Form 31 Attachment
Fac # 159317
Doc # 1905680

Williams

Exploration & Production
1515 Arapahoe Street
Tower 3, Suite 1000
Denver, CO 80202
303/572-3900
303/629-8255 Fax

September 1, 2009

Colorado Oil and Gas Convention Commission
1120 Lincoln Street, Suite 801
Denver, CO 80203

Attn: Jane Stancyzk
Regarding: UIC Permit Application For Federal 299-27-5 (api # 05-103-10624)
Rio Blanco County, CO

Attached, please find the Williams Production Ryan Gulch LLC UIC permit application package for the Federal 299-27-5 well in Rio Blanco County, CO.

Gabe D'Arthenay (303-606-4287, gabe.darthenay@williams.com) is the Sr. Petroleum Engineer responsible for the technical portion of the package and Jennifer Head (303-606-4342, Jennifer.head@williams.com) is our Regulatory Affairs Manager working this project.

Please feel free to call either individual if there are any follow up questions, issues, or clarifications.

Thank you very much for your time and attention.

Regards,

Bruce Bunch
Williams Piceance Highlands
Petroleum Engineering Manager

Cc w/attachments:
Gabe D'Arthenay (Williams – Den)
Jennifer Head (Williams - Den)

Operator: Williams Production Ryan Gulch LLC
UIC "Dedicated Injection Well" Permit Application To COGCC Dated 9-1-09
Well: Federal 299-27-5 (API # 05-103-10624), S27-T2S-R99W, Rio Blanco County, CO
Project: Convert Federal 299-27-5 To Class II SWD Servicing Greater Ryan Gulch Area

.UIC Application for a "Dedicated" Injection Well:

Dedicated Injection Well - Any well as defined under 40 CFR 144.5B, 1992 edition (adopted by US EPA) used for the exclusive purpose of injecting fluids or gas from surface (excludes gas storage wells).

COGCC UIC Application Requirements are addressed as follows:

COGCC Rule 325, Item c, paragraph 1

- *Name, Description and Depth of Injection Formation(s):*

Operator:	**Williams Production Ryan Gulch LLC** (operator # 10286)
Well:	**Federal 299-27-5 (API# 05-103-10624)**
Location:	**SWNE Section 27, T2S, R99W, Rio Blanco County, CO**
Lease:	**Federal, COC-060757**
Mineral Ownership	**100% US Federal Government (BLM)**
Well Ownership	**100% Williams Production Ryan Gulch LLC**
Injection Formation:	**Mesaverde**
Injection Depth:	**6220' - 6836' MD**

- *Underground Sources of Drinking Water Which May Be Affected:*

  Drinkable/potable water in the Piceance is generally considered to be present above the "Dissolution Surface". The lower limit of the Dissolution Surface is in the neighborhood of +/-1800 ft from surface. Consequently, the proposed injection interval is thousands of feet below interval where drinking water may exist.

- *Water Analysis of the Injection Formation:*

  Please See Attachment 1.

- *Fracture Pressure or Fracture Gradient of the Injection Formation:*

  Formation Parting Pressure: 3,600 psi
  Formation Fracture Gradient: 0.58 psi/ft

  Please See Attachment 2 for Step Rate Injection Test Results.

COGCC Rule 325, Item c, paragraph 2

- *Base Plat Covering ½ mile Radius of the Proposed Disposal Well:*

  Please See Attachment 3.

- *Names, Addresses, and Holdings of all Surface and Mineral Owners within ¼ mile of the Proposed Disposal Well, or all Owners of records in the field if a field wide system is proposed:*

  Please See Attachment 4.

  All surface and mineral estate within ¼ mile of proposed disposal well is owned 100% by BLM, with 12.5% royalty interest

- *List of all Domestic and Irrigation Wells within ¼ mile of the Proposed Disposal Well:*

  No Domestic and/or Irrigation water wells are within ¼ mile of the Proposed Disposal Well. (Information available at Colorado Division of Water Resources)

- *Wells Needing Remedial Action That Penetrating Injection Zone within ¼ mile of the Proposed Disposal Well*

  No wells penetrating the injection zone within ¼ mile of Proposed Disposal Well need remedial work.

- *Copy of Water Disposal Well System and Appurtenances Plans and Specifications:*

  Please See Attachment 5.

COGCC Rule 325, Item c, paragraph 3

- *Resistivity Logs Run From Bottom of Surface Casing to TD for Disposal Well and All Other Wells Within 1 Mile of Disposal Well:*

  Please See Attachment 6.

- *Cross Section of Disposal Well and All Other Wells within 1 Mile of Disposal Well:*

  Please See Attachment 7.

COGCC Rule 325, Item c, paragraph 4

- *Full Description of Casing In The Disposal Well including Information On All Remedial Cement Work Performed:*

  Please See Attachment 8.

- *Wellbore Diagram of Water Disposal Well (Present and Once Converted To Injector):*

Please See Attachment 9.

- *Surface Facility Diagram for Water Disposal Well:*

Please See Attachment 10.

- *Listing of All Leases Connected Directly By Pipelines to the Disposal Well:*

No leases will be connected directly via pipeline upon onset of disposal operations. Williams will notifiy COGCC before any future direct pipeline connections are implemented.

Please See Attachment 11.

COGCC Rule 325, Item c, paragraph 5

- *Listing of All Sources of Water, by Lease and Well To Be Injected Submitted On Form 26 (Source of Produced Water For Disposal):*

Please See Attachment 12.

Attachment 12 defines the scope for all potential sources of frac flowback and produced water (by well and lease) that constitute the "Greater Ryan Gulch" Area for wells operated by various Williams entities.

COGCC Rule 325, Item c, paragraph 6

- *Any Proposed Stimulation for the Disposal Well:*

No stimulation is proposed for the Disposal well.

COGCC Rule 325, Item c, paragraph 7

- *Estimated Minimum and Maximum Water To Be Injected Daily With Anticipated Injection Pressures:*

Estimated Maximum Water Injection Rate/Pressure: 5,000 bwpd at 3,400 psig *
Estimated Minimum Water Injection Rate/Pressure: 0 bwpd on vacuum

** Surface pressure resulting from maximum bottom hole pressure less hydrostatic head plus frictional pressure drop. Frictional pressure drop calculated based upon 2-3/8" tubing, internally coated with HDPE type material with internal diameter of 1.710" ID.*

COGCC Rule 325, Item c, paragraph 8

- *Names and Addresses Of Those Persons Notified By The Applicant (As Required By Rule 325, item i) for (a) each Surface Owner and Owner within ¼ Mile and (b) Owners and Operators of Oil and Gas Wells Producing From The Injection Zone within ½ Mile of the Disposal Well:*

No notification was necessary under Rule 325 (i) based on the following:

- **Surface owner is Bureau of Land Management**
- **The only producing MVRD wells within ½ mi. are Williams operated wells where Williams entities have 100% Working Interest.**
- **There are two additional wells within the ½ mile radius, however both are abandoned per COGCC data.**

Miscellaneous Hardcopy Attachments To COGCC UIC Application Filing:

1. **Cross Section of Well Logs: A large printout of the well log cross section in proximity to proposed Federal 299-27-5 injection/disposal well. This is a large version of the same cross section included in the body of this application as an 8-1/2" x 11".**
2. **Formation Evaluation Log: Copy of Schlumberger Platform Express well log for proposed Federal 299-27-5 injection/disposal well dated Nov 26, 2005.**
3. **USIT Cement Log (Post Squeeze): Copy of Schlumberger Ultrasonic Imaging Log, Gamma Ray, and CCL log for proposed Federal 299-27-5 run June 22, 2009 after cement squeeze. Cement squeezes were performed to achieve a minimum 200 ft of quality cement above upper most injection perforation. The production casing cement job was a Schlumberger 10.5 ppg "Litecrete" job pumped by previous operator. Conventional CBL would not be an appropriate tool for evaluating 10.5 ppg "Litecrete" since the acoustic impedance of "Litecrete" is sufficiently lower than standard cement. Consequently, Schlumberger recommended an Ultrasonic Imaging Tool (USIT) to evaluate the post squeeze cement sheath that contains both "Litecrete" and conventional squeeze cement material. Log was reviewed and cement squeeze accepted by Dave Andrews on July 2, 2009.**

FORM 31 Rev 6/99

State of Colorado
Oil and Gas Conservation Commission

1120 Lincoln Street, Suite 801, Denver, Colorado 80203 (303)894-2100 Fax:(303)894-2109

FOR OGCC USE ONLY

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SEP 25 2009

UNDERGROUND INJECTION FORMATION PERMIT APPLICATION

1. Submit original and one copy of this form.
2. If data on this form is estimated, indicate as such.
3. Attachments – see checklist and explanation of attachments.
4. Aquifer exemption is required for all injection formations with water quality <10,000 TDS (Rule 322B). Immediately contact the Commission for further requirements if the total dissolved solids (TDS) as determined by water analysis for the injection zone is less than 10,000 ppm.
5. Attach a copy of the certified receipt to each notice to surface and mineral owner(s) or submit a sample copy of the notice and an affidavit of mailing or delivery with names and addresses of those notified. Each person notified shall be specified as either a surface or mineral owner as defined by C.R.S. 34-60-103(7).

