ENVIRONMENTAL ASSESSMENT for the Hay Reservoir CBNG Infill and Impoundments Project

Sweetwater County, Wyoming

August 2007

MISSION STATEMENT

It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

BLM/WY/PL-07/032+1310

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Rawlins Field Office
P.O. Box 2407 (1300 North Third Street)
Rawlins, Wyoming 82301-2407

August 13, 2007

In Reply Refer To:
1790 (030)

Re: Environmental Assessment for the Hay Reservoir CBNG Infill and Impoundments Project

Dear Reader:

This is to inform you of the availability of the Hay Reservoir Coalbed Natural Gas (CBNG) Infill and Impoundments Project (Project) Environmental Assessment (EA) at the Wyoming Bureau of Land Management's (BLM) website:

http://www.blm.gov/wy/st/en/info/NEPA/documents/nepadocs07.html

In order to satisfy the requirements of the National Environmental Policy Act, this EA was prepared to analyze impacts associated with the drilling of eight additional CBNG wells and the construction and operation of produced water disposal impoundments, north of Wamsutter, Wyoming.

It is expected that this EA can be viewed at our website beginning August 13, 2007. This will begin the 30-day public review/comment period for the document. We will review all comments and will address substantive comments in the Decision Record. A substantive comment is one that would alter conclusions drawn from the analysis based on: 1) new information, 2) why or how the analysis is flawed, 3) evidence of flawed assumptions, 4) evidence of error in data presented, and 5) requests for clarification that bear on conclusions presented in the analysis.

Your comments should be as specific as possible. Comments on the alternatives presented and on the adequacy of the impact analysis will be accepted by the BLM until September 12, 2007.

Comments may be submitted via regular mail to:

Travis Bargsten, Project Manager
Bureau of Land Management
Rawlins Field Office
P.O. Box 2407
Rawlins, Wyoming 82301

or may be submitted electronically at the address shown below (please refer to the Hay Reservoir CBNG Infill and Impoundments Project):

e-mail: rawlins_wymail@blm.gov

Please note that comments, including names, e-mail addresses, and street addresses of respondents, will be available for public review and disclosure at the above address during regular business hours (7:45 a.m. to 4:30 p.m.), Monday through Friday, except holidays. Individual respondents may request confidentiality. If you wish to withhold your name, e-mail address, or street address from public review or from disclosure under the Freedom of Information Act, you must state this plainly at the beginning of your written comment. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, will be made available for public inspection in their entirety.

The EA may also be reviewed at the following locations:

Bureau of Land Management
Wyoming State Office
5353 Yellowstone Road
Cheyenne, Wyoming 82009

Bureau of Land Management
Rawlins Field Office
1300 N. Third Street
Rawlins, Wyoming 82301

If you require additional information regarding this project, please contact Travis Bargsten, Project Manger, at the Rawlins address or phone (307) 328-4387.

Sincerely,

Mark Storzer

Field Manager

Enclosure

U.S. Department of the Interior
Bureau of Land Management

August 6, 2007

ENVIRONMENTAL ASSESSMENT TITLE PAGE
Rawlins Field Office

EA No. WY-030-07-EA-115

Name or Title of Action: Hay Reservoir CBNG Infill and Produced Water Impoundment Project

Proponent: Pinnacle Gas Resources, Inc.

File Name, Number, and Location: Oil and Gas Leases WYW-153188, WYW-153193

Location (BLM Surface, Fed Minerals): T.23N., R.97W., 6th P.M., Sec 26, Sec 35
Location (BLM Surface, WY Minerals): T.23N., R.97W., 6th P.M., Sec 36
Sweetwater County, Wyoming

Field Office: Rawlins Field Office (RFO)

Rawlins Field Office (RFO) Interdisciplinary Team (IDT)

IDT Member	Title
Travis Bargsten	Natural Resource Specialist, Project Lead
David Simons	Environmental Coordinator
Andy Stone	Hydrologist
Mike Calton	Rangeland Management Specialist
Paul Rau	Recreation Planner
Heath Cline	Wildlife Biologist
Bonni Bruce	Archaeologist
Mark Newman	Geologist
Susan Foley	Soil Scientist
Jon Dull	Petroleum Engineer
Hilaire Peck	Engineer
Heather Nino	Realty Specialist

Activity Code: 1310

Appendices: A (Master Drilling Plan)
B (Master Surface Use Plan and Integrated Pest Management Plan)
C (Water Management Plan and Addenda)

INTRODUCTION

PURPOSE AND NEED FOR THE PROPOSED ACTION

The Proposed Action as described in this Environmental Assessment (EA) is necessary for the proponent to exercise lease rights and develop domestic natural gas resources. In Coalbed Natural Gas (CBNG) operations, water is removed from coal formations allowing for desorption of natural gas, principally methane, for production and eventual sale. Disposal of this produced water is then necessary to allow for continued natural gas production. Down-sizing of well spacing (to 80-acre spacing) has been deemed necessary by the Proponent in order to adequately test the feasibility of commercial gas production from the subject oil and gas leases. The purpose and need for this project are to allow for the Proponent to determine if coalbed natural gas production is feasible from the target formation in this geographic area, in order to provide natural gas for eventual sale and consumption. As a pilot project, eventual full-field development could occur should coalbed natural gas production prove feasible. A corollary purpose of this project is to evaluate techniques of gas and produced water production, and to provide information for potential analysis of subsequent full-field development.

CONFORMANCE WITH LAND USE PLAN

Oil and gas development is covered on pages 30-32 in the Great Divide Resource Management Plan (RMP), which was approved on November 8, 1990. Development of oil and gas reserves as described in the Proposed Action is in conformance with the RMP decisions which state that the Management Objective is to provide opportunity for leasing, exploration, and development of oil and gas while protecting other resource values.

The development of this project would not affect the achievement of the Wyoming Standards for Healthy Rangelands (August 1997).

RELATIONSHIP TO STATUTES, REGULATIONS, POLICY, PERMITS OR OTHER PLANS

In 2003, the RFO prepared an EA for a right-of-way (ROW) application by Kennedy Oil to allow for the construction of 4 well locations in Section 36 (in T23N/R97W hereafter, unless otherwise specified). Surface estate in this Section is public land administered by the BLM, and the mineral estate is owned by the State of Wyoming. As a result, the RFO considered the impacts from construction and associated activities. Subsequently, a Decision Record and Finding of No Significant Impact (DR/FONSI) was released allowing for the ROW authorization. Kennedy subsequently drilled the CBNG wells and converted a wellbore to a produced water disposal (reinjection) well. Kennedy Oil then decided to expand the pilot project to better test the feasibility of commercial gas production by proposing the drilling of 8 additional CBNG wells adjacent to Section 36, in Sections 26 and 35.

In September of 2005, the RFO released an EA for the Hay Reservoir Coalbed Natural Gas (CBNG) Pilot Project ("Hay Reservoir CBNG Pilot") for public review. In October of 2005, the RFO issued a Decision Record/Finding of No Significant Impact for the Hay Reservoir CBNG Pilot. This decision provided for the authorization of 8 CBNG well Applications for Permit to Drill (APDs) and a single produced water disposal well APD, along with appurtenant access roads and pipeline- and utility-corridors in Sections 26 and 35. The 8 CBNG wells were proposed by the original proponent, Kennedy Oil, to be located at 160-acre spacing (4 wells per section).

In October of 2006, Pinnacle Gas Resources, Inc. (Proponent) submitted APDs for infill drilling and included a proposal to dispose of produced water in surface impoundments. Pinnacle has obtained the lease rights to explore and develop natural gas within these leases from Kennedy Oil.

In July of 2006, Pinnacle submitted a ROW application for the infill drilling of 4 additional locations in Section 36. An EA was prepared, a DR/FONSI produced, and the ROW was subsequently authorized.

In total, then, there are 8 CBNG wells and a single reinjection well currently authorized in Section 36. There are a total of 8 CBNG wells and a single reinjection well currently authorized in Sections 26 and 35. At the time this EA was in preparation, drilling activity and reinjection operations were on-going.

PROPOSED ACTION AND ALTERNATIVES

Proposed Action

The general location of the proposed wells and impoundments is approximately 56 miles west of Rawlins, Wyoming (*Figure 1*). Access to the project area is provided by existing roads off of Interstate I-80 and Sweetwater County Road 67 (Tipton Road).

On October 22, 2006, the Rawlins Field Office received the first components of a Plan of Development (POD) application from the Proponent for the:

1. Construction, drilling, completion, operation, maintenance, and reclamation of 8 additional CBNG wells (and appurtenant access roads, flowlines, and utility corridors) to provide 80-acre spacing in the project area
2. Construction, operation, and reclamation of 8 water impoundments for the evaporation and storage of approximately 800 acre-feet of CBNG produced water from the project wells
3. Installation and operation of up to 4 diesel generators for power generation for a time period of up to 6 months, and

Several subsequent changes to the POD application were made, with the most recent changes received June 21, 2007. Construction activities and operations would be similar to the description provided in the Hay Reservoir CBNG Pilot Project EA of September 2005 (WY-030-05-EA-390). **A complete description of the proposed action is provided in the Appendices.** The Master Surface Use Plan (MSUP) contains a prediction of total anticipated short-term surface disturbance (new disturbance, not accounting for existing disturbance within project area):

