INFORMATION

Does a chemical and/or bacteriological water quality analysis accompany this form? ☐ Yes ☒ No

It is recommended that chemical and bacteriologic water quality analyses be performed and that the report(s) be filed with the records of this well (contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984).

If not, do you consider the water as Good ☒ Acceptable ☐ Poor Unusable

REMARKS _____

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct, and complete.

Signature of Owner or Authorized Agent

Debra K. Stamberry, Supervisor, Regulatory Affairs

September 10, 20 08

Date

FOR STATE ENGINEER'S USE ONLY

Permit No. U.W. 138898

Date of Receipt SEP 17 2008, 20____

Date of Priorty _____, 20____

Date of Approval 10/29, 20 08

for State Engineer

MS 3-17

Well Completion Log

6.5.09

FORM U.W. 5
Rev. 6/07
FILING FEE SCHEDULE
ON REVERSE SIDE

SE0460559
75.00
6/5/09

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E CHEYENNE, WYOMING 82002
(307) 777-6163

APPLICATION FOR PERMIT TO APPROPRIATE GROUND WATER

APPLICATION FOR WELLS AND SPRINGS

Note: Only springs flowing 25 gallons per minute or less, where the proposed use is domestic and /or stock watering, will be considered as ground water appropriations.

Temporary Filing No. U.W. 41-3-480

FOR OFFICE USE ONLY

PERMIT NO. U.W. 190937
WATER DIVISION NO. 4 DISTRICT 7
U.W. DISTRICT Pinedale Anticline Project

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.
ALL ITEMS MUST BE COMPLETED BEFORE APPLICATION IS ACCEPTABLE

NAME AND NUMBER OF WELL or SPRING Mesa 3-17 WSW

1. Name of applicant(s) 1- Questar Exploration and Production Company 2- Bureau of Land Management Phone: 1)303-308-3068 2)307-367-5300
2. Address of applicant(s) 1- 1050 17th Street, Suite 500 Denver, CO 80265 2- P.O.Box 768, Pinedale, WY 82941
   (MAILING ADDRESS) (CITY) (STATE) (ZIP)
3. Name & address of agent to receive correspondence and notices Debra K. Stanberry, Regional Supervisor, Regulatory Affairs
   1050 17th Street, Suite 500 Denver, CO 80265 Phone: 303-308-3068
   (MAILING ADDRESS) (CITY) (STATE) (ZIP)
4. Use to which the water will be applied:

☐ Domestic. Use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totaling one acre or less. Number of houses served?____.

☐ Stock Watering: Normal livestock use at four tanks or less within one mile of well or spring. Stockwatering pipelines and commercial feedlots are a miscellaneous use. Number of stock tanks?____.

☐ Irrigation: Watering of any lands for agricultural purposes not covered by the definition of domestic use (large-scale lawn watering of golf courses, cemeteries, recreation areas, etc., is miscellaneous use).

☐ Municipal: Use of water in incorporated Towns and Cities. Note 1: use of water in unincorporated towns, subdivisions, improvement districts, mobile home parks, etc. is classified as miscellaneous use. Note 2: a permit may be required by the Wyoming Department of Environmental Quality (WDEQ) if the well will be classified as a public water supply under the WDEQ's rules and regulations.

☐ Industrial: Long term use of water for the manufacture of a product or production of oil/gas or other minerals (oil field water flood operations, power plant water supply, etc.). (Describe in REMARKS)

☒ Miscellaneous: Any use of water not defined under previous definitions such as stock water pipelines, subdivisions, mine dewatering, mineral/oil exploration drilling, potable supplies in office, etc. (Describe in Remarks). Note: a permit may be required by the WDEQ if the well will be classified as a public water supply under the WDEQ's rules and regulations. completions,road construction/ maintenance,dust abatement,well workover's/repairs & reclamation.

☐ Coalbed Methane Water produced in the production of coal bed methane gas. Note: wells used in the production of coal bed methane gas will require a permit from the Wyoming Oil and Gas Conservation Commission.

☐ Monitor, Observation Note: a WDEQ permit may be required ☐ Test Well: (Describe in REMARKS)

5. Location of the well or spring: (NOTE: Quarter-quarter (40 acre subdivision) MUST be shown. EXAMPLE: SE 1/ 4 NW 1/ 4 of Sec. 12, Township 14 North, Range 68 West.) Dep. Res. per BLM GLO 6M 7-18-09
   Sublette County, NE 1/4 NW 1/4 of Sec. 17, T. 32 N., R. 109 W. of the 6th P.M. (W.R.M.), Wyoming. If located in a platted subdivision, also provide Lot/Tract ___ Block ___ of the _____ Subdivision (or Add'n) of _____. Resurvey Location: Tract ____, (or Lot) ____.
6. Estimated depth of the well or spring is ~~1000~~ 1200 Per U.W.6 6M feet. Estimated production interval is ~~700~~ 710 ft. to ~~950~~ 1190 Per U.W.6 6M ft.
7. (a) MAXIMUM instantaneous flow of water to be developed and beneficially used: 125 gallons per minute. NOTE: if for domestic and / or stock use, this application will be processed for a maximum of 25 gallons per minute. For a spring, after approval of this application, some type of artificial diversion or improvement must be constructed to qualify for a water right.

   (b) MAXIMUM volumetric quantity of water to be developed and beneficially used per calendar year: 10 acre feet. Circle appropriate units: (Gallons) (Acre Feet) A four person family utilizes approximately one (1) acre-foot of water per year or 325,000 gallons.
8. Mark the point(s) or area(s) of use in the tabulation box below. Note: Upper row refers to the quarter of the section. Next row refers to the quarter of the quarter section.

TABULATION BOX

TWP	RNG	SEC	NE¼				NW¼				SW¼				SE¼				TOTAL
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	
32	109	17		X			X	X	X	X			X	X			X		

SEE REVERSE SIDE

Permit No. U.W. 190937 Book No. 1378 Page No. 87

9. If for irrigation use:
   a. Describe MAXIMUM acreage to be irrigated in each 40 acre subdivision in the tabulation box above.
   b. ☐ Land will be irrigated from this well only.
   c. ☐ Land is irrigated from existing water right(s) with water from this well to be additional supply. Describe existing water right(s) under REMARKS.

10. If for irrigation use, describe method of irrigation, i.e. center pivot sprinkler, flood, etc.: _____

11. The well or spring is to be constructed on lands owned by Bureau of Land Management
(The granting of a permit does not constitute the granting of a right-of-way. If any easement or right-of-way is necessary in connection with this application, it should be understood that the responsibility is the applicant's. A copy of the agreement should accompany this application, if the land is privately owned and the owner is not the co-applicant.)

12. The water is to be used on lands owned by Bureau of Land Management
(If the landowner is not the applicant, a copy of the agreement relating to the usage of the appropriated water on the land should be submitted to this office. If the landowner is included as co-applicant on the application, this procedure need not be followed.) NOTE: Water rights attach to the area(s) and/or point(s) of use.

REMARKS: This water source well was previously permitted under Permit #176928 which expired on 12/31/07. Water from this well will be used for oil & gas well drilling & completions, road construction/maintenance, dust abatement, well workover's/repairs & reclamation.

Under penalties of perjury, I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete.

Signature of Applicant or Authorized Agent — April 30, 20 09 (Date)

Debra K. Stanberry, Regional Supervisor, Regulatory Affairs

THE LEGALLY REQUIRED FILING FEE MUST ACCOMPANY THIS APPLICATION

DOMESTIC AND/OR STOCK WATERING USES (Domestic use is defined as use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totalling one acre or less.)	$25.00
IRRIGATION, MUNICIPAL, INDUSTRIAL, MISCELLANEOUS, COAL BED METHANE	$50.00
MONITOR (For water level measurements or chemical quality sampling) or TEST WELL	No Fee

IF WELL WILL SERVE MULTIPLE USES, SUBMIT ONLY ONE (THE HIGHER) FILING FEE.

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

THE STATE OF WYOMING)
) ss.
STATE ENGINEER'S OFFICE)

This instrument was received and filed for record on the 5th day of June, A.D. 20 09, at 9:56 o'clock A M.

Permit No. U.W. 190937

for State Engineer

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This application is approved subject to the condition that the proposed use shall not interfere with any existing rights to ground water from the same source of supply and is subject to regulation and correlation with surface water rights, if the ground and surface waters are interconnected. The use of water hereunder is subject to the further provisions of Chapter 169, Session Laws of Wyoming, 1957, and any subsequent amendments thereto.

Granting of a permit does not guarantee the right to have the water level or artesian pressure in the well maintained at any specific level. The well should be constructed to a depth adequate to allow for the maximum development and beneficial use of ground water in the source of supply.

If the well is a flowing artesian well, it shall be so constructed and equipped that the flow may be shut off when not in use without loss of water into sub-surface formations or at the land surface.

Coal Bed Methane wells have Additional Conditions and Limitations on attachment sheet.

FOR ADDITIONAL CONDITIONS AND LIMITATIONS SEE ATTACHED STATUS SHEET.

This permit and accompanying notices serve to register an existing well and establish valid water right for the same. Time limit for Completion of Construction and Completion o Beneficial Use is waived.

~~Approval of this application may be considered as authorization to proceed with construction of the proposed well or spring. A Statement of Completion will be filed within thirty (30) days of completion of construction, including pump installation.~~

~~Completion of construction and completion of the beneficial use of water for the purposes specified in Item 4 of this application will be made by December 31, 20____.~~

The amount of appropriation shall be limited to the quantity to which permittee is entitled as determined at time of proof of application of water to beneficial use.

Witness my hand this 27th day of July, A.D. 20 09.

for PATRICK T. TYRRELL, State Engineer

June 5, 2009 - Statement of Completion on November 14, 2007 received.

June 5, 2009 - Proof of Beneficial Use on November 14, 2007 received.

FORM U.W.6
Rev. 1/07

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E
CHEYENNE, WYOMING 82002

(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

NOTE: Do not fold this form. Use typewriter or print neatly with black pen.

PERMIT NO. U.W. 190937 NAME OF WELL/SPRING Mesa 3-17 WSW

1. NAME OF OWNER 1-Questar Exploration and Production Company 2-Bureau of Land Management

2. ADDRESS 1-1050 17th Street, Suite 500 2-P.O.Box 768
☐ Please check if address has changed from that shown on permit
City 1- Denver 2- Pinedale State 1- Colorado 2- Wyoming Zip Code 1-80265 2-82941 Phone No. 1-303-308-3068 2-307-367-5300

3. USE OF WATER ☐ Domestic ☐ Stock Watering ☐ Irrigation ☐ Municipal ☐ Industrial ☒ Miscellaneous
☐ Monitor or Test ☐ Coal Bed Methane Explain proposed use (Example: One single family dwelling) Reclamation, Oil & Gas Well Drilling & Completions, road construction/maint.,dust abatement,wel workovers/repairs.

4. LOCATION OF WELL/SPRING NE 1/4 NW 1/4 of Section 17 T. 32 N., R. 109 W., of the 6th P.M. (or W.R.M.)
Subdivision Name _____ Lot _____ Block _____
Resurvey Location Tract _____ or Lot _____ Datum ☐ NAD27 ☐ NAD83 _____
Geographic Coordinates: Latitude 42° 45' 7.5916" N Longitude 109° 51' 39.7011" W (degrees, minutes, seconds)
UTM: Zone 12 Northing 4733917.10 Easting 593229.92 (meters)
State Plane Coordinates: Zone _____ Northing _____ Easting _____ (feet)
Land surface elevation (ft. above mean sea level) 7478' Datum ☐ NAVD29 ☐ NAVD88
Source ☒ GPS ☐ Map ☐ Survey ☐ Unkown ☐ Other ☐ Altimeter (for elevation only)

5. TYPE OF CONSTRUCTION ☒ Drilled Rotary ☐ Dug ☐ Driven ☐ Other
Describe _____

6. CONSTRUCTION Total depth of well/spring 1200 ft.
Depth of static water level 198 ft. (below land surface) Casing height 0 ft. above ground
a. Diameter of borehole (bit size) 12 1/2 inches
b. Casing schedule ☒ New ☐ Used Joint type ☐ Threaded ☐ Glued ☒ Welded
16" diameter from 0 ft. to 44 ft. Material Steel Gage .250
8" diameter from 0 ft. to 1200 ft. Material Steel Gage .250
c. Cemented/grouted interval, from 0 ft. to 500 ft.
Amount of cement/grout used 160 cu.ft. (example: 10 sacks) type Cement 1-2 Neat (example: bentonite pellets)
d. Type of completion ☒ Customized perforations ☐ Open hole ☐ Factory screen
Type of perforator used Torch Cut
Size of perforations 1 inches by .25 inches.
Number of perforations and depths where perforated
360 perforations from 740 ft. to 1190 ft.
_____ perforations from _____ ft. to _____ ft.
Open hole from _____ ft. to _____ ft.
Well screen details
Diameter _____ slot size _____ set from _____ ft. to _____ ft.
Diameter _____ slot size _____ set from _____ ft. to _____ ft.
e. Well development method Rotary How long was well developed? 4 days
f. Was a filter/gravel pack installed? ☒ Yes ☐ No Size of sand/gravel 3/4 minus pea gravel
Filter/gravel pack installed from 500 ft. to 1200 ft.
g. Was surface casing used? ☒ Yes ☐ No Was it cemented in place? ☒ Yes ☐ No
Surface casing installed from 0 ft. to 44 ft.

7. NAME AND ADDRESS OF DRILLING COMPANY White Mountain Drilling Co.P.O.Box 2353 13 Industrial Site Ext Road, Pinedale, WY 82941

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) 11/14/2007

9. PUMP INFORMATION Manufacturer Grundfos Type Submersible
Source of power Diesel Generator Horsepower 50 Depth of pump setting or intake 1180 ft.
Amount of water being pumped ~~180~~ 125 / 2 U.W. 53N gal./min.* (For springs or flowing wells, see item 10)
Total volumetric quantity used per calendar year.* 10 acre ft.
*If these amounts exceed permitted amount an enlargement is required.

10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
If artesian flow or spring, yield is _____ gal./min. *Surface pressure is _____ lb./sq.inch, or _____ feet of water.
The flow is controlled by ☐ Valve ☐ Cap ☐ Plug
Does well leak around casing? ☐ Yes ☐ No

Permit No. U.W. 190937 Book No. 1378 Page No. 87

SEE REVERSE SIDE

MAY 2 2009

JUN 5

11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion, i.e., spring box, cribbing, etc., is necessary to qualify for a water right) _____

12. PUMP TEST Was a pump test conducted? ☐ Yes ☒ No
If so, by whom _____
Yield _____ gal./min. with _____ ft. drawdown after _____ hours
Yield _____ gal./min. with _____ ft. drawdown after _____ hours

13. LOG OF WELL Total depth drilled 1200 ft.
Depth of completed well 1200 ft. Diameter of well 12 1/2 inches
Depth to first water bearing formation _____ ft.
Depth to principal water bearing formation Top 740 ft. to Bottom 1190 ft.

DRILL CUTTINGS DESCRIPTION

From Feet	To Feet	Rock Type or Description	Formation	Water Bearing? (Yes or no)
Surface				
0	740	Clay		NO
740	770	Water Sand	Perforation	YES
770	870	Clay		NO
870	890	Water Sand	Perforation	YES
890	1040	Clay		NO
1040	1060	Water Sand	Perforation	YES
1060	1170	Clay		NO
1170	1190	Water Sand	Perforation	YES
1190	1200	Clay		NO

14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM? ☐ Yes ☒ No

15. QUALITY OF WATER INFORMATION

Does a chemical and/or bacteriological water quality analysis accompany this form? ☐ Yes ☒ No
It is recommended that chemical and bacteriologic water quality analyses be performed and that the report(s) be filed with the records of this well (contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984).
If not, do you consider the water as ☐ Good ☒ Acceptable ☐ Poor ☐ Unusable

REMARKS Mesa 3-17 WSW is located inside the boundary of the Pinedale Anticline defined in the 2008 Record of Decision and is subject to be included in the groundwater characterization study that is required through the Record of Decision for Final Supplemental EIS for the Pinedale Anticline.

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct, and complete.

Debra K. Stanberry — Signature of Owner or Authorized Agent

April 30, 20 09 — Date

~~Debra K. Stanberry, Regional Supervisor, Regulatory Affairs~~

FOR STATE ENGINEER'S USE ONLY

Permit No. U.W. 190937

Date of Receipt MAY 21 2009, 20____

Date of Priorty _____, 20____

Date of Approval 7/27, 20 09

for State Engineer

Revised 11/2/2004

PERMIT NO. U.W. 190937
T.F. No. U.W. 41-3-480

PERMIT STATUS

Priority Date: June 5, 2009 **Approval Date:** JUL 2 7 2009

ADDITIONAL CONDITIONS AND LIMITATIONS:

1. The right to the use of ground water granted under this permit is restricted to the point (s) of use shown. The State Engineer is to be notified in writing at least five (5) days prior to utilizing water under this permit at any additional points of use. The written notification shall contain location of the point of use by 40 acre legal subdivision and approximate length of time the water will be used at additional point of use. A copy of the written notification shall be mailed to the field personnel designated below.

2. The right to the use of ground water granted under this permit is for **oil and gas development, road maintenance, dust abatement, well work-over/repairs & reclamation** shall extend until **December 31, 2014**. At that time the permit will be automatically cancelled unless a written request for an extension of time has been received by the State Engineer prior to **December 31, 2014**.

3. If this well is to be drilled on the main portion of the geographic region called "The Mesa", and the surface elevation of the well site is at an altitude greater than 7,250 feet above sea level, this well shall be cased with new or new-like quality blank unperforated casing from the land surface to a depth of at least 500 feet below land surface. Said casing shall be grouted in place utilizing one or more of the following materials, neat cement, cement/bentonite mixed grout, bentonite pellets/chips, or bentonite slurry, from the land surface to the bottom of the blank unperforated casing, interval specified above.

4. If this well is to be located in portions of the Pinedale Anticline Project Area that are not specific to "The Mesa" region as outlined in Condition 3, and, the well is to be situated within 1,000 feet of an existing domestic or stock watering well, the top of the production zone (perforated interval) utilized by this well shall be located at least 200 feet below that of the bottom of the deepest production zone utilized by existing domestic or stock watering wells located within 1,000 feet of this water supply well. In this case, this well shall be cased with new or new-like quality blank unperforated casing from the land surface to the top of the production zone of this well. Said casing shall be grouted in place utilizing one or more of the following materials, neat cement, cement/bentonite mixed grout, bentonite pellets/chips, or bentonite slurry, from the land surface to the bottom of the blank unperforated casing, interval specified above.

5. If this well is to be located in portions of the Pinedale Anticline Project Area that are not specific to "The Mesa" region as outlined in Condition 3, and, this well is not situated within 1,000 feet of an existing domestic or stock watering well, as outlined in Condition 4, this well shall be cased with new or new-like blank unperforated casing from the land surface to a depth of at least 200 feet below land surface. Said casing shall be grouted in place utilizing one or more of the following materials, neat cement, cement/bentonite mixed grout, bentonite pellets/chips, or bentonite slurry, from the land surface to the bottom of the blank unperforated casing, interval specified above

6. The water delivery system from this well shall be equipped with a functional backflow prevention device to eliminate the possibility of fluids or other matter entering the well during use.

7. Part I of the final Proof of Appropriation is required for this permit; however, Parts II and III are waived.

8. The State Engineer may, upon written request, waive all or any portion of these conditions and limitations.

7/27/2009
Date of Approval

for PATRICK T. TYRRELL, State Engineer

COPY OF THIS PERMIT MAILED TO:
Jade Henderson –Superintendent
P.O. Box 277
Cokeville, WY 83114

MS 3-20

Well Completion Log

4:00
6/19/06

FORM U.W. 5
Rev. 7/03
FILING FEE SCHEDULE
ON REVERSE SIDE

See 31 890
50.00
6/19/06

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E CHEYENNE, WYOMING 82002
(307) 777-6163

APPLICATION FOR PERMIT TO APPROPRIATE GROUND WATER

APPLICATION FOR WELLS AND SPRINGS

Note: Only springs flowing 25 gallons per minute or less, where the proposed use is domestic and /or stock watering, will be considered as ground water appropriations.