Complete the Attachment Checklist

Oper OGCC

Form 31 Original & 1 Copy	✓
Analysis fo Injection Zone Water	✓
Analysis of Injection Water	✓
Proposed Injection Program	✓
Resistivity or Induction Log	✓
Cement Bond Log	✓
Surface or Salt Water Displ Agrmt	✓
Notice to Surface/Mineral Owners	✓
Remedial Correction Plan for Wells	✓
Map Oil/Water Wells w/in 1/4 Mile	✓
List Oil/Gas Wells w/in 1/2 Mile	✓
Map Surface Owners w/in 1/4 Mile	✓
List Surface Owners w/in 1/4 Mile	✓
Map Mineral Owners w/in 1/4 Mile	✓
List Mineral Owners w/in 1/4 Mile	✓
Surface Facility Diagram	✓
Wellbore Diagram	✓
If Commercial Facility, Description of Ops & Area Served	N/A
Unit Area Plat	N/A

Project Name: Federal 299-27-5 Project Location: SWNE Sec 27 T2S R99W 6th P.M.

Project Type: ☐ Enhanced Recovery ☑ Disposal ☐ Simultaneous Disposal

Single or Multiple Well Facility? ☑ Single ☐ Multiple

IF UNIT OPERATIONS, ATTACH PLAT SHOWING UNIT AREA

County: _____ Field Name and Number: _____

OGCC Operator Number: 10286

Name of Operator: Williams Production Ryan Gulch LLC

Address: 1515 Arapahoe St. Tower 3 Suite 1000

City: Denver State: CO Zip: 80202

Contact Name and Telephone:

Gabriel J. D'Arthenay

No: 303-606-4287

Fax: 303-629-8275

Injection Fluid Type: ☑ Produced Water ☐ Natural Gas ☐ CO_2 ☐ Drilling Fluids ☐ Exempt Gas Plant Waste ☑ Used Workover Fluids ☐ Other Fluids (describe): _____

Commercial Facility? ☐ Yes ☑ No

If Yes, describe area of operation and types of fluids to be injected at this facility:

PROPOSED INJECTION FORMATIONS

FORMATION A (Name): Mesaverde Porosity: 13.6%

Formation TDS: 11451 Frac Gradient: 0.58 psi/ft Permeability: 0.02 md (est)

Proposed Stimulation Program: ☐ Acid ☐ Frac Treatment ☑ None

FORMATION B (Name): N/A Porosity: _____

Formation TDS: _____ Frac Gradient: _____ psi/ft Permeability: _____

Proposed Stimulation Program: ☐ Acid ☐ Frac Treatment ☐ None

Anticipated Project Operating Conditions

Under normal operating conditions, estimated fluid injection rates and pressures:

FOR WATER: A minimum of 100 bbls/day @ 1000 max psi to a maximum of 5000 bbls/day @ 3400 psi.

FOR GAS: A minimum of _____ mcf/day @ _____ psi to a maximum of _____ bbls/day @ _____ psi.

I hereby certify that the statements made in this form are, to the best of my knowledge, true, correct, and complete.

Print Name: Gabriel J. D'Arthenay Signed: [signature]

Title: Sr. Petroleum Engineer Date: 8/31/09

OGCC Approved: _____ Title: _____ Date: _____

Order No: _____

UIC FACILITY NO:

CONDITIONS OF APPROVAL, IF ANY:

FORM 31 Rev 6/99

State of Colorado
Oil and Gas Conservation Commission

1120 Lincoln Street, Suite 801, Denver, Colorado 80203 (303)894-2100 Fax:(303)894-2109

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COGCC

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Resistivity or Induction Log	✓	
Cement Bond Log	✓	
Surface or Salt Water Displ Agrmt	✓	
Notice to Surface/Mineral Owners	✓	
Remedial Correction Plan for Wells	✓	
Map Oil/Water Wells w/in 1/4 Mile	✓	
List Oil/Gas Wells w/in 1/2 Mile	✓	
Map Surface Owners w/in 1/4 Mile	✓	
List Surface Owners w/in 1/4 Mile	✓	
Map Mineral Owners w/in 1/4 Mile	✓	
List Mineral Owners w/in 1/4 Mile	✓	
Surface Facility Diagram	✓	
Wellbore Diagram	✓	
If Commercial Facility, Description of Ops & Area Served	N/A	
Unit Area Plat	N/A	

Project Name: Federal 299-27-5 Project Location: SWNE Sec 27 T2S R99W 6th P.M.

Project Type: ☐ Enhanced Recovery ☑ Disposal ☐ Simultaneous Disposal

Single or Multiple Well Facility? ☑ Single ☐ Multiple

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Contact Name and Telephone:
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No: 303-606-4287
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If Yes, describe area of operation and types of fluids to be injected at this facility:

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FORMATION B (Name): N/A Porosity: _____

Formation TDS: _____ Frac Gradient: _____ psi/ft Permeability: _____

Proposed Stimulation Program: ☐ Acid ☐ Frac Treatment ☐ None

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Under normal operating conditions, estimated fluid injection rates and pressures:

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FOR GAS: A minimum of _____ mcf/day @ _____ psi to a maximum of _____ bbls/day @ _____ psi.

I hereby certify that the statements made in this form are, to the best of my knowledge, true, correct, and complete.

Print Name: Gabriel J. D'Arthenay Signed: [signature]

Title: Sr. Petroleum Engineer Date: 8/31/09

OGCC Approved: _____ Title: _____ Date: _____

Order No: _____

CONDITIONS OF APPROVAL, IF ANY:

UIC FACILITY NO:

Proposed Injection Program

The Williams Production RMT injection program is required for disposal of produced and used workover fluids that are in excess of the storage capacity in the field. Fluids will be trucked to the injection facility where they are filtered and subsequently injected into the disposal well. Please refer to the surface facility diagram attached to this appliaction for a detailed explanation. Surface pressures will not exceed 3,400 psi for an injection rate of 5,000 bwpd. These values were derived from the Injection Test Analaysis that follows.

Williams Production RMT estimates that the injection program will operate at a lower rate at startup but may increase to the upper injection rate of 5,000 bwpd over time.

The existing well casing was first hydrotested to 1500 psig prior to initiating Step Rate Injection Test (SRIT). Per Dave Andrews on July 2, 2009 a witnessed Mechanical Integrity Test (MIT) was not required prior to placing the final injection/disposal well Bottom Hole Assembly (BHA).

The Step Rate Injection Test (SRIT) was performed on July 15, 2009. SRIT pressures and rates were recorded at surface and was pumped using a tubing and packer configuration. Injection was conducted upon the fractured interval with the following perforations:

Perf Top (ft)	Perf Base (ft)	# Holes	Hole Dia. (in)
6220	6354	42	0.32
6458	6570	45	0.32
6626	6681	27	0.32
6758	6836	36	0.32

A standard Step Rate Injection Test (SRIT) is presented below by plotting the rate of each step vs. the Bottom Hole Pressure (BHP). Figure 1 shows the Pressure vs. Rate plot.

