

Wyoming Department of Environmental Quality  
Water Quality Division  
WYPDES Program

Statement of Basis

RENEWAL

APPLICANT NAME: Pinnacle Gas Resources

MAILING ADDRESS: 1 East Alger Street, Suite 206  
Sheridan, WY 82801

FACILITY LOCATION: Brown Land Lease, which is located in the SENW, SWNW, and NWSW, Section 19, and in the NWSW, NWNW, SWNE, and SWSE, Section 20, Township 55 North, Range 73 West, Campbell County. The produced water will be discharged into various named, on-channel reservoirs (3B) located on several unnamed, ephemeral tributaries (3B) of Squaw Creek (3B). Squaw Creek (3B) is tributary to the Little Powder River (2AB), via Horse Creek (3B). The daily maximum permitted flow rate for this facility is 0.252 MGD. The permit requires that the produced water being discharged at this facility originate in one or more of the following formations: the Anderson, Wall, Canyon, Pawnee, and/or Cook coal seams.

NUMBER: WY0043851

*This permit has been modified from the draft originally advertised in the May 15, 2006 public notice. Language has been added in Part I.C. of this permit describing groundwater monitoring requirements and on-channel reservoir bonding requirements.*

*As part of the renewal for this facility, the following changes are being made in this permit:*

- 1. Relocate all outfalls.*
- 2. Include interim and final effluent limits for SAR and EC protective of agricultural uses within the Horse Creek drainage, which provides a timeline for compliance with end of pipe effluent limits.*
- 3. Rename "POC1" to "ICP1", and relocate it.*
- 4. The pH limit is being updated to 6.5-9.0 standard units, as per the current WYPDES permitting approach for this constituent.*
- 5. Dissolved manganese, total petroleum hydrocarbon, and sulfate end of pipe effluent limits and monitoring requirements are being removed from this permit as per current WYPDES permitting approaches for these constituents.*
- 6. Deactivate POC2, POC3, POC4, POC5, POC6, and POC7.*
- 7. Move effluent limits originally established at the POCs to the end of pipe (the outfall), except for SAR and EC effluent limits during the one-year interim period. After the interim period, all effluent limits must be met at the end of pipe.*
- 8. Change the chloride limit from 46 mg/l at the POC to 150 mg/l at the end of pipe.*
- 9. Based upon historic water quality information available regarding discharges from this facility, the originally established dissolved cadmium effluent limit is being removed, as concentrations of*

*dissolved cadmium within discharges from this facility have never approached the established effluent limit.*

10. *Consolidate three outfalls currently permitted under WY0043842 with this facility. These outfalls will become outfalls 008-010.*

### **Facility Description**

This facility is a typical coal bed methane production facility in which groundwater is pumped from a coal bearing formation resulting in the release of methane from the coal bed. The permit authorizes the discharge to the surface of groundwater produced in this way provided the effluent quality is in compliance with effluent limits that are established by this permit. In developing effluent limits, all federal and state regulations and standards have been considered and the most stringent requirements incorporated into the permit. The EPA Effluent Guidelines and Standards for Oil and Gas Extraction Point Source Category (Part 435, Subpart E) predate the development of coal bed methane extraction technology; however the technology is similar enough to conventional gas extraction that, in the professional judgment of the WDEQ, this effluent limit guideline is appropriately applied to coal bed methane gas production. The guideline limits oil and grease effluent concentrations to less than 35 mg/l and requires that discharges of produced water be used for agricultural production and/or wildlife propagation. This permit does not cover activities associated with discharges of drilling fluids, acids, stimulation waters or other fluids derived from the drilling or completion of the wells.

The permittee has chosen option 2 of the coal bed methane permitting options. Under this permitting option, the produced water is immediately discharged to a class 2 or 3 receiving stream which is eventually tributary to a class 2AB perennial water of the state. The permit establishes effluent limits for the end of pipe, which are protective of all the designated uses defined in Chapter 1 of Wyoming Water Quality Rules and Regulations. This may include drinking water, game and non-game fish, fish consumption, aquatic life other than fish, recreation, agriculture, wildlife, industry and scenic value. Based on a review of this permit application and previous applications in this area, it has been determined that active irrigation uses of surface water occur downstream from the facility on Horse Creek.

The Wyoming DEQ has determined through review of the permit application and available scientific information that effluent discharged from this facility is unlikely to reach the downstream irrigated lands or the Little Powder River. The permittee has submitted a water budget which demonstrates that the effluent from this facility can be contained in the 8 on-channel reservoirs at this site. Review of the permit application also reveals that this facility is located approximately 22 stream miles from the confluence with the Little Powder River. Maximum total effluent flow rate from this facility is limited to 0.39 cfs.