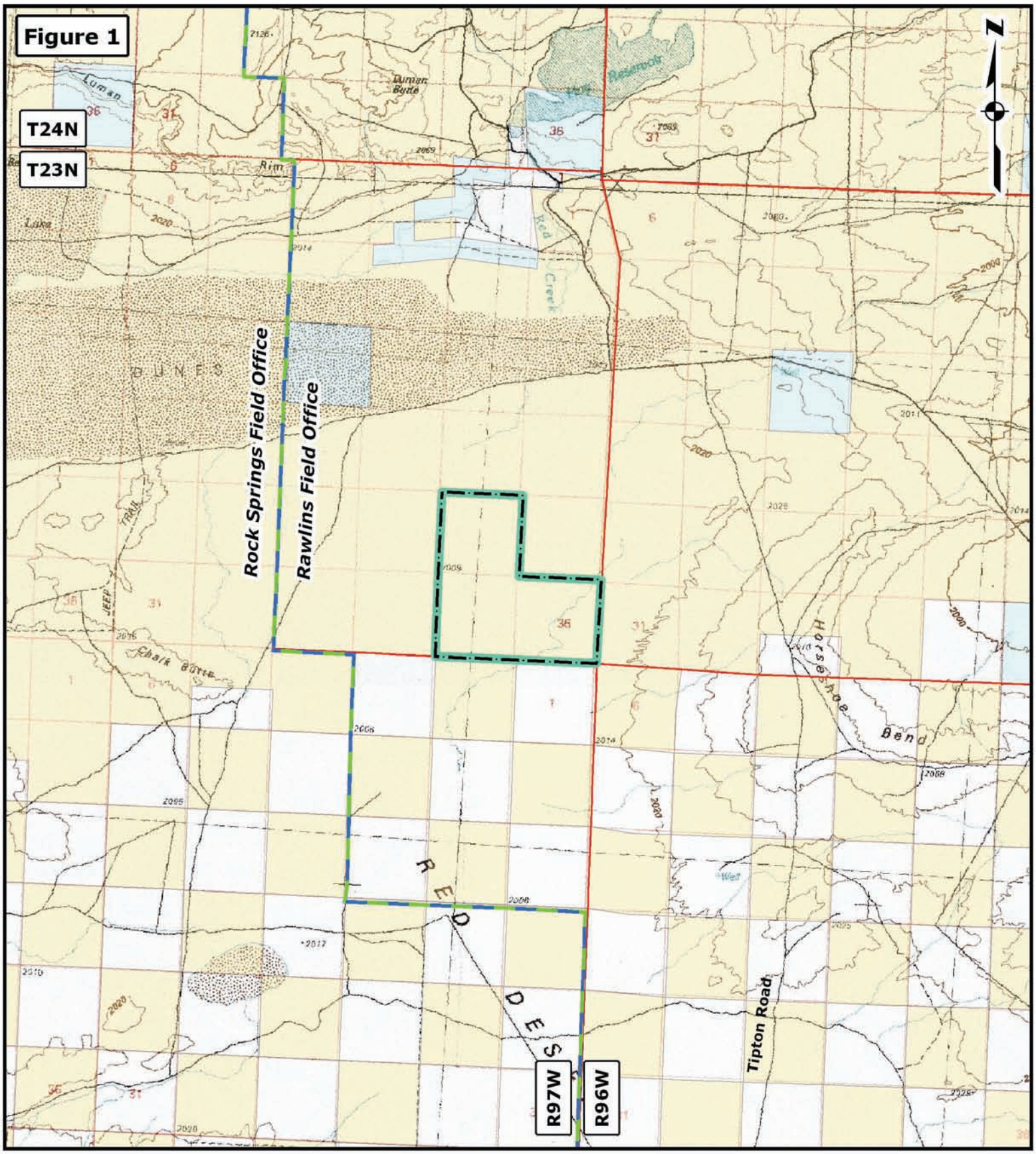
Component	Surface Disturbance	
	Short-Term	*Long-Term*
Well Pads (8)[1]	19.3	4.0
Access Roads/Utility Corridors[2]	28.2	14.1
Produced Water Impoundments[3]	79.4	79.4
Table 1 **Total**	**126.9**	**97.5**

[1] Short-term disturbance area approximately equal to 350' by 300' for each well (2.4 acres). Long-term disturbance area approximately equal to 150' by 150' for each well (0.5 acres).
[2] Short-term disturbance width of road/utility corridors approximately equal to 80'. Total length of proposed access road equal to 2.91 miles. Long-term disturbance area approximately equal to 40'.
[3] 8 impoundments, total, at 7 locations.

On November 17, 2006, the RFO Interdisciplinary Team (IDT) met with the proponent and the proponent's permit agent at the proposed project site to conduct an onsite review of the proposal. The proposed well locations, access roads, facilities, pipelines, and impoundment locations were reviewed and discussed.

The POD application includes several required mitigations or practices, including:

- Use of a bird deterrence system for the produced water impoundments
- Lining of impoundment facilities with 45 mil liner
- Leak detection for impoundment facilities
- Fencing of impoundments and pits to prevent entry by wildlife and livestock
- Monitoring of project components, including leak detection system and impoundments



U.S. Department of the Interior
Bureau of Land Management
Rawlins, Wyoming

0 1 2 3 4 Miles

1 inch equals 8,333.3 feet
1:100,000

Drafted By: TDB 07/25/2007

The BLM can not guarantee the accuracy of these data.

Legend

- Field Office Boundaries
- Hay Reservoir CBNG Infill & Impoundments
- *Bureau of Land Management*
- *Private*
- *State*

Produced gas would be transported by an existing pipeline to the Mountain Gas Resources gas compression facility located 4 miles north and east of the Project Area, at the junction of the Tipton Road and Luman Ranch Road.

The life of this project is estimated to be from 20-50 years.

The surface disturbance from activities would be reclaimed as described in the MSUP. Activities within Section 36, and addressed within this EA, will be considered under ROW application, whereas other activities will be considered under application for on-lease activities. ROW actions within Section 36 addressed in this EA include the construction, operation, and reclamation of the produced water impoundments and appurtenant access roads and pipelines. No additional drilling is considered within this EA for Section 36.

Produced Water Disposal

This project would result in the production of water from the target formation for the life of the project. The proponent has predicted a water production curve that anticipates water production would decline to about one-half of initial production within 9 months of beginning production.

Each well is anticipated to produce approximately 1,200 barrels of water per day, initially. This rate would decrease to approximately 100 barrels of water per day per well by about 3 years (*Figure 2*).

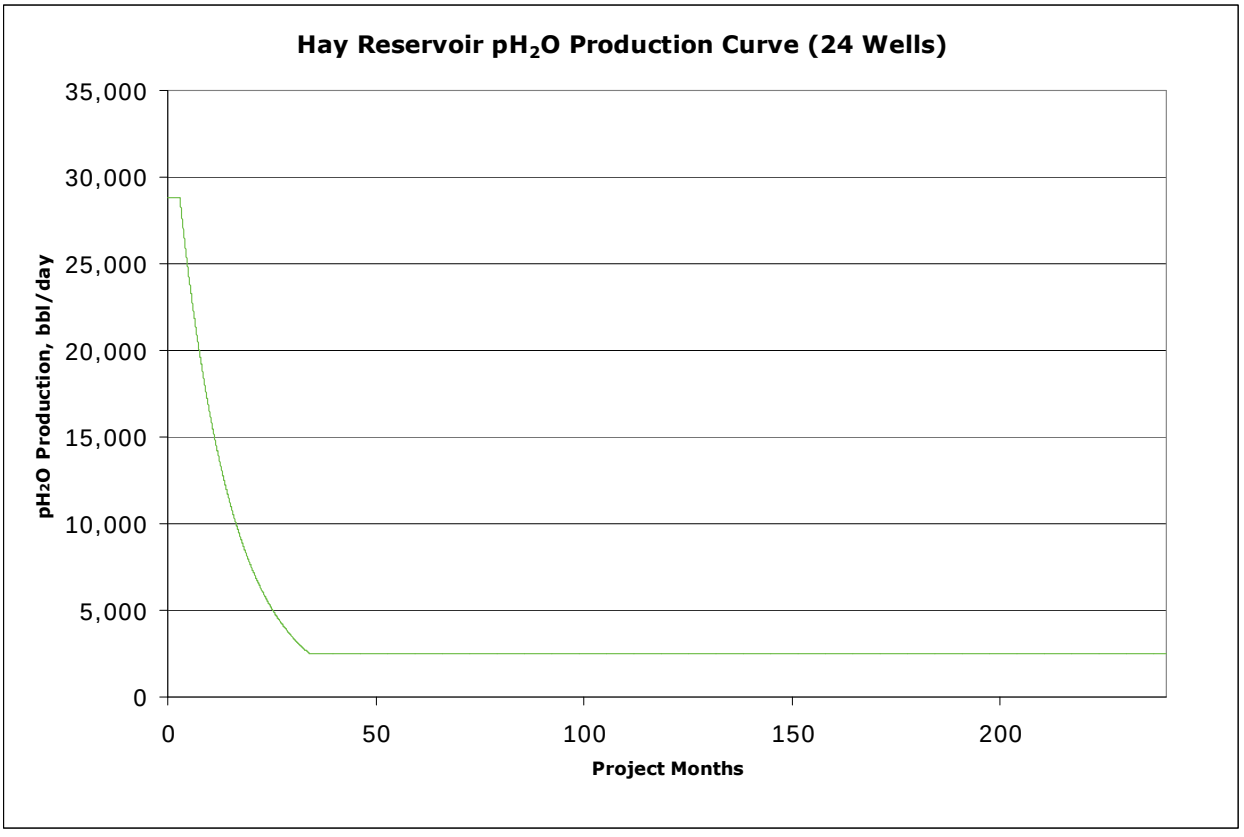


Figure 2

The proponent has developed an estimate of total water production over a 20-year period. Water disposal would occur by evaporation from the proposed 8 water impoundments. Seven water impoundments would be utilized full-time, with the eighth held empty for emergency capacity. Each pit (including berms around the perimeter) would be approximately 750 feet in length, 550 feet in width, and 20 feet in depth. The berms would rise above the native ground level and, so, the excavated depth below native ground level would range

from approximately 10-20 feet. Total surface disturbance from construction of each impoundment would approximately equal 10 acres. A freeboard of at least 2 feet would be maintained on all impoundments.

Evaporation rates would be augmented by utilizing pump-driven sprinklers/misters. These sprinklers/misters would be controlled such that spray is prevented from drifting outside of the impoundments. This would be accomplished by using 5-meter tall wind gauges, with sprinkler/mister operation shut down when wind speeds exceed approximately 15 mph.