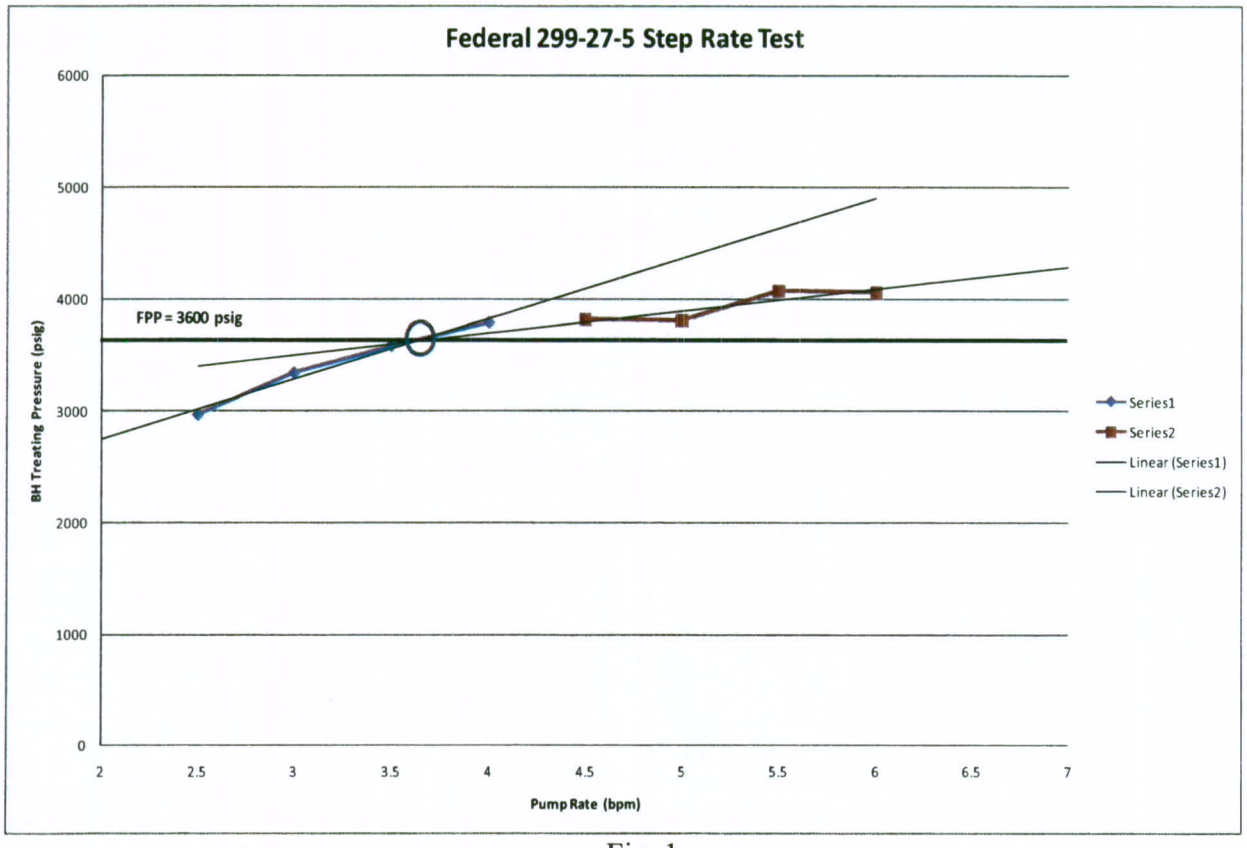

Fig. 1

Step Rate Injection Test Results

Attachment 2

A best fit line is projected through the group of low rate points and another is projected through the high rate points. The interesection of these lines defines the Formation Parting Pressure (FPP) which is the BHP above which the formation breaks down. The FPP is the upper limit on the BHP for injection at matrix conditions.

The FPP for the injection zones is calculated to be 3,600 psi.

Using the top perforation of 6,220 ftmd, a frac gradient of 0.579 psi/ft is obtained.

Proposed Injection Pressures

Based on the SRIT analysis and the calculated pipe friction, the following conditions are proposed to determine the maximum allowable surface pressure.

Assumptions:

2-3/8" Tubing, Internally Coated w/HDPE Type Material (1.710" ID)
Density of Fluid: 8.43 ppg
Top Injection perf: 6,220 ftmd

Calculations:

Max BH Pressure = FPP = 3,600 psi
Hydrostatic Pressure = 6,220 ft * 8.43 ppg * 0.052 = 2,727 psi
Max Surface Pressure = 3,600 psi – 2,727 psi + Friction at Rate
Max Surface Pressure = 873 psi + Friction at Rate

During the SRT a BHP of approximately 3,600 psi was measured at 3.5 bpm (5,040 bwpd). The pipe friction was calculated to be 2,543 psi at 3.5 bpm. The max surface pressure at 3.5 bpm would be:

Max Surface Pressure = 873 psi + 2,543 psi = 3,416 psi

According to the test results, the max injection rate would be approximately 5,000 bwpd. However, actual injection rates would be subject to not exceeding the maximum surface pressure.

Step Rate Injection Test Results

Attachment 2

Operator: Williams Production Ryan Gulch LLC
UIC "Dedicated Injection Well" Permit Application To COGCC
Well: Federal 299-27-5 (API # 05-103-10624), S27-T2S-R99W, Rio Blanco County, CO
Project: Convert Federal 299-27-5 To Class II SWD Servicing Greater Ryan Gulch Area

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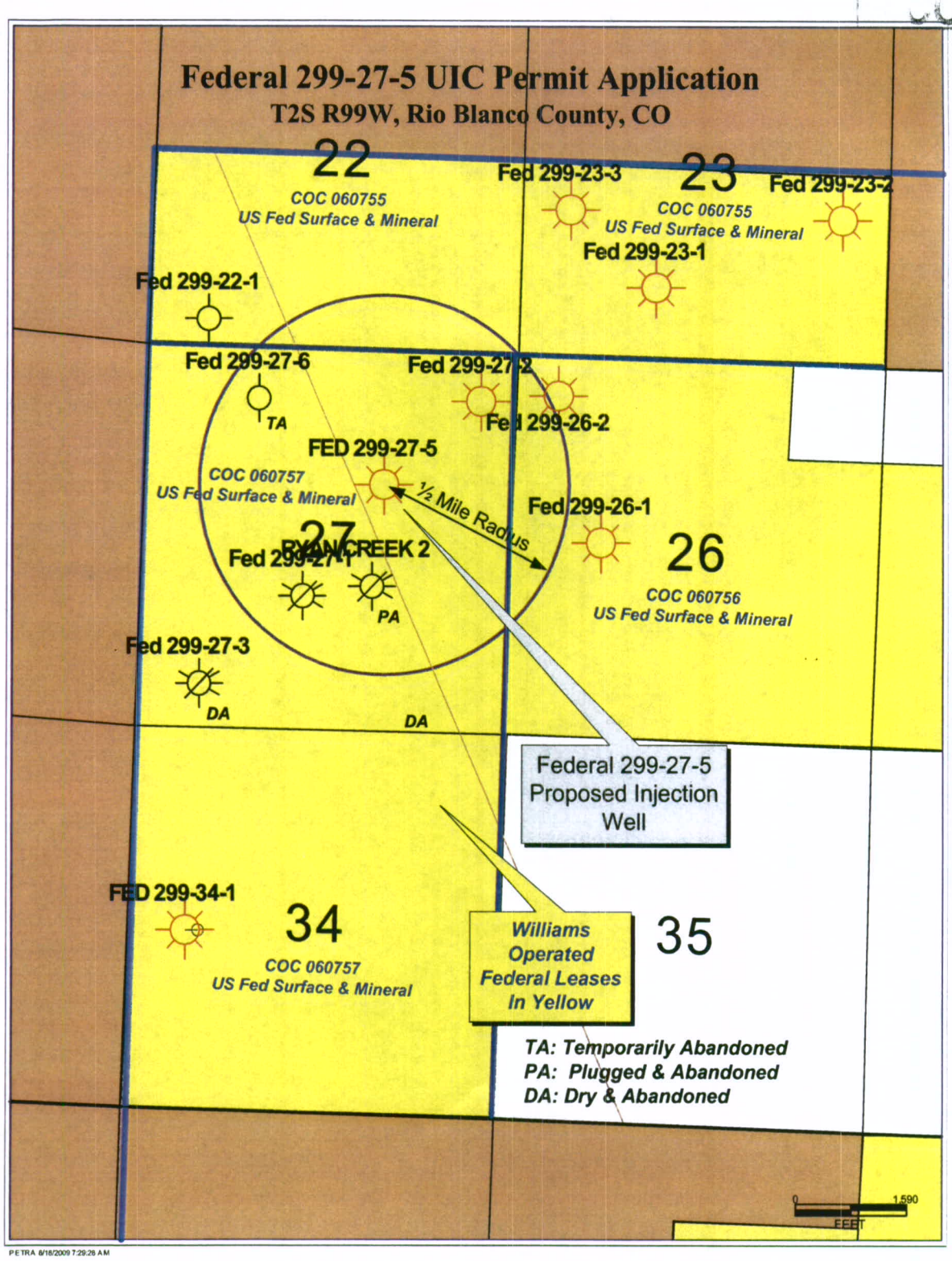

Base Plat of the Proposed Injection Well
Attachment 3

Operator: Williams Production Ryan Gulch LLC
UIC "Dedicated Injection Well" Permit Application To COGCC
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The US Federal Government is the surface and mineral owner for all properties within ½ mile of the proposed injection/disposal well. US Federal ownership in the land is managed through the US Department of Interior, Bureau of Land Management.

