

Southern Utah Wilderness Alliance  
Petition for Review  
UIC Permit UT22291-10328

Exhibit Five

Revised 6/17/14  
With notes by  
Tom Aalto  
of EPA *TBA*

**UNDERGROUND INJECTION CONTROL (UIC)  
PERMIT APPLICATION**

**UIC CLASS II INJECTION WELL**



**RIVER BEND UNIT (RBU) 1-10D  
NENE SEC. 10, T10S, R18E,  
Uintah County, Utah  
API # 43-047-34312  
Lease # FEE**

January 2014  
Revised 6/17/14 *TBA*

Prepared for:

Mr. Bruce Suchomel  
UIC Program  
U.S. Environmental Protection Agency  
U.S. EPA, Region 8  
1595 Wynkoop St.  
Denver, Colorado 80202-1129

Prepared by:

Kleinfelder West Inc.  
300 E. Mineral Ave., Suite 7  
Littleton, Colorado 80122  
(303) 781-8211  
FAX (303) 781-1167

RBU 1-10D  
NENE SEC. 10, T10S, R18E,  
Uintah County, Utah

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## **INTRODUCTION**

### **RBU 1-10D**

### **Injection Well**

The proposed RBU 1-10D injection well is located in the NE/4 NE/4 (826' FNL, 642' FEL) of Section 10, Township 10 South, Range 18 East, Uintah County, Utah. The proposed well will be an Underground Injection Control (UIC) Class II injection well used for the purpose of water injection for secondary recovery of mineral resources from Gasco Energy, Inc. (Gasco) operations in the area of the River Bend Unit. The converted injection well and its facilities will be located on an existing Gasco well pad. No new surface disturbance or roads will be required for the conversion to the RBU 1-10D injection well.

The RBU 1-10D was originally drilled by Dominion Exploration and Production Co. in December 2004 to a total depth of 9400 feet in the Mesaverde Formation and completed as a gas well. Gasco purchased the well in July 2006 along with the rest of the wells in the River Bend Unit. The RBU 1-10D well was shut-in April 2013 as non-commercial. In November 2013 Gasco completed the C-Shoal unit of the Uteland Butte member to test the oil potential.

The RBU 1-10D injection well will be used by Gasco as part of the initial phase of a waterflood/injection unit project. The goal of the project will be to enhance oil recovery of nearby production wells. Gasco proposes to waterflood the Uteland Butte member of the Green River Formation in the River Bend Field area. The proposed project is located in Section 10 of Township 10 South, Range 18 East.

The RBU 1-10D well is located on a previously developed well pad currently owned and operated by Gasco. There are two wells located within the ¼-mile radius Area of Review (AOR) for the proposed RBU 1-10D injection well. Seven other wells are located just outside the ¼-mile AOR. It is not anticipated that corrective action will be required to ensure cement isolation across the upper and lower confining zones. The existing RBU 1-10D perforations will be used for injection in the proposed RBU 1-10D well. An injection pressure and rate test, a step rate test, and a tracer or temperature log will be run across the proposed injection at RBU 1-10D to insure well suitability, establish the true maximum allowable injection pressure, and verify zone isolation.

The proposed injection interval for the RBU 1-10D well is the Uteland Butte member of the Lower Green River Formation. At the RBU 1-10D location those depths range from approximately 4,700 feet to 4,880 feet below ground surface. The primary zone is the C Shoal basal limestone (4,860 to 4,880 feet) with the ULB A-H sands and limestones secondary. Water samples from the injection zones will be collected from RBU 1-10D after the injection well is converted. Representative water samples from the same producing intervals for wells adjacent to RBU 1-10D contained total dissolved solid (TDS) concentrations greater than 10,000 milligrams per liter (mg/l).

After producing oil during the UIC permit application approval process, the RBU 1-10D well will be converted to injection. RBU 1-10D will be used to inject water into the proposed intervals for secondary recovery of reservoir fluids. The injected fluids help maintain a pressure that continues to move oil to Gasco's adjacent producing wells. Injected fluids will be limited to fluids produced in connection with oil and gas production from wells that Gasco has a working interest in the River Bend Unit.

**UIC WELL PERMIT APPLICATION**  
**RBU 1-10D**  
**API # 43-047-34312**  
**Lease # FEE**

The following document contains information provided in support of the permit application for the conversion of the existing RBU 1-10D to a UIC Class II injection well.

This well was spudded on December 28, 2004, and was completed in the Mesaverde Formation at a total vertical depth (TVD) of 9,400 feet bgs. Gasco purchased the well in July 2006 along with the rest of the wells in the River Bend Unit. The RBU 1-10D well was shut-in April 2013 as non-commercial. In November 2013 Gasco completed the C-Shoal unit of the Uteland Butte member to test the oil potential. The well is being proposed for conversion to inject Class II fluids produced from Gasco well operations in the River Bend Unit, and for the purposes of enhanced oil recovery.

The RBU 1-10D well falls within land designated as Indian Country. The EPA is the agency that reviews and permits UIC wells in Indian Country.

Gasco's business address and phone number is provided below:

Gasco Energy, Inc.  
7979 East Tufts Avenue  
Denver, Colorado, 80237  
303.483.0044

**A. Area of Review**

**Attachment A1** is a map that shows the area around the existing RBU 1-10D well. The legal location for the RBU 1-10D is 826 feet FNL & 642 feet FEL NENE, Section 10, T10S, R18E, Uintah County, Utah.

**Attachment A2** is a site map that shows the Area of Review (AOR). This map includes a ¼-mile radius centered on the RBU 1-10D well, which encompasses the AOR. Gasco is required to investigate all wells for mechanical integrity within the AOR. One active producing oil well (RBU 8-10D) is located within the AOR. **Table A-1** summarizes information about the subject well, and the six wells located just outside the AOR boundary.

**Table A-1: AOR and Non-AOR Wells Details**

Well	Well Type	Well Status	Distance from EOR Well	Surface Casing			Production Casing		
				Size (in)	Depth	Cement Top	Size (in)	Depth	Estimated Cement Top
RBU 1-10D	Oil	P	0'	8.625	0-2414'	Surface	5.5	0-9383'	2980'
<b>RBU 8-10D</b>	<b>Oil</b>	<b>P</b>	<b>1018'</b>	<b>8.625</b>	<b>0-374'</b>	<b>Surface</b>	<b>5.5</b>	<b>0-4896'</b>	<b>850'</b>
RBU 2-10D	Oil	P	1533'	8.625	0-414'	Surface	5.5	0-5082'	Surface*
RBU 4-11D	Oil	P	1514'	8.625	0-391'	Surface	5.5	0-4950'	Surface*
RBU 5-11D	Gas	SI	1619'	8.625	0-500'	Surface	5.5	0-8455'	4160'
RBU 16-3D	Oil	P	1545'	8.625	0-401'	Surface	5.5	0-5074'	1350'
UTELAND FED 44-3-10-18	-	LA	Not applicable						
UTELAND FED 31-10-10-18	-	LA	Not applicable						

Notes: APD = Approved permit; LA = Location Abandoned; P = Producing; SI = Shut-in; **BOLD indicates AOR well**;  
\*from completion report

The ¼-mile radius also identifies those lands (and the owners thereof) that must be provided notice of this application. **Attachment A3a** includes a map that shows the known surface owners located within the 1/2-mile AOR of the proposed RBU 1-10D well. The working interest owners within the AOR are listed in **Table A-2** and on **Attachment A3b**. **Attachment A3** also includes the Affidavit Notification and a list of landowners including addresses.