The Water Management Plan states that "Pinnacle may identify and develop other off-channel containment facilities that would be added to the [POD]." If additional impoundment/disposal capacity is necessary, the BLM will require Pinnacle to submit new applications, and such actions would be subject to additional NEPA analysis and disclosure prior to consideration for authorization. This project proposal does not include a proposal for the transport of produced water from federal leases to off-lease impoundments; should such a proposal be made, additional review and NEPA analysis would be necessary.

Some amount of reinjection may be feasible by utilizing the two existing injection wells within the POD. Pinnacle expects that the injection rate of both wells, combined, is approximately 1400 bbls per day. The period of time over which injection at this rate is feasible is unknown.

Potential for seepage or release of produced water from the impoundments will be reduced by installation of a 45-mil liner and leak detection system. During production, the leak detection would be monitored quarterly for the first year of use, and then semi-annually until the project is completed and abandoned.

The impoundments would accumulate water from production inflows, and would lose water by evaporation. Pinnacle predicts that water evaporation would not occur during the winter months, when the air temperature and snow cover impede evaporation. Over time, water in the pit would evapo-concentrate salts (primarily NaCl and KCL, See *Figure 3*).

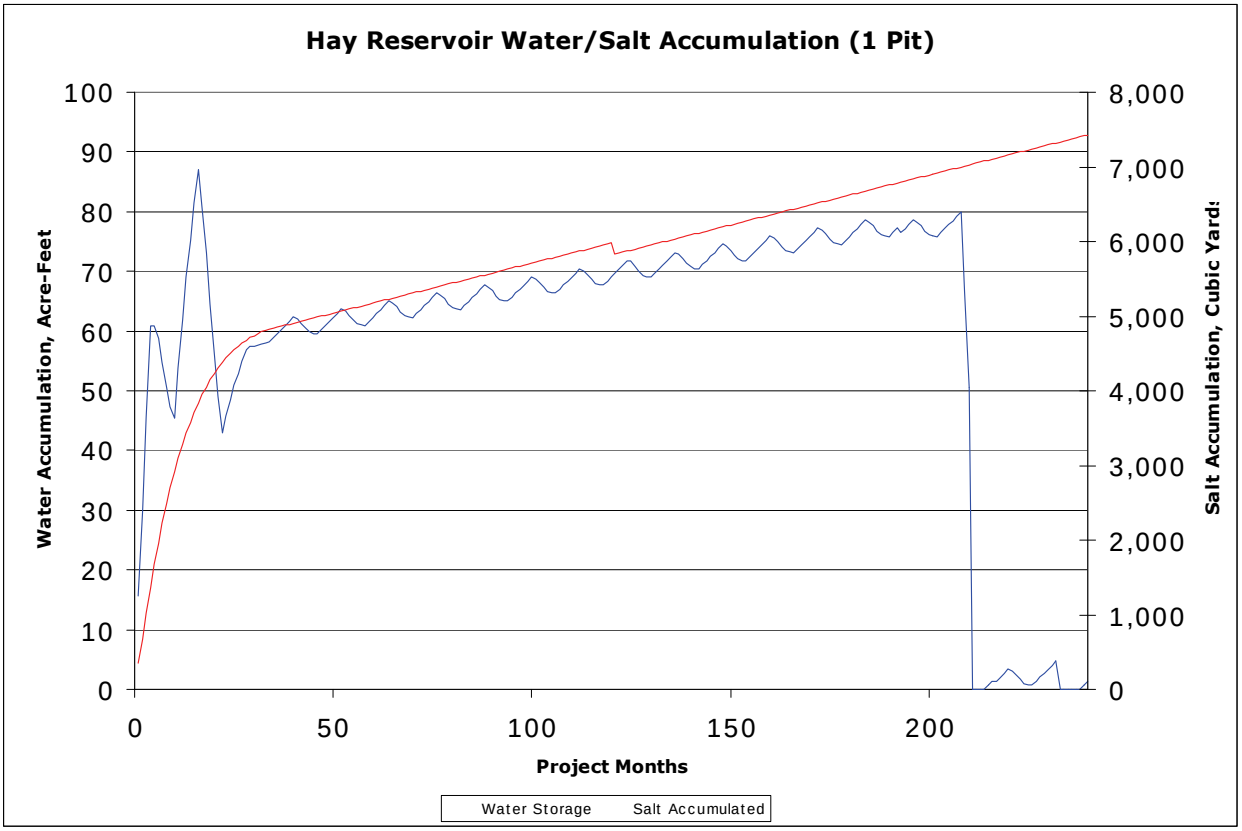


Figure 3*

* Assumes sprayers/misters are operating from beginning through Year 4 of the project, then turned off until they are briefly turned on again for short periods in Year 18 and Year 20.

Upon completion of the project (using a 20-year LOP), Pinnacle predicts that approximately 53,000 yd^3 of salt would be left behind in the impoundments. This would result in each of 7 impoundments (with one impoundment held for emergency purposes) containing salt solids and precipitates totaling approximately 4.7% of total pit capacity, or to a depth of approximately 2½ feet in the typical pit.

Upon completion of the project, the salt remaining in the lined impoundments would be sealed/wrapped between the impoundment liner (45 mil thickness) and (if necessary) additional liner that would be welded onto the impoundment liner (using a 20 mil liner), sealing the salts. The sealed salt cake would then be buried under native fill and mounded. The leak detection system would be kept in-place, and monitored for an additional 5 years past the date of field abandonment, on a semi-annual basis.

Should leachate be detected in the leak detection system, Pinnacle has indicated that they would have a trained diver examine the liner, and would weld any tears or punctures (during production) or make repairs to the liner (after production has ceased).

Development of Alternatives

In the development of alternatives for this analysis, guidance from BLM policy contained in Washington Office Instructional Memorandum (WY-IM) 2005-247, dated September 30, 2005:

> "The alternatives that must be analyzed are those: 1) which meet the purpose and need for the proposed action; 2) which reduce the adverse environmental effects of the proposed action; 3) which are feasible; 4) whose effects can be analyzed; and 5) which are not substantially similar in effects to an alternative that is analyzed."

No Action Alternative

NEPA regulations require that alternative analyses in NEPA documents "include the alternative of no action" (40 CFR 1502.14(d)). For this analysis, "no action" means that the BLM would reject the proponent's proposal and "the proposed activity would not take place."

ALTERNATIVES CONSIDERED, BUT ELIMINATED FROM FURTHER ANALYSIS

Drilling of Additional Reinjection Wells

Under this alternative, the Proponent would drill additional injection wells in order to dispose of produced water from the project.

The RFO asked the Proponent to prepare a report that analyzes, in detail, the potential for additional water disposal capacity by drilling additional reinjection wells. Specifically, the RFO asked the Proponent to address the potential for injection in shallower, deeper, and/or multiple formations relative to the current injection wells (completed to the "K-T Sands").

On January 19, 2007, the RFO received a report from the Proponent entitled "Evaluation of Water Disposal in Section 26 and 35, T23N, R97W." The RFO reviewed this report and supplemental information provided in the Water Management Plan (WMP).

It is apparent that there is limited feasibility for reinjection of produced water to acceptable formations. On January 8, 2007, the Proponent conducted an injection test at the #1-35I. The results of this test indicate that the formations currently completed into have limited capacity for injection, with an average injection rate of approximately 1400 bbls/day. Each CBNG well is predicted to produce approximately an equal amount of water, so an individual injection well would need to be drilled for each producing well. The Proponent indicated that this would be prohibitively expensive for them to consider, and is so infeasible.

In addition, geological cross-sections and downhole logs were reviewed to determine if potential alternative formations exist. As a result of this analysis, no readily-apparent alternative formations can be identified with stronger potential for reinjection/disposal.

Netting of Impoundments

Under this alternative, the bird deterrence system would be replaced with netting over the impoundments, preventing bird entry.

The Proponent has indicated that this is not a feasible alternative, as the expanse of netting necessary and the cost of installing and maintaining that netting, would render the project infeasible. In addition, the Proponent indicated that the number of the impoundments would need to be revised significantly upward and the size made much smaller, in order to reduce the span for the netting. This would result in an unknown, but additional amount of surface disturbance.

Netting of these pits would be difficult, as well, due to the high winds and snow accumulation in the winter. The RFO is uncertain if netting would render the project economically infeasible, as indicated by the Proponent. The RFO is unable to corroborate the claim that BLM Pinedale Field Office personnel have visited sites "on many occasions" with similar systems and that BLM personnel "were satisfied with their operations" (WMP at Page 9). The Proponent has full confidence in the bird deterrence system currently proposed, and is willing to "take full responsibility for any take of migratory birds."

Removal of Accumulated Salts to an Authorized Disposal Facility

Under this alternative, the 53,000 yd^3 of salts would not remain buried on public lands for perpetuity, but would be end-hauled to an appropriate disposal facility. The RFO asked the Proponent to consider such an alternative, but the Proponent indicated that the cost of end-hauling the salt (approximately equal to 4,400 dump truck loads) to a disposal facility such as an authorized landfill would be prohibitively expensive.

In addition, the use ofroad infrastructure from increased truck traffic to and from the disposal site would likely result in substantial, additional impacts (i.e., to wildlife, air quality, etc.).

AFFECTED ENVIRONMENT

The following critical elements of the human environment (Table 2) were considered in the course of this analysis.

	Affected			Affected	
Critical Element	**Yes**	**No**	**Critical Element**	**Yes**	**No**
Air Quality	X		T and E Species		X
ACEC's		X	Wastes, Hazardous/Solid	X	
Cultural Resources	X		Water Quality	X	
Prime/Unique Farmlands		X	Wetlands/Riparian Zones		X
Floodplains		X	Wild and Scenic Rivers		X
Native American Religious Concerns		X	Wilderness		X
Environmental Justice		X	Invasive, Nonnative Species	X	

Table 2

The Hay Reservoir CBNG Pilot EA (2005) provides a detailed description of the Affected Environment for the Proposed Action, and is incorporated by reference. Where additional detail or description has been deemed necessary, additional text is provided in this EA.