FOR OFFICE USE ONLY

PERMIT NO. U.W. 178314
WATER DIVISION NO. 4 DISTRICT 7
U.W. DISTRICT Sublette Co.

Temporary Filing No. U.W. 39-1-100

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.
ALL ITEMS MUST BE COMPLETED BEFORE APPLICATION IS ACCEPTABLE

NAME AND NUMBER OF WELL or SPRING Mesa Water Well No. 3-20

1. Name of applicant(s) 1) Questar Exploration and Production Company 2) Bureau of Land Management — Phone: 1) 303-672-6970 2) 307-367-5300

2. Address of applicant(s) 1) 1050 17th Street, Suite 500 Denver, CO 80265 2) P.O. Box 768 Pinedale WY 82941
(MAILING ADDRESS) (CITY) (STATE) (ZIP)

3. Name & address of agent to receive correspondence and notices Jane Seiler, Regulatory Affairs Manager
1050 17th Street, Suite 500 Denver, WY 80265 Phone: 303-672-6970
(MAILING ADDRESS) (CITY) (STATE) (ZIP)

4. Use to which the water will be applied:

☐ Domestic: Use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totaling one acre or less. Number of houses served?____.

☐ Stock Watering: Normal livestock use at four tanks or less within one mile of well or spring. Stockwatering pipelines and commercial feedlots are a miscellaneous use. Number of stock tanks?____.

☐ Irrigation: Watering of commercially grown crops (large-scale lawn watering of golf courses, cemeteries, recreation areas, etc., is miscellaneous use).

☐ Municipal: Use of water in incorporated Towns and Cities. Note 1: use of water in unincorporated towns, subdivisions, improvement districts, mobile home parks, etc. is classified as miscellaneous use. Note 2: a permit may be required by the Wyoming Department of Environmental Quality (WDEQ) if the well will be classified as a public water supply under the WDEQ's rules and regulations.

☐ Industrial: Long term use of water for the manufacture of a product or production of oil/gas or other minerals (oil field water flood operations, power plant water supply, etc.). (Describe in REMARKS)

☒ Miscellaneous: Any use of water not defined under previous definitions such as stock water pipelines, subdivisions, mine dewatering, mineral/oil exploration drilling, potable supplies in office, etc Describe in Remarks. Note: a permit may be required by the WDEQ if the well will be classified as a public water supply under the WDEQ's rules and regulations. road Construction, maintenance, dust abatement, work overs/repairs & reclamation.

☐ Coalbed Methane Water produced in the production of coal bed methane gas. Note: wells used in the production coal bed methane will require a permit from the Wyoming Oil and Gas Conservation Commission.

☐ Monitor, Observation Note: a WDEQ permit may be required ☐ Test Well: (Describe in REMARKS)

5. Location of the well or spring: (NOTE: Quarter-quarter (40 acre subdivision) MUST be shown. EXAMPLE: SE 1/ 4 NW 1/ 4 of Sec. 12, Township 14 North, Range 68 West.)
Sublette County, NE 1/4 NW 1/4 of Sec. 20, T. 32 N., R. 109 W. of the 6th P.M. (W.R.M.), Wyoming. If located in a platted subdivision, also provide Lot/Tract ___ Block ___ of the _____ Subdivision (or Add'n) of _____. Resurvey Location: Tract ____, (or Lot) ____.

6. Estimated depth of the well or spring is 900 feet. Estimated production interval is 660 ft. to 800 ft.

7. (a) MAXIMUM instantaneous flow of water to be developed and beneficially used: 125 gallons per minute. NOTE: if for domestic and / or stock use, this application will be processed for a maximum of 25 gallons per minute. For a spring, after approval of this application, some type of artificial diversion or improvement must be constructed to qualify for a water right.

(b) MAXIMUM volumetric quantity of water to be developed and beneficially used per calendar year: 10.
Circle appropriate units: (Gallons) (Acre Feet) A four person family utilizes approximately one (1) acre-foot of water per year or 325,000 gallons.

8. Mark the point(s) or area(s) of use in the tabulation box below.

TABULATION BOX

Per e-mail Rec'd 9/14/06 H

TWP	RNG	SEC	NE¼				NW¼				SW¼				SE¼				TOTAL
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	
32	109	20	X	X	X	X	X	X	X	X	All	Quarter	- Quarters						
32	109	17	All	Quarter-	Quarters						X	X	X	X	X	X	X	X	
32	109	18	X	X	X	X									X	X	X	X	
32	109	19	X	X	X	X									X	X	X	X	

Permit No. U.W. 178314 SEE REVERSE SIDE Book No. 1294 Page No. 66

9. If for irrigation use:
   a. Describe MAXIMUM acreage to be irrigated in each 40 acre subdivision in the tabulation box above.
   b. ☐ Land will be irrigated from this well only.
   c. ☐ Land is irrigated from existing water right(s) with water from this well to be additional supply. Describe existing water right(s) under REMARKS.

10. If for irrigation use, describe method of irrigation, i.e. center pivot sprinkler, flood, etc.: _____

11. The well or spring is to be constructed on lands owned by Bureau of Land Management
(The granting of a permit does not constitute the granting of right-of-way. If any easement or right-of-way is necessary in connection with this application, it should be understood that the responsibility is the applicant's. A copy of the agreement should accompany this application, if the land is privately owned and the owner is not the co-applicant.)

12. The water is to be used on lands owned by Bureau of Land Management
(If the landowner is not the applicant, a copy of the agreement relating to the usage of appropriated water on the land should be submitted to this office. If the landowner is included as co-applicant on the application, this procedure need not be followed.) NOTE: Water rights attach to the area(s) and/or point(s) of use.

REMARKS: This water source well was previously permitted under Permit No. U.W. 126623 which expired on 12/31/02. Water from this well will be used for oil/gas well drilling and completions, road construction & maintenance, dust abatement, well workovers and repairs and reclamation

Under penalties of perjury, I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete.

Questar Exploration and Production Company

Signature of Applicant or Authorized Agent — Date: June 9, 2006

Jane Seiler, Regulatory Affairs Manager

THE LEGALLY REQUIRED FILING FEE MUST ACCOMPANY THIS APPLICATION

DOMESTIC AND/OR STOCK WATERING USES (Domestic use is defined as use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totalling one acre or less.)	$25.00
IRRIGATION, MUNICIPAL, INDUSTRIAL, MISCELLANEOUS, COAL BED METHANE	$50.00
MONITOR (For water level measurements or chemical quality sampling) or TEST WELL	No Fee

IF WELL WILL SERVE MULTIPLE USES, SUBMIT ONLY ONE (THE HIGHER) FILING FEE.

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

THE STATE OF WYOMING)
) ss.
STATE ENGINEER'S OFFICE)

This instrument was received and filed for record on the 19th day of June, A.D. 20 06, at 9:00 o'clock a M.

Permit No. U.W. 178314

for State Engineer

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This application is approved subject to the condition that the proposed use shall not interfere with any existing rights to ground water from the same source of supply and is subject to regulation and correlation with surface water rights, if the ground and surface waters are interconnected. The use of water hereunder is subject to the further provisions of Chapter 169, Session Laws of Wyoming, 1957, and any subsequent amendments thereto.

Granting of a permit does not guarantee the right to have the water level or artesian pressure in the well maintained at any specific level. The well should be constructed to a depth adequate to allow for the maximum development and beneficial use of ground water in the source of supply.

If the well is a flowing artesian well, it shall be so constructed and equipped that the flow may be shut off when not in use without loss of water into sub-surface formations or at the land surface.

Coal Bed Methane wells have Additional Conditions and Limitations on attachment sheet.

FOR ADDITIONAL CONDITIONS AND LIMITATIONS SEE ATTACHED STATUS SHEET.

This permit and accompanying notices serve to register an existing well and establish a valid water right for the same. Time limit for Completion of Construction And Completion of Beneficial Use is waived

~~Approval of this application may be considered as authorization to proceed with construction of the proposed well or spring. A Statement of Completion will be filed within thirty (30) days of completion of construction, including pump installation.~~

~~Completion of construction and completion of the beneficial use of water for the purposes specified in Item 4 of this application will be made by December 31, 20___.~~

~~The amount of appropriation shall be limited to the quantity to which permittee is entitled as determined at time of proof of application of water to beneficial use.~~

Witness my hand this 24th day of November, A.D. 20 06.

PATRICK T. TYRRELL, State Engineer

Revised 11/2/2004

PERMIT NO. U.W. 178314
T.F. No. U.W. 39-1-100

PERMIT STATUS

Priority Date June 19th, 2006 **Approval Date** NOV 24 2006

ADDITIONAL CONDITIONS AND LIMITATIONS:

1. The right to the use of ground water granted under this permit is restricted to the point (s) of use shown. The State Engineer is to be notified in writing at least five (5) days prior to utilizing water under this permit at any additional points of use. The written notification shall contain location of the point of use by 40 acre legal subdivision and approximate length of time the water will be used at additional point of use. A copy of the written notification shall be mailed to the field personnel designated below.

2. The right to the use of ground water granted under this permit for **oil & gas well drilling, road construction and maintenance, dust abatement, well work-overs/repairs, and reclamation** shall extend until **December 31, 2009**. At that time the permit will be automatically cancelled unless a written request for an extension of time has been received by the State Engineer prior to **December 31, 2009**.

3. **This well is located within the Pinedale Anticline Project Area on the geographic area known as "The Mesa", and at an elevation greater than 7,250 feet above sea level. The Additional Conditions and Limitations concerning construction of wells of this type in this location developed in conjunction with the United States Department of Interior, Bureau of Land Management require that the well annulus be fully sealed from land surface to a depth of at least 500 feet in order to eliminate production of water from those zones targeted by the existing stock watering wells located on "The Mesa". This existing well was constructed by emplacing cement within the well annulus from land surface to a depth of 480 feet. The log of the well indicates that cement has been emplaced opposite all of the productive zones targeted by stock watering wells in the area, effectively eliminating production of water from those zones by this well. On November 15, 2006, a letter signed by both the applicant and the United States Department of Interior, Bureau of Land Management, the agency responsible for the implementation of the Record of Decision for the Pinedale Anticline Project was received requesting that the 500 foot cemented interval requirement be waived in this instance, and the request is hereby granted.**

4. Part I of the final Proof of Appropriation is required for this permit; however, Parts II and III are waived.

5. The State Engineer may, upon written request, waive all or any portion of these conditions and limitations.

November 24, 2006
Date of Approval

for PATRICK T. TYRRELL, State Engineer

COPY OF THIS PERMIT MAILED TO:
Chris Carlsen – Assistant Superintendent
Box 1080
Big Piney, WY 83113

August 14, 2006 – Statement of Completion on August 20, 2000 received.

August 14, 2006 – Proof of Beneficial Use on August 20, 2000 received.

FORM U.W.6
Rev. 7/05

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E
CHEYENNE, WYOMING 82002

(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

NOTE: Do not fold this form. Use typewriter or print neatly with black pen.

PERMIT NO. U.W. 178314 NAME OF WELL/SPRING Mesa Water Well No. 03-20

1. NAME OF OWNER (1) Questar Exploration and Production Company (2) BLM

2 ADDRESS (1) 1050 17th Street, Suite 500 (2) P.O. Box 768
☐ Please check if address has changed from that shown on permit
City (1) Denver (2) Pinedale State CO WY Zip Code 80265 82941 Phone No. 303-672-6970 307-367-5300

3. USE OF WATER ☐ Domestic ☐ Stock Watering ☐ Irrigation ☐ Municipal ☐ Industrial ☒ Miscellaneous
☐ Monitor or Test ☐ Coal Bed Methane Explain proposed use (Example: One single family dwelling)

4. LOCATION OF WELL/SPRING NE 1/4 NW 1/4 of Section 20 T. 32 N.,R. 109 W., of the 6th P.M. (or W.R.M.)
GPS Coordinates UTM Zone Easting Northing
Subdivision Name Lot Block
If surveyed, bearing, distance and reference point
Longitude (degrees, minutes, seconds) 109.86111 Latitude (degrees, minutes, seconds) 42.73611
Datum ☐ 1927 ☒ 1983 Source: ☐ GPS ☐ Map ☒ Survey

5. TYPE OF CONSTRUCTION ☒ Drilled Rotary (Type of rig, and fluid used, if any) ☐ Dug ☐ Driven ☐ Other
Describe 15W Gardner Denver

6. CONSTRUCTION Total depth of well/spring 940 ft.
Depth of static water level 495 ft. (below land surface) Casing height ft. above ground
a. Diameter of borehole (bit size) 9-7/8 inches
b. Casing schedule ☒ New ☐ Used Joint type ☐ Threaded ☐ Glued ☐ Welded
6-5/8" diameter from 0 ft. to 940 ft. Material steel Gage .188
diameter from ft. to ft. Material Gage
c. Cemented/grouted interval, from 480 ft. to surface ft.
Amount of cement/grout used (example: 10 sacks) type done by Schlumberger (example: bentonite pellets)
d. Type of completion ☐ Factory screen ☐ Open hole ☐ Customized perforations
Type of perforator used torch
Size of perforations 1/8 inches by 8 inches.
Number of perforations and depths where perforated
140 perforations from 730 ft. to 930 ft.
perforations from ft. to ft.
Open hole from ft. to ft.
Well screen details
Diameter slot size set from ft. to ft.
Diameter slot size set from ft. to ft.
e. Well development method How long was well developed?
f. Was a filter/gravel pack installed? ☒ Yes ☐ No Size of sand/gravel 3/8" washed pea
Filter/gravel pack installed from ft. to ft.
g. Was surface casing used? ☐ Yes ☒ No Was it cemented in place? ☐ Yes ☐ No
Surface casing installed from ft. to ft.

7. NAME AND ADDRESS OF DRILLING COMPANY N.R. Bideau Drilling, 2131 Kingsboro Rd., Casper, WY 82604

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) 8/20/2000

9. PUMP INFORMATION Manufacturer Grundfos Type submersible
Source of power generator Horsepower 30 Depth of pump setting or intake 920 ft.
Amount of water being pumped 110 gal./min. (For springs or flowing wells, see item 10)
Total volumetric quantity used per calendar year. 60,000 gallons, JH

10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
If artesian flow or spring, yield is gal./min. Surface pressure is lb./sq.inch, or feet of water.
The flow is controlled by: ☐ Valve ☐ Cap ☐ Plug
Does well leak around casing? ☐ Yes ☐ No

Permit No. U.W. 178314 Book No. 1294 Page No. 66

SEE REVERSE SIDE

11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion, i.e., spring box, cribbing, etc., is necessary to quality for a water right)

12. PUMP TEST Was a pump test conducted? ☐ Yes ☒ No

If so, by whom

Yield gal./min. with ft. drawdown after hours

Yield gal./min. with ft. drawdown after hours

13. LOG OF WELL Total depth drilled 940 ft.

Depth of completed well 940 ft. Diameter of well 6-5/8 inches

Depth to first water bearing formation 80 ft.

Depth to principal water bearing formation Top 730 910 ft. to Bottom 790 935 ft.

Land surface elevation (ft. above mean sea level) Datum ☐ 1929 ☐ 1988

How determined ☐ Map ☐ Altimeter ☐ Survey ☐ Other

DRILL CUTTINGS DESCRIPTION

From Feet	To Feet	Rock Type or Description	Formation	Water Bearing? (Yes or no)
Surface	8	Sand & Small Boulders		
0	80	Shale, Green		
80	115	Sand (Water)		Yes
115	300	Shale, Blue & Red/Sand Streaks		
300	340	Sand (Water)		Yes
340	730	Clay, Blue & Red/Sand Stringers		
730	790	Sand (Water)		Yes
790	910	Shale, Blue & Red/Sand Stringers		
910	935	Sand		Yes
935	940	Shale		

14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM? ☐ Yes ☒ No

15. QUALITY OF WATER INFORMATION

Does a chemical and/or bacteriological water quality analysis accompany this form? ☐ Yes ☐ No

It is recommended that chemical and bacteriologic water quality analyses be performed and that the report(s) be filed with the records of this well (contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984).

If not, do you consider the water as ☐ Good ☒ Acceptable ☐ Poor ☐ Unusable

REMARKS Refiling of expired permit #126623, expired 12/31/02

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct, and complete.

Questar Exploration and Production Company

By Regulatory Affairs Manager 8/11/06 ,20

Signature of Owner or Authorized Agent Date

FOR STATE ENGINEER'S USE ONLY

Permit No. U.W. 178314

Date of Receipt AUG 14 2006 , 20

Date of Priorty , 20

Date of Approval Nov. 24 , 20 06

for State Engineer

MS 3-22

Well Completion Log

Rev. 3-99
FILING FEE SCHEDULE
ON REVERSE SIDE

SE014838
8-1-01
50.00

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E CHEYENNE, WYOMING 82002

APPLICATION FOR PERMIT TO APPROPRIATE GROUND WATER

APPLICATION FOR WELLS AND SPRINGS

Note: Only springs flowing 25 gallons per minute or less, where the proposed use is domestic and/or stock watering, will be considered as ground water appropriations.

FOR OFFICE USE ONLY

PERMIT NO. U.W. 138174
WATER DIVISION NO. 4 DISTRICT 7
U.W. DISTRICT Sublette Co.

Temporary Filing No. U.W. 32-6-284

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.

ALL ITEMS MUST BE COMPLETED BEFORE APPLICATION IS ACCEPTABLE

NAME AND NUMBER OF WELL or SPRING Mesa Water Well No. 3-22

1. Name of applicant(s) (1) Questar Exploration and Production Company (2) Bureau of Land Management Phone: 307-382-9791
2. Address of applicant(s) (1) P. O. Box 458, Rock Springs, WY 82902-0458 (2) P. O. Box 1828, Cheyenne, WY 82002-1828
   (MAILING ADDRESS) (CITY) (STATE) (ZIP)
3. Name & address of agent to receive correspondence and notices Cathy Flansburg, Coordinator, Regulatory Aff.
   Questar E & P, P. O. Box 458, Rock Springs, WY 82902-0458 Phone: 307-352-7555
   (MAILING ADDRESS) (CITY) (STATE) (ZIP)
4. Use to which the water will be applied:

☐ Domestic: Use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totalling one acre or less. Number of houses served? _____ .

☐ Stock Watering: Normal livestock use at four tanks or less within one mile of well or spring. Stockwatering pipelines and commercial feedlots are a miscellaneous use. Number of stock tanks? _____ .

☐ Irrigation: Watering of commercially grown crops (large-scale lawn watering of golf courses, cemeteries, recreation areas, etc., is miscellaneous use).

☐ Municipal: Use of water in incorporated Towns and Cities (use of water in unincorporated towns, subdivisions, improvement districts, mobile home parks, etc. are classified as miscellaneous use).

☐ Industrial: Long term use of water for the manufacture of a product or production of oil/gas or other minerals (oil field water flood operations, power plant water supply, etc.). (Describe in REMARKS)

☒ Miscellaneous: Any use of water not defined under previous definitions such as stockwater pipelines, subdivisions, mine dewatering, mineral / oil exploration drilling, potable supplies in office, etc. Describe in remarks.

☐ Coal Bed Methane Water produced in production of coal bed methane gas.

☐ Monitor, Observation or ☐ Test Well: (Describe in REMARKS)

5. Location of the well or spring: (NOTE: Quarter-quarter (40 acre subdivision) MUST be shown. EXAMPLE: SE 1/4 NW 1/4 of Sec. 12, Township 14 North, Range 68 West.)
   Sublette County, NE 1/4 NW 1/4 of Sec. 22, T. 32 N., R. 109 W. of the 6th P.M. (W.R.M.), Wyoming. If located in a platted subdivision, also provide Lot/Tract _____ Block _____ of the _____ Subdivision (or Add'n) of _____. Resurvey Location: Tract _____, (or Lot) _____.
6. Estimated depth of the well or spring is 772 feet.
7. (a) MAXIMUM instantaneous flow of water to be developed and beneficially used: 125 gallons per minute. NOTE: If for domestic and / or stock use, this application will be processed for a maximum of 25 gallons per minute. For a spring, after approval of this application, some type of artificial diversion or improvement must be constructed to qualify for a water right.