### **Effluent Limits Based On Numeric Water Quality Standards**

Permit effluent limits are based on federal and state regulations and are effective as of the date of issuance. The daily maximum effluent flow limit for this facility is 0.252 million gallons per day (MGD). The pH must remain within 6.5 and 9.0 standard units. Effluent limits for total dissolved solids (5,000 mg/l) and specific conductance (7,500 micromhos/cm) are included to protect for stock and wildlife watering. These limits are based upon Wyoming Water Quality Rules and Regulations, Chapter 7 and apply to discharge from any permitted outfall. In addition, the permit establishes a total barium limit of 1800 µg/l, a total arsenic limit of 3.6 µg/l, and a chlorides limit of 150 mg/l. These limits are based on standards for class 2AB waters which are intended to protect for the above listed designated uses and reflect the application of "tier two" anti-degradation protection as set forth in the *Wyoming Surface Water Quality Standards - Implementation Policies*. This permit also establishes a dissolved iron limit of 1000 µg/l which reflects the application of "tier one" anti-degradation protection for the class 3B immediate receiving water. Results are to be reported twice-yearly and if no discharge occurs then "no discharge" is to be reported.

This permit originally established a total radium<sup>226</sup> limit of 60 pCi/l, a dissolved cadmium limit of 0.67 µg/l, a dissolved manganese limit of 621 µg/l, a sulfate limit of 3000 mg/l, and a total petroleum hydrocarbons (TPH) limit of 10 mg/l at the end of pipe. Based upon water quality data collected by WDEQ since the time this permit was originally issued, a permitting approach for establishing total radium limits in coal bed methane permits has been developed. This approach is based upon the distance of the outfall from a class 2 water. The removal of the

originally-established total radium<sup>226</sup> limit is based on this permitting approach. In addition, review of discharge monitoring report data for this facility and other CBM facilities in Northeast Wyoming indicates that the maximum reported concentrations for total petroleum hydrocarbons (TPH), dissolved cadmium, sulfates, and dissolved manganese in the discharge were well below the established water quality standards of 10 mg/l for TPH, 621 µg/l for dissolved manganese, 0.67 µg/l for dissolved cadmium, and 3000 mg/l for sulfate established in *Chapter 1 of the Wyoming Water Quality Rules and Regulations*. Therefore, WDEQ has removed the effluent limits and monitoring requirements for TPH, dissolved cadmium, sulfate, and dissolved manganese in this permit. Based on evaluation of the available data, it is WDEQ's determination that removing the dissolved cadmium, dissolved manganese, sulfate, total radium<sup>226</sup> and total petroleum hydrocarbons limits from this permit conforms to the anti-backsliding requirements established in *Section 402(o).2.B.i of the Clean Water Act*.

### **Irrigation Protection**

The closest irrigation occurring downstream of this CBM facility along the main channel of Horse Creek is described by the irrigator as a system of headgates and ditches, which supplies water to native grass hay and alfalfa meadows whenever sufficient flow is present in Horse Creek. This irrigation historically occurred as a result of upstream storm or snowmelt events. In order to monitor and regulate this coal bed methane discharge for compliance with Chapter 1, Section 20 (protection of agricultural water supply), effluent limits for sodium adsorption ratio (SAR) and specific conductance are included in this permit. Originally, the permit established an SAR limit of 6 and an EC limit of 2000 micromhos/cm, to be met at a downstream location, identified in the original permit as a "point of compliance". The premise behind the POC approach was that should discharges from the facility reach the downstream POC, they would have been diluted by natural runoff within the basin, and have had contact time with materials present within the streambed. The combination of runoff dilution and contact time with materials within the streambed was modeled within the original permit application, and demonstrated to provide a combination of dilution and buffering that should have allowed the discharges, once they reached the downstream POC, to meet effluent limits protective of the downstream irrigation uses within the Horse Creek drainage. Based upon information provided to the WDEQ, the most salinity-sensitive crop under irrigation is alfalfa. Originally, the WDEQ had determined that an SAR of 6 and EC of 2000 micromhos/cm would provide sufficient protection for irrigation uses within the Horse Creek drainage.

Since the time the permit was originally issued, however, The Wyoming DEQ has changed the methodology used to calculate default limits for SAR and EC. Based upon this new method, the WDEQ has determined that default limits for SAR of 7.5 and specific conductance of 1330 micromhos/cm are protective of the downstream agricultural uses occurring in Horse Creek. The specific conductance limit of 1330 micromhos/cm is based on the salinity threshold value for the downstream irrigated vegetation. Based on information published in *"Agricultural Salinity and Drainage"*, Hanson et al., 1999 revision, alfalfa has a threshold soil EC sensitivity of 2000 micromhos/cm. To calculate the allowable EC limit for irrigation water that could be applied and not exceed the "no reduction in yield" soil EC threshold, the soil EC was divided by 1.5, which is the accepted methodology published within *"Agricultural Salinity and Drainage"*, Hanson et al., 1999 revision, to calculate applicable irrigation water salinity which could be applied without causing a reduction in crop yield. This calculation indicates that application of irrigation water having an EC concentration of 1330 µg/l would not reduce of crop yields for alfalfa within the drainage. Once the maximum EC concentration was calculated, the maximum SAR value was calculated using the Hanson Diagram.