The pertinent regional BLM office for the subject land is located as follows:

Name/Address:

United States Dept. of the Interior
Bureau of Land Management
Colorado State Office
2850 Youngfield St.
Lakewood, CO 80125-7093

Surface and Mineral Interest Owners Within ½ Mile
Attachment 4

Operator: Williams Production Ryan Gulch LLC
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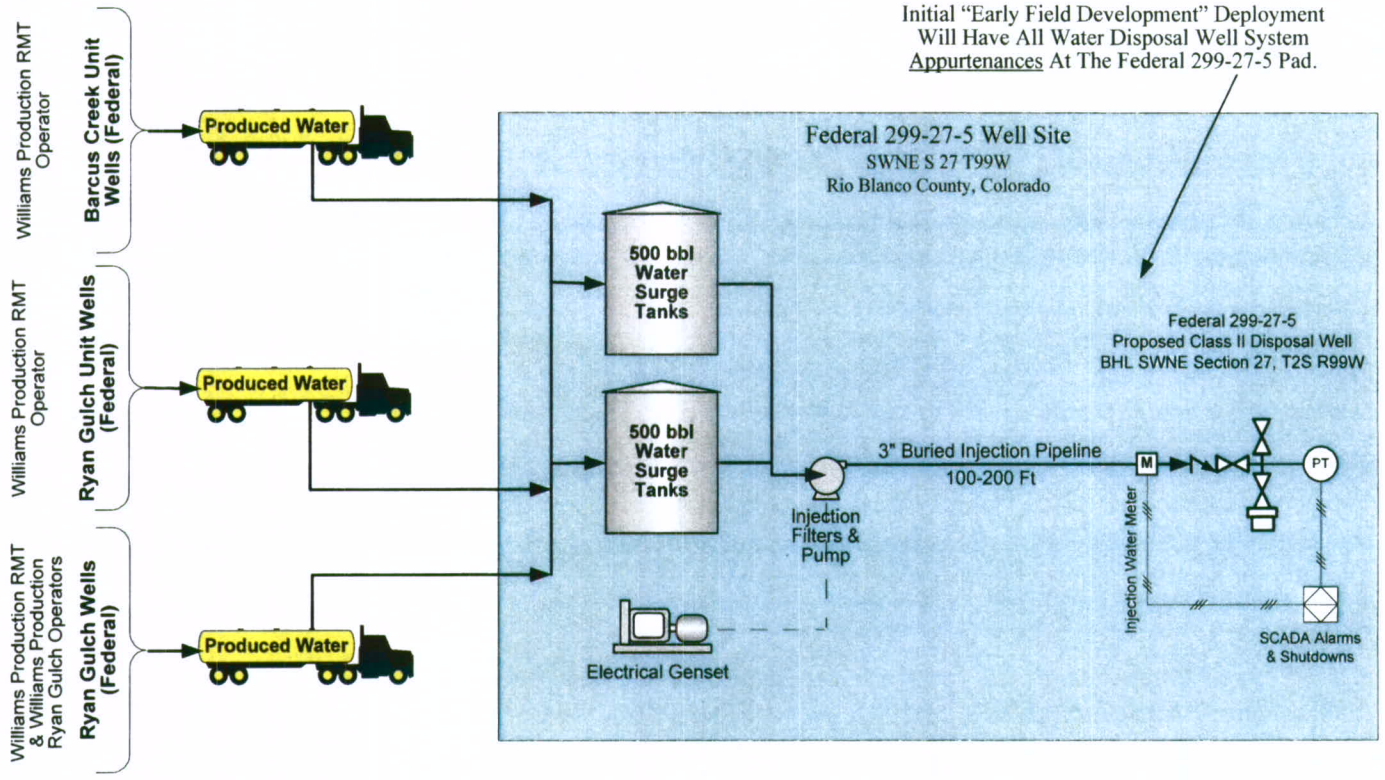
Williams Production RMT & Williams Production Ryan Gulch LLC Operator
COGCC UIC Permit Application For "Dedicated Injection Well"

Simplified Water Disposal Well "System & Appurtenances Diagram"

Initial "Early Field Development" Deployment Of Water Disposal Facility For Federal 299-27-5 Disposal Well



In The Future As Pipeline Infrastructure Builds Out The Above Will Be Replaced With A Disposal Water Pipeline System From A Central Site.

Water Disposal Well System & Appurtenances Plans & Specifications.

Attachment 5

Operator: Williams Production Ryan Gulch LLC
UIC "Dedicated Injection Well" Permit Application To COGCC
Well: Federal 299-27-5 (API # 05-103-10624), S27-T2S-R99W, Rio Blanco County, CO
Project: Convert Federal 299-27-5 To Class II SWD Servicing Greater Ryan Gulch Area

Federal 299-27-5 Log Information (Proposed Injection Well)	05-103-10624
Type	**Location**
Borehole	See COGCC website
Variable Density	See COGCC website
CBL	See COGCC website
Caliper Print	See COGCC website
Array Induction	See COGCC website
Gamma Ray	See COGCC website
Density Porosity	See COGCC website

Federal 299-27-6 Log Information (Offset Within 1-Mile)	05-103-10644
Type	**Location**
Cement Volume	See COGCC website
Array Induction	See COGCC website
Field Dip Print	See COGCC website
Density Porosity	See COGCC website

Federal 299-27-2 Log Information (Offset Within 1-Mile)	05-103-10496
Type	**Location**
Platform Express	See COGCC website
GPIT	See COGCC website

Federal 299-26-2 Log Information (Offset Within 1-Mile)	05-103-10538
Type	**Location**
PE-AI/GR	See COGCC website
CNL/LD/GR	See COGCC website
PE-CAL/GR	See COGCC website
FE	See COGCC website
CBL/GR/CCL	See COGCC website

Federal 299-26-1 Log Information (Offset Within 1-Mile)	05-103-10364
Type	**Location**
CBL/GR/Array Induction/Density-Neutron	See COGCC website

Federal 299-23-1 Log Information (Offset Within 1-Mile)	05-103-10488
Type	**Location**
GR	See COGCC website
SCMT	See COGCC website
RST	See COGCC website
Cased Hole Gyroscope	See COGCC website