Where no measurable effects are anticipated to a Critical Element or resource, descriptions (Affected Environment and Environmental Consequences) of that element or resource are limited in order to focus this analysis on the principal issues to be considered in making a decision. RFO IDT review of the proposal was used to identify what the principal issues are for this project. Where determined by the IDT to be necessary,

Affected Environment descriptions are provided when that information is crucial for the context of considering the Proposed Action and alternatives.

Geology/Paleontology

No known scientifically significant paleontological resources are present in the project area.

Climate and Air Quality

The Project Area is located in a continental dry, cold-temperature-boreal climate (Trewartha 1968). This climate is characterized by a deficiency of precipitation (i.e., evaporation exceeds precipitation), and generally has cold temperatures where fewer than eight months of the year have an average temperature greater than 50° F, with warm summer days, cool summer nights, and cold winters.

The wind is often strong and gusty, reflecting and channeling flows in response to complex terrain. During the winter months, strong winds are often accompanied by snow, producing blizzard conditions and drifting snow. Winds are generally out of the south or southwest.

Mean annual precipitation is about 5 - 6 inches in the project area depending on elevation. January is the driest month (0.5 inches at Rawlins). The majority of precipitation falls as rain from frontal systems and thunderstorms. In regard to intensity of rainfall events, the 50-year, 24-hour precipitation rate ranges from 2.2 inches to 2.6 inches in the project area (Miller et al. 1973). Precipitation in this region varies significantly from year to year. For example, at Rawlins, the month of May has had as little as 0.03 inch and January as much as 1.9 inches of precipitation. The greatest annual precipitation recorded at Rawlins was 12.6 inches in 1998, while the least was 4.9 inches in 1954 (WRCC 2005).

Mean annual pan evaporation for this portion of southern Wyoming is about 75 inches, while the mean annual lake evaporation is around 55 inches. The potential annual evapotranspiration is roughly 20 inches (Martner 1986). Compared to the average annual precipitation of 10 inches, this gives an average annual deficit of approximately 10 inches.

Soils

The water erosion hazard potential for these soils is severe and the wind erosion hazard potential is slight.

Water Resources

The proposed Project is located in the Great Divide Basin, so named for its position on the Continental Divide. Elevations range from 9,225 feet on Whiskey Peak to 6,500 feet on the Basin's floor. The elevations of the proposed Project Area are between approximately 6,585 and 6,600 feet. Major water resources in this part of the Basin include the Chain Lakes area and numerous playas that serve as drainage basins for intermittent streams. There are no major drainages in the Project Area.

There is a large dry lakebed located in Sections 26, 35, and 36 of T23N, R97W of the Project Area. As a result of the arid nature of this location, the only water in the lake occurs from direct rainfall and snowmelt. In the event of a 100-year storm, the lake could potentially hold 593 acre-feet of runoff which would fill the lake to a depth of approximately six inches. The vast size of the ponded area compared to the contributing watershed area prevents the lake from filling any deeper (Applied Hydrology Associates, Inc. 2003).

Groundwater

Hydrogeology

Very little hydrogeologic data exists for the Great Divide Basin. In general, aquifers in Quaternary alluvium, wind blown, lacustrine, and gravel deposits are unconfined (i.e. permeable material extends from the land surface to the saturated zone). In Tertiary (or deeper) geological units, artesian (confined) conditions exist.

Depth to confined or unconfined groundwater generally ranges from 80 to 200 feet (Welder and McGreevy, 1966; Welder, 1968), but can be substantially deeper. Major recharge areas for the Great Divide Basin occur in high areas of the northeast part of the basin, in the southwest near the Rock Springs Uplift, along the Rawlins Uplift, and in the high areas around Creston Junction (Fisk, 1967). Fisk (1967) reported that, although structurally distinct, there exists direct hydraulic communication between the Great Divide Basin and the Washakie Structural Basin. The principal aquifers of the Great Divide Basin include the Madison, Tensleep, and Mesaverde. Recharge along the basin periphery tends to migrate towards the basin axis, while discharge from the basin flows east, out of the east-central part of the basin via the Wasatch zone of the Wasatch-Fort Union aquifer (Fisk, 1967).

Groundwater data for the project area comes from several different monitoring wells drilled for hydrogeological analysis. Groundwater in the project area is unconfined with depths to initial water typically less than 40 feet below ground surface. Water quality results from these monitoring wells can be found in Appendix C.

Vegetation/Wetlands/Invasive Weeds

The Great Divide Basin is within the Upper Sonoran zone. The most commonly seen plants in the Project Area are greasewood, Gardner's saltbush, squirreltail, bluegrass and Polanasia spp.

The Project Area is within the Cyclone Rim Allotment (#10103). Acreage for this allotment is approximately 308,608 acres, of which approximately 291,954 acres are BLM-administered public lands. Grazing operators include Jolley Livestock Grazing Association, LLC, Peterson Livestock, LLC, Alkali Creek Grazing Association, LLC, Stratton Sheep Company, and Salisbury Livestock Co.

Animal Unit Months (AUMs) are determined by livestock type and season. Dormant season grazing is able to support more livestock: cattle use in the winter is approximately 12 acres per AUM verses cattle use in the summer which is approximately 20 acres per AUM; sheep use in the winter is approximately 10 acres per AUM verses summer grazing which is approximately 20 acres per AUM.

In 2002 a Standards and Guidelines evaluation was performed. Grazing management on this Allotment was evaluated by the RFO as satisfactory, and the overall trend of use and sustainability is static. In the Standards and Guides Report for the Great Divide Basin (Rawlins Field Office), the Cyclone Rim Allotment passed all standards except #2 Riparian/Wetland Health (USDI BLM 2003). The riparian/wetland health standards are currently being addressed in management plans or as range improvement projects. There are no riparian or wetland areas within the Project Area.

Wildlife/Fisheries

Three big game species, pronghorn antelope, mule deer, and elk occur in the Project Area during all or parts of the year. No big game crucial winter range occurs within the Project Area.

The greater sage-grouse is an important upland game bird in the State of Wyoming. The Project Area is not within suitable sage grouse habitat for breeding, nesting, brood rearing or winter occupation. According to WGF records and RFO records, no leks are located within 2 miles of the Project area.

Several species of raptors and other migratory birds occur or potentially occur within the Project Area and use the area for feeding and travel routes. They include the ferruginous hawk, burrowing owl, golden eagle, northern harriers, redtailed hawk, prairie falcon, American kestrel, long-eared owl, short-eared owl, great horned owl and Swainson's hawk. No active nests are known within the Project Area.

Wild Horses

The Project Area is within the Lost Creek wild horse Herd Management Area (HMA). The Lost Creek HMA encompasses 250,000 acres, of which 235,000 acres are BLM-administered public lands. The "appropriate management level" (AML) for this HMA is 70 horses. The current herd population is approximately 116

animals. The Project Area is in a portion of the Lost Creek HMA that historically has been used by wild horses which most likely came from the Divide HMA administered by the Rock Springs BLM Field Office.

Recreation and Visual Resources

Recreational activities occurring in or near the Project Area include hunting for small and big game, camping, hiking wildlife and wild horse viewing, ORV use and sightseeing. No developed recreational sites, facilities, or special recreational management areas exist within or near the Project Area.

The project is located within Class III Visual Resource Management (VRM). This classification permits changes to the landscape as follows:

> "Contrasts to the basic elements caused by a management activity are evident but should remain subordinate to the existing landscape."

Cultural Resources

A cultural resources inventory has been previously-conducted for the area directly impacted by the Proposed Action (area of proposed surface disturbance).

No National Register of Historic Places-eligible sites were discovered where new surface disturbance is proposed.

Socioeconomics

Oil and gas development represents an important and significant contributor to the economy of Carbon County and the State of Wyoming. Natural gas production is important for the region and nation as a source of energy.

Health and Safety

Hazards associated with existing activities in the project area include occupational hazards from construction and development activity, increased traffic on roads, and low-probability events such as rangeland fires.

Noise

Artificial noise within the project area currently arises from on-going oil and gas operations, vehicle traffic, and jet over-flights at high altitudes. The wind common to this area plays an important role in directing artificially-generated noise and in the background noise present.

ENVIRONMENTAL CONSEQUENCES

Environmental Consequences- Proposed Action

Geology/Paleontology

No measurable impacts to geologic or paleontologic resources are predicted.

Climate and Air Quality

The construction and operation of the project would have an impact, though immeasurable, on air quality. The impacts would include the addition of dust and vehicle emissions during construction, and the release of various production gases. The airborne pollutant concentrations that would result from emissions at the location and along the access road would meet all Wyoming and federal ambient air quality standards. Likewise, the impact to air quality-related values (visibility, acid deposition, and soils/vegetation) would not be noticeable.

Soils

Approximately 126.9 acres of additional surface disturbance would directly impact soils. Soil productivity on disturbed areas would be reduced until reclamation is effectively complete. Erosion from the constructed facilities would be controlled by the operator in accordance with the MSUP.

Water Resources

The construction and use of the produced water impoundments creates the potential for contamination of shallow groundwater by produced water in storage. The use of a 45-mil liner, leak detection, and the relative impermeability of native soils substantially reduces the risk of groundwater contamination.

Vegetation/Wetlands/Invasive Weeds

Vegetation

Construction of the water treatment facilities and pipeline would result in the short-term disturbance of approximately 126.9 acres of surface area. The range site carrying capacities in this area of the Cyclone Rim allotment are generally low (~15-20 acres/animal-unit month (AUM)), and it is predicted that less than approximately 8 AUM (~780 pounds, air-dry) of forage would be lost during construction operations.

Invasive Weeds

The disturbance associated with construction activities may result in the subsequent infestation of project-related disturbances by Halogeton, which is present on adjacent disturbances. Sheep use of the project area requires that Halogeton be strictly monitored and controlled.