Using the calculated irrigation water EC effluent limit of 1330 micromhos/cm, a sodium adsorption ratio effluent limit of 7.5 is derived from Figure 3 of the USDA *"Agricultural Salinity and Drainage"* handbook, Hanson et al., 1999 revision. The SAR limit in this permit is intended to prevent a reduction in soil permeability within the downstream irrigated areas along Squaw Creek. Again using the calculated EC effluent limit, a limit for total dissolved solids (TDS) is calculated by again dividing the EC limit by 1.5, resulting in a calculated TDS limit for this facility of 890 mg/l. Limits protective of irrigation uses apply at the end of pipe.

This existing facility's water quality is unable to meet the new effluent limits protective of irrigation at the end of pipe. In order to allow the operator a "window of opportunity" to investigate methodologies that could be utilized to achieve end of pipe effluent limits protective of irrigation uses that are being established in this permit renewal, the permit establishes interim and final effluent limits. The permittee is allowed to discharge produced water for one year after the issuance of this renewal under the SAR and EC effluent limits established in the original permit - EC = 2000 micromhos/cm and SAR = 6, to be met at either the POC (now described as an ICP or irrigation compliance

point), or the outfall. After the initial year following issuance of this renewal, the permittee must meet effluent limits protective of irrigation at the end of pipe (at the outfalls), EC = 1330 micromohs/cm, SAR = 7.5. In lieu of the default effluent limits described above, the permittee also has the option of performing a site-specific Section 20 analysis that would provide sufficient information for the WYPDES Program to establish site-specific effluent limits for SAR and EC.

### **General Requirements**

The permit also requires sampling at designated water quality monitoring stations located on the receiving stream (Horse Creek), and on the perennial receiving water (the Little Powder River). (See Table 1, Part I.B.12 of the permit for water quality monitoring station location information).

Information gathered from the water quality monitoring stations may result in modification of the permit to protect existing uses on the tributary and the mainstem.

There shall be no discharge of floating solids or visible foam in other than trace amounts, nor shall the discharge cause formation of visible deposits of iron, hydrocarbons or any other constituent on the bottom or shoreline of the receiving water. In addition, erosion control measures will be implemented to prevent significant damage to or erosion of the receiving water channel at the point of discharge.

The discharge of wastewater and the effluent limits that are established in this permit have been reviewed to ensure that the levels of water quality necessary to protect the designated uses of the receiving waters are maintained and protected. An antidegradation review has been conducted and verifies that the permit conditions, including the effluent limitations established, provide a level of protection to the receiving water consistent with the antidegradation provisions of Wyoming surface water quality standards.

Self monitoring of effluent quality and quantity is required on a regular basis with reporting of results semiannually. The permit is scheduled to expire on December 31, 2008. This expiration date was determined through review of the watershed permitting schedule which the WDEQ is implementing in order to synchronize the permitting and expiration of facilities within the same watershed. This holistic approach will provide for more efficient permitting of point-source discharges.

Kathy Shreve  
Environmental Senior Analyst  
Water Quality Division  
Department of Environmental Quality  
Drafted: May 1, 2006

AUTHORIZATION TO DISCHARGE UNDER THE  
WYOMING POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, (hereinafter referred to as "the Act"), and the Wyoming Environmental Quality Act,

Pinnacle Gas Resources,

Is authorized to discharge from the wastewater treatment facilities serving the

Brown Land Lease,  
located in

the SENW, SWNW, and NWSW, Section 19, and in the NWSW, NWNW, SWNE, and SWSE, Section 20,  
Township 55 North, Range 73 West, Campbell County.


To receiving waters named

various named, on-channel reservoirs (3B) located on several unnamed, ephemeral tributaries (3B) of Squaw  
Creek (3B). Squaw Creek (3B) is tributary to the Little Powder River (2AB), via Horse Creek (3B).

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II and III hereof.

This permit renewal shall become effective on the date of signature by the Director of the Department of Environmental  
Quality.

This permit and the authorization to discharge shall expire at midnight, December 31, 2008.

  
\_\_\_\_\_  
John F. Wagner  
Administrator - Water Quality Division

10/05/06  
Date

  
\_\_\_\_\_  
John V. Corra  
Director - Department of Environmental Quality

10/05/06  
Date

**PART I**

**A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS**

Effective immediately and lasting through December 31, 2008, the quality of effluent discharged by the permittee shall, at a minimum, meet the limitations set forth below. The permittee is authorized to discharge from outfalls serial numbers 001-003, 005, 008-010.