Attachment 6

Resistivity Logs for Injection/Disposal Well & All Other Wells Within 1 Mile

Attachment 6

Operator: Williams Production Ryan Gulch LLC
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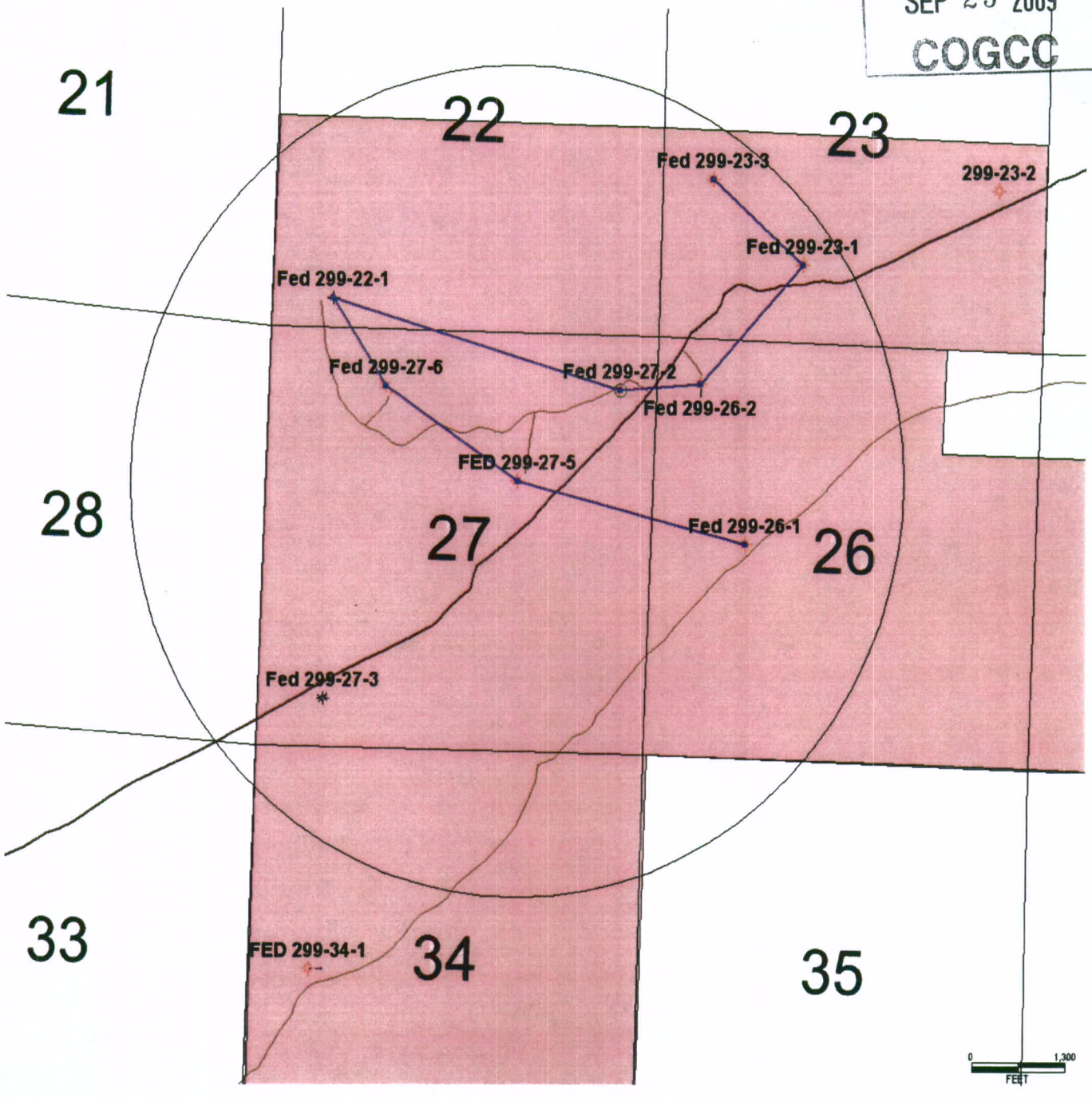

Cross Section of Injection/Disposal Well & All Other Wells Within 1 Mile

Attachment 7

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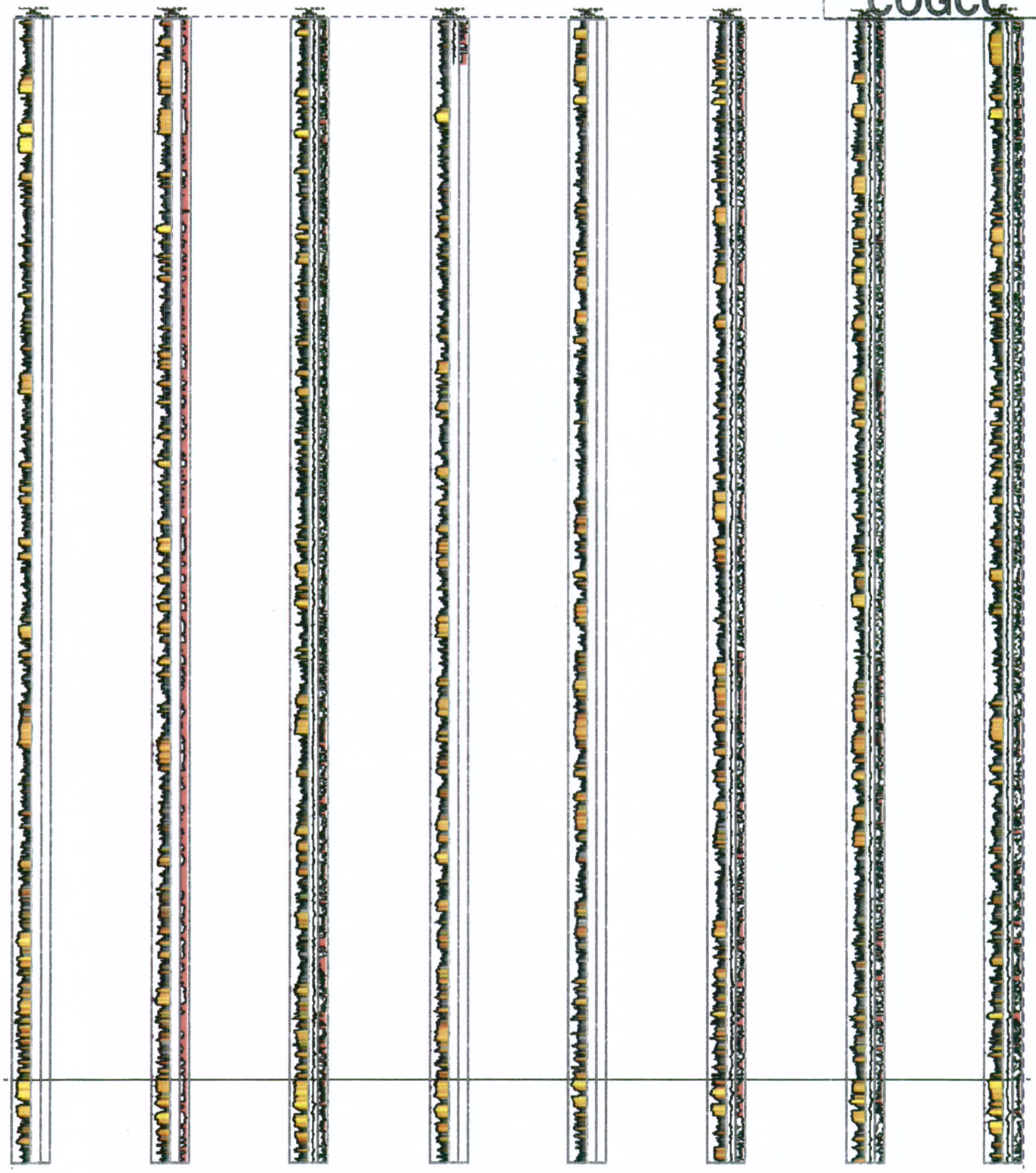
COGCC



Cross Section of Injection/Disposal Well & All Other Wells Within 1 Mile

Attachment 7

(Note - A Large Printout Of The Above Cross-Section Is Attached To The Back Of The UIC Application.)