The Proponent will be required to control weed infestations arising from their operations; the identification and monitoring of weed populations (if present) would be necessary to determine if the Proposed Action results in the spread of invasive weeds. The Proponent has described how weeds would be controlled in the *Integrated Pest Management Plan* (See Appendix B)

Wildlife/Fisheries

Wildlife

Migratory birds may be attracted to the open impoundments. The effectiveness of the bird deterrence system proposed is unknown. Should the bird deterrence system not prove to be totally effective, migratory birds may come into contact with the water.

Salt toxicosis has been reported in ponds with sodium concentrations over 17,000 milligrams per liter (parts per million) (Windingstad et al. 1987). Ingestion of water containing high sodium levels can also pose chronic effects to aquatic birds, especially if a source of freshwater is not available nearby. Aquatic birds ingesting hypersaline water can be more susceptible to avian botulism (Cooch 1964). During cooler temperatures, sodium in the hypersaline water can crystallize on the feathers of birds landing in these waterbodies. The sodium crystals destroy the feathers' thermoregulatory and buoyancy functions causing the bird to die of hypothermia or drowning. Birds preening the salt crystals off their feathers can ingest the salt. Ingestion of as little as 4 g of salt crystals (NaCl) could be lethal for waterfowl. Sodium intoxication can cause neurological impairment resulting in the bird's inability to hold its head upright (Meteyer et al. 1997). The bird's head will droop into the water and cause it to drown.

Construction activities will result in the temporary displacement of small mammals and other animals that may be present.

No sensitive species are known to occupy the project area, and no impacts to sensitive species are foreseen if bird deterrence is effective.

Recreation and Visual Resources

This project is not anticipated to directly affect recreation use in the vicinity. Visual impacts would be minimized by painting above ground facilities, re-contouring during intermediate and final reclamation, and revegetation of disturbances.

The reclaimed impoundments are designed with a mounded surface, to shed water away from the sequestered salt cake. These mounds will be apparent for perpetuity in a landscape dominated by flat terrain with small dune complexes.

Cultural Resources

No NRHP-eligible resources were found to be present where surface-disturbing activities are proposed, and so no impacts to cultural resources are expected as a result of construction.

If any cultural artifacts or materials are located during project construction activities, work will stop and the Authorized Officer of the BLM will be notified.

Socioeconomics

The activity associated with the Proposed Action would result in additional wage-earning revenue for workers participating in development activities, and potentially additional royalties, taxes, and other benefits to Federal, State, and local governments.

Health and Safety

There would be some increased risk caused by the Proposed Action. Risks include higher vehicle accident potential due to increased traffic, as well as the normal hazards to industry workers from construction operations.

Hazardous Substances/Wastes

The Proponent has indicated in their POD application that hazardous substances will be used in project operations. The term "hazardous materials" as used here means: 1) any substance, pollutant, or contaminant (regardless of quantity) listed as hazardous under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended, 42 U.S.C. 9601 et seq., and the regulations issued under CERCLA; 2) any hazardous waste as defined in the Resource Conservation and Recovery Act (RCRA) of 1976, as amended; and 3) any nuclear or nuclear byproduct as defined by the Atomic Energy Act of 1954, as amended, 42 U.D.C. 2011 et seq.

The Proponent will be required to provide a contingency plan to the RFO to address accidental releases of hazardous substances, produced water, and/or hydrocarbons.

Impacts to soils, surface and groundwater resources, wildlife, vegetation, and human health could result from the accidental release of hazardous materials. Since the project operation would be designed to comply with all applicable federal and state laws concerning hazardous materials, no impacts are anticipated.

The waste salt left buried for perpetuity in the sequestered salt cakes is not expected to be released to the environment in the near future (five years from the end of the project). The integrity of the liners sealing the salt cake over the long term (i.e., many decades) is unknown. Should the liners' integrity be compromised while the leak detection system is being monitored (during production and up to five years post-abandonment), the release should be detected. A repair of the liner or mitigation of the release could then be implemented.

In addition, this area is subject to irregular and intermittent inundation. Should the salt be released from the liner, salts could slowly migrate upward, affecting vegetation by percolating into the root zones of plants

present and resulting in salt-kill. As well, the leachate from the salt cake (if the liner is not effective forever) could slowly migrate to shallow groundwater, causing contamination of the ground water.

The abandonment of approximately 53,000 yd^3 of salt buried on public lands will potentially limit future uses of the land where the impoundments are located. The reclaimed impoundments are designed with a mounded surface, to shed water away from the sequestered salt cake. These mounds will be apparent for perpetuity.

Noise

The Proposed Action would increase noise levels in the immediate area during construction and water treatment operations. Construction activities and associated increased noise levels would be temporary, lasting as long as the construction activities were ongoing. At the treatment facility, operations noise would occur for the duration of operations.

EPA has established a level of 55 dBA as a guideline for acceptable environmental noise. A noise level of 60 dBA is generated between two people engaged in normal conversation standing five feet apart. Anticipated background noise levels in rural areas is anticipated to be approximately 40 dBA. Given that the project vicinity is subject to frequent winds, the natural noise levels in the project area may approximate 50 dBA during the daylight hours. Wind typically adds 5 to 10 dBA. Damage to the unprotected human ear can occur at noise levels of 115 dBA and above. The 55 dBA EPA standard represents very low noise levels and indicates the level below which no environmental effects could reasonably be expected.

Based on an average noise level of 85 dBA measured at 50 feet from a typical construction site, the expected noise levels would be 85 dBA at 50 feet, 65 dBA at 100 feet, 59 dBA at 500 feet, 55 dBA at 1,500 feet, and 53 dBA at 2,000 feet from the construction equipment. Therefore, an area of somewhat less than 288 acres around the project site would temporarily experience noise levels in excess of the EPA standard. The area around the project location would experience temporary noise levels in excess of those associated with normal human conversation. The absence of any residence or human receptor likely to experience extended noise levels associated with this development under the Proposed Action limits potential impacts due to temporary and intermittent increases in noise levels for the duration of drilling and construction activity.

Environmental Consequences- No Action Alternative

Under the No Action alternative, the Proposed Action would not be authorized. As such, no additional direct or indirect impacts to human health and the environment would occur. On-going natural gas development would continue to occur, and future actions would be considered as submitted by proponents in the project area.

Environmental Consequences: Cumulative Impacts

Cumulative impacts are those impacts to the environment resulting from incremental impacts of an action when added to past, present, and reasonably foreseeable future actions. The Cumulative Impacts Assessment Area (CIAA) for the Proposed Action and alternatives is primarily the HUC-12 watershed inclusive of the project. Although the domain used for a CIAA typically varies by resource or jurisdictional boundary, the predicted impacts from the Proposed Action and alternative actions are expected to be fairly local in scope. In addition, where impacts are expected to be un-measurable, cumulative impacts analysis may serve to only document existing impacts within a CIAA. As a result, the CIAA for this section of the impacts analysis is limited to the affected HUC-12 watershed.

New surface disturbance arising from construction operations would be located, in all alternatives, within the North Red Desert Basin HUC-12 watershed. This watershed is equal to 84,701 acres in size.

Cumulative Impacts- Existing Setting

Within the CIAA, primary existing and reasonably foreseeable activities include oil and gas development, livestock production, and hunting and other recreation activities. There is a single public road within the project area. Primary landscape-scale perturbations have arisen from oil and gas development activities.

There are 59 wells producing, shut-in, or in the process of being drilled within the Hydrologic Unit Code (HUC) 12-level watershed (North Red Desert Basin) in which the project is located (Figure 4). There are, in addition, 26 approved APD's (not yet drilled) on file at the Wyoming Oil and Gas Conservation Commission as of September 2006. In total, then, there are 85 existing and reasonably foreseeable APDs in the watershed.

In a 2005 review of surface disturbance within the RFO jurisdiction, the average per-well disturbance area for natural gas wells (well pad and access road) was found to be 7.0 acres. This does not account for pipelines, compression facilities, and other actions related to natural gas development. In other project areas, these ancillary facilities increased the average per-well disturbance by a proportion of approximately 25-30%. So, for the purposes of this analysis, and since actual disturbance within the CIAA is unknown, an assumption is made that per-well disturbance is equal to 9.0 acres (7.0 acres [pad and road] plus 2.0 acres [pipelines, ancillary facilities]).

Using an assumption of 9.0 acres of disturbance per well, the 85 existing and reasonably foreseeable wells would result in a total cumulative oil and gas development disturbance (short-term) of 765.0 acres within the watershed. This equals approximately 0.9% of the 84,701-acre watershed area. Undoubtedly, some unknown proportion of the existing wells have had reclamation initiated or even successfully completed for production operations. Likewise, some of the plugged and abandoned wells within the CIAA may not have been completely and/or successfully reclaimed.

Cumulative Impacts- Proposed Action

In total, the approval of this project would add approximately 126.9 acres of construction-related surface disturbance to the area. This represents approximately a 0.2% increase in extant surface disturbance within the CIAA, and corresponding .changes in forage availability and soil productivity.

Incremental increases in measurable impacts to soils, vegetation, invasive weed infestations, terrestrial wildlife, recreation, and noise are expected, but would be small.

Cumulative Impacts- No Action Alternative

Under this alternative, no additional impacts would be created; existing development and activities would remain, and future activities from oil and gas development are likely to occur.

Consultation and Coordination

The RFO has consulted, formally or informally, with the following organizations or agencies:

- Pinnacle Gas Resources, Inc. (Sheridan, Wyoming): proponent
- Pearl Field Services (Sheridan, Wyoming): proponent's permit agent
- U.S. Fish and Wildlife Service (Rawlins, Woming [Pilot Office Representative]): Federal agency
- State Historic Preservation Office (Cheyenne, Wyoming): regulatory agency

The BLM-RFO Interdisciplinary Team (IDT) prepared this EA, conducted field reviews and data gathering, and consulted with the above entities.