**Table A-2: List of Interest Owners within ½ Mile**

**1/2-mile radius Surface Ownership**

Bureau of Land Management  
Green River Field Office  
170 S. 500 E  
Vernal, UT84078

State of Utah School and Institutional Trust Lands Acq.  
675 East 500 South, Suite 500  
Salt Lake City, UT 84101

**1/2-mile radius Mineral Ownership**

Gasco Energy, Inc.  
7979 East Tufts Ave.  
Denver, CO 80237

Wapiti Energy, LLC  
1625 Broadway, Suite 950  
Denver, CO 80202

QEP Resources, Inc.  
1050 17th Street, Suite 500  
Denver, CO 80265

State of Utah School and Institutional Trust Lands Acq.  
675 East 500 South, Suite 500  
Salt Lake City, UT 84101

No new surface disturbance or roads will be required for the RBU 1-10D well. **Attachment A4** is an aerial image map showing the location of existing roads in the area.

**Attachment A5** is a map that shows the location of the existing wells in the surrounding area of the proposed RBU 1-10D. The converted UIC Class II injection well and its facilities will be located on an existing well pad that is operated by Gasco.

### **B. Corrective Action and Well Data**

Gasco proposes to convert and use the RBU 1-10D well as an injector for secondary recovery of reservoir fluids. The injected fluids help maintain a pressure that continues to move oil to Gasco's adjacent producing wells. Injected fluids will be limited to fluids produced in connection with oil and gas production from wells that Gasco has a working interest in the River Bend Unit.

**RBU 1-10D Injection Well:** **Attachment B1** contains the following materials for the existing RBU 1-10D well:

- Copies of all regulatory filings regarding activities related to the physical state of the well including:
  - Application to Drill
  - Well Chronology Report
  - Cement Bond Log (CBL)
- A schematic of the current well borehole

We do not believe that any corrective action is needed on the RBU 1-10D well. Based on well records, the 8½" surface casing string is cemented from 2,414' to the surface. Based on the CBL, the 5½" production casing is cemented from the 9,400' to 2,980' from the surface. The CBL illustrates greater than 80% bond extending from 7,300' to 3,050' across the injection zone both confining zones.

**RBU 8-10D:** This is the only active AOR well. RBU 8-10D is an active producing oil well. **Attachment B2** contains the following materials for the RBU 8-10D.

- Copies of all regulatory filings regarding activities related to the physical state of the well including:
  - Application to Drill
  - Well Chronology Report
- A schematic of the current well borehole

We do not believe that any corrective action is needed on the RBU 8-10D well. Based on the well records, the 8½" surface casing string is cemented from 374' to the surface. Based on a temperature log, the 5½" production casing is cemented from 4,896' to approximately 850' from the surface.

Of the seven wells located outside the ¼-mile AOR, three are producing oil wells; one is a shut-in gas well; two are location abandoned (LA) gas wells; and one is an approved permit gas well. These wells are located outside the AOR; therefore, Gasco is not required to perform corrective action. Since Gasco is the operator of these wells, well records were readily available and construction details were provided in **Table A-1**, above.



### C. Names and Depths of Underground Sources of Drinking Water (USDWs)

**Attachment C1** represents the Base of Moderately Saline Water (BMSW) [*Plate 1: BMSW Elevation Contour Map, Uinta Basin, Utah* (DNR, 2012<sup>1</sup>)] for the subject well. It shows the elevation contour to the BMSW (3,000 to 10,000 mg/L TDS) to be approximately 2,500 feet bgs at the location of the proposed RBU 1-10D well. The surveyed ground elevation at RBU 1-10D is 5,023 feet above mean sea level (amsl). Based on *Plate 1*, the BMSW occurs at a depth of approximately 2,523 feet at the RBU 1-10D. The top of the proposed injection zone is approximately 2,181 feet below the approximate BMSW depth.

A search of Division of Water Rights records shows several water rights within a 10,000 foot radius of the RBU 1-10D well location. Categories of the water rights included surface water, point to point and underground. Based on the records, there is currently one underground water right within the 10,000 foot radius. **Attachment C2** shows the closest known potential Underground Source of Drinking Water (USDW) to the proposed injection well at approximately 1.88 miles to the south. Majority of water rights in the area are for surface water. Division of Water Rights records indicates the closet well (ID: 0647001M00) was drilled to 493 feet. The well is listed as a non-production well used for cathodic protection. The driller's log does not indicate a depth to groundwater.

The converted injection well and its facilities are located on an existing Gasco well pad; therefore, no outside water sources will be utilized for drilling or completions. During the waterflood project produced water from nearby wells will be utilized. For these reasons, the U.S. Fish and Wildlife Service was not contacted related to any possible water depletion fees associated with this project.

**Attachment C3** contains water analysis results for water from the injection intervals at the two nearby wells. Both water samples were collected from Gasco operated wells located just outside the ¼-mile AOR. The average concentration of TDS for the two samples is 64,446 mg/l.

**Table C-1: Summary of TDS Concentrations –Injection Zone Fluid**

Well Name	Sample Date	Sample Type	Sodium (mg/L)	Chloride (mg/L)	TDS (mg/L)
RBU 02-10D	10/17/13	Separator	19,896	38,000	62,276
RBU 16-03D	10/17/13	Separator	24,019	40,000	66,616
Average Concentration			<b>21,958</b>	<b>39,000</b>	<b>64,446</b>

<sup>1</sup> Moderately Saline Groundwater in the Uinta Basin, Utah: Special Study 144, Utah Geological Survey, Division of Utah Department of Natural Resource, 2012.

**D. Geology of Injection and Confining Zones**

**Estimated Tops of Important Geologic Markers:**

<u>Formation</u>	<u>Depth</u>	<i>(Approximate)</i>	<i>BEA</i>
Uinta	Surface to 1,186'		
Upper Green River	1,186'		
Mahogany Oil Shale Unit	2,097'		
Base USDW	2,523'		
Mahogany Shale Marker	2,597'		
Middle Green River/Garden Gulch	2,661'		
Upper Douglas Creek	3,550'		
Lower Douglas Creek	4,082'		
Castle Peak Carbonate Marker	4,270'		
Top Black Shale	4,346'	(Top of Upper Confining Layer)	
Uteland Butte Limestone	4,704'	(Base of Upper Confining Layer)	} Proposed Injection Zone
Top A Sand Member	4,751'		
Top C Shoal	4,860'		
Wasatch/Colton	<i>4,880'</i>	<del>4,878'</del> (Top of Lower Confining Layer)	<i>BEA</i>
Base of Lower Confining	<i>BEA</i>	5,480' (Base of Lower Confining Layer)	
Mesaverde	7,800'		
TD	9,400'		

The contact between the Green River and the Wasatch/Colton is an intertonguing of red shales and lacustrine gray-black shales and limestone. The C Shoal carbonate is the basal unit of the Green River Formation-Uteland Butte member in this area.