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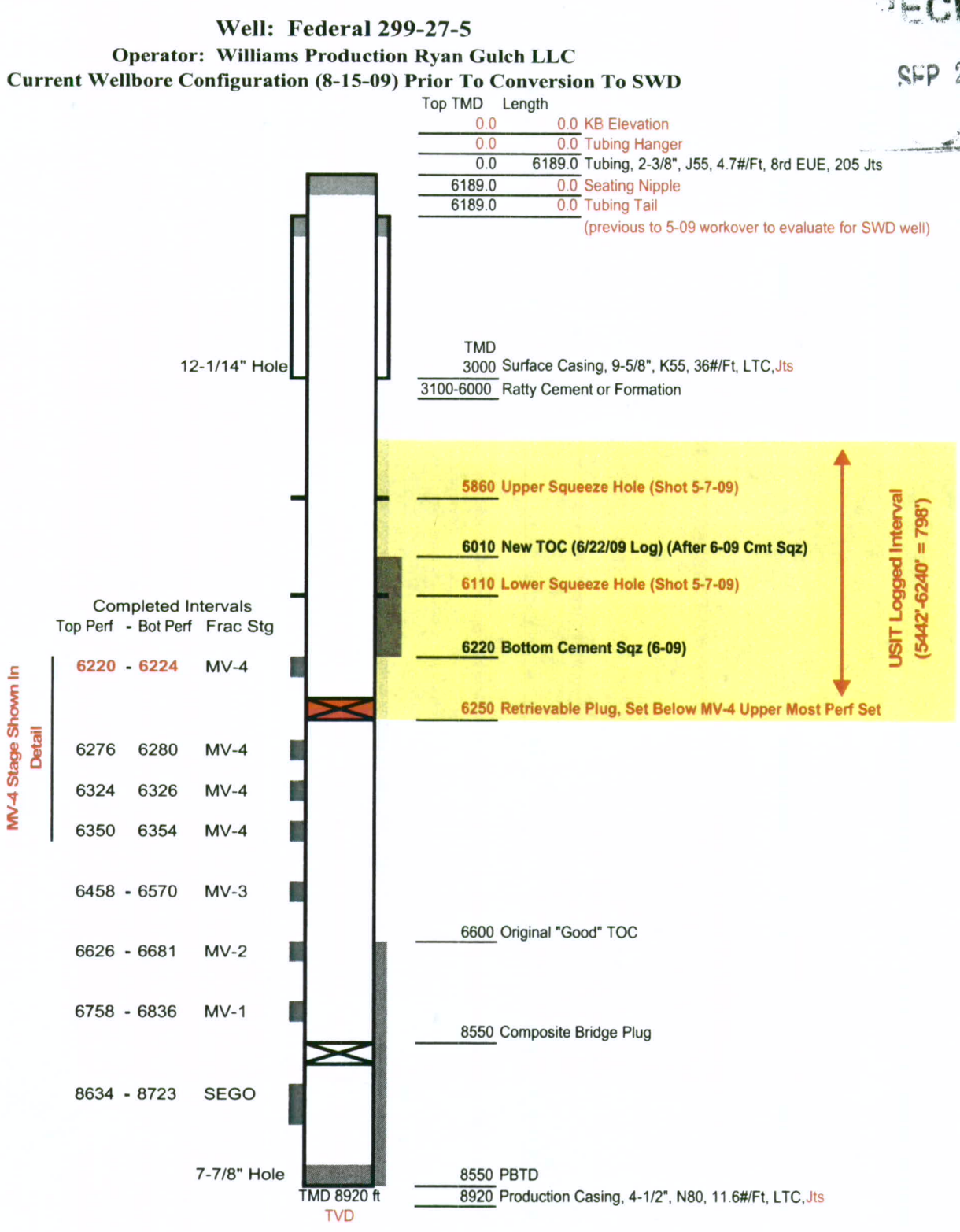


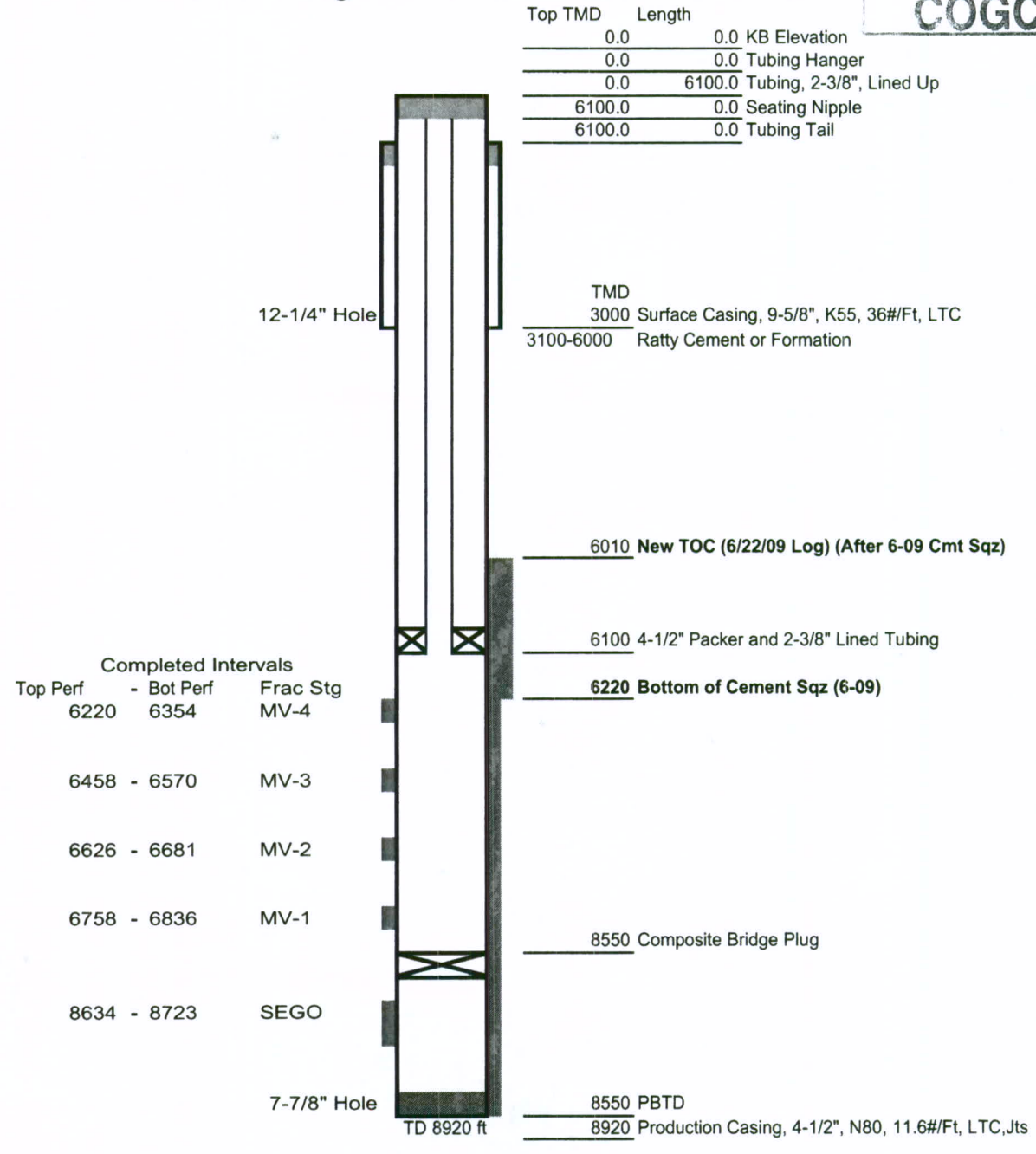
Wellbore Diagram of Water Injection/Disposal Well – Current Configuration

Attachment 8

Well: Federal 299-27-5

Operator: Williams Production Ryan Gulch LLC

Future Wellbore Configuration - After Conversion To SWD Well



Wellbore Diagram of Water Injection/Disposal Well – After Conversion

Attachment 9

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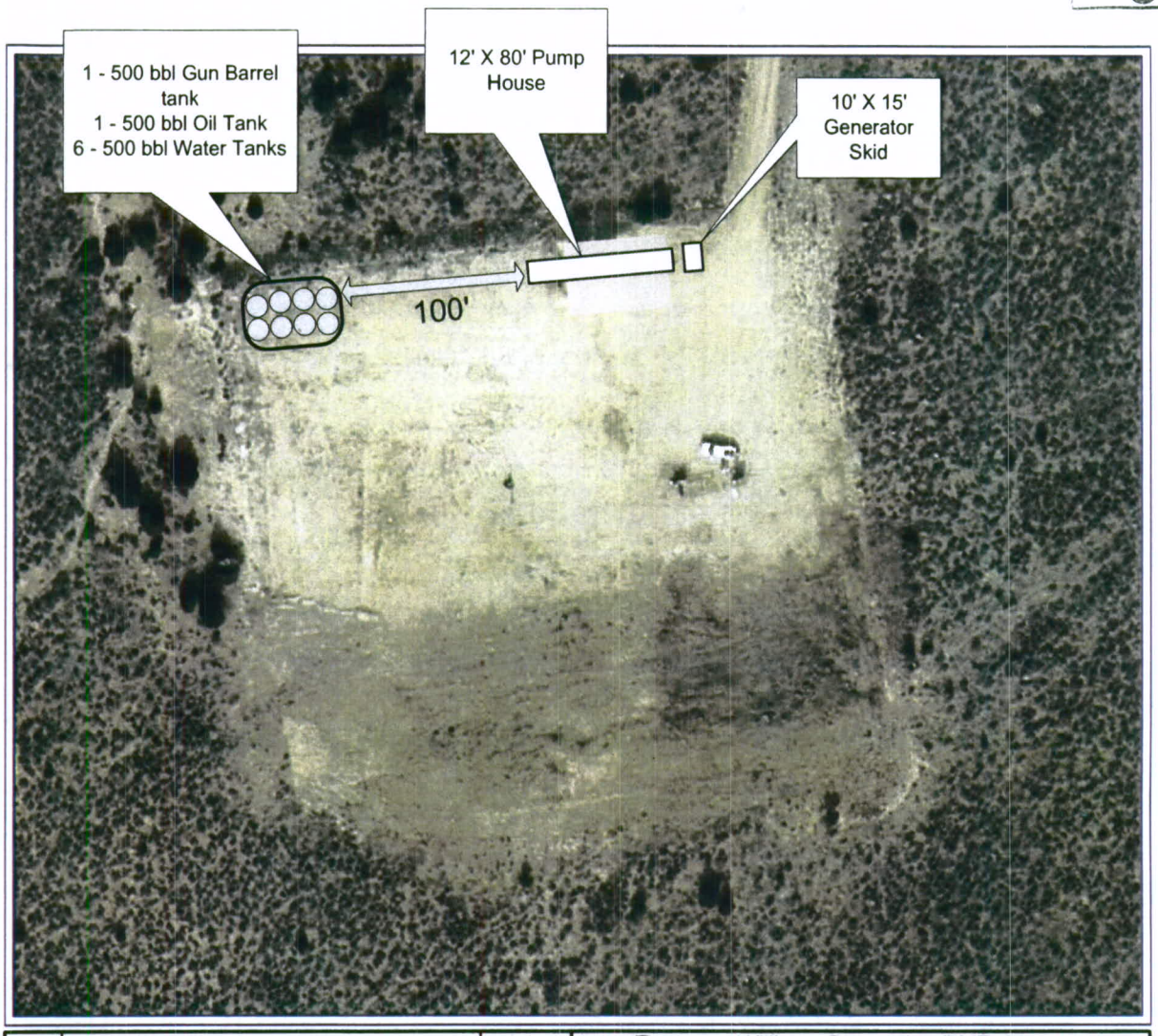