- Travis Bargsten, Natural Resource Specialist, Project Lead
- David Simons, Environmental Planner
- Andy Stone, Hydrologist
- Mike Calton, Rangeland Management Specialist
- Hilaire Peck, Engineer
- Heather Nino, Realty Specialist
- Paul Rau, Recreation Planner
- Heath Cline, Biologist
- Bonni Bruce, Archaeologist

- Mark Newman, Geologist
- Susan Foley, Soil Scientist
- Jon Dull, Petroleum Engineer

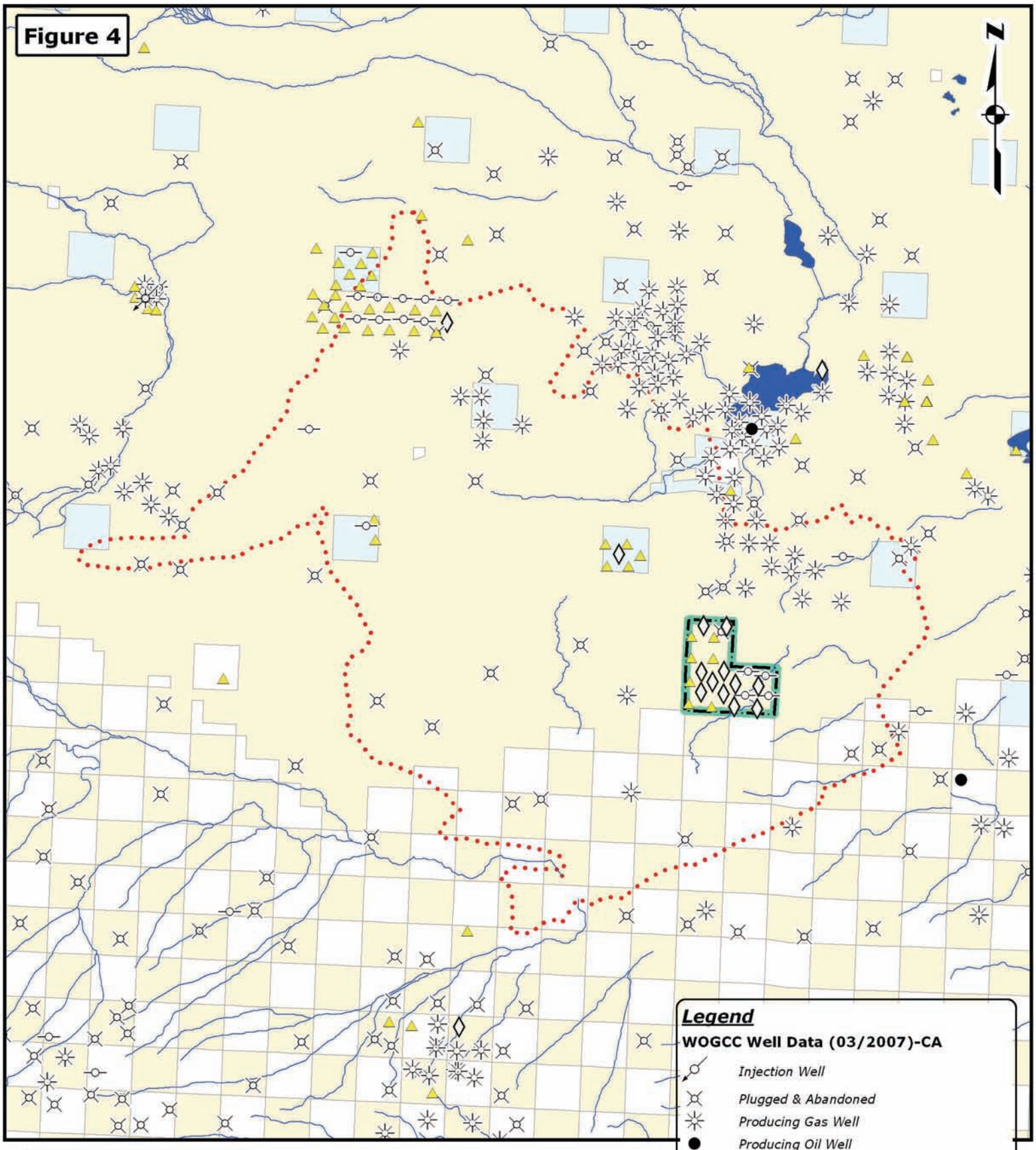


Figure 4
N
Legend
WOGCC Well Data (03/2007)-CA
Injection Well
Plugged & Abandoned
Producing Gas Well
Producing Oil Well
Shut-In
Spud
North Red Desert Basin
Hay Reservoir CBNG Infill & Impoundments
Bureau of Land Management
Private
State
Miles
0 1 2 3 4 5 6 7
1 inch equals 15,000 feet
1:180,000
Drafted By: TDB 07/25/2007
The BLM can not guarantee the accuracy of these data.
U.S. Department of the Interior
Bureau of Land Management
Rawlins, Wyoming

REFERENCES

Cooch, F. G. 1964. A preliminary study of the survival value of a functional salt gland in prairie Anatidae. Auk 81:380-393

Fisk, E.P., 1967, Groundwater geology and hydrology of the Great Divide and Washakie basins south central Wyoming: Los Angeles, University of Southern California, unpublished maters thesis, 132 p.

Meteyer CU, Dubielzig RR, Dein FJ, Baeten LA, Moore MK, Jehl JR Jr and K Wesenberg. 1997. Sodium toxicity and pathology associated with exposure of waterfowl to hypersaline playa lakes of southeast New Mexico. J. Vet. Diagn. Invest. 9: 269-280

Welder, G.E., 1968, Ground-water reconnaissance of the Green River Basin southwestern Wyoming: U.S. Geological Survey Hydrologic Investigations Atlas HA-290, 2 sheets; accompanying text, 5 p.

Welder G.E., and McGreevy, L.J., 1966, Ground-water reconnaissance of the Great Divide and Washakie Basins and some adjacent areas, southwestern Wyoming: U.S. Geological Survey Hydrologic Investigations Atlas HA-219, 3 sheets; accompanying text, 10 p.

Windingstad, R.M. et al. 1987. Salt toxicosis in waterfowl in North Dakota. Jour. Wildlife Diseases 23(3):443-446

WOGCC, 2006. GIS Data for State APDs, Carbon County, Wyoming.

WSEO, 2007. Ground and Surface Water Appropriations Data (obtained from WSEO website: http://seo.state.wy.us/wrdb/index.aspx).

APPENDIX A

MASTER DRILLING PLAN

Pinnacle Gas Resources, Inc.
Sweetwater South Federal POD
Sweetwater County, Wyoming

Plan of Development (POD) – Interim Coalbed Methane Wells

The Pinnacle Gas Resources, Inc. (Pinnacle) Sweetwater South Coalbed Methane Federal Plan of Development Project is located in Sweetwater County, Wyoming. This POD includes portions of Sections 26 and 35 in Township 23 North, Range 97 West.

The Sweetwater South Federal POD development proposal consists of 8 wells at 8 locations with attendant developments and facilities as shown on the Project Map (see Project Map in Section 5). These 8 wells, identified in Appendix 3.1 *Proposed Well List*, are coalbed methane (CBNG) exploration/development wells. The listed wells and corresponding leases are located within the Sweetwater South Coalbed Methane Federal Plan of Development Project area. Drill site locations will be on approved 80-acre spacing, although in the future, Pinnacle may find it necessary to increase that to 40-acre spacing.

1. ESTIMATED IMPORTANT GEOLOGICAL MARKERS

Formation	Depth (feet)
Fort Union	1400
Big Red	3800

Please see Table 1-2: *Proposed Well List – Drilling Data* in Appendix 3.1 *Proposed Well List* for target coal seam for each well.

2. ESTIMATED DEPTH OF ANTICIPATED WATER OR GAS

Shallow sands from surface to the top of the Fort Union coals may contain fresh water. Any shallow water zones encountered will be adequately protected and reported. All potentially productive hydrocarbon zones will be cemented off..

3. PRESSURE CONTROL PROGRAM

1.0 **TYPE:** 10" 2mm Hydril with choke, manifold, and 9"-10" casing head. There will be a fill line above the uppermost preventer.

2.0 **PRESSURE RATING:** 2000 psi BOP, 2000 psi choke manifold and accumulator, and a 2000 psi casing head.

3.0 **TESTING PROCEDURE:** Hydril preventer and related control equipment (choke manifold, Kelly cocks, etc.) will be pressure-tested to 100% of their rated working pressure for 10 minutes. The casing string will be tested to 70% of its internal yield strength.

BOPs will be tested when installed, every 30 days, or when any seal is broken (per Onshore Order No. 2). The fill line will be 2", the kill line will be 2", and the choke relief line will be 3". BOP drills and tests will be recorded in the driller's log.

The choke manifold will be located outside the sub-structure or hydraulic BOP closing unit will be located at least 25 feet from the well head. Exact locations and configurations will depend on the particular rig contracted to drill each hole.

The choke line that connects the BOP stack to the choke manifold will be as straight as possible and turns, if required, will have a targeted T-block if the required BOP stack is three thousand pounds or greater. A flare line will be installed after the choke manifold and will extend a minimum of 125 feet from the center of the drill hole to the pit.

4. CASING AND CEMENTING PROGRAM

1.0 Casing Program

The wells will be drilled to an estimated total depth of less than 4800' (TMD). Surface casing on all Pinnacle Gas Resources, Inc. wells will always be at least 10% of the total depth of the well. Pinnacle Gas Resources, Inc. will cement all surface casings with Type III cement with returns of the cement slurry to surface.

TABLE 4-1

DEPTH	HOLE SIZE (inches)	CASING SIZE (inches)	GRADE	WT./FT.	JOINT
*	12 ¼	9 5/8	J55	36#	ST&C
TD	8 3/4	7	J-55	23#	ST&C/LT&C

Casing strings will be pressure tested to 0.22 psi/ft or 1500 psi, whichever is greater. Minimum design factors for tension, collapse, and burst are:

- Tension: 1.6
- Collapse: 1.125
- Burst: 1.0

2.0 Cementing Program

1.0.0 Surface Pipe

Surface pipe will be cemented back to the surface, with 100% excess, using CBM Lite cement and a 2% calcium chloride accelerator with additives.