**General Geology**

Uinta Formation: Surface to estimated 1,186' in the RBU 1-10D area.

The Uinta Formation (Eocene) consists of alternating beds of light-gray calcareous mudstones and light brown to brown siltstones and sandstones. The Uinta Formation was deposited in fluvial and flood plain environments. The siltstone and sandstone beds were deposited in fluvial channels and are more abundant in the lower portion of the formation. The intervening calcareous mudstones were deposited in flood plain environments. The lower portion of the Uinta Formation is transitional into lacustrine deposits in the central portion of the Uinta Basin.

Green River Formation: Estimated 1,186' to 4,880' in the RBU 1-10D area.

The Green River Formation (Eocene) is a complex mixture of clastics, carbonates and organic rich claystones deposited in an alluvial to lacustrine depositional system. The Green River interfingers with both the overlying Uinta and underlying Wasatch Formations. The Green River Formation is subdivided into four members which in ascending order are: Douglas Creek Member, Garden Gulch member, Parachute Creek member and Evacuation Creek member.

- The Douglas Creek member consists of light gray alternating beds of calcareous sandstone and dark gray to brown brittle shale with minor amounts of oil shale, dolomite and limestone.

- The Garden Gulch member directly overlies the Douglas Creek member and consists primarily of dark colored shales and very fine grained sandstones. Shale intervals are thicker than those of the Douglas Creek member and organic rich.
- The Parachute Creek member directly overlies the Garden Gulch member and consists of a thick succession of dark brown, dark gray, light green and red shales with occasional fine grained sandstones. The Parachute Creek Member contains the most organic rich oil shales, including the Mahogany Oil Shale Zone.
- The Evacuation Creek member directly overlies the Parachute Creek member and is overlain by the Uinta Formation. The Evacuation Creek member is composed primarily of light gray-green shale, tan marl and interbedded thin brown sandstones. The upper portion of the Evacuation Creek member contains the informally named "Birds Nest" zone. The Birds Nest was deposited during a regressive lacustrine phase. The lake waters in the deeper portion of the lake became concentrated in salts, primarily sodium bicarbonate during this regressive phase.

Wasatch Formation: Estimated 4,878 feet to 7,800 feet in the RBU 1-10D area.

The Wasatch Formation (Paleocene - Eocene) consists of poorly sorted variegated mudstones and siltstones in shades of red, green and gray interbedded with beds and lenses of sandstone, conglomerate and minor carbonate deposits. Sandstones are very light brown to gray, irregularly bedded and are fine to medium grained. Conglomeratic sandstones often containing black chert and varicolored quartzite pebbles commonly occur at the base of sand bodies. Wasatch deposition took place in mixed fluvial to lacustrine depositional environments. The Wasatch Formation interfingers with and in places is time equivalent to the Green River Formation.

Mesaverde Formation: Estimated 7,800 feet to ~11,000 feet in the RBU 1-10D area.

The Cretaceous Upper Mesaverde (Price River) consists of lenticular coastal plain sands and shales. The Cretaceous Lower Mesaverde (Bluecastle Tongue) also consists of lenticular coastal plain sandstones, shales, carbonaceous shales and minor coals. The top of overpressuring (flare) is usually encountered in the Lower Mesaverde.

Upper Confining Zone:

The upper confining zone consists of black shales of the Black Shale zone of the Castle Peak member. The thickness of the upper confining zone in the area of the proposed RBU 1-10D is approximately 358 feet.

Injection Zone:

The proposed injection zones are the C Shoal basal limestone and the ULB A-H sandstones and limestones at approximately 4,704 feet to 4,880 feet located in the Uteland Butte member of the Lower Green River formation. These intervals are composed of porous and permeable sandstone interbedded with lower permeability limestone. The overall thickness of the proposed injection zone is 176 feet.

Lower Confining Zone:

The lower confining consists of low porosity and permeability red shales of the Wasatch Formation. The thickness of the lower confining zone in the area of the proposed RBU 1-10D is approximately 602 feet.

**Attachment D1** contains a log section of RBU 1-10D illustrating the Uteland Butte member of the Lower Green River Formation. Also included in D1 is a cross-section of wells in the AOR showing the correlation of the upper confining zone, injection zone and lower confining zone. **Attachment D2** contains structure maps for the top of the Uteland Butte member and Wasatch Formation. Structure on the Uteland Butte member show dip of approximately 200 feet per mile to the north, with no folds or faults indicated neither in the subsurface nor at the surface.

**E. Operating Data**

The daily volumetric disposal for the RBU 1-10D will vary depending upon water production rates from producing wells in the vicinity. The injection rate will be constrained by the maximum allowable injection pressure (MAIP) at the surface. The estimated MAIP is based on the fracture gradient observed on the completion interval, the approximate depth of the top of injection zone, and the average disposal fluid specific gravity. The estimated MAIP is 2,010 pounds per square inch (psi). **Attachment E1** provides the bottom hole and MAIP assumptions and calculations.

**F. Stimulation Procedures**

No additional stimulations are planned for the proposed UIC well.

**G. Injection Procedures**

Injection fluids are planned to be trucked to the site for disposal. The injected fluid will consist of produced water from River Bend Unit wells operated by Gasco. No fluid of any type from outside-operated wells will be injected. **Attachment G1** provides a list of wells that plan to use the injection well.

Water samples were collected from to represent the general chemistry of the fluids to be injected into the proposed UIC well. **Attachment G2** contains a water analysis report for the produced water collected from the DSS Evap sample. Some results are summarized in **Table G-1**.

**Table G-1: Summary of TDS Concentrations – Representative Injection Fluid**

Sample Name	Sample Date	Sample Type	Sodium (mg/L)	Chloride (mg/L)	TDS (mg/L)
DSS Evap	10/17/13	Separator	51,317	94,000	158,679

## **H. Construction Details**

Once the draft permit is issued, Gasco will conduct a mechanical integrity test (MIT). The MIT will be conducted following EPA guidance and requirements.

**Attachment H1** contains the written procedures to convert the existing RBU 1-10D well to a UIC injection well. A converted injection wellbore diagram is also enclosed. The conversion work will be satisfactory completed and submitted on EPA Form 7520-12.