   (b) MAXIMUM volumetric quantity of water to be developed and beneficially used per calendar year: 15 acre feet. Circle appropriate units: (Gallons) (Acre Feet) A four person family utilizes approximately one (1) acre-foot of water per year or 325,000 gallons.
8. Mark the point(s) or area(s) of use in the tabulation box below.

TABULATION BOX

TWP	RNG	SEC	NE 1/4				NW 1/4				SW 1/4				SE 1/4				TOTAL
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	
32	109	16				X	MESA	NO.	8-16D						X MESA	NO.	9-16		
32	109	16														X MESA	NO.	10-16	
32	109	16												X	MESA	NO.	14-16		
32	109	16																X	MESA NO. 16-16
32	109	17									X	MESA	NO.	11-17					

9. If for irrigation use:
   a. Describe MAXIMUM acreage to be irrigated in each 40 acre subdivision in the tabulation box above. 32, 109, 21 X Mesa 5-21
   b. ☐ Land will be irrigated from this well only.
   c. ☐ Land is irrigated from existing water right(s) with water from this well to be additional supply. Describe existing water right(s) under REMARKS.
10. If for irrigation use, describe method of irrigation, i.e. center pivot sprinkler, flood, etc.: _____

SEE REVERSE SIDE

Permit No. U.W. 138174 Book No. 1028 Page No. 50

11. The well or spring is to be constructed on lands owned by Bureau of Land Management
(The granting of a permit does not constitute the granting of right-of-way. If any easement or right-of-way is necessary in connection with this application, it should be understood that the responsibility is the applicant's. A copy of the agreement should accompany this application, if the land is privately owned and the owner is not the co-applicant.)

12. The water is to be used on lands owned by State of Wyoming
(If the landowner is not the applicant, a copy of the agreement relating to the usage of appropriated water on the land should be submitted to this office. If the landowner is included as co-applicant on the application, this procedure need not be followed.)
NOTE: Water rights attach to the area(s) and/or point(s) of use.

REMARKS: This well was originally permitted under U.W. No. 110965 by Ultra Petroleum. This water well will be used extensively on The Mesa for oil and gas well drilling for at least the next twenty years. An extended right to use the ground water is therefore requested. In addition to the wells noted in the tabulation, the water will also be used to drill the Mesa 5-21 Well located in the SW NW 21-32N-109W.

Under penalties of perjury, I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete.

[signature] 7-30-01
Signature of Applicant or Authorized Agent — Date, 20____

THE LEGALLY REQUIRED FILING FEE MUST ACCOMPANY THIS APPLICATION

DOMESTIC AND/OR STOCK WATERING USES (Domestic use is defined as use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totalling one acre or less.)	$25.00
IRRIGATION, MUNICIPAL, INDUSTRIAL, MISCELLANEOUS, COAL BED METHANE	$50.00
MONITOR (For water level measurements or chemical quality sampling) or TEST WELL	NO FEE

IF WELL WILL SERVE MULTIPLE USES, SUBMIT ONLY ONE (THE HIGHER) FILING FEE.

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

THE STATE OF WYOMING)
) ss.
STATE ENGINEER'S OFFICE)

This instrument was received and filed for record on the 1ST day of August, A.D. 20 01, at 9:12 o'clock A. M.

Permit No. U.W. 138174

[signature]
for State Engineer

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This application is approved subject to the condition that the proposed use shall not interfere with any existing rights to ground water from the same source of supply and is subject to regulation and correlation with surface water rights, if the ground and surface waters are interconnected. The use of water hereunder is subject to the further provisions of Chapter 169, Session Laws of Wyoming, 1957, and any subsequent amendments thereto.

Granting of a permit does not guarantee the right to have the water level or artesian pressure in the well maintained at any specific level. The well should be constructed to a depth adequate to allow for the maximum development and beneficial use of ground water in the source of supply.

If the well is a flowing artesian well, it shall be so constructed and equipped that the flow may be shut off when not in use without loss of water into sub-surface formations or at the land surface.

Coal Bed Methane wells have Additional Conditions and Limitations on attachment sheet.
FOR ADDITIONAL CONDITIONS AND LIMITATIONS SEE ATTACHED STATUS SHEET.
This permit and accompanying notices serve to register an existing well and establish a valid water right for the same. Time limit for Completion of Construction and Completion of Beneficial Use is waived.

~~Approval of this application may be considered as authorization to proceed with construction of the proposed well or spring. A Statement of Completion will be filed within thirty (30) days of completion of construction, including pump installation.~~

~~Completion of construction and completion of the beneficial use of water for the purposes specified in Item 4 of this application will be made by December 31, 20____.~~

~~The amount of appropriation shall be limited to the quantity to which permittee is entitled as determined at time of proof of application of water to beneficial use.~~

Witness my hand this 4th day of Sept., A.D. 20 01.

for [signature]
Patrick T. Tyrrell, State Engineer

FORM UW: C&L A4
Rev: 2-4-81

PERMIT NO. U.W. 138174
T.F. No. U.W. 32-6-284

PERMIT STATUS

Priority Date August 1, 2001 **Approval Date** SEP 04 2001

ADDITIONAL CONDITIONS AND LIMITATIONS:

1. The right to the use of ground water granted under this permit is restricted to the point (s) of use shown. The State Engineer is to be notified in writing at least five (5) days prior to utilizing water under this permit at any additional points of use. The written notification shall contain location of the point of use by 40 acre legal subdivision and approximate length of time the water will be used at additional point of use. A copy of the written notification shall be mailed to the field personnel designated below.

2. The right to the use of ground water granted under this permit for **oil & gas well drilling** shall extend until **December 31, 2022.** At that time the permit will be automatically cancelled unless a written request for an extension of time has been received by the State Engineer prior to **December 31,2022.**

3. This well shall be cased with new or new-like quality blank unperforated casing from the land surface to a depth of at least 500 feet below land surface. Said casing shall be cemented in place from the land surface to a depth of at least 500 feet.

4. Part I of the final Proof of Appropriation is required for this permit; however, Parts II and III are waived.

5. The State Engineer may, upon written request, waive all or any portion of these conditions and limitations.

9/4/01
Date of Approval

for PATRICK T. TYRRELL, State Engineer

COPY OF THIS PERMIT MAILED TO:
Loren Smith - Assistant Superintendent
Box 7
Big Piney, WY 83113

August 1, 2001 – Statement of Completion on August 13, 1998 received.

August 1, 2001 – Proof of Beneficial use on August 16, 1998 received.

FORM U.W.6
Rev. 6/00

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BUILDING
CHEYENNE, WYOMING 82002
(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.

PERMIT NO. U.W. 138174 NAME OF WELL (SPRING) Mesa Water Well No. 3-22

1. NAME OF OWNER (1) Questar Exploration and Production Company (2) Bureau of Land Management
2. ADDRESS (1) P. O. Box 458, Rock Springs, WY 82902-0458 (2) P. O. Box 1828, Cheyenne, WY 82002-1828
   Please check if address has changed from that shown on permit
   City _____ State _____ Zip Code _____ Phone No. _____
3. USE OF WATER: Domestic ☐ Stock Watering ☐ Irrigation ☐ Municipal ☐ Industrial ☐ Miscellaneous ☒
   Monitor or Test ☐ Coal Bed Methane ☐ Explain proposed use (Example: One single family dwelling)
   Drilling water for oil and gas wells.
4. LOCATION OF WELL (SPRING): NE ¼ NW ¼ of Section 22, T. 32 N., R. 109 W., of the 6th P.M. (or W.R.M.),
   Subdivision Name _____ Lot _____ Block _____
   If surveyed, bearing, distance and reference point: _____
5. TYPE OF CONSTRUCTION: Drilled ☒ Air Rotary (Type of Rig) Dug ☐ Driven ☐ Other ☐
   Describe: _____
6. CONSTRUCTION: Total Depth of Well/Spring 772 ft.
   Depth to Static Water Level 350 ft. (Below land surface)
   a. Diameter of borehole (Bit size) 8-3/4 inches.
   b. Casing Schedule New ☒ Used ☐
   6-5/8 diameter from +2 ft. to 772 ft. Material Steel Gage .156
   _____ diameter from _____ ft. to _____ ft. Material _____ Gage _____
   c. Was casing cemented: Yes ☒ No ☐ Cemented Interval, From 0+.5 feet to 400 feet.
   d. Number of sacks of cement used 40 type of cement Portland (+8% bentonite)
   e. Perforations: Type of perforator used Torch
   Size of perforations 1/8 inches by 6 inches.
   Number of perforations and depths where perforated:
   250 perforations from 523 ft. to 772 feet.
   _____ perforations from _____ ft. to _____ feet.
   f. Was well screen installed? Yes ☐ No ☒
   Diameter: _____ slot size: _____ set from _____ feet to _____.
   Diameter: _____ slot size: _____ set from _____ feet to _____.
   g. Was well gravel packed? Yes ☒ No ☐ Size of gravel 3/8" Washed Pea Gravel
   h. Was surface casing used: Yes ☒ No ☐ Was it cemented in place? Yes ☐ No ☐
7. NAME & ADDRESS OF DRILLING COMPANY True North Drilling Company, Vernal, Utah 84078
8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) 8-13-98
9. PUMP INFORMATION: Manufacturer Grundfos Type Submersible
   Source of power Generator Horsepower 20 Depth of Pump Setting or intake 550
   Amount of Water Being Pumped 100 Gallons Per Minute. (For Springs or flowing wells, see item 10.)
   Total Volumetric Gallons Used Per Calendar Year. 15 acre feet
10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well).
   If well yields artesian flow or if spring, yield is _____ gal./min. Surface pressure is _____ lb./sq. inch, or _____ feet of water.
   The flow is controlled by: valve ☐ cap ☐ plug ☐
   Does well leak around casing? Yes ☐ No ☐

Permit No. U.W. 138174 Book No. 1028 Page No. 50

SEE REVERSE SIDE

11. If spring, how was it constructed? (Some method of artificial diversion, i.e., spring box, cribbing, etc., is necessary to qualify for a water right.) _____

12. PUMP TEST: Was a pump test made? Yes ☐ No ☒
If so, by whom _____ Address _____
Yield: _____ gal./min. with _____ foot drawdown after _____ hours.
Yield: _____ gal./min. with _____ foot drawdown after _____ hours.

13. LOG OF WELL: Total depth drilled 772 feet.
Depth of completed well 772 feet. Diameter of well 6 inches.
Depth to first water bearing formation 140 feet. (cemented out)
Depth to principal water bearing formation. Top 540 feet to Bottom 550 feet.
645 650
Ground Elevation, if known _____ 745 750

DRILL CUTTINGS DESCRIPTION:

From Feet	To Feet	Material Type, Texture Color	Remarks (Cementing, Shutoff)	Indicate Water Bearing Formation & Name	Indicate Perforated Casing Location
0	16	Sand-Gravel-Cobbles	Cased off		
16	140	Clay			
140	145	Sand	Cemented off	Show water	
145	540	Clay - Shale			
540	550	Sand		Water	Perfs
550	645	Clay - Shale			
645	650	Sand		Water	Perfs
650	745	Clay - Shale			
745	750	Sand		Water	Perfs
750	772	Clay - shale			
Casing	perforated	from 523' - 770' on 1 slot per foot intervals			

14. QUALITY OF WATER INFORMATION:
Does a chemical and/or bacteriological water quality analysis accompany this form? Yes ☐ No ☒
It is recommended that chemical and bacteriologic water quality analyses be performed and that the report(s) be filed with the records of this well. (Contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984.)
If not, do you consider the water as: Good ☐ Acceptable ☒ Poor ☐ Unusable ☐

REMARKS: 6-5/8" casing was pressure grouted using 1" pipe. Cement grout was pumped from 400' back to surface.

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct and complete.

Signature of Owner or Authorized Agent

7-30-01, 20 ____
Date

FOR STATE ENGINEER'S USE ONLY

Date of Receipt AUG 2 2001, 20 ____

Date of Priority Aug. 1, 20 01

Date of Approval Sept. 4, 2001

for State Engineer

MS 6-16

Well Completion Log

09-02-08 RCVD 1045 (1) CN

FORM U.W. 5
Rev. 6/07
FILING FEE SCHEDULE
ON REVERSE SIDE

S0038943
50.00
9/2/08

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E CHEYENNE, WYOMING 82002
(307) 777-6163

APPLICATION FOR PERMIT TO APPROPRIATE GROUND WATER

APPLICATION FOR WELLS AND SPRINGS

Note: Only springs flowing 25 gallons per minute or less, where the proposed use is domestic and /or stock watering, will be considered as ground water appropriations.

Temporary Filing No. U.W. 41-2-259

FOR OFFICE USE ONLY

PERMIT NO. U.W. 189556
WATER DIVISION NO. 4 DISTRICT 7
U.W. DISTRICT Sublette Co.

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.
ALL ITEMS MUST BE COMPLETED BEFORE APPLICATION IS ACCEPTABLE

NAME AND NUMBER OF WELL or SPRING Mesa 6-16 WSW

1. Name of applicant(s) 1- Wexpro Company 2- State Board of Land Commissioners Phone: 303-308-3068
2. Address of applicant(s) 1- 1050 17th Street, Suite 500 Denver, CO 80265 2- Herschler Bldg. 3W, Cheyenne, WY ~~80202~~ 82002 JH
   (MAILING ADDRESS) (CITY) (STATE) (ZIP)
3. Name & address of agent to receive correspondence and notices Debra K. Stanberry, Supervisor, Regulatory Affairs
   1050 17th Street, Suite 500 Denver, CO 80265 Phone: 303-308-3068
   (MAILING ADDRESS) (CITY) (STATE) (ZIP)
4. Use to which the water will be applied:

[ ]	Domestic:	Use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totaling one acre or less. Number of houses served?____.
[ ]	Stock Watering:	Normal livestock use at four tanks or less within one mile of well or spring. Stockwatering pipelines and commercial feedlots are a miscellaneous use. Number of stock tanks?____.
[ ]	Irrigation:	Watering of any lands for agricultural purposes not covered by the definition of domestic use (large-scale lawn watering of golf courses, cemeteries, recreation areas, etc., is miscellaneous use).
[ ]	Municipal:	Use of water in incorporated Towns and Cities. Note 1: use of water in unincorporated towns, sub-divisions, improvement districts, mobile home parks, etc. is classified as miscellaneous use. Note 2: a permit may be required by the Wyoming Department of Environmental Quality (WDEQ) if the well will be classified as a public water supply under the WDEQ's rules and regulations.
[ ]	Industrial:	Long term use of water for the manufacture of a product or production of oil/gas or other minerals (oil field water flood operations, power plant water supply, etc.). (Describe in REMARKS)
[X]	Miscellaneous:	Any use of water not defined under previous definitions such as stock water pipelines, subdivisions, mine dewatering, mineral/oil exploration drilling, potable supplies in office, etc. (Describe in Remarks). Note: a permit may be required by the WDEQ if the well will be classified as a public water supply under the WDEQ's rules and regulations. Road maintenance, dust abatement, well work-overs/rep and reclamation Per correspondence Rec'd 10/20
[ ]	Coalbed Methane	Water produced in the production of coal bed methane gas. Note: wells used in the production of coal bed methane gas will require a permit from the Wyoming Oil and Gas Conservation Commission.
[ ]	Monitor, Observation	Note: a WDEQ permit may be required [ ] Test Well: (Describe in REMARKS)

5. Location of the well or spring: (NOTE: Quarter-quarter (40 acre subdivision) MUST be shown. EXAMPLE: SE 1/ 4 NW 1/ 4 of Sec. 12, Township 14 North, Range 68 West.)
   Sublette County, SE 1/4 NW 1/4 of Sec. 16, T. 32 N., R. 109 W. of the 6th P.M. (W.R.M.), Wyoming. If located in a platted subdivision, also provide Lot/Tract ___ Block ___ of the _____ Subdivision (or Add'n) of _____. Resurvey Location: Tract ____, (or Lot) ____.
6. Estimated depth of the well or spring is 650 feet. Estimated production interval is ____ ft. to ____ ft.
7. (a) MAXIMUM instantaneous flow of water to be developed and beneficially used: 125 gallons per minute. NOTE: if for domestic and / or stock use, this application will be processed for a maximum of 25 gallons per minute. For a spring, after approval of this application, some type of artificial diversion or improvement must be constructed to qualify for a water right.

   (b) MAXIMUM volumetric quantity of water to be developed and beneficially used per calendar year: 15 acre feet. Circle appropriate units: (Gallons) (Acre Feet) A four person family utilizes approximately one (1) acre-foot of water per year or 325,000 gallons.
8. Mark the point(s) or area(s) of use in the tabulation box below. Note: Upper row refers to the quarter of the section. Next row refers to the quarter of the quarter section.

Per Correspondence Rec'd 10/20/08

TABULATION BOX

TWP	RNG	SEC	NE¼				NW¼				SW¼				SE¼				TOTAL
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	
32	109	16	X	X	X	X	X	X	X	X		X-out							

Permit No. U.W. 189556 SEE REVERSE SIDE Book No. 1369 Page No. 56

9. If for irrigation use:
   a. Describe MAXIMUM acreage to be irrigated in each 40 acre subdivision in the tabulation box above.
   b. ☐ Land will be irrigated from this well only.
   c. ☐ Land is irrigated from existing water right(s) with water from this well to be additional supply. Describe existing water right(s) under REMARKS.

10. If for irrigation use, describe method of irrigation, i.e. center pivot sprinkler, flood, etc.: _____

11. The well or spring is to be constructed on lands owned by State of Wyoming Office of State Lands & Investments
(The granting of a permit does not constitute the granting of a right-of-way. If any easement or right-of-way is necessary in connection with this application, it should be understood that the responsibility is the applicant's. A copy of the agreement should accompany this application, if the land is privately owned and the owner is not the co-applicant.)

12. The water is to be used on lands owned by State of Wyoming Office of State Lands & Investments
(If the landowner is not the applicant, a copy of the agreement relating to the usage of the appropriated water on the land should be submitted to this office. If the landowner is included as co-applicant on the application, this procedure need not be followed.) NOTE: Water rights attach to the area(s) and/or point(s) of use.

Per correspondence Rec'd 10/20/08

REMARKS: Drilling of oil and gas wells, road maintenance, dust abatement, well work-overs/repairs and reclamation. Refile of cancelled permit #139429

Under penalties of perjury, I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete.

Signature of Applicant or Authorized Agent — August 20, 2008 (Date)

Debra K. Stanberry, Supervisor, Regulatory Affairs

THE LEGALLY REQUIRED FILING FEE MUST ACCOMPANY THIS APPLICATION

DOMESTIC AND/OR STOCK WATERING USES (Domestic use is defined as use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totalling one acre or less.)	$25.00
IRRIGATION, MUNICIPAL, INDUSTRIAL, MISCELLANEOUS, COAL BED METHANE	$50.00
MONITOR (For water level measurements or chemical quality sampling) or TEST WELL	No Fee

IF WELL WILL SERVE MULTIPLE USES, SUBMIT ONLY ONE (THE HIGHER) FILING FEE.

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

THE STATE OF WYOMING)
) ss.
STATE ENGINEER'S OFFICE)

This instrument was received and filed for record on the 2nd day of September, A.D. 2008, at 10:45 o'clock A M.

Permit No. U.W. 189556

for State Engineer

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This application is approved subject to the condition that the proposed use shall not interfere with any existing rights to ground water from the same source of supply and is subject to regulation and correlation with surface water rights, if the ground and surface waters are interconnected. The use of water hereunder is subject to the further provisions of Chapter 169, Session Laws of Wyoming, 1957, and any subsequent amendments thereto.

Granting of a permit does not guarantee the right to have the water level or artesian pressure in the well maintained at any specific level. The well should be constructed to a depth adequate to allow for the maximum development and beneficial use of ground water in the source of supply.

If the well is a flowing artesian well, it shall be so constructed and equipped that the flow may be shut off when not in use without loss of water into sub-surface formations or at the land surface.

Coal Bed Methane wells have Additional Conditions and Limitations on attachment sheet.