2.0.0 Production Casing

Production casing will be cemented back to surface using lite cement and the appropriate number of sacks of Class G (tail).

A sufficient amount of cement will be used, in all cases, to ensure that all potentially

productive hydrocarbon zones are cemented off. Bond logs will be run in the event of lost circulation.

3.0.0 WOC Time

WOC time is a *minimum* of 12 hours until cement is stabilized.

4.0.0 Centralizers

Three (3) on bottom three (3) jts of surface pipe (I on each jt.); three (3) on bottom of long string; one (1) in surface for production casing.

5. MUD PROGRAM

TABLE 5-1

INTERVAL	TYPE	WEIGHT	FUNNEL VISCOSITY	FLUID LOSS
0-TD	Native/surfactants/LCM*/bentonite	9.34	35-40 seconds	NC

*Drilling mud would consist of fresh water, native clays, and bentonite gel. As hole conditions dictate, small amounts of polymer additives, potassium chloride salts, surfactants, and loss-circulation materials will be added for hole cleaning and stabilization.

6. WATER SOURCE

Water for the drilling program will be pulled from a private water well in the NENE Section 11, TR45, T24N, R97W near Hay Reservoir and from SWS State 01BR-36-23-97. Water analysis reports from both wells can be found in Appendix 6.2.

7. EVALUATION PROGRAM

1.0 **Logs:** Dual Induction/Gamma Ray (TD-surface), Density (optional)

2.0 **DSTs:** None anticipated

3.0 **Cores:** None anticipated

4.0 **Samples:** 10' samples to bottom of producing casing: 1' samples across coal. Evaluation program may change at the discretion of the well site supervisor.

8. ABNORMAL CONDITIONS

1.0 None anticipated during drilling and completion.

2.0 The surface sands and the Fort Union coal are potential zones of lost circulation.

This will be alleviated by the use of lost circulation materials, as needed.

3.0 Maximum anticipated bottom hole pressure equals 2078 psi. Maximum anticipated surface pressure equals 0 psi.

4.0 Pinnacle does not expect to encounter any H_2S gas based on reports from previous drilling in the area at the same depth.

9. DRILLING ACTIVITY

1.0 **Anticipated Starting Date:** BLM will be notified of spud date at least 24 hours in advance for each individual well.

2.0 **Drilling Days:** Approximately 10 days

3.0 **Completion Days:** Approximately 20 days

4.0 **Auxiliary Equipment and Additional Instructions:**

- A Kelly cock will be kept in the string at all times.
- Each tour, the mud system will be checked periodically.
- A stabbing valve will be kept on the derrick floor to be stabbed into the drill pipe whenever the Kelly is not in the string.
- No bit float will be used.

10. COMPLETION ACTIVITY/STIMULATION

1.0 **Perforate Big Red Coal:** Six (6) shots per foot with 4" casing gun.

2.0 **Frac with proposed frac program:** 6000# per foot with 20/40 frac sand.

3.0 **Tubing:** 2 7/8" J55, 6.4#.

4.0 **Drill site:** As approved, will be of sufficient size to accommodate all completion activities.

5.0 **Gas Measurement:** Pinnacle proposes and requests approval to use 2" meter tubes that are constructed in accordance with API 14.3/AGA 2000 Report #3 and EFCs that comply with the standards in NTL 2004-1 at the well head. Pinnacle will also have a centralized measurement facility at a custody transfer point planned for the northeast of Section 26, T23N, R97W.

11. NOTIFICATION

Specific contacts and phone numbers are located in Appendix 4.8 *Contact Information.*

All wells (drilling, producing, suspended, or abandoned) shall be identified in accordance with 43 CFR 3162.6 which requires the name of the operator, lease number, well number, and location of the well. In accordance with *Onshore Oil & Gas Order No.1,* all wells will be reported on MMS from 3160-6, *Monthly Report of Operations and Production* (form #3160-6), starting with the month in which operations commenced and continuing each month until the well is physically plugged and abandoned.

All undesirable events (fires, accidents, blowouts, spills, discharges) as specified in NTL-3A will be reported to the Rawlins Field Office. Major events will be reported verbally within twenty-four (24) hours and will be followed with a written report within fifteen (15) days. 'Other than Major Events' will be reported in writing within fifteen (15) days. 'Minor Events' will be reported on the *Monthly Report of Operations and Production* (Form #3160-6).

No well abandonment operations will be commenced without the prior approval of the Authorized Officer (AO). In the case of newly-drilled dry holes or failures, and in emergency situations, oral approval will be obtained from the Area Petroleum Engineer.

A *Notice of Intent to Abandon* (Form #3160-5) will be filed with the AO within fifteen (15) days following the granting of oral approval to plug and abandon. Upon completion of approval plugging, a regulation marker will be erected in accordance with 43 CFR 3162.6. The following information will be permanently placed on the marker with a plate or cap, or beaded-on with a welding torch: Operator Name, Well Name and Number, Location by Quarter/Quarter, Section, Township, Range, and Federal Lease Number.

A *Subsequent Report of Abandonment* (Form #3160-5) will be submitted within thirty (30) days following the actual plugging of the well bore. This report will indicate where plugs were placed and the current status of surface restoration operations. If surface restoration has not been completed at that time, a follow-up report on form 3160-5 will be filed when all surface restoration work has been completed and the location is considered ready for final inspection. Pursuant to NTL-4A, lessees and operators are authorized to vent/flare gas during initial well evaluation tests, not exceeding a period of thirty (30) days or the production of fifty (50) MMCF of gas, whichever occurs first. An application must be filed with the AO, and approval received, for any venting/flaring of gas beyond the initial thirty (30) days or otherwise authorized test period.

Not later than the 5th business day after any well begins production on which royalty is due anywhere on a lease site or allocated to a lease site, or resumes production in the case of a well which has been off production for more than ninety (90) days, the operator shall notify the AO by letter or Sundry Notice of the date on which such production has begun or resumed.

The notification shall provide, as a minimum, the following information:

- Operator name, address, telephone number
- Well name and number
- Well location, i.e. quarter/quarter, applicable Dependent Resurvey Lot Number, township, range, and principal meridian.

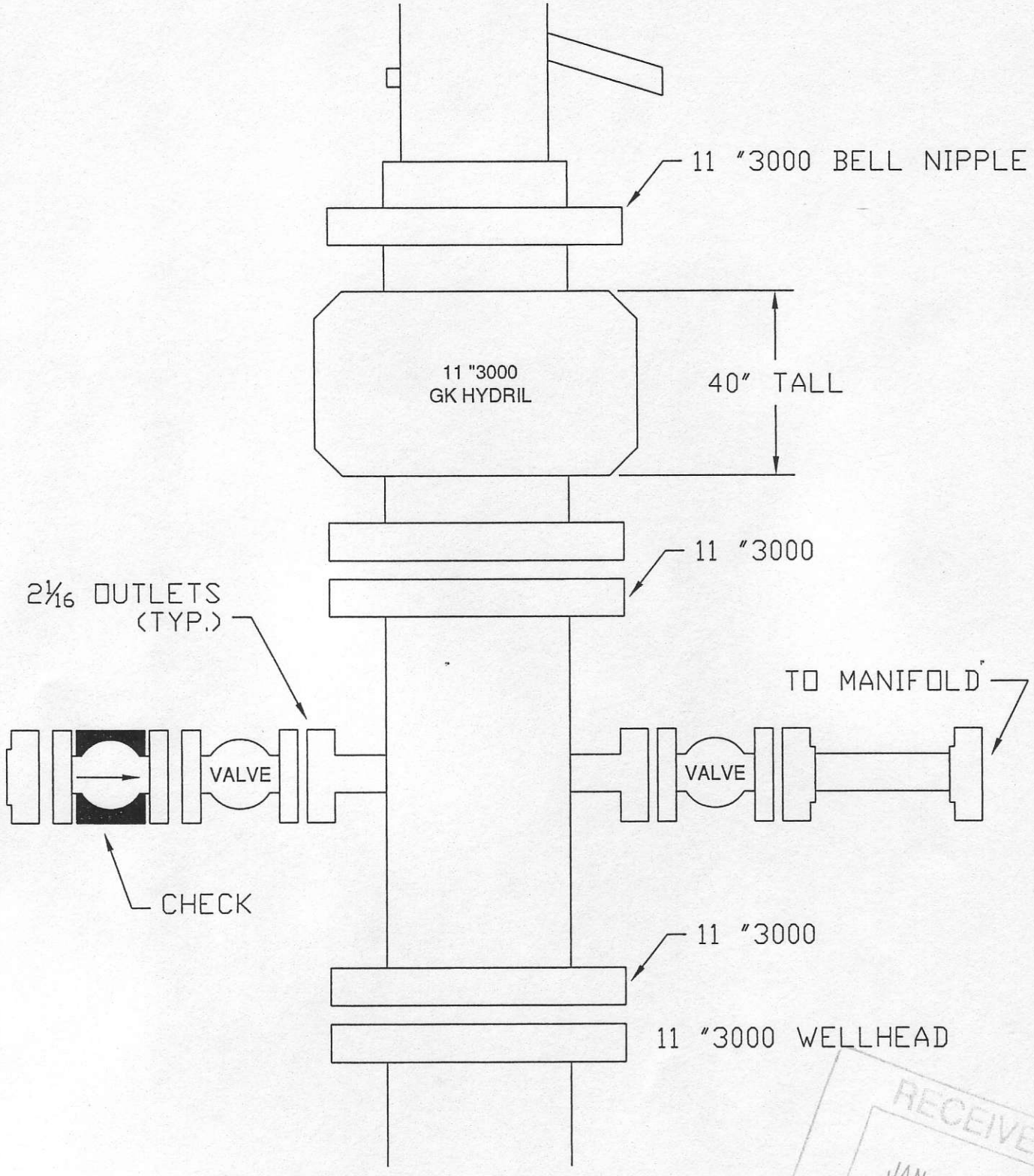
- Date well was placed into production status
- The nature of the well's production, i.e. crude oil, casinghead gas, natural gas, and entrained liquid hydrocarbons
- The OCS, Federal, or Indian lease prefix and number on which the well is located. Otherwise, the non-Federal or non-Indian land category, i.e. state or private.