Per EPA requirements, Gasco plans to install monitoring equipment at the well site. At a minimum, the well will be installed with pressure gauges (calibrated at all times to industry standards and manufacturer's specifications) on the tubing and casing-tubing annulus. If any non-compliant situation is found, the well will be immediately shut-in and regulatory agencies will be notified.

## **I. Plugging and Abandonment Plan**

The Plugging & Abandonment (P&A) procedure for the RBU 1-10D well will be conducted in accordance with EPA guideline requirements. **Attachment II** includes:

- P&A Form 7520-14
- P&A Procedure
- Schematic of proposed P&A plan

## **J. Financial Responsibility Demonstration**

Gasco is required to maintain financial responsibility and resources to close, plug, and abandon the underground injection operation in a manner prescribed by the EPA Director (Director). The permittee shall show evidence of such financial responsibility to the Director by the submission of a surety bond, or other adequate assurance such as financial statements or other materials acceptable to the Director. The Director may, on a periodic basis, require the holder of a lifetime permit to submit a revised estimate of the resources needed to plug and abandon the well to reflect inflation of such costs and a revised demonstration of financial responsibility, if necessary.

Gasco will demonstrate financial responsibility by a surety bond in the amount of \$55,000 with the approval by the EPA. Evidence of continuing financial responsibility is required to be submitted to the Director annually. The Director may revise the amount required and may require the permittee to obtain and provide updated estimates of costs for plugging the well according to the approved P&A plan.

## **K. Aquifer Exemption**

An aquifer exemption is not expected at the proposed RBU 1-10D well. The average concentration of TDS for water samples collected from the proposed injection interval is 64,446 mg/l. The RBU 1-10D well is located 1.88 miles from the closest known potential USDW.

**L. Existing EPA Permits**

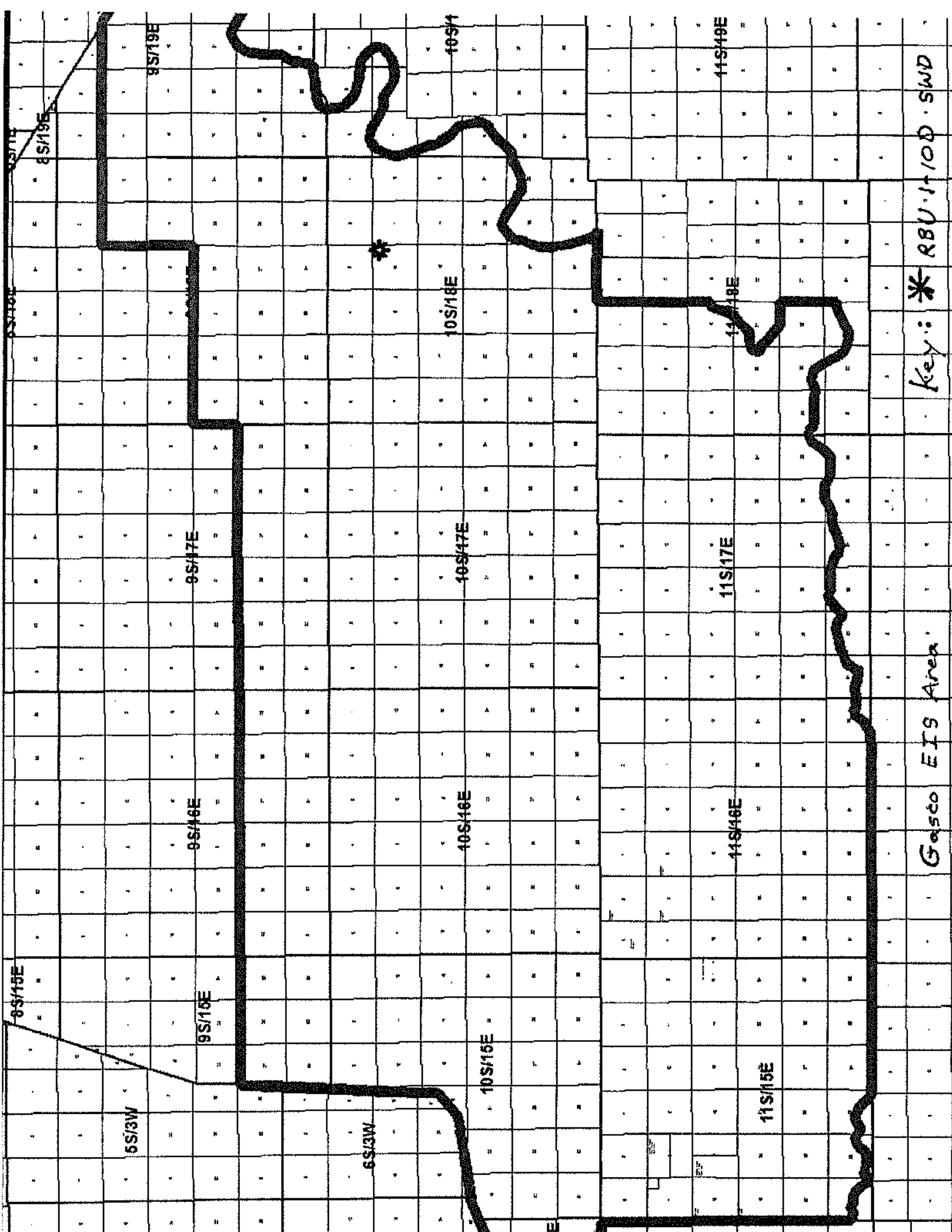
Gasco has one EPA issued permit.

FINAL Permit  
EPA UIC Permit UT22244-09698  
Well: Federal 32-20-X-9-19  
Uintah County, UT  
API No. 43-047-53020

**M. Applicant-Committed Environmental Protection Measures**

The location of the proposed UIC well does not include any new surface disturbance or roads; therefore, new surveys to clear threatened and endangered species, cultural resources, and paleontological resources are not required.