FOR ADDITIONAL CONDITIONS AND LIMITATIONS SEE ATTACHED STATUS SHEET.

This permit and accompanying notices serve to register an existing well and establish a valid water right for the same. Time limit for Completion of Construction and Completion of Beneficial Use is waived.

~~Approval of this application may be considered as authorization to proceed with construction of the proposed well or spring. A Statement of Completion will be filed within thirty (30) days of completion of construction, including pump installation.~~

~~Completion of construction and completion of the beneficial use of water for the purposes specified in Item 4 of this application will be made by December 31, 20__.~~

~~The amount of appropriation shall be limited to the quantity to which permittee is entitled as determined at time of proof of application of water to beneficial use.~~

Witness my hand this 24TH day of February, A.D. 2009.

PATRICK T. TYRRELL, State Engineer

Revised 11/2/2004

PERMIT NO. U.W. 189556

T.F. No. U.W. 41 - 2 - 259

PERMIT STATUS

Priority Date September 2, 2008 **Approval Date** FEB 24 2009

This well is a water supply well to supply water for oil/gas well drilling and associated operations within the Pinedale Anticline Project Area (PAPA).

The Additional Conditions and Limitations attached to permits issued by this office for water supply wells in the PAPA are reflective of the requirements for these types of wells listed in the 2000 Record of Decision for the Pinedale Anticline Project, and are designed to insure a level of protection for the users of the shallow sandstone aquifers in the PAPA by limiting the ability of the water supply wells associated with the project to utilize the same resource targeted by the existing stock and/or domestic wells in the PAPA.

The Additional Condition and Limitation attached to permits issued by this office for water supply wells in this location, located on "The Mesa", normally requires that the well must be cased with un-perforated casing to a depth of 500 feet and that the casing must be fully cemented/grouted in the borehole to that depth. However, due to the variability of the geology of the area, this office is aware that the same level of protection of the shallow sandstone aquifers can be achieved by somewhat less than the 500 foot cemented interval in some cases.

A review of the Statement of Completion and Description of Well form submitted with this application indicates that the well has not been constructed in a manner in which the 500 foot cemented interval Condition described above can be satisfied. A review of the well log associated with the Completion form indicates, however, that an effective seal has been emplaced between the un-perforated well casing and the well bore to eliminate the production of water from any of the shallow sandstone aquifers present between the land surface and 500 feet below land surface in the immediate area. As such, the intent of the Condition, the isolation and protection of the shallow sandstone aquifers, has been achieved in this instance. **Therefore, this permit is approved, as this well is constructed, subject to the following ADDITIONAL CONDITIONS AND LIMITATIONS:**

ADDITIONAL CONDITIONS AND LIMITATIONS:

1. The right to the use of ground water granted under this permit is restricted to the point (s) of use shown. The State Engineer is to be notified in writing at least five (5) days prior to utilizing water under this permit at any additional points of use. The written notification shall contain location of the point of use by 40 acre legal subdivision and approximate length of time the water will be used at the additional point of use. A copy of the written notification shall be mailed to the field personnel designated below.

2. The right to the use of ground water granted under this permit is for **oil and gas development, road maintenance, dust abatement, well work-over/repairs & reclamation** and shall extend until **December 31, 2014**. At that time the permit will be automatically cancelled unless a written request for an extension of time has been received by the State Engineer prior to **December 31, 2014**.

3. **The water delivery system from this well shall be equipped with a functional backflow prevention device to eliminate the possibility of fluids or other matter entering the well during use.**

4. **The approval of this permit does not obligate the State Engineer to issue any permits for the use of water from this well for any purpose from this point forward, beyond what is authorized by this permit.**

5. Part I of the final Proof of Appropriation is required for this permit; however, Parts II and III are waived.

6. The State Engineer may, upon written request, waive all or any portion of these conditions and limitations.

February 24, 2009
Date of Approval

PATRICK T. TYRRELL, State Engineer

COPY OF THIS PERMIT MAILED TO:
Jade Henderson –Superintendent
P.O. Box 277
Cokeville, WY 83114

FORM U.W.6
Rev. 1/07

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E
CHEYENNE, WYOMING 82002

(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

NOTE: Do not fold this form. Use typewriter or print neatly with black pen.

PERMIT NO. U.W. 189556 NAME OF WELL/SPRING Mesa 6-16 Water Source Well

1. NAME OF OWNER 1-Wexpro Company 2-State Board of Land Commissioners

2. ADDRESS 1-1050 17th Street, Suite 500 2-Herschler Bldg. 3W
☐ Please check if address has changed from that shown on permit
City 1- Denver 2- Cheyenne State 1- Colorado 2- Wyoming Zip Code 1-80265 ~~2-82002~~ 82002 Phone No. 303-308-3068

3. USE OF WATER ☐ Domestic ☐ Stock Watering ☐ Irrigation ☐ Municipal ☐ Industrial ☒ Miscellaneous
☐ Monitor or Test ☐ Coal Bed Methane Explain proposed use (Example: One single family dwelling)
Oil & Gas Well Drilling

4. LOCATION OF WELL/SPRING SE 1/4 NW 1/4 of Section 16 T. 32 N.,R. 109 W., of the 6th P.M. (or W.R.M.)
Subdivision Name _____ Lot _____ Block _____
Resurvey Location Tract _____ or Lot _____ Datum ☐ NAD27 ☐ NAD83 _____
Geographic Coordinates: Latitude _____ N Longitude _____ W (degrees, minutes, seconds)
UTM: Zone 12 Northing 4733535 Easting 594834 (meters)
State Plane Coordinates: Zone _____ Northing ~~4733535~~ Easting ~~594834~~ (feet)
Land surface elevation (ft. above mean sea level) 7465 Datum ☐ NAVD29 ☐ NAVD88
Source ☒ GPS ☐ Map ☐ Survey Unkown ☐ Other ☐ Altimeter (for elevation only)

5. TYPE OF CONSTRUCTION ☒ Drilled Rotary ☐ Dug ☐ Driven ☐ Other
Describe _____

6. CONSTRUCTION Total depth of well/spring 1000 ft.
Depth of static water level 400 ft. (below land surface) Casing height 0 ft. above ground
a. Diameter of borehole (bit size) 9 7/8 inches
b. Casing schedule ☒ New ☐ Used Joint type ☐ Threaded ☐ Glued ☒ Welded
6 5/8 diameter from 0 ft. to 1000 ft. Material Steel Gage 0.188
_____ diameter from _____ ft. to _____ ft. Material _____ Gage _____
c. Cemented/grouted interval, from 0 ft. to 440 ft.
Amount of cement/grout used 200 Sacks (example: 10 sacks) type Class G with 2% CaCl (example: bentonite pellets)
d. Type of completion ☒ Customized perforations ☐ Open hole ☐ Factory screen
Type of perforator used Torch Cut
Size of perforations 6 inches by 1/8 inches.
Number of perforations and depths where perforated
200 perforations from 700 ft. to 1000 ft.
_____ perforations from _____ ft. to _____ ft.
Open hole from _____ ft. to _____ ft.
Well screen details
Diameter _____ slot size _____ set from _____ ft. to _____ ft.
Diameter _____ slot size _____ set from _____ ft. to _____ ft.
e. Well development method Rotary How long was well developed? _____
f. Was a filter/gravel pack installed? ☒ Yes ☐ No Size of sand/gravel 3/8" Washed
Filter/gravel pack installed from _____ ft. to _____ ft.
g. Was surface casing used? ☒ Yes ☐ No Was it cemented in place? ☐ Yes ☒ No
Surface casing installed from _____ ft. to _____ ft.

7. NAME AND ADDRESS OF DRILLING COMPANY N.R. Bideau Drilling, 2131 Kingsboro Road, Casper, WY 82604

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) 11/01/2001

9. PUMP INFORMATION Manufacturer Grundfoss Type Submersible
Source of power Generator Horsepower 30 Depth of pump setting or intake 850 ft.
Amount of water being pumped 100 gal./min.* (For springs or flowing wells, see item 10)
Total volumetric quantity used per calendar year.* 15 Acre feet/year per U.W. 5
*If these amounts exceed permitted amount an enlargement is required.

10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
If artesian flow or spring, yield is _____ gal./min. *Surface pressure is _____ lb./sq.inch, or _____ feet of water.
The flow is controlled by ☐ Valve ☐ Cap ☐ Plug
Does well leak around casing? ☐ Yes ☐ No

Permit No. U.W. 189556 Book No. 1369 Page No. 56

SEE REVERSE SIDE

11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion, i.e., spring box, cribbing, etc., is necessary to qualify for a water right) _____

12. PUMP TEST Was a pump test conducted? ☐ Yes ☒ No
If so, by whom _____
Yield _____ gal./min. with _____ ft. drawdown after _____ hours
Yield _____ gal./min. with _____ ft. drawdown after _____ hours

13. LOG OF WELL Total depth drilled 1000 ft.
Depth of completed well 1000 ft. Diameter of well 9 7/8 inches
Depth to first water bearing formation 200 ft.
Depth to principal water bearing formation Top 540 / 860 ft. to Bottom 620 / 930 ft.

DRILL CUTTINGS DESCRIPTION

From Feet	To Feet	Rock Type or Description	Formation	Water Bearing? (Yes or no)
Surface				
0	20	Sand and gravel		No
20	105	Clay, green		No
105	200	Clay, gray		No
200	225	Sand, green		Yes
225	300	Clay, red & Gray		No
300	420	Sand		No
420	540	Clay, red, sand stringers		No
540	620	Sand		Yes
620	860	Clay, red & Gray		No
860	980	Sand		No
980	1000	Clay & sand stringers		Yes
				Note: Perforations
				700' to 1000'

14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM? ☐ Yes ☒ No

15. QUALITY OF WATER INFORMATION

Does a chemical and/or bacteriological water quality analysis accompany this form? ☐ Yes ☒ No
It is recommended that chemical and bacteriologic water quality analyses be performed and that the report(s) be filed with the records of this well (contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984).
If not, do you consider the water as Good ☒ Acceptable ☐ Poor Unusable

REMARKS _____

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct, and complete.

Signature of Owner or Authorized Agent: Debra K. Stanberry, Supervisor, Regulatory Affairs

August 20, 2008
Date

FOR STATE ENGINEER'S USE ONLY

Permit No. U.W. 189556

Date of Receipt SEP 02 2008, 20____

Date of Priorty _____, 20____

Date of Approval February 24, 2009

for State Engineer

SP 14-20

Well Completion Log

FORM U.W. 5
Rev. 6/07
FILING FEE SCHEDULE
ON REVERSE SIDE

SC0 39066
50.00
9/17/08

09-17-08 RCVD 0936

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E CHEYENNE, WYOMING 82002
(307) 777-6163

APPLICATION FOR PERMIT TO APPROPRIATE GROUND WATER

APPLICATION FOR WELLS AND SPRINGS

Note: Only springs flowing 25 gallons per minute or less, where the proposed use is domestic and /or stock watering, will be considered as ground water appropriations.

Temporary Filing No. U.W. 41-8-275

FOR OFFICE USE ONLY

PERMIT NO. U.W. 190125
WATER DIVISION NO. 4 DISTRICT 7
U.W. DISTRICT Sublette Co.

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.
ALL ITEMS MUST BE COMPLETED BEFORE APPLICATION IS ACCEPTABLE

NAME AND NUMBER OF WELL or SPRING Stewart Point 14-20 WSW

1. Name of applicant(s) 1- Wexpro Company 2- Bureau of Land Management Phone: 303-308-3068
2. Address of applicant(s) 1- 1050 17th Street, Suite 500 Denver, CO 80265 2- P.O.Box 768, Pinedale, WY 82941
   (MAILING ADDRESS) (CITY) (STATE) (ZIP)
3. Name & address of agent to receive correspondence and notices Debra K. Stanberry, Supervisor, Regulatory Affairs
   1050 17th Street, Suite 500 Denver, CO 80265 Phone: 303-308-3068
   (MAILING ADDRESS) (CITY) (STATE) (ZIP)
4. Use to which the water will be applied:

	Domestic:	Use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totaling one acre or less. Number of houses served?____.
	Stock Watering:	Normal livestock use at four tanks or less within one mile of well or spring. Stockwatering pipelines and commercial feedlots are a miscellaneous use. Number of stock tanks?____.
	Irrigation:	Watering of any lands for agricultural purposes not covered by the definition of domestic use (large-scale lawn watering of golf courses, cemeteries, recreation areas, etc., is miscellaneous use).
	Municipal:	Use of water in incorporated Towns and Cities. Note 1: use of water in unincorporated towns, sub-divisions, improvement districts, mobile home parks, etc. is classified as miscellaneous use. Note 2: a permit may be required by the Wyoming Department of Environmental Quality (WDEQ) if the well will be classified as a public water supply under the WDEQ's rules and regulations.
	Industrial:	Long term use of water for the manufacture of a product or production of oil/gas or other minerals (oil field water flood operations, power plant water supply, etc.). (Describe in REMARKS)
X	Miscellaneous:	Any use of water not defined under previous definitions such as stock water pipelines, subdivisions, mine dewatering, mineral/oil exploration drilling, potable supplies in office, etc. (Describe in Remarks). Note: a permit may be required by the WDEQ if the well will be classified as a public water supply under the WDEQ's rules and regulations.
	Coalbed Methane	Water produced in the production of coal bed methane gas. Note: wells used in the production of coal bed methane gas will require a permit from the Wyoming Oil and Gas Conservation Commission.
	Monitor, Observation	Note: a WDEQ permit may be required ☐ Test Well: (Describe in REMARKS)

5. Location of the well or spring: (NOTE: Quarter-quarter (40 acre subdivision) MUST be shown. EXAMPLE: SE 1/ 4 NW 1/ 4 of Sec. 12, Township 14 North, Range 68 West.) Sublette County, SE 1/4 SW 1/4 of Sec. 20, T. 33 N., R. 109 W. of the 6th P.M. (W.R.M.), Wyoming. If located in a platted subdivision, also provide Lot/Tract ___ Block ___ of the ___ Subdivision (or Addition) of ___. Resurvey Location: Tract ___, (or Lot) ___.
6. Estimated depth of the well or spring is ~~650~~ 1000 feet. Estimated production interval is 700 ft. to 1000 ft. Per u.w.b. JH
7. (a) MAXIMUM instantaneous flow of water to be developed and beneficially used: 125 gallons per minute. NOTE: if for domestic and / or stock use, this application will be processed for a maximum of 25 gallons per minute. For a spring, after approval of this application, some type of artificial diversion or improvement must be constructed to qualify for a water right.

   (b) MAXIMUM volumetric quantity of water to be developed and beneficially used per calendar year: 15 acre feet. Circle appropriate units: (Gallons) (Acre Feet) A four person family utilizes approximately one (1) acre-foot of water per year or 325,000 gallons.
8. Mark the point(s) or area(s) of use in the tabulation box below. Note. Upper row refers to the quarter of the section. Next row refers to the quarter of the quarter section.

TABULATION BOX

TWP	RNG	SEC	NE¼				NW¼				SW¼				SE¼				TOTAL
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	
33	109	20									X			X	X	X	X		
												Per letter rec'd 11/4/2008 JH							

SEE REVERSE SIDE

Permit No. U.W. 190125 Book No. 1373 Page No. 25

9. If for irrigation use:
   a. Describe MAXIMUM acreage to be irrigated in each 40 acre subdivision in the tabulation box above.
   b. ☐ Land will be irrigated from this well only.
   c. ☐ Land is irrigated from existing water right(s) with water from this well to be additional supply. Describe existing water right(s) under REMARKS.

10. If for irrigation use, describe method of irrigation, i.e. center pivot sprinkler, flood, etc.: _____

11. The well or spring is to be constructed on lands owned by Bureau of Land Management
(The granting of a permit does not constitute the granting of a right-of-way. If any easement or right-of-way is necessary in connection with this application, it should be understood that the responsibility is the applicant's. A copy of the agreement should accompany this application, if the land is privately owned and the owner is not the co-applicant.)

12. The water is to be used on lands owned by Bureau of Land Management
(If the landowner is not the applicant, a copy of the agreement relating to the usage of the appropriated water on the land should be submitted to this office. If the landowner is included as co-applicant on the application, this procedure need not be followed.) NOTE: Water rights attach to the area(s) and/or point(s) of use.

REMARKS: Drilling of oil and gas wells
Refile of cancelled permit #138913

Under penalties of perjury, I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete.

Signature of Applicant or Authorized Agent — September 10, 20 08
Date

Debra K. Stanberry, Supervisor, Regulatory Affairs

THE LEGALLY REQUIRED FILING FEE MUST ACCOMPANY THIS APPLICATION

DOMESTIC AND/OR STOCK WATERING USES (Domestic use is defined as use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totalling one acre or less.)	$25.00
IRRIGATION, MUNICIPAL, INDUSTRIAL, MISCELLANEOUS, COAL BED METHANE	$50.00
MONITOR (For water level measurements or chemical quality sampling) or TEST WELL	No Fee

IF WELL WILL SERVE MULTIPLE USES, SUBMIT ONLY ONE (THE HIGHER) FILING FEE.

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

THE STATE OF WYOMING)
) ss.
STATE ENGINEER'S OFFICE)

This instrument was received and filed for record on the 17th day of September, A.D. 20 08, at 9:36 o'clock A M.

Permit No. U.W. 190125

for State Engineer

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This application is approved subject to the condition that the proposed use shall not interfere with any existing rights to ground water from the same source of supply and is subject to regulation and correlation with surface water rights, if the ground and surface waters are interconnected. The use of water hereunder is subject to the further provisions of Chapter 169, Session Laws of Wyoming, 1957, and any subsequent amendments thereto.

Granting of a permit does not guarantee the right to have the water level or artesian pressure in the well maintained at any specific level. The well should be constructed to a depth adequate to allow for the maximum development and beneficial use of ground water in the source of supply.

If the well is a flowing artesian well, it shall be so constructed and equipped that the flow may be shut off when not in use without loss of water into sub-surface formations or at the land surface.

Coal Bed Methane wells have Additional Conditions and Limitations on attachment sheet.

FOR ADDITIONAL CONDITIONS AND LIMITATIONS SEE ATTACHED STATUS SHEET.
This permit and accompanying notices serve to register an existing well and establish a valid water right for the same. Time limit for Completion of Construction and Completion of Beneficial Use is waived.

~~Approval of this application may be considered as authorization to proceed with construction of the proposed well or spring. A Statement of Completion will be filed within thirty (30) days of completion of construction, including pump installation.~~

~~Completion of construction and completion of the beneficial use of water for the purposes specified in Item 4 of this application will be made by December 31, 20____.~~

The amount of appropriation shall be limited to the quantity to which permittee is entitled as determined at time of proof of application of water to beneficial use.

Witness my hand this 27TH day of May, A.D. 20 09.

PATRICK T. TYRRELL, State Engineer

Revised 11/2/2004

PERMIT NO. U.W. 190125
T.F. No. U.W. 41 - 8 - 275

PERMIT STATUS

Priority Date September 17, 2008 **Approval Date** MAY 27 2009

This well is a water supply well to supply water for oil/gas well drilling and associated operations within the Pinedale Anticline Project Area (PAPA).

The Additional Conditions and Limitations attached to permits issued by this office for water supply wells in the PAPA are reflective of the requirements for these types of wells listed in the 2000 Record of Decision for the Pinedale Anticline Project, and are designed to insure a level of protection for the users of the shallow sandstone aquifers in the PAPA by limiting the ability of the water supply wells associated with the project to utilize the same resource targeted by the existing stock and/or domestic wells in the PAPA.

The Additional Condition and Limitation attached to permits issued by this office for water supply wells in this location, located on "The Mesa", normally requires that the well must be cased with un-perforated casing to a depth of 500 feet and that the casing must be fully cemented/grouted in the borehole to that depth. However, due to the variability of the geology of the area, this office is aware that the same level of protection of the shallow sandstone aquifers can be achieved by somewhat less than the 500 foot cemented interval in some cases.