Rev	Description	Date
0	Draft For Review and Comment	7/28/2009

Williams Production RMT, Piceance Highlands Asset
Water Injection Configuration

Federal 299-27-5
SWNE, Sec. 27, 2S, 99W
Rio Blanco County, Colorado

Drn By: GJD	7/28/2009	Scale: 1in = 100ft. 0in.	Dwg No: 1 Rev 0

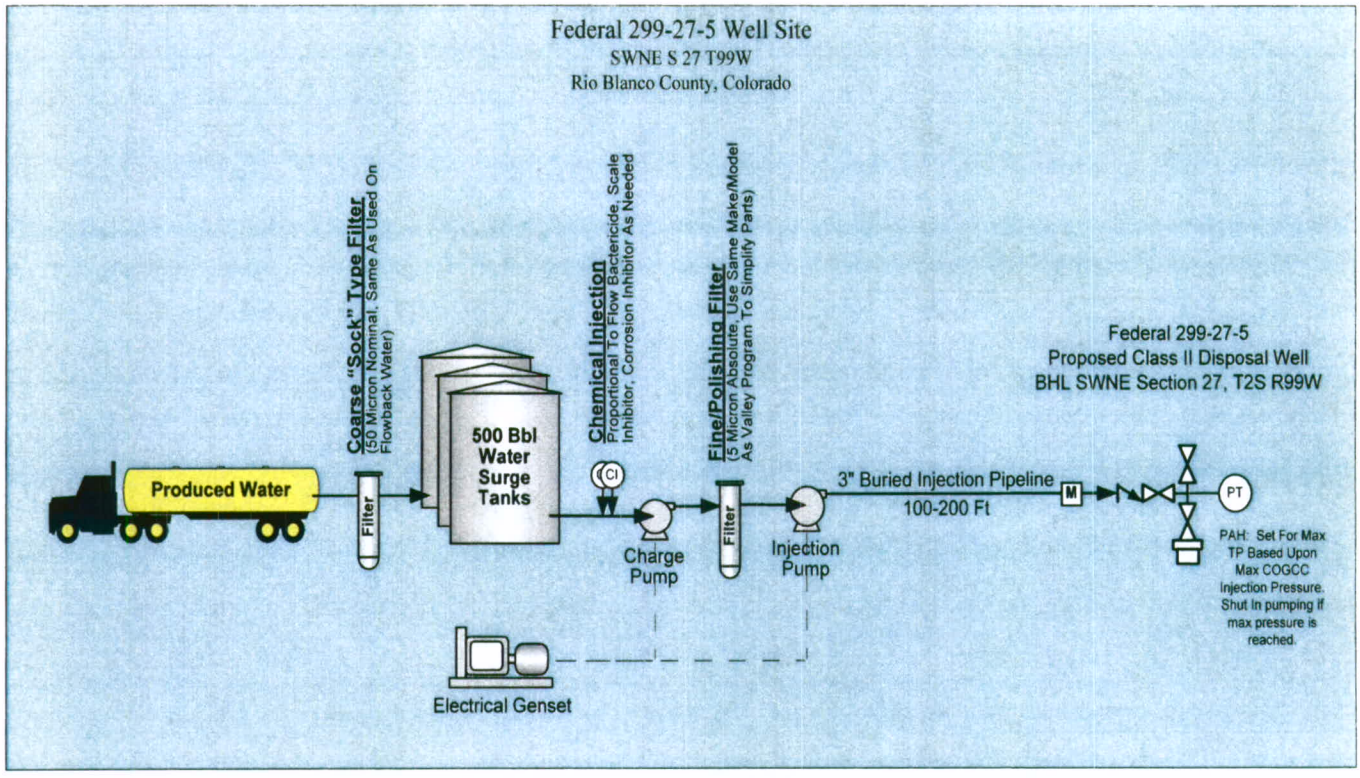
Surface Facility Plot Plan For Injection/Disposal Well

Attachment 10

Williams Production Ryan Gulch LLC - Federal 299-27-5
COGCC UIC Permit Application For "Dedicated Injection Well"

Simplified Flow Diagram For Injection Facilities

Initial "Early Field Development" Deployment Of Water Disposal Facility For Federal 299-27-5 Disposal Well



In The Future As Pipeline Infrastructure Builds Out The Above Will Be Replaced With A Disposal Water Pipeline System From A Central Site.

Surface Facility Diagram For Injection/Disposal Well

Attachment 10

No leases will be connected directly via pipeline upon onset of injection/disposal operations.

As of August 2009 Williams is developing plans for a future water disposal pipeline system but the plans tentative without hard details.

Williams will notify COGCC before any future direct pipeline connections are implemented.

Listing Of Leases Connected Directly By Pipeline To Injection/Disposal Well

Attachment 11

Operator: Williams Production Ryan Gulch LLC
UIC "Dedicated Injection Well" Permit Application To COGCC
Well: Federal 299-27-5 (API # 05-103-10624), S27-T2S-R99W, Rio Blanco County, CO
Project: Convert Federal 299-27-5 To Class II SWD Servicing Greater Ryan Gulch Area

Schlumberger

Client:
Well: Fed 299-27-5
Date: 7/17/2009
Tested By: Aida Vazquez

WATER ANALYSIS REPORT

Collection date	7/16/2009	7/16/2009		
Temp (°F)	67	67		
pH	8.0	8.0		
Specific Gravity	1.009	1.009		
Chlorides (mg/l)	7100	6745		
Iron (mg/l)	0	0		
Bicarbs (mg/l)	0	0		
Carbonates (mg/l)	600	600		
Hydroxides (mg/l)	170	170		
Calcium (mg/l)	800	400		
Magnesium (mg/l)	480	480		
Sulfates (mg/l)	100	90		
Sodium (mg/l)	3481	3708		
Potassium (mg/l)	450	450		
TDS (mg/l)	11451	11313		
Percentage Chloride	1.5	1.4		
Resistivity	0.57	0.57		

COMMENTS:

Water Analysis Of The Injected Formation
Attachment 1

Operator: Williams Production Ryan Gulch LLC
UIC "Dedicated Injection Well" Permit Application To COGCC
Well: Federal 299-27-5 (API # 05-103-10624), S27-T2S-R99W, Rio Blanco County, CO
Project: Convert Federal 299-27-5 To Class II SWD Servicing Greater Ryan Gulch Area

NALCO

Water Analysis Report

Field : Ryan Gulch	**Sample Date : 2/7/2008**
County : Rio Blanco	**Formation :**
Location : RG 12-10	**Rock Type :**
Lab ID : Williams	**Depth :**
Comments : Mn - .39 PPM	Recompletion