Key: \* RBU-110D-SWD

Gasco EIS Area

8S/15E

6S/3W

9S/16E

9S/17E

8S/19E

9S/18E

6S/3W

10S/16E

10S/17E

10S/18E

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10S/15E

11S/16E

11S/17E

11S/18E

11S/19E

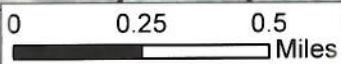
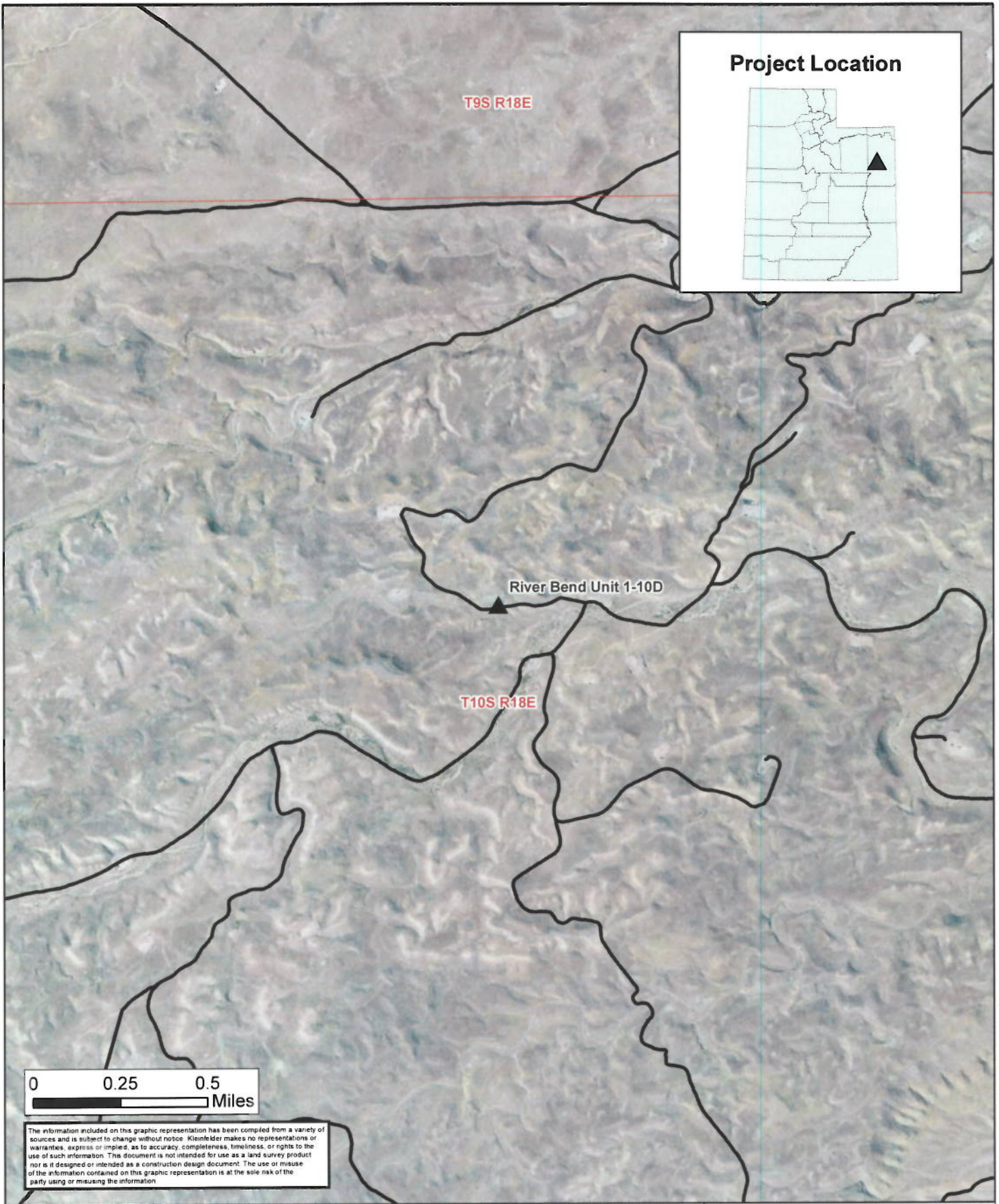
11S/15E

Key: \* RBU-110D-SWD

Gasco EIS Area







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- Legend**
- ▲ River Bend Unit 1-10D
  - Existing Roads



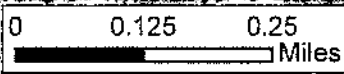
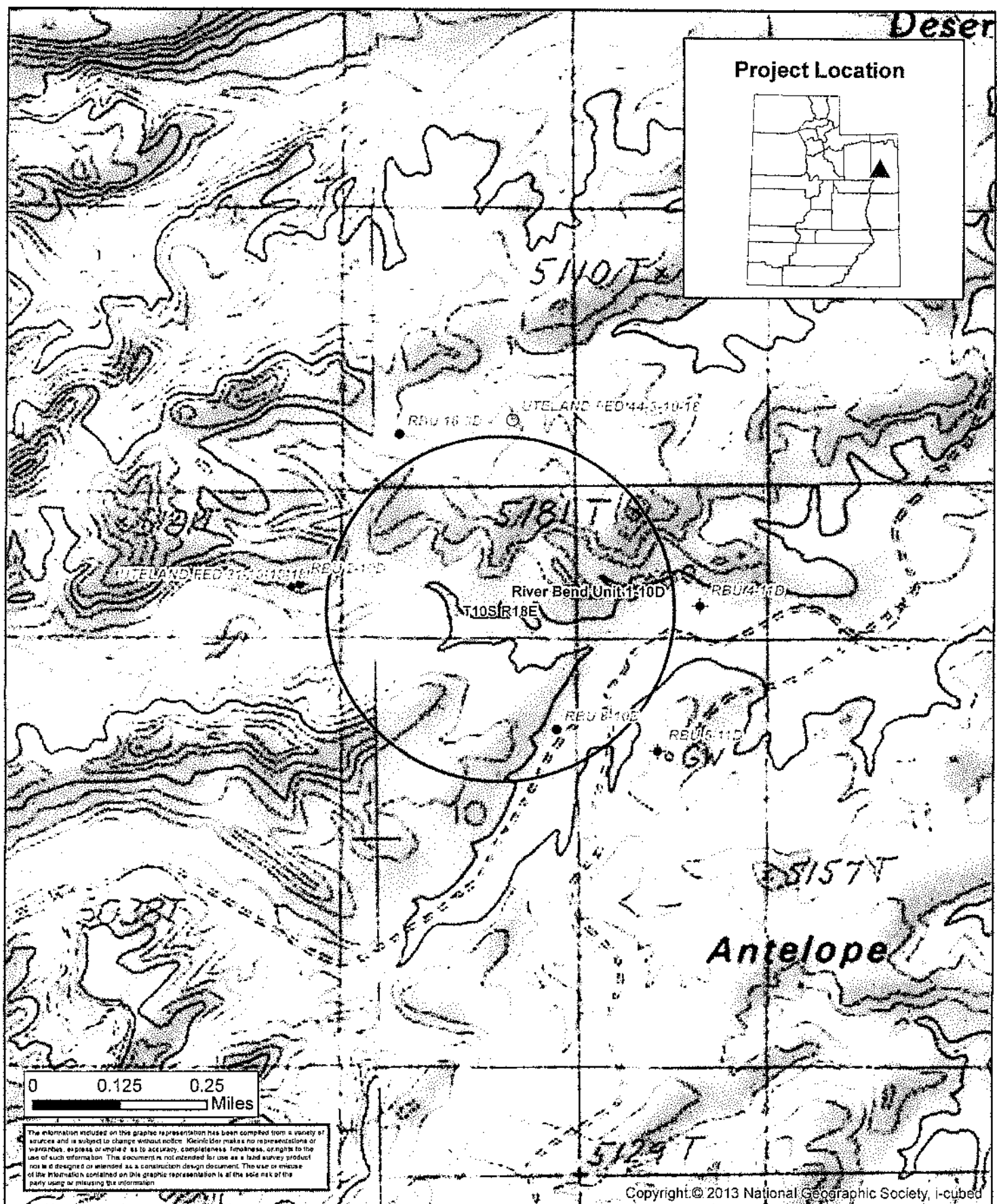
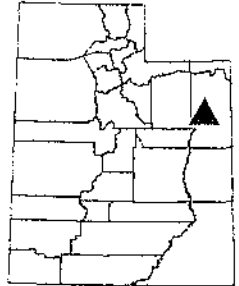
PROJECT NO.	137424
DRAWN:	10/22/2013
DRAWN BY:	A. Leonard
CHECKED BY:	B. Woodard
FILE NAME:	RBU1-10D_FigA4_Roads_v1.mxd