A review of the Statement of Completion and Description of Well form submitted with this application indicates that the well has not been constructed in a manner in which the 500 foot cemented interval Condition described above can be satisfied. A review of the well log associated with the Completion form indicates, however, that an effective seal has been emplaced between the un-perforated well casing and the well bore to eliminate the production of water from any of the shallow sandstone aquifers present between the land surface and 500 feet below land surface in the immediate area. As such, the intent of the Condition, the isolation and protection of the shallow sandstone aquifers, has been achieved in this instance. **Therefore, this permit is approved, as this well is constructed, subject to the following ADDITIONAL CONDITIONS AND LIMITATIONS:**

ADDITIONAL CONDITIONS AND LIMITATIONS:

1. The right to the use of ground water granted under this permit is restricted to the point (s) of use shown. The State Engineer is to be notified in writing at least five (5) days prior to utilizing water under this permit at any additional points of use. The written notification shall contain location of the point of use by 40 acre legal subdivision and approximate length of time the water will be used at the additional point of use. A copy of the written notification shall be mailed to the field personnel designated below.

2. The right to the use of ground water granted under this permit is for **oil and gas well drilling, road maintenance, dust abatement, well work-over/repairs & reclamation** and shall extend until **December 31, 2010**. At that time the permit will be automatically cancelled unless a written request for an extension of time has been received by the State Engineer prior to **December 31, 2010**.

3. **The water delivery system from this well shall be equipped with a functional backflow prevention device to eliminate the possibility of fluids or other matter entering the well during use.**

4. **The approval of this permit does not obligate the State Engineer to issue any permits for the use of water from this well for any purpose from this point forward, beyond what is authorized by this permit.**

5. Part I of the final Proof of Appropriation is required for this permit; however, Parts II and III are waived.

6. The State Engineer may, upon written request, waive all or any portion of these conditions and limitations.

May 27, 2009
Date of Approval

for PATRICK T. TYRRELL, State Engineer

COPY OF THIS PERMIT MAILED TO:
Jade Henderson –Superintendent
P.O. Box 277
Cokeville, WY 83114

September 17, 2008 – Statement of Completion on June 20, 2002 received.

September 17, 2008 – Proof of Beneficial Use on September 1, 2008 received.

FORM U.W.6
Rev. 1/07

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E
CHEYENNE, WYOMING 82002

(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

NOTE: Do not fold this form. Use typewriter or print neatly with black pen.

PERMIT NO. U.W. 190125 NAME OF WELL/SPRING Stewart Point 14-20 WSW

1. NAME OF OWNER 1-Wexpro Company 2-Bureau of Land Management

2. ADDRESS 1-1050 17th Street, Suite 500 2-P.O.Box 768
☐ Please check if address has changed from that shown on permit
City 1- Denver 2- Pinedale State 1- Colorado 2- Wyoming Zip Code 1-80265 2-82941 Phone No. 303-308-3068

3. USE OF WATER ☐ Domestic ☐ Stock Watering ☐ Irrigation ☐ Municipal ☐ Industrial ☒ Miscellaneous
☐ Monitor or Test ☐ Coal Bed Methane Explain proposed use (Example: One single family dwelling)
Oil & Gas Well Drilling

4. LOCATION OF WELL/SPRING SE 1/4 SW 1/4 of Section 20 T. 33 N., R. 109 W., of the 6th P.M. (or W.R.M.)
Subdivision Name ____ Lot ____ Block ____
Resurvey Location Tract ____ or Lot ____ Datum ☐ NAD27 ☐ NAD83 ____
Geographic Coordinates: Latitude ____ N Longitude ____ W (degrees, minutes, seconds)
UTM: Zone ____ Northing ____ Easting ____ (meters)
State Plane Coordinates: Zone ____ Northing 4740330 Easting 590627 (feet)
Land surface elevation (ft. above mean sea level) 7500 Datum ☐ NAVD29 ☐ NAVD88
Source ☒ GPS ☐ Map ☐ Survey ☐ Unkown ☐ Other ☐ Altimeter (for elevation only)

5. TYPE OF CONSTRUCTION ☒ Drilled Rotary ☐ Dug ☐ Driven ☐ Other
Describe ____

6. CONSTRUCTION Total depth of well/spring 1000 ft.
Depth of static water level 350 ft. (below land surface) Casing height 0 ft. above ground
a. Diameter of borehole (bit size) 10 5/8 inches
b. Casing schedule ☒ New ☐ Used Joint type ☐ Threaded ☐ Glued ☒ Welded
6 5/8 diameter from 0 ft. to 1000 ft. Material Steel Gage 0.188
____ diameter from ____ ft. to ____ ft. Material ____ Gage ____
c. Cemented/grouted interval, from 65 ft. to 470 ft.
Amount of cement/grout used 130 Sacks (example: 10 sacks) type Class G with 10 sx bentonite bottom seal *Bentonite plug to top out 65' to surface (example: bentonite pellets)
d. Type of completion ☒ Customized perforations ☐ Open hole ☐ Factory screen
Type of perforator used Torch Cut
Size of perforations 1/8 inches by 12 inches.
Number of perforations and depths where perforated
250 perforations from 700 ft. to 1000 ft.
____ perforations from ____ ft. to ____ ft.
Open hole from ____ ft. to ____ ft.
Well screen details
Diameter ____ slot size ____ set from ____ ft. to ____ ft.
Diameter ____ slot size ____ set from ____ ft. to ____ ft.
e. Well development method Rotary How long was well developed? ____
f. Was a filter/gravel pack installed? ☒ Yes ☐ No Size of sand/gravel 3/8" Washed pea
Filter/gravel pack installed from ____ ft. to ____ ft.
g. Was surface casing used? ☒ Yes ☐ No Was it cemented in place? ☒ Yes ☐ No
Surface casing installed from ____ ft. to ____ ft.

7. NAME AND ADDRESS OF DRILLING COMPANY Searle Bros., 149 Pollux Drive, Rock Springs, WY 82901

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) 06/20/2002

9. PUMP INFORMATION Manufacturer Grundfoss Type Submersible
Source of power Generator Horsepower 30 Depth of pump setting or intake 870 ft.
Amount of water being pumped 110 gal./min.* (For springs or flowing wells, see item 10)
Total volumetric quantity used per calendar year.* 15 acre feet
*If these amounts exceed permitted amount an enlargement is required.

10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
If artesian flow or spring, yield is ____ gal./min. *Surface pressure is ____ lb./sq.inch, or ____ feet of water.
The flow is controlled by ☐ Valve ☐ Cap ☐ Plug
Does well leak around casing? ☐ Yes ☐ No

Permit No. U.W. 190125 Book No. 1373 Page No. 25

SEE REVERSE SIDE

11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion, i.e., spring box, cribbing, etc., is necessary to qualify for a water right) _____

12. PUMP TEST Was a pump test conducted? ☐Yes ☒No

If so, by whom_____

Yield _____gal./min. with _____ ft. drawdown after _____ hours

Yield _____gal./min. with _____ ft. drawdown after _____ hours

13. LOG OF WELL Total depth drilled 1000 ft.

Depth of completed well 1000 ft. Diameter of well 10 5/8 inches

Depth to first water bearing formation 102 ft.

Depth to principal water bearing formation Top 547 ft. to Bottom 972 ft.

DRILL CUTTINGS DESCRIPTION

From Feet	To Feet	Rock Type or Description	Formation	Water Bearing? (Yes or no)
Surface	102	Tan and grey Shale		No
102	191	Sandstone & shale		Yes
191	315	Blue shale & red clay		No
315	321	Sandstone		Yes
321	547	Blue shale & Sandstone		No
547	562	Sandstone		Yes
562	720	Red & Blue Shale		No
720	738	Sandstone		Yes
738	792	Blue shale		No
792	813	Sandstone	Note: Perforations	Yes
813	865	Blue shale	from 700' to 1000'	No
865	881	Sandstone		Yes
881	956	Blue shale		No
956	972	Sandstone		Yes
972	1000	Blue shale		No

14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM? ☐Yes ☒No

* Bentonite plug surface to 65', cemented from 65' to 470', Bentonite plug 470' to 500'.

15. QUALITY OF WATER INFORMATION

Does a chemical and/or bacteriological water quality analysis accompany this form? ☐Yes ☒No

It is recommended that chemical and bacteriologic water quality analyses be performed and that the report(s) be filed with the records of this well (contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984).

If not, do you consider the water as [ ] Good [X] Acceptable [ ] Poor [ ] Unusable

REMARKS _____

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct, and complete.

Debra K. Stanberry, Supervisor, Regulatory Affairs
Signature of Owner or Authorized Agent

September 10, 20 08
Date

FOR STATE ENGINEER'S USE ONLY

Permit No. U.W. 190125

Date of Receipt SEP 17 2008, 20____

Date of Approval_____, 20____

Date of Priorty _____, 20____

for State Engineer

SP 15-17

Well Completion Log

State Engineer's Office

HERSCHLER BUILDING, 4-E CHEYENNE, WYOMING 82002
(307) 777-7354 FAX (307) 777-5451
seoleg@seo.wyo.gov

DAVE FREUDENTHAL
GOVERNOR

PATRICK TYRRELL
STATE ENGINEER

November 14, 2008

QUESTAR EXPLORATION & PRODUCTION CO.
1050 17TH ST., SUITE 500
Denver, CO 80265

Dear Applicant or Agent:

You are advised that the State Engineer approved the following application(s) to appropriate ground water for **MIS** on **November 13, 2008**. A copy of your permit is enclosed. Also enclosed are the form and instructions for submitting data to the State Engineer relating to the completion of the well and the beneficial use of the water, as required by law.

PERMIT NUMBER - WELL NAME
U.W. 189049 - STEWART POINT 15-17 WSW
WELL LOCATION - SWSE 17-33-109

By statute the well must be completed and the water beneficially utilized by December 31, 2009. ***IF THE REQUIRED NOTICES ARE NOT RETURNED TO THIS OFFICE WITHIN THE STATUTORY TIME LIMITS SET FORTH, THE PERMIT(S) WILL BE SUBJECT TO CANCELLATION, WHICH ACTS AS A FORFEITURE OF THE WATER RIGHT GRANTED BY THIS PERMIT.***

An extension of time may be requested for completion of work when good reason is provided. A request for such extension must be received in the State Engineer's Office prior to the expiration date shown on the permit. Requests for extension of time must indicate due diligence on the part of the applicant to comply with the time limits imposed by this permit. ***(PLEASE NOTE: The conditions and limitations of your permit may NOT allow an extension of time.)***

ALSO NOTE: THE WATER DELIVERY SYSTEM FROM THIS WELL SHALL BE EQUIPPED WITH A FUNCTIONAL BACKFLOW PREVENTION DEVICE TO ELIMINATE THE POSSIBILITY OF FLUIDS OR OTHER MATTER ENTERING THE WELL DURING USE.

Sincerely,

Lisa Lindemann

Lisa Lindemann, Administrator
Ground Water Division

LL:CL
xc: DIV 4 (7)

FORM U.W. 5
Rev. 6/07
FILING FEE SCHEDULE
ON REVERSE SIDE

STATE OF WYOMING

09-17-08 RCVD 0936

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E CHEYENNE, WYOMING 82002
(307) 777-6163

SE039070
50.00
9/17/08

APPLICATION FOR PERMIT TO APPROPRIATE GROUND WATER

APPLICATION FOR WELLS AND SPRINGS

Note: Only springs flowing 25 gallons per minute or less, where the proposed use is domestic and /or stock watering, will be considered as ground water appropriations.

Temporary Filing No. U.W. 41-7-275

FOR OFFICE USE ONLY

PERMIT NO. U.W. 189049
WATER DIVISION NO. 4 DISTRICT 7
U.W. DISTRICT Sublette Co.

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.
ALL ITEMS MUST BE COMPLETED BEFORE APPLICATION IS ACCEPTABLE

NAME AND NUMBER OF WELL or SPRING Stewart Point 15-17 WSW

1. Name of applicant(s) 1- Questar Exploration and Production Company
2- Bureau of Land Management Phone: 303-308-3068

2. Address of applicant(s) 1- 1050 17th Street, Suite 500 Denver, CO 80265
2- P.O.Box 768, Pinedale, WY 82941
(MAILING ADDRESS) (CITY) (STATE) (ZIP)

3. Name & address of agent to receive correspondence and notices Debra K. Stanberry, Supervisor, Regulatory Affairs
1050 17th Street, Suite 500 Denver, CO 80265 Phone: 303-308-3068
(MAILING ADDRESS) (CITY) (STATE) (ZIP)

4. Use to which the water will be applied:

[ ] Domestic: Use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totaling one acre or less. Number of houses served?____.

[ ] Stock Watering. Normal livestock use at four tanks or less within one mile of well or spring. Stockwatering pipelines and commercial feedlots are a miscellaneous use. Number of stock tanks?____.

[ ] Irrigation: Watering of any lands for agricultural purposes not covered by the definition of domestic use (large-scale lawn watering of golf courses, cemeteries, recreation areas, etc., is miscellaneous use).

[ ] Municipal: Use of water in incorporated Towns and Cities. Note 1: use of water in unincorporated towns, subdivisions, improvement districts, mobile home parks, etc. is classified as miscellaneous use. Note 2: a permit may be required by the Wyoming Department of Environmental Quality (WDEQ) if the well will be classified as a public water supply under the WDEQ's rules and regulations.

[ ] Industrial: Long term use of water for the manufacture of a product or production of oil/gas or other minerals (oil field water flood operations, power plant water supply, etc.). (Describe in REMARKS)

[X] Miscellaneous: Any use of water not defined under previous definitions such as stock water pipelines, subdivisions, mine dewatering, mineral/oil exploration drilling, potable supplies in office, etc. (Describe in Remarks). Note: a permit may be required by the WDEQ if the well will be classified as a public water supply under the WDEQ's rules and regulations.

[ ] Coalbed Methane Water produced in the production of coal bed methane gas. Note: wells used in the production of coal bed methane gas will require a permit from the Wyoming Oil and Gas Conservation Commission.

[ ] Monitor, Observation Note: a WDEQ permit may be required [ ] Test Well: (Describe in REMARKS)

5. Location of the well or spring: (NOTE: Quarter-quarter (40 acre subdivision) MUST be shown. EXAMPLE: SE 1/ 4 NW 1/ 4 of Sec. 12, Township 14 North, Range 68 West.)
Sublette County, SW 1/4 SE 1/4 of Sec. 17, T. 33 R.S. N., R. 109 W. of the 6th P.M. (W.R.M.), Wyoming. If located in a platted subdivision, also provide Lot/Tract ___ Block ___ of the _____ Subdivision (or Add'n) of _____ Resurvey Location: Tract ____, (or Lot) 15 per G/O's A Per U.W.E. JH

6. Estimated depth of the well or spring is ~~1000~~ 940 feet. Estimated production interval is 640 ft. to 940 ft.

7. (a) MAXIMUM instantaneous flow of water to be developed and beneficially used: 125 gallons per minute. NOTE: if for domestic and / or stock use, this application will be processed for a maximum of 25 gallons per minute. For a spring, after approval of this application, some type of artificial diversion or improvement must be constructed to qualify for a water right.

(b) MAXIMUM volumetric quantity of water to be developed and beneficially used per calendar year: 15 acre feet. Circle appropriate units: (Gallons) (Acre Feet) A four person family utilizes approximately one (1) acre-foot of water per year or 325,000 gallons.

8. Mark the point(s) or area(s) of use in the tabulation box below. Note: Upper row refers to the quarter of the section. Next row refers to the quarter of the quarter section. Per Email rec'd 11/4/08 A

TABULATION BOX

TWP	RNG	SEC	NE¼				NW¼				SW¼				SE¼				TOTAL
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	
33	109	17	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
33	109	20	X	X		X	X						X						

SEE REVERSE SIDE

Permit No. U.W. 189049 Book No. 1365 Page No. 149

9. If for irrigation use:
   a. Describe MAXIMUM acreage to be irrigated in each 40 acre subdivision in the tabulation box above.
   b. ☐ Land will be irrigated from this well only.
   c. ☐ Land is irrigated from existing water right(s) with water from this well to be additional supply. Describe existing water right(s) under REMARKS.

10. If for irrigation use, describe method of irrigation, i.e. center pivot sprinkler, flood, etc.: _____

11. The well or spring is to be constructed on lands owned by Bureau of Land Management
(The granting of a permit does not constitute the granting of a right-of-way. If any easement or right-of-way is necessary in connection with this application, it should be understood that the responsibility is the applicant's. A copy of the agreement should accompany this application, if the land is privately owned and the owner is not the co-applicant.)

12. The water is to be used on lands owned by Bureau of Land Management .
(If the landowner is not the applicant, a copy of the agreement relating to the usage of the appropriated water on the land should be submitted to this office. If the landowner is included as co-applicant on the application, this procedure need not be followed.) NOTE: Water rights attach to the area(s) and/or point(s) of use.

Per E-mail Lee 11/4/08

REMARKS: Drilling of oil and gas wells, road maintenance, dust abatement, well work-overs/repairs and reclamation
Refile of cancelled permit #144088

Under penalties of perjury, I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete.

Signature of Applicant or Authorized Agent

September 10, 20 08
Date

Debra K. Stanberry, Supervisor Regulatory Affairs

THE LEGALLY REQUIRED FILING FEE MUST ACCOMPANY THIS APPLICATION

DOMESTIC AND/OR STOCK WATERING USES (Domestic use is defined as use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totalling one acre or less.)	$25.00
IRRIGATION, MUNICIPAL, INDUSTRIAL, MISCELLANEOUS, COAL BED METHANE	$50.00
MONITOR (For water level measurements or chemical quality sampling) or TEST WELL	No Fee

IF WELL WILL SERVE MULTIPLE USES, SUBMIT ONLY ONE (THE HIGHER) FILING FEE.

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

THE STATE OF WYOMING)
) ss.
STATE ENGINEER'S OFFICE)

This instrument was received and filed for record on the 17th day of September, A.D. 2008, at 9:36 o'clock AM.

Permit No. U.W. 189049

for State Engineer

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This application is approved subject to the condition that the proposed use shall not interfere with any existing rights to ground water from the same source of supply and is subject to regulation and correlation with surface water rights, if the ground and surface waters are interconnected. The use of water hereunder is subject to the further provisions of Chapter 169, Session Laws of Wyoming, 1957, and any subsequent amendments thereto.

Granting of a permit does not guarantee the right to have the water level or artesian pressure in the well maintained at any specific level. The well should be constructed to a depth adequate to allow for the maximum development and beneficial use of ground water in the source of supply.

If the well is a flowing artesian well, it shall be so constructed and equipped that the flow may be shut off when not in use without loss of water into sub-surface formations or at the land surface.

Coal Bed Methane wells have Additional Conditions and Limitations on attachment sheet.

FOR ADDITIONAL CONDITIONS AND LIMITATIONS SEE ATTACHED STATUS SHEET.

This permit and accompanying notices serve to register an existing well and establish a valid water right for the same. Time limit for Completion of Construction is waived.

~~Approval of this application may be considered as authorization to proceed with construction of the proposed well or spring. A Statement of Completion will be filed within thirty (30) days of completion of construction, including pump installation.~~

Completion ~~of construction and completion~~ of the beneficial use of water for the purposes specified in Item 4 of this application will be made by December 31, 20 09.

~~The amount of appropriation shall be limited to the quantity to which permittee is entitled as determined at time of proof of application of water to beneficial use.~~

Witness my hand this 13th day of Nov., A.D. 20 08.

for PATRICK T. TYRRELL, State Engineer

Revised 11/1/2004

PERMIT NO. U.W. 189049
T.F. No. U.W. 41-7-275

PERMIT STATUS

Priority Date September 17, 2008 **Approval Date** NOV 13 2008

ADDITIONAL CONDITIONS AND LIMITATIONS:

1. The right to the use of ground water granted under this permit is restricted to the point (s) of use shown. The State Engineer is to be notified in writing at least five (5) days prior to utilizing water under this permit at any additional points of use. The written notification shall contain location of the point of use by 40 acre legal subdivision and approximate length of time the water will be used at additional point of use. A copy of the written notification shall be mailed to the field personnel designated below.