1. **From the date of permit renewal issuance until midnight, May 31, 2007, the following interim effluent limits are established:**

**Effluent Limits**

<u>Effluent Characteristic</u>	<u>Daily Maximum. Outfall</u>	<u>Daily Maximum, Irrigation Compliance Point</u>
Chlorides, mg/l	150	
Dissolved Iron, µg/l	1000	
pH, standard units	6.5 – 9.0	
Specific Conductance, micromhos/cm	7500	2000**
Total Recoverable Arsenic, µg/l	3.6	
Total Recoverable Barium, µg/l	1800	
Total Dissolved Solids, mg/l	5000	
Total Flow, MGD*	0.252	
Sodium Adsorption Ratio, calculated as unadjusted for bicarbonate ratio		6**

\*Total flow is to be calculated as the sum of all discharge from all permitted outfalls.

\*\* The permittee may, if so desired, elect to meet these effluent limitations at the end of pipe (the outfall).

Note: 1) 'Dissolved' value for metals refers to the amount that will pass through a 0.45 µm membrane filter prior to acidification to pH 1.5-2.0 with Nitric Acid.

2) 'Total' value for metals refers to the total recoverable amount of that metal in the water column.

2. **From June 1, 2007 until permit expiration, the following final effluent limits are established:**

**Effluent Limits**

<u>Effluent Characteristic</u>	<u>Daily Maximum. Outfall</u>
Chlorides, mg/l	150
Dissolved Iron, µg/l	1000
pH, standard units	6.5 – 9.0
Specific Conductance, micromhos/cm	1330
Sodium Adsorption Ratio (calculated as unadjusted for bicarbonate ratio)	7.5
Total Recoverable Arsenic, µg/l	3.6
Total Recoverable Barium, µg/l	1800

<u>Effluent Characteristic</u>	<u>Daily Maximum, Outfall</u>
Total Dissolved Solids, mg/l	890
Total Flow, MGD*	0.252

\* Total flow is to be calculated as the sum of all discharge from all permitted outfalls.

Note: 1) 'Dissolved' value for metals refers to the amount that will pass through a 0.45 µm membrane filter prior to acidification to pH 1.5-2.0 with Nitric Acid.

2) 'Total' value for metals refers to the total recoverable amount of that metal in the water column.

Effluent limits protective of the downstream irrigation uses are established year-round, as the downstream irrigator has little to no ability to direct CBM discharges away from the irrigated acreage.

**3. Limits and Requirements applicable at all outfalls during both the interim and final effluent limit periods:**

The pH shall not be less than 6.5 standard units nor greater than 9.0 standard units in any single grab sample.

The permittee may, if so desired, discharge water produced from any authorized well to any permitted outfall, as long as all permit limits and requirements can be met. This facility has a total combined daily maximum flow rate of 0.252 million gallons per day (MGD), to be calculated as the sum of all discharges from all permitted outfalls. Upon renewal, this facility is authorized to discharge from 57 CBM wells, and has 8 permitted outfalls. The produced water being discharged at this facility will originate from any of the following formations: the Anderson, Wall, Canyon, Cook, and Pawnee coal seams.

Information gathered from the water quality monitoring stations may result in modification of the permit to protect existing uses on the tributary and the mainstem.

There shall be no discharge of floating solids or visible foam in other than trace amounts, nor shall the discharge cause formation of a visible sheen or visible hydrocarbon deposits on the bottom or shoreline of the receiving water.

All waters shall be discharged in a manner to prevent erosion, scouring, or damage to stream banks, stream beds, ditches, or other waters of the state at the point of discharge. In addition, there shall be no deposition of substances in quantities which could result in significant aesthetic degradation, or degradation of habitat for aquatic life, plant life or wildlife; or which could adversely affect public water supplies or those intended for agricultural or industrial use.

The permittee will be required to contain all effluent during "dry" operating conditions within a series of on-channel reservoirs during the period of time in which interim effluent limits are effective. The permittee has submitted documentation in their permit application indicating that such containment is feasible. During the period of time in which interim effluent limits are applicable, discharges from the reservoirs being utilized to contain CBM produced water at this facility are not allowed except in the event precipitation causes the reservoirs to fill and overtop. Under such circumstances, discharges are limited to natural overtopping only. Intentional discharges from the reservoirs are not allowed under any circumstances, and will be considered a violation of this permit. Once the permittee is operating under the final effluent limits established in this permit renewal, discharges from the reservoirs may occur at any time.

**4. Discharges shall be monitored by the permittee as specified below:**

- a. Monitoring of the initial discharge