<b>Gasco Energy, Inc.</b>	
River Bend Unit 1-10D Existing Roads	FIGURE <b>A4</b>



Deser

### Project Location



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- Legend**
- ▲ River Bend Unit 1-10D
  - 1/4 mile radius
  - ◆ Approved Permit
  - Location Abandoned
  - Producing
  - ◆ Shut-in



PROJECT NO.	137424
DRAWN:	12/20/2013
DRAWN BY:	A. Leonard
CHECKED BY:	B. Woodard
FILE NAME:	RBU1-10D_FigA2_AOR_v1.mxd

<b>Gasco Energy, Inc.</b>	
River Bend Unit 1-10D Area of Review	FIGURE <b>A2</b>



**RBU I-10D: Proposed Injection Configuration**

**CONDUCTOR**

SIZE:	13 3/8"
WT/GRD:	K-55
WT/GRD:	54.5#
CSA:	84"
SX:	Ready mix
CIRC:	Y
TOC:	Surface
HOLE SIZE:	17 1/2"

**SURFACE CASING**

SIZE:	8 5/8"
WT/GRD:	J-55
WT/GRD:	32#
CSA:	2,414
SX:	500 sx Class G
	250 sx Class G
CIRC:	Y
TOC:	Surface
HOLE SIZE:	12 1/4"

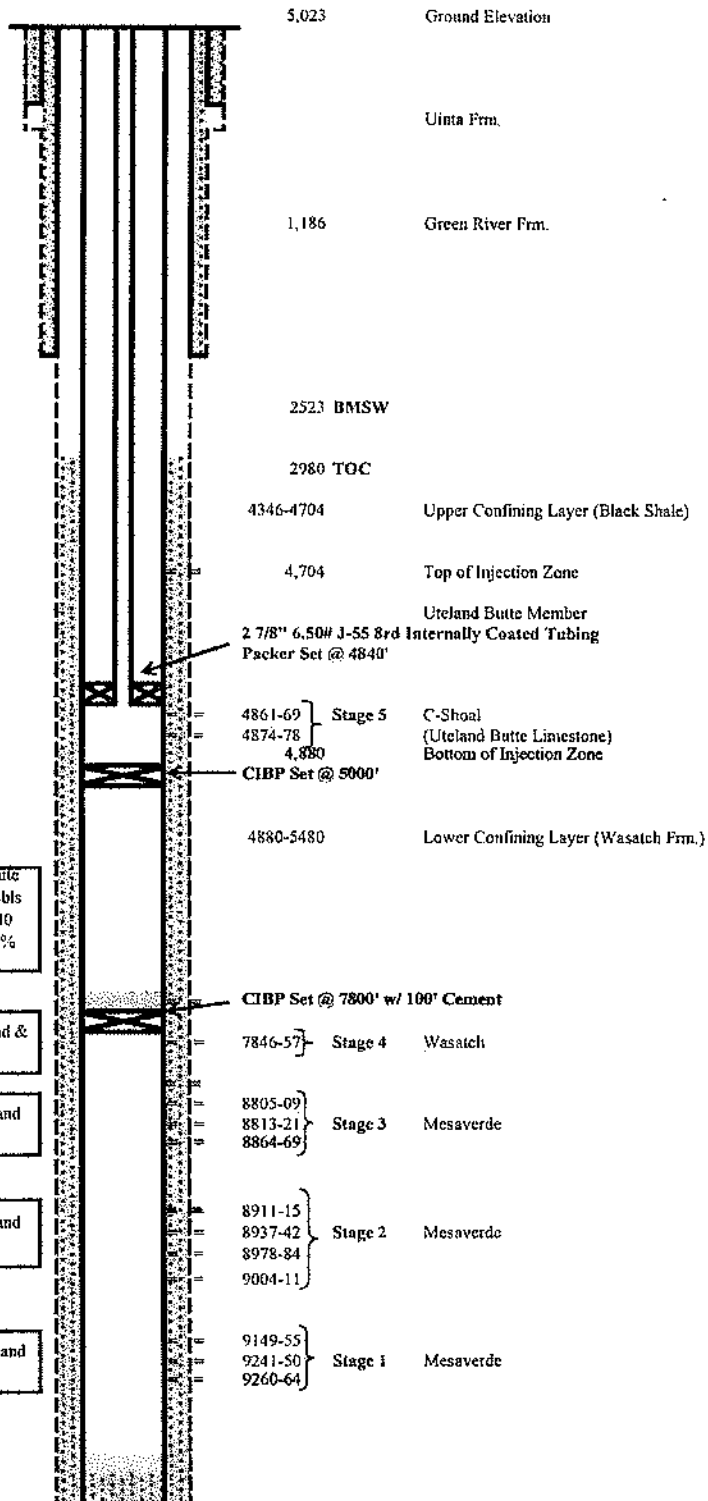
**PRODUCTION CASING**

SIZE:	5 1/2"
WT/GRD:	N-80
WT/GRD:	17#
CSA:	9,383
SX:	100 sx HiFil
	1025 sx Type V
CIRC:	Y
TOC:	2980'
HOLE SIZE:	7 7/8"

**Stimulation**

Stage 5: 12/17/2013	Hybrid frac w/ 75, 140# 20/40 white sand, 47 bbls 15% HCL acid, 1,255 bbls PR slick water, 903 bbls 15# Delta 140 gelled fluid, and flushed w/ 112 bbls 2% KCl
Stage 4: 1/23/2005	N2 Frac w/ 38891# 20/40 Ottawa sand & 211 MCF N2
Stage 3: 1/22/2005	N2 Frac w/ 31566# 20/40 PR 6000 sand & 314 MCF N2
Stage 2: 1/22/2005	N2 Frac w/ 58972# 20/40 PR 6000 sand & 400 MCF N2
Stage 1: 1/22/2005	N2 Frac w/ 44,837# 20/40 PR 6000 sand & 313 MCF N2

MD:	9400
TD:	9400



**RBU 1-10D****Bottom Hole Pressure Calculation**

The bottom hole pressure *BHP* caused by a static column of fluid is given by:

$$BHP = (SG \rho) g h \quad (1)$$

where *SG* is the specific gravity of the fluid,  $\rho$  is the density of pure water, *g* is the gravitational acceleration, and *h* is the well depth.