2. The right to the use of ground water granted under this permit is for **oil and gas development, road maintenance, dust abatement, well work-over/repairs & reclamation** shall extend until **December 31, 2013**. At that time the permit will be automatically cancelled unless a written request for an extension of time has been received by the State Engineer prior to **December 31, 2013**.

3. If this well is to be drilled on the main portion of the geographic region called "The Mesa", and the surface elevation of the well site is at an altitude greater than 7,250 feet above sea level, this well shall be cased with new or new-like quality blank unperforated casing from the land surface to a depth of at least 500 feet below land surface. Said casing shall be grouted in place utilizing one or more of the following materials, neat cement, cement/bentonite mixed grout, bentonite pellets/chips, or bentonite slurry, from the land surface to the bottom of the blank unperforated casing, interval specified above.

4. If this well is to be located in portions of the Pinedale Anticline Project Area that are not specific to "The Mesa" region as outlined in Condition 3, and, the well is to be situated within 1,000 feet of an existing domestic or stock watering well, the top of the production zone (perforated interval) utilized by this well shall be located at least 200 feet below that of the bottom of the deepest production zone utilized by existing domestic or stock watering wells located within 1,000 feet of this water supply well. In this case, this well shall be cased with new or new-like quality blank unperforated casing from the land surface to the top of the production zone of this well. Said casing shall be grouted in place utilizing one or more of the following materials, neat cement, cement/bentonite mixed grout, bentonite pellets/chips, or bentonite slurry, from the land surface to the bottom of the blank unperforated casing, interval specified above.

5. If this well is to be located in portions of the Pinedale Anticline Project Area that are not specific to "The Mesa" region as outlined in Condition 3, and, this well is not situated within 1,000 feet of an existing domestic or stock watering well, as outlined in Condition 4, this well shall be cased with new or new-like blank unperforated casing from the land surface to a depth of at least 200 feet below land surface. Said casing shall be grouted in place utilizing one or more of the following materials, neat cement, cement/bentonite mixed grout, bentonite pellets/chips, or bentonite slurry, from the land surface to the bottom of the blank unperforated casing, interval specified above

6. The water delivery system from this well shall be equipped with a functional backflow prevention device to eliminate the possibility of fluids or other matter entering the well during use.

7. Part I of the final Proof of Appropriation is required for this permit; however, Parts II and III are waived.

8. The State Engineer may, upon written request, waive all or any portion of these conditions and limitations.

11/13/2008
Date of Approval

For Steve R. Hall
PATRICK T. TYRRELL, State Engineer

COPY OF THIS PERMIT MAILED TO:
Jade Henderson –Superintendent
P.O. Box 277
Cokeville, WY 83114

September 17, 2008 - Statement of Completion on May 22, 2002 received.

FORM U.W.6
Rev 1/07

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E
CHEYENNE, WYOMING 82002

(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

NOTE: Do not fold this form. Use typewriter or print neatly with black pen.

PERMIT NO. U.W. 189049 NAME OF WELL/SPRING Stewart Point 15-17 WSW

1. NAME OF OWNER 1-Questar Exploration and Production Company 2-Bureau of Land Management

2. ADDRESS 1-1050 17th Street, Suite 500 2-P.O.Box 768
Please check if address has changed from that shown on permit
City 1- Denver 2- Pinedale State 1- Colorado 2- Wyoming Zip Code 1-80265 2-82941 Phone No. 303-308-3068

3. USE OF WATER [ ] Domestic [ ] Stock Watering [ ] Irrigation [ ] Municipal [ ] Industrial [X] Miscellaneous
[ ] Monitor or Test [ ] Coal Bed Methane Explain proposed use (Example: One single family dwelling)
Oil & Gas Well Drilling

4. LOCATION OF WELL/SPRING SW 1/4 SE 1/4 of Section 17 T. 33 N., R. 109 W., of the 6th P.M. (or W.R.M.)
Subdivision Name _____ Lot _____ Block _____
Resurvey Location Tract _____ or Lot _____ Datum [ ] NAD27 [ ] NAD83
Geographic Coordinates: Latitude _____ N Longitude _____ W (degrees, minutes, seconds)
UTM: Zone _____ Northing _____ Easting _____ (meters)
State Plane Coordinates: Zone _____ Northing 4741853 Easting 590908 (feet)
Land surface elevation (ft. above mean sea level) 7276 Datum [ ] NAVD29 [ ] NAVD88
Source [X] GPS [ ] Map [ ] Survey Unkown [ ] Other [ ] Altimeter (for elevation only)

5. TYPE OF CONSTRUCTION [X] Drilled Rotary [ ] Dug [ ] Driven [ ] Other
Describe _____

6. CONSTRUCTION Total depth of well/spring 940 ft.
Depth of static water level 520 ft. (below land surface) Casing height 0 ft. above ground
a. Diameter of borehole (bit size) 10 5/8 inches
b. Casing schedule [X] New [ ] Used Joint type [ ] Threaded [ ] Glued [X] Welded
6 5/8 diameter from 0 ft. to 940 ft. Material Steel Gage 0.188
_____ diameter from _____ ft. to _____ ft. Material _____ Gage _____
c. Cemented/grouted interval, from 0 ft. to 500 ft.
Amount of cement/grout used 130 Sacks (example: 10 sacks) type Class G with 10-SX *bentonite plug seal below (example: bentonite pellets)
d. Type of completion [X] Customized perforations [ ] Open hole [ ] Factory screen
Type of perforator used Torch Cut
Size of perforations 10 inches by 1/8 inches.
Number of perforations and depths where perforated
300 perforations from 640 ft. to 940 ft.
_____ perforations from _____ ft. to _____ ft.
Open hole from _____ ft. to _____ ft.
Well screen details
Diameter _____ slot size _____ set from _____ ft. to _____ ft.
Diameter _____ slot size _____ set from _____ ft. to _____ ft.
e. Well development method Rotary How long was well developed? _____
f. Was a filter/gravel pack installed? [X] Yes [ ] No Size of sand/gravel 3/8" Washed
Filler/gravel pack installed from _____ ft. to _____ ft.
g. Was surface casing used? [X] Yes [ ] No Was it cemented in place? [ ] Yes [X] No
Surface casing installed from 0 ft. to 20 ft.

7. NAME AND ADDRESS OF DRILLING COMPANY Searle Bros., 149 Pollux Drive, Rock Springs, WY 82901

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) 05/22/2002

9. PUMP INFORMATION Manufacturer Grundfoss Type Submersible
Source of power Generator Horsepower 30 Depth of pump setting or intake 860 ft.
Amount of water being pumped 110 gal./min.* (For springs or flowing wells, see item 10)
Total volumetric quantity used per calendar year.* 15 acre feet
*If these amounts exceed permitted amount an enlargement is required.

10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
If artesian flow or spring, yield is _____ gal./min. *Surface pressure is _____ lb./sq.inch, or _____ feet of water.
The flow is controlled by [ ] Valve [ ] Cap [ ] Plug
Does well leak around casing? [ ] Yes [ ] No

Permit No. U.W. 189049 Book No. 1365 Page No. 149

SEE REVERSE SIDE

11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion, i.e., spring box, cribbing, etc., is necessary to qualify for a water right) _____

12. PUMP TEST Was a pump test conducted? ☐ Yes ☒ No
If so, by whom _____
Yield _____ gal./min. with _____ ft. drawdown after _____ hours
Yield _____ gal./min. with _____ ft. drawdown after _____ hours

13. LOG OF WELL Total depth drilled 940 ft.
Depth of completed well 940 ft. Diameter of well 10 5/8 inches
Depth to first water bearing formation 97 ft.
Depth to principal water bearing formation Top 640 ft. to Bottom 922 ft.

DRILL CUTTINGS DESCRIPTION

From Feet	To Feet	Rock Type or Description	Formation	Water Bearing? (Yes or no)
Surface	4	Gravel		No
4	75	Grey shale		No
75	97	Sandstone		Yes
97	201	Grey shale		No
201	212	Sandstone		Yes
212	322	Grey shale, red clay		No
322	338	Sandstone		Yes
338	640	Grey shale & sand stringers		No
640	656	Sandstone		Yes
656	692	Grey Shale	Note: Perforations	No
692	735	Sandstone	from 640' to 940'	Yes
735	810	Grey shale		No
810	860	Tight sandstone		No
860	872	Red clay		No
872	922	Sandstone		Yes
922	940	Grey shale		No

14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM? ☐ Yes ☒ No

* Cemented 470' to surface 30' bentonite plug 470' to 500'.

15. QUALITY OF WATER INFORMATION

Does a chemical and/or bacteriological water quality analysis accompany this form? ☐ Yes ☒ No
It is recommended that chemical and bacteriologic water quality analyses be performed and that the report(s) be filed with the records of this well (contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984).
If not, do you consider the water as Good ☒ Acceptable ☐ Poor Unusable

REMARKS _____

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct, and complete.

Signature of Owner or Authorized Agent

Debra K. Stanberry, Supervisor, Regulatory Affairs

September 10, 20 08
Date

FOR STATE ENGINEER'S USE ONLY

Permit No. U.W. 189049
SEP 17 2008

Date of Receipt _____, 20____

Date of Priorty _____, 20____

Date of Approval 11/13, 20 08

for State Engineer

SP 8-32

Well Completion Log

FORM U.W. 5
Rev. 6/07
FILING FEE SCHEDULE
ON REVERSE SIDE

09-25-08 RCVD 0917

S003 9141
50.00
9/25/08

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E CHEYENNE, WYOMING 82002
(307) 777-6163

APPLICATION FOR PERMIT TO APPROPRIATE GROUND WATER

APPLICATION FOR WELLS AND SPRINGS

Note: Only springs flowing 25 gallons per minute or less, where the proposed use is domestic and /or stock watering, will be considered as ground water appropriations.

FOR OFFICE USE ONLY

PERMIT NO. U.W. 189095
WATER DIVISION NO. 4 DISTRICT 7
U.W. DISTRICT Sublette Co.

Temporary Filing No. U.W. 41-4-283

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.
ALL ITEMS MUST BE COMPLETED BEFORE APPLICATION IS ACCEPTABLE

NAME AND NUMBER OF WELL or SPRING Stewart Point 8-32D WSW

1. Name of applicant(s) 1- Questar Exploration and Production Company
2- Bureau of Land Management Phone: 303-308-3068
2. Address of applicant(s) 1- 1050 17th Street, Suite 500 Denver, CO 80265
2- P.O.Box 768, Pinedale, WY 82941
(MAILING ADDRESS) (CITY) (STATE) (ZIP)
3. Name & address of agent to receive correspondence and notices Debra K. Stanberry, Supervisor, Regulatory Affairs
1050 17th Street, Suite 500 Denver, CO 80265 Phone: 303-308-3068
(MAILING ADDRESS) (CITY) (STATE) (ZIP)
4. Use to which the water will be applied:

[ ]	Domestic:	Use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totaling one acre or less. Number of houses served?____.
[ ]	Stock Watering:	Normal livestock use at four tanks or less within one mile of well or spring. Stockwatering pipelines and commercial feedlots are a miscellaneous use. Number of stock tanks?____.
[ ]	Irrigation:	Watering of any lands for agricultural purposes not covered by the definition of domestic use (large-scale lawn watering of golf courses, cemeteries, recreation areas, etc., is miscellaneous use).
[ ]	Municipal:	Use of water in incorporated Towns and Cities. Note 1: use of water in unincorporated towns, subdivisions, improvement districts, mobile home parks, etc. is classified as miscellaneous use. Note 2: a permit may be required by the Wyoming Department of Environmental Quality (WDEQ) if the well will be classified as a public water supply under the WDEQ's rules and regulations.
	Industrial:	Long term use of water for the manufacture of a product or production of oil/gas or other minerals (oil field water flood operations, power plant water supply, etc.). (Describe in REMARKS)
[X]	Miscellaneous:	Any use of water not defined under previous definitions such as stock water pipelines, subdivisions, mine dewatering, mineral/oil exploration drilling, potable supplies in office, etc. (Describe in Remarks). Note: a permit may be required by the WDEQ if the well will be classified as a public water supply under the WDEQ's rules and regulations.
[ ]	Coalbed Methane	Water produced in the production of coal bed methane gas. Note: wells used in the production of coal bed methane gas will require a permit from the Wyoming Oil and Gas Conservation Commission.
[ ]	Monitor, Observation	Note: a WDEQ permit may be required [ ] Test Well: (Describe in REMARKS)

5. Location of the well or spring: (NOTE: Quarter-quarter (40 acre subdivision) MUST be shown. EXAMPLE: SE 1/4 NW 1/4 of Sec. 12, Township 14 North, Range 68 West.) Sublette County. SE 1/4 NE 1/4 of Sec. 32, T. 33 N., R. 109 W. of the 6th P.M. (W.R.M.), Wyoming. If located in a platted subdivision, also provide Lot/Tract ___ Block ___ of the ___ Subdivision (or Add'n) of ___ DEP. Resurvey Location: Tract ___, (or Lot) 8 Per Email Req 11/4/08
6. Estimated depth of the well or spring is ~~1000~~ 1090 feet. Estimated production interval is 810 ft. to 1090 ft. Per U.W. 6 JH
7. (a) MAXIMUM instantaneous flow of water to be developed and beneficially used: 125 gallons per minute. NOTE: if for domestic and / or stock use, this application will be processed for a maximum of 25 gallons per minute. For a spring, after approval of this application, some type of artificial diversion or improvement must be constructed to qualify for a water right.

   (b) MAXIMUM volumetric quantity of water to be developed and beneficially used per calendar year: 15 acre feet. Circle appropriate units: (Gallons) (Acre Feet) A four person family utilizes approximately one (1) acre-foot of water per year or 325,000 gallons.
8. Mark the point(s) or area(s) of use in the tabulation box below. Note: Upper row refers to the quarter of the section. Next row refers to the quarter of the quarter section.

Per E-mail Rec'd 11/4/08

TABULATION BOX

TWP	RNG	SEC	NE¼				NW¼				SW¼				SE¼				TOTAL
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	
33	109	32			X	X			X	X	X				X	X		X	
33	109	33			~~X~~	~~out JH~~			X			X							
33	109	29												X			X		

SEE REVERSE SIDE

Permit No. U.W. 189095 Book No. 1366 Page No. 45

9. If for irrigation use:
   a. Describe MAXIMUM acreage to be irrigated in each 40 acre subdivision in the tabulation box above.
   b. ☐ Land will be irrigated from this well only.
   c. ☐ Land is irrigated from existing water right(s) with water from this well to be additional supply. Describe existing water right(s) under REMARKS.

10. If for irrigation use, describe method of irrigation, i.e. center pivot sprinkler, flood, etc.: _____

11. The well or spring is to be constructed on lands owned by Bureau of Land Management
(The granting of a permit does not constitute the granting of a right-of-way. If any easement or right-of-way is necessary in connection with this application, it should be understood that the responsibility is the applicant's. A copy of the agreement should accompany this application, if the land is privately owned and the owner is not the co-applicant.)

12. The water is to be used on lands owned by Bureau of Land Management
(If the landowner is not the applicant, a copy of the agreement relating to the usage of the appropriated water on the land should be submitted to this office. If the landowner is included as co-applicant on the application, this procedure need not be followed.) NOTE: Water rights attach to the area(s) and/or point(s) of use.

Per E-mail Rec'd 11/4/08

REMARKS: Drilling of oil and gas wells, road maintenance, dust abatement, well workover/repairs & rehabilitation. Refile of cancelled permit #154968

Under penalties of perjury, I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete.

Signature of Applicant or Authorized Agent: [signature] Date: September 17, 2008

Debra K. Stanberry, Supervisor, Regulatory Affairs

THE LEGALLY REQUIRED FILING FEE MUST ACCOMPANY THIS APPLICATION

DOMESTIC AND/OR STOCK WATERING USES (Domestic use is defined as use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totalling one acre or less.)	$25.00
IRRIGATION, MUNICIPAL, INDUSTRIAL, MISCELLANEOUS, COAL BED METHANE	$50.00
MONITOR (For water level measurements or chemical quality sampling) or TEST WELL	No Fee

IF WELL WILL SERVE MULTIPLE USES, SUBMIT ONLY ONE (THE HIGHER) FILING FEE.

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

THE STATE OF WYOMING)
) ss.
STATE ENGINEER'S OFFICE)

This instrument was received and filed for record on the 25th day of September, A.D. 2008, at 9:17 o'clock A M.

Permit No. U.W. 189095

for State Engineer

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This application is approved subject to the condition that the proposed use shall not interfere with any existing rights to ground water from the same source of supply and is subject to regulation and correlation with surface water rights, if the ground and surface waters are interconnected. The use of water hereunder is subject to the further provisions of Chapter 169, Session Laws of Wyoming, 1957, and any subsequent amendments thereto.

Granting of a permit does not guarantee the right to have the water level or artesian pressure in the well maintained at any specific level. The well should be constructed to a depth adequate to allow for the maximum development and beneficial use of ground water in the source of supply.

If the well is a flowing artesian well, it shall be so constructed and equipped that the flow may be shut off when not in use without loss of water into sub-surface formations or at the land surface.

Coal Bed Methane wells have Additional Conditions and Limitations on attachment sheet.

FOR ADDITIONAL CONDITIONS AND LIMITATIONS SEE ATTACHED STATUS SHEET.

This permit and accompanying notices serve to register an existing well and establish a valid water right for the same. Time limit for Completion of Construction and Completion of Beneficial Use is waived.

~~Approval of this application may be considered as authorization to proceed with construction of the proposed well or spring. A Statement of Completion will be filed within thirty (30) days of completion of construction, including pump installation.~~

~~Completion of construction and completion of the beneficial use of water for the purposes specified in Item 4 of this application will be made by December 31, 20____.~~

~~The amount of appropriation shall be limited to the quantity to which permittee is entitled as determined at time of proof of application of water to beneficial use.~~

Witness my hand this 2nd day of Dec., A.D. 2008.

for [signature]
PATRICK T. TYRRELL, State Engineer

Revised 11/1/2004

PERMIT NO. U.W. 189095
T.F. No. U.W. 41-4-283

PERMIT STATUS

Priority Date September 25, 2008 **Approval Date** DEC 2 2008

ADDITIONAL CONDITIONS AND LIMITATIONS:

1. The right to the use of ground water granted under this permit is restricted to the point (s) of use shown. The State Engineer is to be notified in writing at least five (5) days prior to utilizing water under this permit at any additional points of use. The written notification shall contain location of the point of use by 40 acre legal subdivision and approximate length of time the water will be used at additional point of use. A copy of the written notification shall be mailed to the field personnel designated below.

2. The right to the use of ground water granted under this permit is for **oil and gas development, road maintenance, dust abatement, well work-over/repairs & reclamation** shall extend until **December 31, 2013**. At that time the permit will be automatically cancelled unless a written request for an extension of time has been received by the State Engineer prior to **December 31, 2013**.

3. If this well is to be drilled on the main portion of the geographic region called "The Mesa", and the surface elevation of the well site is at an altitude greater than 7,250 feet above sea level, this well shall be cased with new or new-like quality blank unperforated casing from the land surface to a depth of at least 500 feet below land surface. Said casing shall be grouted in place utilizing one or more of the following materials, neat cement, cement/bentonite mixed grout, bentonite pellets/chips, or bentonite slurry, from the land surface to the bottom of the blank unperforated casing, interval specified above.

4. If this well is to be located in portions of the Pinedale Anticline Project Area that are not specific to "The Mesa" region as outlined in Condition 3, and, the well is to be situated within 1,000 feet of an existing domestic or stock watering well, the top of the production zone (perforated interval) utilized by this well shall be located at least 200 feet below that of the bottom of the deepest production zone utilized by existing domestic or stock watering wells located within 1,000 feet of this water supply well. In this case, this well shall be cased with new or new-like quality blank unperforated casing from the land surface to the top of the production zone of this well. Said casing shall be grouted in place utilizing one or more of the following materials, neat cement, cement/bentonite mixed grout, bentonite pellets/chips, or bentonite slurry, from the land surface to the bottom of the blank unperforated casing, interval specified above.