CATIONS	mg/l	meq/l	ANIONS	mg/l	meq/l
Potassium	3,305.0	84.53	**Sulfate**	27.0	0.56
Sodium	8,235.9	358.24	**Chloride**	16,300.0	459.76
Calcium	636.0	31.74	**Carbonate**	0.0	0.00
Magnesium	80.5	6.62	**Bicarbonate**	1,439.6	23.60
Iron	7.3	0.26	**Bromide**	0.0	0.00
Barium	174.0	2.53	**Organic Acids**	0.0	0.00
Strontium	0.0	0.00	**Hydroxide**	0.0	0.00
SUM +	**12,438.7**	**483.92**	**SUM -**	**17,766.6**	**483.92**

Solids

Total Dissolved Solids @180°C	29,342	mg/l
Total Solids, Calc less CO_2	29,342	mg/l
Total Solids, Calculated	30,205	mg/l
Total Solids, NaCl equivalents	25,243	mg/l
Chloride as NaCl	20,937	mg/l
NaCl% of Total Dissolved Solids	69.31	%
Accuracy	0.00	Sigma

Sample Conditions

pH, s.u. (Field)	7.80	s.u.
Sample Pressure	6.00	psia
Mole% CO_2, Gas	3.00	%
pH, s.u. (from CO_2)	7.82	s.u.
Surface Temp	60	°F
Downhole Temp	125	°F
Ionic Strength	0.520	μ

Dissolved Gases

Bisulfide ion, HS^-	1.7	mg/l
Hydrogen Sulfide, H_2S	0.3	mg/l
Total Sulfide	2.0	mg/l

Dissolved O_2, aq	0.0	ppb
Measured CO_2, aq	0.0	mg/l
Calculated CO_2, aq	18.3	mg/l

Other Properties

Calcium Hardness as $CaCO_3$	1,587.9	mg/l
Magnesium Hardness as $CaCO_3$	331.1	mg/l
Total Hardness as $CaCO_3$	1,919.0	mg/l
Hardness, grains	111.74	grains/gallon

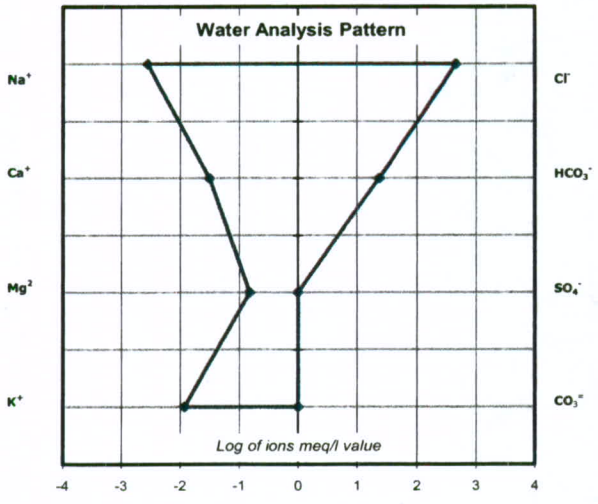
Specific Gravity	1.021	measured
Specific Gravity	1.021	calculated
Resistivity, 68°F	0.250	ohm-cm
Conductivity 25°C	40,000	μmhos/cm

Microbiological

Sulfate Reducing	nd
Aerobic Bacteria	nd

Scaling Conditions

Calcium Carbonate	$CaCO_3$ +
Calcium Sulfate	$CaSO_4$ - - -
Barium Sulfate	$BaSO_4$ +
Strontium Sulfate	$SrSO_4$ -



Probable Mineral Residue, Dry

Calculation error = 0 %

COMPOUND	mg/l
NaCl	20,936.6
KCl	6,301.9
Ca(HCO3)2	1,881.2
CaCl2	473.0
MgCl2	315.4
BaSO4	65.6

Note: nd denotes 'Not Determined'
Analyzed by: Creg Wilkins
Approved: Creg Wilkins
12/17/03 v947MDCarney

Water Analysis <u>Indicative of Typical Sego-Mesaverde Source Water Well</u>

Attachment 1

Operator: Williams Production Ryan Gulch LLC
UIC "Dedicated Injection Well" Permit Application To COGCC
Well: Federal 299-27-5 (API # 05-103-10624), S27-T2S-R99W, Rio Blanco County, CO
Project: Convert Federal 299-27-5 To Class II SWD Servicing Greater Ryan Gulch Area

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Water Analysis Report

Field : Ryan Gulch	**Sample Date : 12/12/2006**
County : Rio Blanco	**Formation :**
Location : RG 31-20	**Rock Type :**
Lab ID : Williams	**Depth :**
Comments : Mn - .50	

CATIONS	mg/l	meq/l	ANIONS	mg/l	meq/l
Potassium	189.0	4.83	**Sulfate**	10.0	0.21
Sodium	2,930.0	127.45	**Chloride**	3,500.0	98.72
Calcium	40.0	2.00	**Carbonate**	0.0	0.00
Magnesium	24.4	2.01	**Bicarbonate**	2,318.0	38.00
Iron	8.5	0.30	**Bromide**	0.0	0.00
Barium	25.0	0.36	**Organic Acids**	0.0	0.00
Strontium	0.0	0.00	**Hydroxide**	0.0	0.00
SUM +	**3,216.9**	**136.95**	**SUM -**	**5,828.0**	**136.93**

Solids

Total Dissolved Solids @180°C	7,654	mg/l
Total Solids, Calc less CO_2	7,654	mg/l
Total Solids, Calculated	9,045	mg/l
Total Solids, NaCl equivalents	7,310	mg/l
Chloride as NaCl	5,769	mg/l
NaCl% of Total Dissolved Solids	63.79	%
Accuracy	-0.01	Sigma

Sample Conditions

pH, s.u. (Field)	7.80	s.u.
Sample Pressure	6.00	psia
Mole% CO_2, Gas	5.00	%
pH, s.u. (from CO_2)	7.85	s.u.
Surface Temp	60	°F
Downhole Temp	125	°F
Ionic Strength	0.141	μ

Dissolved Gases

Bisulfide Ion, HS^-	0.0	mg/l
Hydrogen Sulfide, H_2S	0.0	mg/l
Total Sulfide	0.0	mg/l

Dissolved O_2, aq	0.0	ppb
Measured CO_2, aq	0.0	mg/l
Calculated CO_2, aq	32.6	mg/l

Other Properties

Calcium Hardness as $CaCO_3$	99.9	mg/l
Magnesium Hardness as $CaCO_3$	101.1	mg/l
Total Hardness as $CaCO_3$	201.0	mg/l
Hardness, grains	11.70	grains/gallon

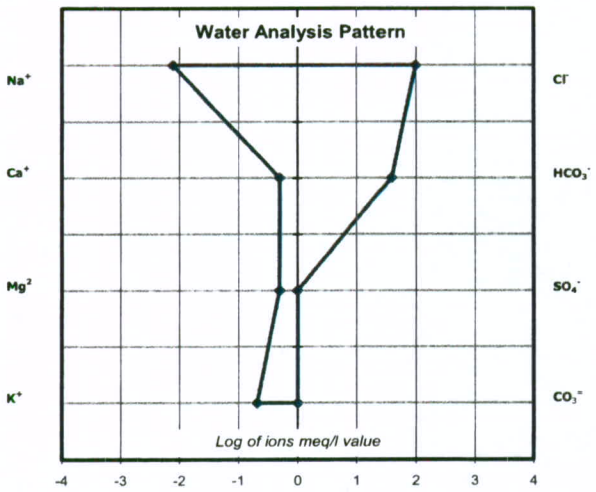
Specific Gravity	1.006	measured
Specific Gravity	1.006	calculated
Resistivity, 68°F	1.065	ohm-cm
Conductivity 25°C	9,390	μmhos/cm

Microbiological

Sulfate Reducing	nd
Aerobic Bacteria	nd

Scaling Conditions

Calcium Carbonate	$CaCO_3$ +
Calcium Sulfate	$CaSO_4$ - - -
Barium Sulfate	$BaSO_4$ +
Strontium Sulfate	$SrSO_4$ -



Probable Mineral Residue, Dry

Calculation error = 0 %

COMPOUND	mg/l
NaCl	5,497.9
NaHCO3	2,803.0
KCl	346.6
Ca(HCO3)2	161.8
Mg(HCO3)2	146.9
BaSO4	24.3

Note: nd denotes 'Not Determined'
Analyzed by: Creg Wilkins
Approved: Creg Wilkins
12/17/03 v947MDCarney

Water Analysis <u>Indicative of Low TDS Source Water Well</u>

Attachment 1

Index Map For Log Cross Section "A-A"

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SEP 25 2009
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