The shallowest perforation is at 4861 feet (1487 m), and the specific gravity of the injected water is anticipated to be no more than 1.03. Substituting these values into Eq. (1), (using SI units for convenience), we obtain a bottom hole pressure of:

$$BHP = (1.03)(1000)(9.80665)(1482) = 14.97 \text{ MPa} = 2171 \text{ psi}$$

The bottom hole pressure from a static column of injection fluid will be **2171 psi**.

Using the measured frac gradient for the well of 0.86 psi per foot, we obtain a fracture pressure at the perf of **4180 psi**, resulting in a maximum surface injection pressure of **2010 psi**.

Multi-Chem Analytical Laboratory

1553 East Highway 40

Vernal, UT 84078

**multi-chem**<sup>®</sup>

A HALLIBURTON SERVICE

Units of Measurement: **Standard**

Water Analysis Report

Production Company: **Gasco**  
 Well Name: **DSS EVAP**  
 Sample Point: **Separator**  
 Sample Date: **10/17/2013**  
 Sample ID: **WA-255835**

Sales Rep: **Michael McBride**  
 Lab Tech: **Gary Peterson**

Scaling potential predicted using ScaleSoftPitzer from  
 Brine Chemistry Consortium (Rice University)

Sample Specifics		Analysis @ Properties in Sample Specifics			
Test Date: 10/18/2013		Cations mg/L		Anions mg/L	
System Temperature 1 (°F):	300	Sodium (Na):	51316.98	Chloride (Cl):	94000.00
System Pressure 1 (psig):	1300	Potassium (K):	6732.00	Sulfate (SO4):	50.00
System Temperature 2 (°F):	70	Magnesium (Mg):	824.00	Bicarbonate (HCO3):	1342.00
System Pressure 2 (psig):	15	Calcium (Ca):	3677.00	Carbonate (CO3):	
Calculated Density (g/ml):	1.100	Strontium (Sr):	295.00	Acetic Acid (CH3COO)	
pH:	8.30	Barium (Ba):	132.00	Propionic Acid (C2H5COO)	
Calculated TDS (mg/L):	158678.35	Iron (Fe):	2.40	Butanoic Acid (C4H7COO)	
CO2 in Gas (%):		Zinc (Zn):	0.25	Isobutyric Acid ((CH3)2CHCOO)	
Dissolved CO2 (mg/L):	640.00	Lead (Pb):	0.26	Fluoride (F):	
H2S in Gas (%):		Ammonia NH3:		Bromine (Br):	
H2S in Water (mg/L):	5.00	Manganese (Mn):	1.60	Silica (SiO2):	104.89

Notes:

B=228 Al=.24 Li=57 \*\*\*\*\*Disregard prior did not include Boron, Aluminum and Lithium. Sorry

(PTB = Pounds per Thousand Barrels)

Temp (°F)	PSI	Calcium Carbonate		Barium Sulfate		Iron Sulfide		Iron Carbonate		Gypsum CaSO4.2H2O		Celestite SrSO4		Halite NaCl		Zinc Sulfide	
		SI	PTB	SI	PTB	SI	PTB	SI	PTB	SI	PTB	SI	PTB	SI	PTB	SI	PTB
70.00	14.00	3.08	306.02	1.38	39.02	2.96	1.32	1.47	1.69	0.00	0.00	0.00	0.00	0.00	0.00	9.68	0.13
95.00	157.00	3.10	304.74	1.19	37.30	2.68	1.32	1.57	1.70	0.00	0.00	0.00	0.00	0.00	0.00	9.10	0.13
121.00	300.00	3.10	312.57	1.02	35.15	2.46	1.32	1.63	1.70	0.00	0.00	0.00	0.00	0.00	0.00	8.59	0.13
146.00	443.00	3.11	319.91	0.87	32.66	2.28	1.31	1.67	1.71	0.00	0.00	0.00	0.00	0.00	0.00	8.13	0.13
172.00	585.00	3.10	326.81	0.73	29.92	2.13	1.31	1.68	1.71	0.00	0.00	0.00	0.00	0.00	0.00	7.72	0.13
197.00	728.00	3.10	333.29	0.62	27.07	2.02	1.31	1.67	1.71	0.00	0.00	0.00	0.00	0.00	0.00	7.35	0.13
223.00	871.00	3.11	339.37	0.52	24.20	1.93	1.30	1.84	1.70	0.00	0.00	0.00	0.00	0.00	0.00	7.01	0.13
248.00	1014.00	3.11	345.05	0.44	21.35	1.86	1.30	1.59	1.70	0.00	0.00	0.00	0.00	0.00	0.00	6.70	0.13
274.00	1157.00	3.12	350.34	0.36	18.53	1.81	1.29	1.52	1.69	0.00	0.00	0.00	0.00	0.00	0.00	6.42	0.13
300.00	1300.00	3.14	355.21	0.30	15.65	1.77	1.29	1.44	1.68	0.00	0.00	0.00	0.00	0.00	0.00	6.15	0.13



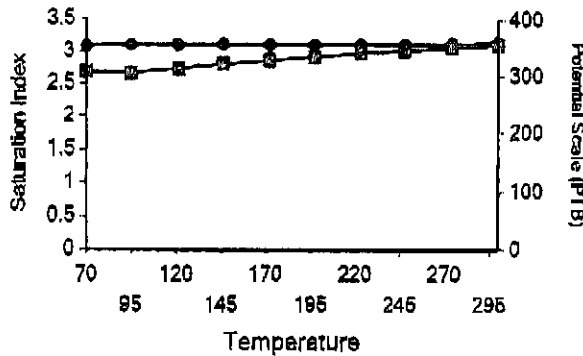
Water Analysis Report

Temp (°F)	PSI	Hemihydrate CaSO <sub>4</sub> · 0.5H <sub>2</sub> O		Anhydrite CaSO <sub>4</sub>		Calcium Fluoride		Zinc Carbonate		Lead Sulfide		Mg Silicate		Ca Mg Silicate		Fe Silicate	
		SI	PTB	SI	PTB	SI	PTB	SI	PTB	SI	PTB	SI	PTB	SI	PTB	SI	PTB
70.00	14.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.10	0.11	8.20	103.11	5.87	64.27	8.36	1.86
95.00	157.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.20	0.11	8.90	107.63	6.19	64.85	8.61	1.86
121.00	300.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.41	0.11	9.57	115.92	6.50	65.42	8.86	1.86
148.00	443.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.70	0.11	10.20	122.43	6.80	65.77	9.10	1.86
172.00	585.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.02	9.08	0.11	10.79	125.66	7.09	65.97	9.32	1.86
197.00	728.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.05	8.52	0.11	11.33	128.79	7.36	66.08	9.51	1.86
223.00	871.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.06	8.01	0.11	11.83	127.02	7.62	66.14	9.67	1.86
248.00	1014.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.06	7.55	0.11	12.29	127.10	7.86	66.18	9.81	1.86
274.00	1157.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.05	7.13	0.11	12.72	127.13	8.08	66.20	9.92	1.86
300.00	1300.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.03	6.74	0.11	13.12	127.13	8.29	66.21	10.01	1.86