5. If this well is to be located in portions of the Pinedale Anticline Project Area that are not specific to "The Mesa" region as outlined in Condition 3, and, this well is not situated within 1,000 feet of an existing domestic or stock watering well, as outlined in Condition 4, this well shall be cased with new or new-like blank unperforated casing from the land surface to a depth of at least 200 feet below land surface. Said casing shall be grouted in place utilizing one or more of the following materials, neat cement, cement/bentonite mixed grout, bentonite pellets/chips, or bentonite slurry, from the land surface to the bottom of the blank unperforated casing, interval specified above

6. The water delivery system from this well shall be equipped with a functional backflow prevention device to eliminate the possibility of fluids or other matter entering the well during use.

7. Part 1 of the final Proof of Appropriation is required for this permit; however, Parts II and III are waived.

8. The State Engineer may, upon written request, waive all or any portion of these conditions and limitations.

12/2/2008
Date of Approval

for PATRICK T. TYRRELL, State Engineer

COPY OF THIS PERMIT MAILED TO:
Jade Henderson –Superintendent
P.O. Box 277
Cokeville, WY 83114

September 25, 2008 - Statement of Completion on December 21, 2003 received.
September 25, 2008 - Proof of Beneficial Use on July 17, 2008 received.

FORM U.W.6
Rev. 1/07

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E
CHEYENNE, WYOMING 82002

(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

NOTE: Do not fold this form. Use typewriter or print neatly with black pen.

PERMIT NO. U.W. 189095 NAME OF WELL/SPRING Stewart Point 8-32D WSW

1. NAME OF OWNER 1-Questar Exploration and Production Company 2-Bureau of Land Management

2. ADDRESS 1-1050 17th Street, Suite 500 2-P.O.Box 768
☐ Please check if address has changed from that shown on permit
City 1- Denver 2- Pinedale State 1- Colorado 2- Wyoming Zip Code 1-80265 2-82941 Phone No. 303-308-3068

3. USE OF WATER ☐ Domestic ☐ Stock Watering ☐ Irrigation ☐ Municipal ☐ Industrial ☒ Miscellaneous
☐ Monitor or Test ☐ Coal Bed Methane Explain proposed use (Example: One single family dwelling)
Oil & Gas Well Drilling

4. LOCATION OF WELL/SPRING SE 1/4 NE 1/4 of Section 32 T. 33 N., R. 109 W., of the 6th P.M. (or W.R.M.)
Subdivision Name ____ Lot ____ Block ____
Resurvey Location Tract ____ or Lot ____ Datum ☐ NAD27 ☐ NAD83 ~~PLL WGS84 lat/long~~
Geographic Coordinates: Latitude ~~42° 47' 17.02~~ N Longitude ~~109° 52' 52.98"~~ W (degrees, minutes, seconds)
UTM: Zone ____ Northing 4737791.601 Easting 591405.5736 (meters)
State Plane Coordinates: Zone ____ Northing ~~15543935.7~~ Easting ~~1940307.0~~ (feet)
Land surface elevation (ft. above mean sea level) ____ Datum ☐ NAVD29 ☐ NAVD88
Source ☒ GPS ☐ Map ☐ Survey ☐ Unkown ☐ Other ☐ Altimeter (for elevation only)

5. TYPE OF CONSTRUCTION ☒ Drilled Rotary ☐ Dug ☐ Driven ☐ Other
Describe ____

6. CONSTRUCTION Total depth of well/spring 1090 ft.
Depth of static water level 400 ft. (below land surface) Casing height 24" ft. above ground
a. Diameter of borehole (bit size) 12 1/4 inches
b. Casing schedule ☒ New ☐ Used Joint type ☐ Threaded ☐ Glued ☒ Welded
8 5/8 diameter from 0 ft. to 1090 ft. Material Steel Gage 0.188
____ diameter from ____ ft. to ____ ft. Material ____ Gage ____
c. Cemented/grouted interval, from 0 ft. to 500 ft.
Amount of cement/grout used 130 Sacks (example: 10 sacks) type Cement (example: bentonite pellets)
d. Type of completion ☒ Customized perforations ☐ Open hole ☐ Factory screen
Type of perforator used Torch Cut
Size of perforations 12 inches by 1/8 inches.
Number of perforations and depths where perforated
320 perforations from 810 ft. to 1090 ft.
____ perforations from ____ ft. to ____ ft.
Open hole from ____ ft. to ____ ft.
Well screen details
Diameter ____ slot size ____ set from ____ ft. to ____ ft.
Diameter ____ slot size ____ set from ____ ft. to ____ ft.
e. Well development method Rotary How long was well developed? 9 hours
f. Was a filter/gravel pack installed? ☒ Yes ☐ No Size of sand/gravel 3/8" Pea
Filter/gravel pack installed from 500 ft. to 1090 ft.
g. Was surface casing used? ☒ Yes ☐ No Was it cemented in place? ☒ Yes ☐ No
Surface casing installed from 0 ft. to 25 ft.

7. NAME AND ADDRESS OF DRILLING COMPANY Searle Bros. 149 Pollux Drive, Rock Sprints, WY 82901

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) 12/21/2003

9. PUMP INFORMATION Manufacturer Grundfoss Type Submersible
Source of power Generator Horsepower 50 Depth of pump setting or intake 1080 ft.
Amount of water being pumped ~~145.25~~ gal./min.* (For springs or flowing wells, see item 10). per u.w. 5 JH
Total volumetric quantity used per calendar year.* 15 acre feet
*If these amounts exceed permitted amount an enlargement is required.

10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
If artesian flow or spring, yield is ____ gal./min. *Surface pressure is ____ lb./sq.inch. or ____ feet of water.
The flow is controlled by ☐ Valve ☐ Cap ☐ Plug
Does well leak around casing? ☐ Yes ☐ No

Permit No. U.W. 189095 Book No. 1366 Page No. 45

SEE REVERSE SIDE

SEP 25 2008

11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion, i.e., spring box, cribbing, etc., is necessary to qualify for a water right) N/A

12. PUMP TEST Was a pump test conducted? ☒ Yes ☐ No
If so, by whom Warco Pump Service
Yield 145 gal./min. with 100 ft. drawdown after 6 hours
Yield _____ gal./min. with _____ ft. drawdown after _____ hours

13. LOG OF WELL Total depth drilled 1090 ft.
Depth of completed well 1090 ft. Diameter of well 12-1/4 inches
Depth to first water bearing formation 403 ft.
Depth to principal water bearing formation Top 403 ft. to Bottom 1000 ft.

DRILL CUTTINGS DESCRIPTION

From Feet	To Feet	Rock Type or Description	Formation	Water Bearing? (Yes or no)
Surface				
		SEE ATTACHED EXHIBIT 'A'		

14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM? ☐ Yes ☒ No

15. QUALITY OF WATER INFORMATION

Does a chemical and/or bacteriological water quality analysis accompany this form? ☐ Yes ☒ No
It is recommended that chemical and bacteriologic water quality analyses be performed and that the report(s) be filed with the records of this well (contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984).
If not, do you consider the water as ☐ Good ☒ Acceptable ☐ Poor ☐ Unusable

REMARKS _____

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct, and complete.

Signature of Owner or Authorized Agent

Debra K. Stanberry, Supervisor Regulatory Affairs

September 17, 2008
Date

FOR STATE ENGINEER'S USE ONLY

Permit No. U.W. 189095

Date of Receipt SEP 25 2008, 20____

Date of Priorty _____, 20____

Date of Approval 12/2/2008, 20 08

for State Engineer

Attachment for Statement of Completion U.W. 189095

EXHIBIT A
Stewart Point 8-32D Water Source Well

From Feet Surface	To Feet	Rock Type or Description	Formation	Water Bearing? (Yes or No)
0	20	Gravel		No
20	65	Green Sandy Clay		No
65	182	Gray Shale		No
182	360	Gray Siltstone		No
360	375	Red Clay		No
375	403	Gray Shale		No
403	412	Sandstone		Yes
412	453	Tan Shale		No
453	585	Gray Siltstone		No
585	634	Sandstone		Yes
634	694	Gray Siltstone		No
694	721	Red & Gray Shale		No
721	730	Gray Shale		No
730	751	Sandstone		Yes
751	803	Gray Shale		No
803	835	Red & Gray Shale		No
835	861	Gray Shale		No
861	873	Sandstone		Yes
873	931	Gray Siltstone		No
931	1000	Broken Gray Rock		Yes
1000	1029	Gray Siltstone		No
1029	1090	Blue & Red Shale		No

Note: Perforations from 810' to 1090'

ANNEX 4C-3

WELL COMPLETION LOGS
FOR SOUTH ZONE

AN 5-4

Well Completion Log

FORM U.W.6
Rev. 1/07

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E
CHEYENNE, WYOMING 82002

(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

NOTE: Do not fold this form. Use typewriter or print neatly with black pen.

PERMIT NO. U.W. 200779 NAME OF WELL/SPRING Antelope 5-4

1. NAME OF OWNER Linn Operating, Inc.

2. ADDRESS 600 Travis, Suite 5100
☐ Please check if address has changed from that shown on permit

City Houston State Texas Zip Code 77002 Phone No. 713-904-6537

3. USE OF WATER ☐ Domestic ☐ Stock Watering ☐ Irrigation ☐ Municipal ☐ Industrial ☒ Miscellaneous
☐ Monitor or Test ☐ Coal Bed Methane Explain proposed use (Example: One single family dwelling) _____

4. LOCATION OF WELL/SPRING SW 1/4 NW 1/4 of Section 4 T. 29 N.,R. 107 W., of the 6th P.M. (or W.R.M.)
Subdivision Name _____ Lot _____ Block _____
Resurvey Location Tract _____ or Lot _____ Datum ☐ NAD27 ☒ NAD83 _____
Geographic Coordinates: Latitude 42.51222 N Longitude 109.613889 W (degrees, minutes, seconds)
UTM: Zone _____ Northing _____ Easting _____ (meters)
State Plane Coordinates: Zone _____ Northing _____ Easting _____ (feet)
Land surface elevation (ft. above mean sea level) _____ Datum ☐ NAVD29 ☐ NAVD88
Source ☐ GPS ☐ Map ☐ Survey ☐ Unkown ☐ Other ☐ Altimeter (for elevation only)

5. TYPE OF CONSTRUCTION ☒ Drilled _____ ☐ Dug ☐ Driven ☐ Other
Describe _____

6. CONSTRUCTION Total depth of well/spring 550 ft.
Depth of static water level 90 ft. (below land surface) Casing height 2.2 ft. above ground
a. Diameter of borehole (bit size) 10 5/8 inches
b. Casing schedule ☒ New ☐ Used Joint type ☒ Threaded ☐ Glued ☐ Welded
6 5/8 diameter from 0 ft. to 550 ft. Material _____ Gage _____
_____ diameter from _____ ft. to _____ ft. Material _____ Gage _____
c. Cemented/grouted interval, from 0 ft. to 220 ft.
Amount of cement/grout used 127 (example: 10 sacks) type Bentonite seal (example: bentonite pellets)
d. Type of completion ☒ Customized perforations ☐ Open hole ☐ Factory screen
Type of perforator used _____
Size of perforations 12 inches by 1/8 inches.
Number of perforations and depths where perforated
240 perforations from 430 ft. to 550 ft.
_____ perforations from _____ ft. to _____ ft.
Open hole from _____ ft. to _____ ft.
Well screen details
Diameter _____ slot size _____ set from _____ ft. to _____ ft.
Diameter _____ slot size _____ set from _____ ft. to _____ ft.
e. Well development method _____ How long was well developed? _____
f. Was a filter/gravel pack installed? ☒ Yes ☐ No Size of sand/gravel pea gravel
Filter/gravel pack installed from _____ ft. to _____ ft.
g. Was surface casing used? ☐ Yes ☒ No Was it cemented in place? ☐ Yes ☐ No
Surface casing installed from _____ ft. to _____ ft.

7. NAME AND ADDRESS OF DRILLING COMPANY Searle Bros. Construction 149 Pollux Dr. Rock Springs, WY

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) 8/5/14

9. PUMP INFORMATION Manufacturer Grundfos Type 80S200-18
Source of power Generator Horsepower 20 Depth of pump setting or intake 465 ft.
Amount of water being pumped 80 gal./min.* (For springs or flowing wells, see item 10)
Total volumetric quantity used per calendar year.* _____
*If these amounts exceed permitted amount an enlargement is required.

10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
If artesian flow or spring, yield is _____ gal./min. *Surface pressure is _____ lb./sq.inch, or _____ feet of water.
The flow is controlled by ☐ Valve ☐ Cap ☐ Plug
Does well leak around casing? ☐ Yes ☒ No

Permit No. U.W. _____ Book No. _____ Page No. _____

SEE REVERSE SIDE

Searle Bros. Construction

149 Pollux Drive
Rock Springs, Wyoming 82901

Name: Stone Energy LLC
Address: 1670 Broadway St. 2800 Denver Co 80202
Phone #:
Well name: Antlope 5-4
Permit #:

Borehole size: 10 5/8 depth: 550
Casing size: 6 5/8 new: Y used:
Perforations: 240 size: 12" by 1/8"
screen: — slot size: —
Depth from: 430 to: 550
Completed Depth: 550
Static water level: 90'

	start	finish
Date	10-16-02	10-18-02

Test pump Yes: No: X
Gravel pack: Pea
Surface Casing: 1V

FROM FEET	TO FEET	MATERIAL	PERFORATIONS	WATER ZONES	REMARKS (CEMENTING)
0	6	Tan Clay			Bentionite Seal
6	18	Sandy Clay			0-220'
18	43	Gray Shale			127 sacks
43	68	Tan Sandstone			
68	100	Gray Shale			
100	135	Red Clay			
135	140	Sandstone		X	
140	165	Gray Shale			
165	172	Sandstone		X	
172	210	Gray Shale			
210	225	Sandstone		X	
225	445	Gray Shale			
445	458	Sandstone	X	X	
458	487	Gray Shale	Y		
487	499	Sandstone	Y	X	
499	521	Gray Shale	Y		
521	576	Sandstone	Y	X	
576	550	Gray Shale	Y		

Well Completion Log

BO 14-32

Well Completion Log

RECEIVED
AUG 18 2006

FORM U.W.6
Rev. 5/05

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E
CHEYENNE, WYOMING 82002
(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.

PERMIT NO. U.W. **176438** NAME OF WELL/SPRING **BOULDER 14-32**

1. NAME OF OWNER **SHELL ROCKY MOUNTAIN PRODUCTION, LLC.**

2. ADDRESS P O Box 1666, Pinedale WY 82941-1666
☐ Please check if address has changed from that shown on permit.
City _____ State _____ Zip Code _____ Phone No. 307-367-7904

3. USE OF WATER ☐ Domestic ☐ Stock Watering ☐ Irrigation ☐ Municipal ☐ Industrial ☒ Miscellaneous
☐ Monitor or Test ☐ Coal Bed Methane Explain proposed use (Example: One single family dwelling)
Oil and gas development, dust abatement, construction for pads

4. LOCATION OF WELL/SPRING SE 1/4 SW 1/4 of Section 32, T. 31 N.,R 108 W., of the 6th P.M. (or W.R.M.)
GPS coordinates UTM Zone _____ Easting _____ Northing _____
Subdivision name _____ Lot _____ Block _____
If surveyed, bearing, distance, and reference point _____
Longitude (degrees, minutes, seconds) 109.745989 Latitude (degrees, minutes, seconds) 42.607369
Datum: ☐ 1927 ☐ 1983 Source: ☒ GPS ☐ Map ☐ Survey

5. TYPE OF CONSTRUCTION Drilled ☒ Air Rotary (type of rig, and fluid used, if any) ☐ Dug ☐ Driven ☐ Other
Describe _____

6. CONSTRUCTION Total depth of well/spring 700 ft.
Depth to static water level 65 ft. (below land surface) Casing height 1.5 ft. above ground
a. Diameter of borehole (bit size) 9 7/8 inches
b. Casing schedule ☒ New ☐ Used Joint type ☐ Threaded ☐ Glued ☒ Welded
6 " diameter from 0 ft. to 700 ft. Material Steel Gage _____
_____ diameter from _____ ft. to _____ ft. Material _____ Gage _____
c. Cemented/grouted interval, from 0 ft. to 200 ft.
Amount of grout used 85 sacks (example: 10 sacks) type bentonite pellets (example: bentonite pellets)
d. Type of completion ☐ Factory screen ☐ Open hole ☒ Customized perforations
Type of perforator used Torch
Size of perforations 6 inches by 1/8 inches
Number of perforations and depths where perforated
150 perforations from 380 ft. to 400 ft. 100 perforations from 620 to 660'
150 perforations from 500 ft. to 580 ft.
Open hole from _____ ft. to _____ ft.
Well screen details
Diameter _____ slot size _____ set from _____ ft. to _____ ft.
Diameter _____ slot size _____ set from _____ ft. to _____ ft.
e. Well development method Air How long did development last? 1 hour
f. Was a filter/gravel pack installed? ☒ Yes ☐ No Size of sand/gravel pea gravel
Filter pack/gravel installed from 200 ft. to 700 ft.
g. Was surface casing used? ☒ Yes ☐ No Was it cemented in place? ☒ Yes ☐ No
Surface casing installed from 0 ft. to 20 ft.

7. NAME AND ADDRESS OF DRILLING COMPANY Excel Drilling P O Box 267 Rock Springs WY

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) 09-21-06

9. PUMP INFORMATION Manufacturer Grundfos Type Submersible
Source of power Generator Horsepower 30 Depth of pump setting or intake 672' ft.
Amount of water being pumped 85 gal./min. (For springs or flowing wells, see item 10)
Total volumetric quantity used per calendar year 3.5 million

10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
If well yields artesian flow or if spring , yield is _____ gal./min. Surface pressure is _____ lb./sq.inch, or _____ feet of water
The flow is controlled by ☐ Valve ☐ Cap ☐ Plug
Does well leak around casing? ☐ Yes ☐ No

Permit No. U.W. **176438** Book No. **1281** Page No. **139**

SEE REVERSE SIDE

11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion, i.e., springbox, cribbing, etc., is necessary to qualify for a water right) _____

12. PUMP TEST Was a pump test conducted? ☐ Yes ☐ No
If so, by whom _____
Yield _____ gal./min. with _____ ft. drawdown after _____ hours
Yield _____ gal./min. with _____ ft. drawdown after _____ hours

13. LOG OF WELL Total depth drilled 700 ft.
Depth of completed well 700 ft. Diameter of well 6 inches.
Depth to first water bearing formation 120 ft.
Depth to principal water bearing formation top 380 ft. to bottom 650 ft.

Land surface elevation (ft. above mean sea level) 7052 Datum ☐ 1929 ☐ 1988
How determined ☐ Map ☐ Altimeter ☐ Survey ☐ Other

DRILL CUTTINGS DESCRIPTION:

From	To Ft.	Rock Type Or Description	Formation	Water Bearing? (Yes or No)
Surface				
		see attached log		

14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM? ☐ Yes ☒ No

15. QUALITY OF WATER INFORMATION
Does a chemical and/or bacteriological water quality analysis accompany this form? ☐ Yes ☒ No
It is recommended that chemical and bacteriologic water quality analyses be performed and that the report(s) be filed with the records of this well. (Contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984.)
If not, do you consider the quality of water as ☒ Good ☐ Acceptable ☐ Poor ☐ Unusable

REMARKS _____

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct, and complete.

Simon Davison
Signature of Owner or Authorized Agent

10/14/06, 20____
Date

FOR STATE ENGINEER'S USE ONLY

Permit No. U.W. **176438**

Date of Receipt _____, 20____

Date of Approval _____, 20____

Date of Priority **7/17/2006**

_____
for State Engineer

Attachment for the Boulder 14-32 Water Well					
Cuttings Description Continued for the					
From Feet	**To Feet**	**Rock Type Texture, color**	**Formation**	**Water Bearing Formations (Yes or No)**	**Perforated casing Location**
0	12	Sandstone			
12	25	Blue Shale			
25	40	Sandstone			
75	110	Green Shale			
110	120	Sandstone		Yes	
120	210	Green Shale			
210	250	Brown Shale			
250	280	Sandstone		yes	
280	340	Green Shale			
340	380	Brown Shale			
380	390	Sandstone		Yes	Perfs 380-400
390	490	Brown Shale			
490	500	Sandstone		Yes	500'-580'
500	515	Blue Shale			
515	530	Sandstone		Yes	
530	545	Blue Shale			
545	565	Sandstone		Yes	
565	620	Brown Shale			
620	650	Sandstone		Yes	620' - 660'
650	700	Blue Shale			

RB 15-31

Well Completion Log

FORM U.W.6
Rev. 1/07

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E
CHEYENNE, WYOMING 82002

(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

NOTE: Do not fold this form. Use typewriter or print neatly with black pen.

PERMIT NO. U.W. 200787 NAME OF WELL/SPRING Rainbow 15-31

1. NAME OF OWNER Linn Operating, Inc.

2 ADDRESS 600 Travis, Suite 5100
☐ Please check if address has changed from that shown on permit
City Houston State Texas Zip Code 77002 Phone No. 713-904-6537

3. USE OF WATER ☐ Domestic ☒ Stock Watering ☐ Irrigation ☐ Municipal ☐ Industrial ☒ Miscellaneous
☐ Monitor or Test ☐ Coal Bed Methane Explain proposed use (Example: One single family dwelling) _____

4. LOCATION OF WELL/SPRING SW 1/4 SE 1/4 of Section 31 T. 30 N.,R. 107 W., of the 6th P.M. (or W.R.M.)
Subdivision Name _____ Lot _____ Block _____
Resurvey Location Tract _____ or Lot _____ Datum ☐ NAD27 ☒ NAD83 _____
Geographic Coordinates: Latitude 42.519722 N Longitude 109.644444 W (degrees, minutes, seconds)
UTM: Zone _____ Northing _____ Easting _____ (meters)
State Plane Coordinates: Zone _____ Northing _____ Easting _____ (feet)
Land surface elevation (ft. above mean sea level) _____ Datum ☐ NAVD29 ☐ NAVD88
Source ☒ GPS ☐ Map ☐ Survey ☐ Unkown ☐ Other ☐ Altimeter (for elevation only)

5. TYPE OF CONSTRUCTION ☒ Drilled _____ ☐ Dug ☐ Driven ☐ Other
Describe _____

6. CONSTRUCTION Total depth of well/spring 740 ft.
Depth of static water level _____ ft. (below land surface) Casing height 3 ft. above ground
a. Diameter of borehole (bit size) 9 7/8 inches
b. Casing schedule ☒ New ☐ Used Joint type ☐ Threaded ☐ Glued ☐ Welded
6" diameter from 0 ft. to 740 ft. Material _____ Gage _____
_____ diameter from _____ ft. to _____ ft. Material _____ Gage _____
c. Cemented/grouted interval, from 0 ft. to 200 ft.
Amount of cement/grout used 95 bags (example: 10 sacks) type Bentonite (example: bentonite pellets)
d. Type of completion ☐ Customized perforations ☐ Open hole ☐ Factory screen
Type of perforator used _____
Size of perforations 1/8 inches by 6 inches.
Number of perforations and depths where perforated
250 perforations from 530 ft. to 698 ft.
_____ perforations from _____ ft. to _____ ft.
Open hole from _____ ft. to _____ ft.
Well screen details
Diameter _____ slot size _____ set from _____ ft. to _____ ft.
Diameter _____ slot size _____ set from _____ ft. to _____ ft.
e. Well development method _____ How long was well developed? _____
f. Was a filter/gravel pack installed? ☒ Yes ☐ No Size of sand/gravel pea gravel
Filter/gravel pack installed from 200 ft. to 740 ft.
g. Was surface casing used? ☒ Yes ☐ No Was it cemented in place? ☒ Yes ☐ No
Surface casing installed from 0 ft. to 20 ft.

7. NAME AND ADDRESS OF DRILLING COMPANY Excel Drilling, P.O. Box 267, Rock Springs, WY 82902

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) 11/14/13

9. PUMP INFORMATION Manufacturer Grundfos Type 85-5250-19
Source of power generator Horsepower 30 Depth of pump setting or intake 628 ft.
Amount of water being pumped _____ gal./min.* (For springs or flowing wells, see item 10)
Total volumetric quantity used per calendar year.* _____
*If these amounts exceed permitted amount an enlargement is required.

10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
If artesian flow or spring, yield is _____ gal./min. *Surface pressure is _____ lb./sq.inch, or _____ feet of water.
The flow is controlled by ☐ Valve ☐ Cap ☐ Plug
Does well leak around casing? ☐ Yes ☒ No

Permit No. U.W. _____ Book No. _____ Page No. _____

SEE REVERSE SIDE

EXCEL DRILLING

P.O. BOX 267
ROCK SPRNGS, WY. 82902
(307) 362-7194

Name Stone Energy	Borehole size 9 7/8"	depth 740'	start finish
Address	Casing Size 6"	☒new ☐used	Date ____ ____
	Perforations 250	size1/8 by 6	
Phone #	Screen	slot size	Test pump ☐Yes ☒No
Well name Rainbow 15-31	Depth from 530'	to 698'	Gravel pack Pea Gravel
Permit #	Completed Depth 740'		Surface Casing 20'-10"
Well development method		How long did development last?	5 bags cement
Tpe of Completion ☐Factory Screen ☐Open Hole ☐Customized Perforations			
Filter Pack ☐Yes ☐No	Casing Height above ground		
Joint Type: ☐Threaded ☐Glued ☐		Static water level 170'	

From Feet	To Feet	Material	Perfor-ations	Water Zones	Remarks (cementing)
0	8	Sandstone			
8	16	Brown Shale			
16	30	Sandstone			
30	60	Brown Shale			95 bags of Bentonite
60	70	Sandstone			
70	125	Blue Shale			from 0 to 200'
125	140	Brown Shale			
140	180	Blue Shale			
180	190	Sandstone		x	
190	275	Blue Shale			
275	315	Brown Shale			
315	335	Blue Shale			
335	340	Sandstone			
340	505	Blue Shale			
505	520	Brown Shale			
520	550	Sandstone	x	x	
550	575	Blue Shale			
575	585	Brown Shale			
585	595	Sandstone	x	x	
595	605	Blue Shale			
605	620	Brown Shale			
620	640	Sandstone	x	x	
640	675	Brown Shale			
675	695	Sandstone	x	x	
695	740	Blue & Brown Shale			

Well Completion Log

WB 11-4

Well Completion Log

FORM U.W.6
Rev. 5/05

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E
CHEYENNE, WYOMING 82002
(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.

PERMIT NO. U.W. **179159** NAME OF WELL/SPRING **WARBONNET 11-4 WW**

1. NAME OF OWNER **SHELL ROCKY MOUNTAIN PRODUCTION, LLC.**

2. ADDRESS P O Box 1666
☐ Please check if address has changed from that shown on permit.
City Pinedale State WY Zip Code 82941-1666 Phone No. 307-367-7904

3. USE OF WATER ☐ Domestic ☐ Stock Watering ☐ Irrigation ☐ Municipal ☐ Industrial ☒ Miscellaneous
☐ Monitor or Test ☐ Coal Bed Methane Explain proposed use (Example: One single family dwelling)

4. LOCATION OF WELL/SPRING NE 1/4 SW 1/4 of Section 4, T. 30 N., R 108 W., of the 6th P.M. (or W.R.M.)
GPS coordinates UTM Zone ____ Easting ____ Northing ____
Subdivision name ____ Lot ____ Block ____
If surveyed, bearing, distance, and reference point
Longitude (degrees, minutes, seconds) 109° 43' 34" Latitude (degrees, minutes, seconds) 42° 35' 52"
Datum: ☐ 1927 ☐ 1983 Source: ☒ GPS ☐ Map ☐ Survey

5. TYPE OF CONSTRUCTION Drilled ☒ Air Rotary ____ ☐ Dug ☐ Driven ☒ Other
Describe Drilled pneumatic perforator (any)

6. CONSTRUCTION Total depth of well/spring 800 ft.
Depth to static water level 187 ft. (below land surface) Casing height 2.5 ft. above ground
a. Diameter of borehole (bit size) 9 5/8 inches
b. Casing schedule ☒ New ☐ Used Joint type ☐ Threaded ☐ Glued ☒ Welded
6 5/8" diameter from 0 ft. to 20 ft. Material Steel Gage .250
____ diameter from ____ ft. to ____ ft. Material ____ Gage ____
c. Cemented/grouted interval, from 200' ft. to Surface ft.
Amount of grout used ____ (example: 10 sacks) type 5yds cement 10 yards gravel (example: bentonite pellets)
d. Type of completion ☐ Factory screen ☐ Open hole ☒ Customized perforations
Type of perforator used Pneumatice perforator
Size of perforations ____ inches by ____ inches
Number of perforations and depths where perforated
10 perforations from 570 ft. to 600 ft. 750 to 800
10 perforations from 660 ft. to 690 ft.
Open hole from ____ ft. to ____ ft.
Well screen details
Diameter ____ slot size ____ set from ____ ft. to ____ ft.
Diameter ____ slot size ____ set from ____ ft. to ____ ft.
e. Well development method Air Rotary How long did development last? ____
f. Was a filter/gravel pack installed? ☒ Yes ☐ No Size of sand/gravel Pea gravel
Filter pack/gravel installed from ____ ft. to ____ ft.
g. Was surface casing used? ☒ Yes ☐ No Was it cemented in place? ☒ Yes ☐ No
Surface casing installed from ____ ft. to ____ ft.

7. NAME AND ADDRESS OF DRILLING COMPANY White Mtn Drilling:POB 2353:Pinedale WY 82941

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) 04-20-07

9. PUMP INFORMATION Manufacturer Grundfos Type Submersible
Source of power Generator Horsepower 30 Depth of pump setting or intake 768 ft.
Amount of water being pumped 150 gal./min. (For springs or flowing wells, see item 10)
Total volumetric quantity used per calendar year 8,000,000

10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
If well yields artesian flow or if spring , yield is ____ gal./min. Surface pressure is ____ lb./sq.inch, or ____ feet of water
The flow is controlled by ☐ Valve ☐ Cap ☐ Plug
Does well leak around casing? ☐ Yes ☐ No

Permit No. U.W. **179159** Book No. **1300** Page No. **11**

SEE REVERSE SIDE

11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion, i.e., springbox, cribbing, etc., is necessary to qualify for a water right) _____

12. PUMP TEST Was a pump test conducted? [X] Yes [ ] No
If so, by whom Premier Pumps, Farson WY
Yield 150 gal./min. with 355 ft. drawdown after 24 hours
Yield _____ gal./min. with _____ ft. drawdown after _____ hours

13. LOG OF WELL Total depth drilled 800 ft.
Depth of completed well _____ ft. Diameter of well _____ inches.
Depth to first water bearing formation _____ ft.
Depth to principal water bearing formation top _____ ft. to bottom _____ ft.

Land surface elevation (ft. above mean sea level) 7103' Datum [ ] 1929 [ ] 1988
How determined [X] Map [ ] Altimeter [ ] Survey [ ] Other

DRILL CUTTINGS DESCRIPTION:

From	To Ft.	Rock Type Or Description	Formation	Water Bearing? (Yes or No)
Surface				
0	40	Clay sand		
40	250	Clay		
250	310	Sandstone		
310	500	Shale		
500	570	Clay and Shale		
570	600	Water Sand	X	X
600	660	Shale		
660	690	Water Sand	X	X
690	750	CLay		
750	800	Water Sand	X	X

14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM? [ ] Yes [X] No

15. QUALITY OF WATER INFORMATION
Does a chemical and/or bacteriological water quality analysis accompany this form? [ ] Yes [X] No
It is recommended that chemical and bacteriologic water quality analyses be performed and that the report(s) be filed with the records of this well. (Contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984.)
If not, do you consider the quality of water as [ ] Good [X] Acceptable [ ] Poor [ ] Unusable

REMARKS _____

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct, and complete.

[signature] 23 April, 2007
Signature of Owner or Authorized Agent Date

FOR STATE ENGINEER'S USE ONLY

Permit No. U.W. **179159**

Date of Receipt _____, 20____ **Date of Approval** _____, 20____

Date of Priority **1/18/2007**

for State Engineer

WB 8-25

Well Completion Log

11-13-07
1:30 pm
PH
50 -

FORM U.W.6
REV. 7/05

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E
CHEYENNE, WYOMING 82002

(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

NOTE: Do not fold this form. Use typewriter or print neatly with black pen.

PERMIT NO. U.W. 183921 NAME OF WELL/SPRING WARBONNET 8-25

1. NAME OF OWNER 1) ULTRA RESOURCES, INC. 2) U.S.D.I., Bureau of Land Management
2. ADDRESS 1) 304 INVERNESS WAY SOUTH, SUITE 295 2) P.O. Box 1828, Cheyenne, WY 82003
   [ ] Please check if address has changed from that shown on permit
   City 1) ENGLEWOOD State CO Zip Code 80112 Phone No. 303-645-9835
3. USE OF WATER [ ] Domestic [ ] Stock Watering [ ] Irrigation [ ] Municipal [ ] Industrial [X] Miscellaneous
   [ ] Monitor or Test [ ] Coal Bed Methane Explain proposed use (Example: One single family dwelling) For the geographic area specified in Paragraph 8 of Form U.W.5 Ultra requests the right to the use of ground water under Permit #162587 for oil & gas well drilling, completion, road construction/maintenance, dust abatement, and reclamation.
4. LOCATION OF WELL/SPRING SE 1/4 NE 1/4 of Section 25 T. 30 N.,R. 108 W., of the 6th P.M. (or W.P.M.)
   GPS Coordinates UTM Zone _____ Easting _____ Northing _____
   Subdivision Name _____ Lot _____ Block _____
   If surveyed, bearing, distance and reference point _____
   Longitude (degrees, minutes, seconds) W 109*39.488' Latitude (degrees, minutes, seconds) N 42*32.499'
   Datum [ ] 1927 [ ] 1983 Source: [X] GPS [ ] Map [ ] Survey
5. TYPE OF CONSTRUCTION [X] Drilled AIR ROTARY RT 1800 (Type of rig, and fluid used, if any) [ ] Dug [ ] Driven [ ] Other
   Describe _____
6. CONSTRUCTION Total depth of well/spring 670 ft.
   Depth of static water level 290 ft. (below land surface) Casing height 3' ft. above ground
   a. Diameter of borehole (bit size) 10 5/8 inches
   b. Casing schedule [X] New [ ] Used Joint type [ ] Threaded [ ] Glued [X] Welded
   6 5/8 diameter from 0 ft. to 670 ft. Material STEEL Gage .188
   _____ diameter from _____ ft. to _____ ft. Material _____ Gage _____
   c. Cemented/grouted interval, from 0 ft. to 200 ft.
   Amount of cement/grout used 90 SACKS (example: 10 sacks) type BENTONITE PELLETS (example: bentonite pellets)
   d. Type of completion [ ] Factory screen [ ] Open hole [ ] Customized perforations
   Type of perforator used TORCHED
   Size of perforations 12 inces by 1/8 inches.
   Number of perforations and depths where perforated
   250 perforations from 550 ft. to 670 ft. per attached well log
   _____ perforations from _____ ft. to _____ ft.
   Open hole from _____ ft. to _____ ft.
   Well screen details
   Diameter _____ slot size _____ set from _____ ft. to _____ ft.
   Diameter _____ slot size _____ set from _____ ft. to _____ ft.
   e. Well development method AIR LIFT How long was well developed? 3 HRS
   f. Was a filter/gravel pack installed? [X] Yes [ ] No Size of sand/gravel PEA
   Filter/gravel pack installed from 505 ft. to 670 ft.
   g. Was surface casing used? [ ] Yes [X] No Was it cemented in place? [ ] Yes [ ] No
   Surface casing installed from _____ ft. to _____ ft. REMOVED
7. NAME AND ADDRESS OF DRILLING COMPANY SEARLE BROS. CONSTRUCTION, ROCK SPRINGS, WY 82901
8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) 10/27/2004
9. PUMP INFORMATION Manufacturer GRUNDFOS Type SUBMERSIBLE
   Source of power PUMP Horsepower 40 Depth of pump setting or intake 640 ft.
   Amount of water being pumped 150 gal./min. (For springs or flowing wells, see item 10)
   Total volumetric quantity used per calendar year. 2,000,000 gallons, Per U.W.5
10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
   If artesian or spring, yield is _____ gal./min. Surface pressure is _____ lb./sq.inch, or _____ feet of water.
   The flow is controlled by: [ ] Valve [ ] Cap [ ] Plug
   Does well leak around casing? [ ] Yes [ ] No

Permit NO. U.W. 183921 Book No. 1331 Page No. 121

SEE REVERSE SIDE

11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion, i.e., spring box, cribbing, etc., is necessary to quality for a water right) _____

12. PUMP TEST Was a pump test conducted? [X] Yes [ ] No

If so, by whom KIM BROWN PREMIER PUMPS FARSON, WY 82932

Yield 150 gal./min. with 175 ft. drawdown after 24 hours

Yield _____ gal./min. with _____ ft. drawdown after _____ hours

13. LOG OF WELL Total depth drilled 670 ft.

Depth of completed well 670 ft. Diameter of well _____ inches

Depth to first water bearing formation 279 ft.

Depth to principal water bearing formation Top 575 ft. to Bottom 670 ft.

Land surface elevation (ft. above mean sea level) _____ Datum [ ] 1929 [ ] 1988

How determined [ ] Map [ ] Altimeter [ ] Survey [ ] Other

DRILL CUTTINGS DESCRIPTION

From Feet	To Feet	Rock Type or Description	Formation	Water Bearing? (Yes or no)
Surface				
		SEE ATTACHED WELL COMLETION LOG		

14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM? [ ] Yes [X] No

15. QUALITY OF WATER INFORMATION

Does a chemical and/or bacteriological water quality analysis accompany this form? [ ] Yes [X] No

It is recommended that chemical and bacteriologic water quality analyses be performed and that the report(s) be filed with the records of this well (contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984).

If not, do you consider the water as [X] Good [ ] Acceptable [ ] Poor [ ] Unusable

REMARKS _____

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct, and complete.

Robin Fountain
Signature of Owner or Authorized Agent

September 20, 20 07
Date

FOR STATE ENGINEER'S USE ONLY

Permit No. U.W. 183921

Date of Receipt NOV 13 2007, 20 _____

Date of Priority _____, 20 _____

Date of Approval 12/19, 20 07

John R. Hayes
for State Engineer

Attachment for Statement of Completion U.W. **183921**

Searle Bros. Construction

149 Pollux Drive
Rock Springs, Wyoming 82901

Name: Ultra Resources
Address:
Phone #:
Well name: Warbonnett 9-25
Permit #:

Borehole size: 10 5/8 depth: 670
Casing size: 6 5/8 new: Y used:
Perforations: 250 size: 12" by 1/8"
screen: slot size:
Depth from: 550 to: 670
Completed Depth: 670'
Static water level: 290'

	start	finish
Date	10-22-04	10-22-04

Test pump: Yes: No: X
Gravel pack: Pea
Surface Casing: No

FROM FEET	TO FEET	MATERIAL	PERFORATIONS	WATER ZONES	REMARKS (CEMENTING)
0	5	Gray Shale			3' Pipe Stick up
5	9	Red Clay			
9	16	Tan Sand			200' Bentonite Seal
16	78	Red Shale			90 Sacks
78	125	Gray Siltstone			
125	137	Tan Sand			3 hrs Developing
137	223	Gray Siltstone			Air Lift Method
223	226	Gray Shale			
267	279	Sandstone		X	6 5/8 Steel Pipe
279	321	Gray Siltstone			Torch Cut Perfs.
321	346	Red Shale			Welded
346	374	Gray Shale			
374	412	Gray Siltstone			
412	428	Sandstone		X	
428	433	Gray Shale			
433	452	Sandstone		X	
452	466	Gray Shale			
466	473	Red Shale			
473	488	Gray Siltstone			
488	498	Red Shale			
498	505	Sandstone		X	
505	525	Gray Shale	X		
525	601	Sandstone	X	X	
601	618	Red Shale	X		Main Water
618	645	Gray Shale	X		
645	655	Sandstone	X	X	
655	670	Gray Shale	X		

Well Completion Log