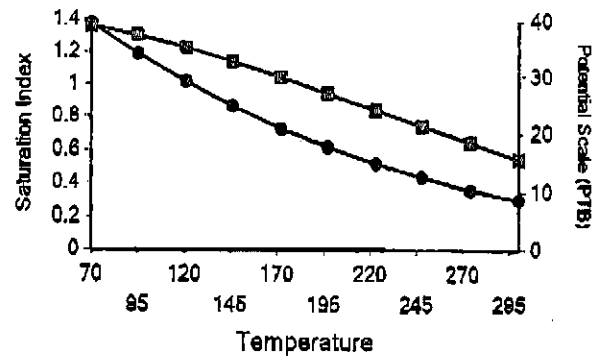
These scales have positive scaling potential under initial temperature and pressure: Calcium Carbonate Barium Sulfate Iron Sulfide Iron Carbonate Zinc Sulfide Lead Sulfide Mg Silicate Ca Mg Silicate Fe Silicate

These scales have positive scaling potential under final temperature and pressure: Calcium Carbonate Barium Sulfate Iron Sulfide Iron Carbonate Zinc Sulfide Zinc Carbonate Lead Sulfide Mg Silicate Ca Mg Silicate Fe Silicate

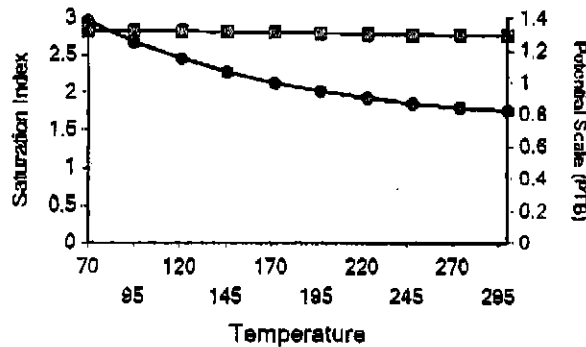
Calcium Carbonate



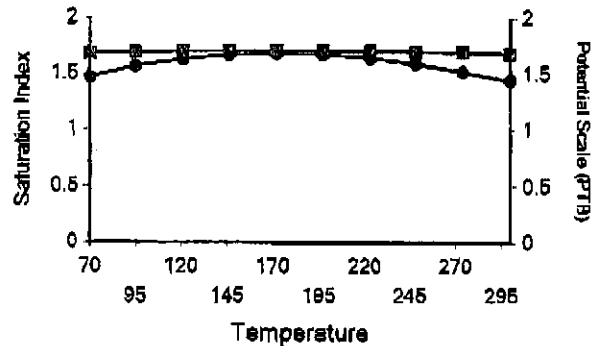
Barium Sulfate



Iron Sulfide

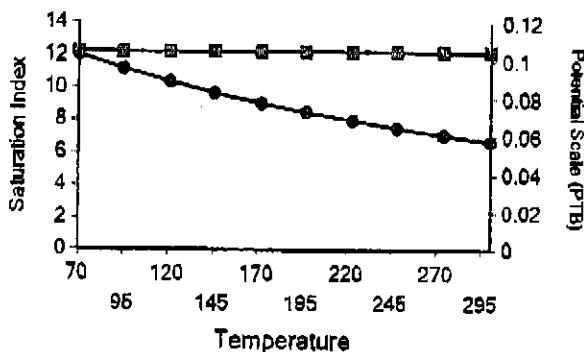


Iron Carbonate

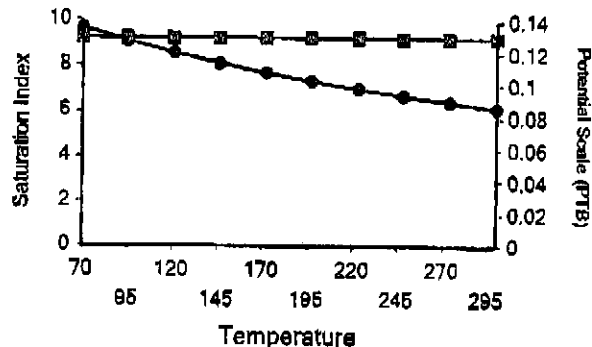


Water Analysis Report

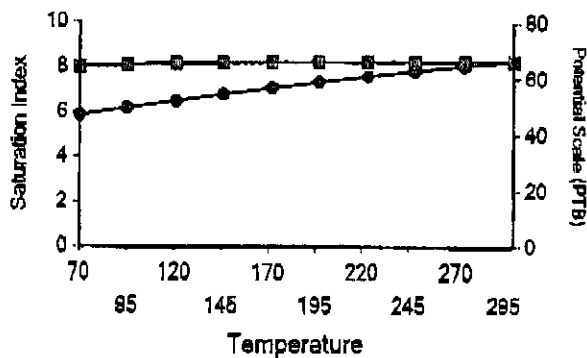
Lead Sulfide



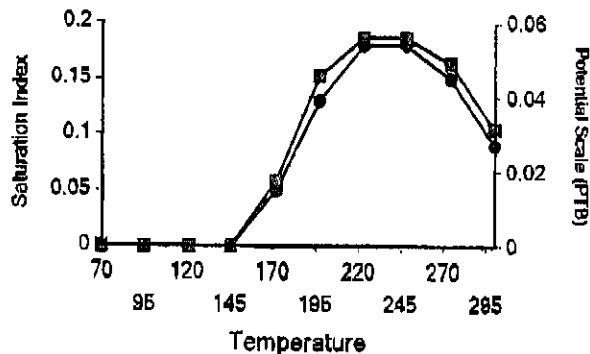
Zinc Sulfide



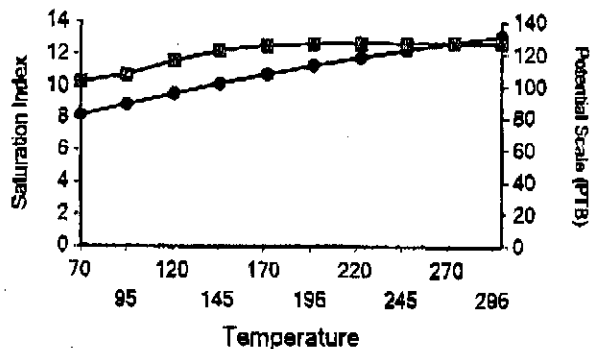
Ca Mg Silicate



Zinc Carbonate



Mg Silicate



Water Analysis Report