As per 43 CFR 3162.7-4(d), within sixty (60) days following construction of a new tank battery, a site facility diagram of the battery showing actual conditions and piping must be submitted to the AO. Facility diagrams shall be filed within sixty (60) days after existing facilities are modified.

Pursuant to *Onshore Oil & Gas Order No.1*, lessees and operators have the responsibility to see that their exploration, development, production, and construction operations are conducted in such a manner which conforms with applicable Federal laws and regulations and with State and local laws and regulations to the extent that such state and local laws an regulations are applicable to operations on Federal and Indian lands.

CLIENT:	PINNACLE GAS RESOURCES, INC.
PROJECT NAME:	SOUTH SWEETWATER PROJECT
PROJECT No.:	40-0034
DRAWING TITLE:	DIVERTER SCHEMATIC DRAWING
DRAWING No.:	SOUTH SWEETWATER DIVERTER SHT. 1

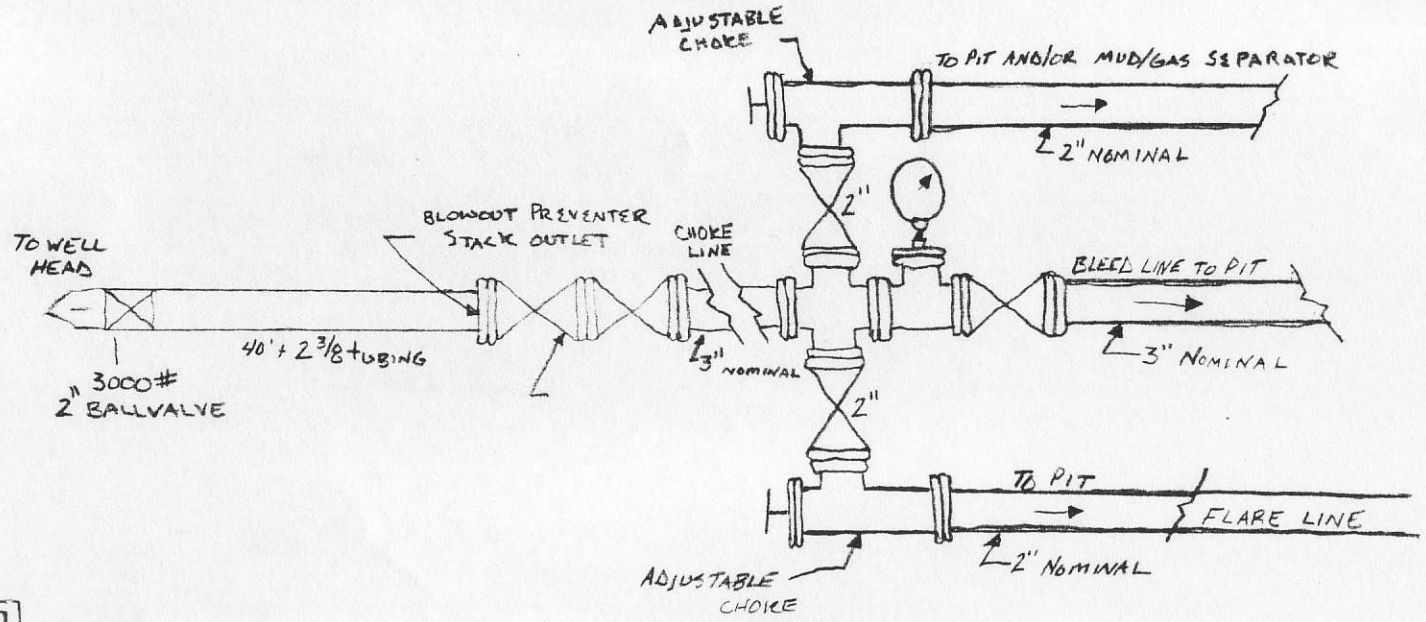
ISSUE	
REV.	A
REV. DATE	23-JAN-07
BY	JJR
APPROVED	



DIVERTER SCHEMATIC

PINNACLE GAS RESOURCES, INC.

14 FEB 07



TYPICAL CHOKE MANIFOLD ASSEMBLY

6 VALVE MANIFOLD (GATE VALVES)
2 CHOKES 2 1/16" 5,000# VALVES

1/1

APPENDIX B

SURFACE USE PLAN

Pinnacle Gas Resources, Inc.
Sweetwater South Federal POD
Sweetwater County, Wyoming

Plan of Development (POD) – Interim Coalbed Methane Wells

The Pinnacle Gas Resources, Inc. Sweetwater South Coalbed Methane Federal Plan of Development Project is located in Sweetwater County, Wyoming. This POD includes Sections 26 and 35 of Township 23N, Range 97W. There are eight (8) federal wells proposed in this project on eight (8) different well locations in addition to the eight (8) previously approved, drilled, and shut-in CBNG wells.

One may access the Sweetwater South Federal POD exiting Interstate 80 at Sweetwater County Road 67 (Tipton Road), approximately 56 miles west of Rawlins, Wyoming. Travel 22.5 miles north and then travel west 2.75 miles to the northeast corner of Section 35. The Sweetwater South Federal POD development proposal consists of 8 wells at 8 locations with attendant developments and facilities as shown on the Project Map (see Project Map in Section 5). These eight (8) wells, identified in Appendix 3.1 *Proposed Well List*, are coalbed methane (CBNG) exploration/development wells. The listed wells and corresponding leases are located within the Sweetwater South Coalbed Methane Federal Plan of Development Project area.

The primary targeted reservoir in the Sweetwater South Federal area is coalbed methane (CBNG) from the coal seams within the Big Red zone. All unproductive wells will be plugged and abandoned as soon as practical after the conclusion of production testing. Productive wells may be shut-in temporarily for gas pipeline connections and/or Sundry Notices by the Bureau of Land Management (BLM) for production activities and facilities.

1. EXISTING ROADS

The existing roads will be maintained in the same or better condition as existed prior to the start of operations. Maintenance of existing roads used to access the drill locations will continue until final abandonment and reclamation of the well locations occurs. Roads will not be flat bladed. Excessive rutting or other surface disturbances will be avoided. Vehicle traffic will be restricted to well pads and access roads following construction. Operations will be suspended temporarily during adverse weather conditions if ruts exceed 4" when access routes are wet, soft, or partially frozen.

Refer to the Project Map, located in Section 5 of this POD submission, for the location of the well, access route, and for the location of existing roads nearby.

2. PROPOSED ACCESS ROADS

Location, design and construction of all new roads in the Sweetwater South POD project area will be constructed in accordance with road guidelines contained in the joint BLM/USFS publication: *Surface Operating Standards for Oil and Gas Exploration and*

Development, Third Edition and/or BLM Manual Section 9113 concerning road construction standards on projects subject to federal jurisdiction. It is the responsibility of Pinnacle Gas Resources, Inc., or its representative, to determine the appropriate design classification for the roads in the Sweetwater South POD. Any area that may exceed the BLM Gold Book standards will be designed by a licensed professional engineer for construction purposes. Plans for construction of roads requiring Engineering Road Design Plans will be submitted to the BLM for review and acceptance by the BLM civil engineer. This review will ensure the design plans meet or exceed BLM minimum standards as presented in the guidebooks.

Improved crowned and ditched roads will provide access to the individual well sites per the BLM's request. Please see Appendix 4.4 for the mandatory road design template. Intermittent spot upgrades, by applying scoria or gravel to the tracks, may be necessary in unsafe areas and are depicted on the project map "A" and Table 1-1. Main access routes will also be improved crowned and ditched roads. Because they will be used infrequently for the purposes of maintenance and sampling, the access roads to the containment ponds will be two-track. The access roads will follow existing terrain and the travelway will be approximately 14 to 16 feet wide with the exception of the two-track access roads, which will be 12 wide. All access roads will be surfaced with gravel prior to drilling. All equipment and vehicles will be confined to this travel corridor and other areas specific in the plan of development. All disturbances related to the access routes will be confined within the travel corridor. Where feasible, gas and water pipelines and electrical cables will be installed in disturbance corridors.

Where needed, a Pinnacle Gas Resources, Inc. representative will conduct a "Plans in Hand" review with contractors to review the access routes to well locations and directional markers will be temporarily placed to mark access routes. The centerline and locations of the roads, pipelines and structures will be staked, color-coded and clearly marked. All markers will be removed as soon as they are no longer needed.

Alternate routes of ingress and egress were inspected for the Sweetwater South project well sites. The chosen access routes avoid unnecessary resource or wildlife impacts and allow safe, year-round, environmentally sound access. Proper planning has resulted in minimal number of roads and special attention was given to meeting or exceeding the minimum vertical and horizontal curves. Proper signage will be installed to ensure safe travel along the routes that do not meet BLM specifications.

After wells are completed and equipment is installed, travel to wells will generally be limited to one visit every other day. A light truck or utility vehicles would be used to check on operations, read meters, and provide light service during the life of the project. Well service trips may be rescheduled or postponed during periods of wet weather when vehicle traffic could cause ruts in excess of 4".

2.1 The proposed resource roads will adhere to the following specifications:

2.1.1 Width

A fourteen (14) to sixteen (16) foot running surface will be used for all roads in the

project area except for the containment pond access roads, which will be twelve (12) feet wide. Short term ROW disturbance will be up to 80 feet; ROW width will be approximately 40 feet.

2.1.2 Construction Standards

These resource access roads will be designed and constructed to meet the standards of the anticipated traffic flow and all-weather requirements. Construction will include ditching, draining, graveling, crowning, and capping the roadbed as necessary to provide a well-constructed and safe roadway. The BLM Authorized Officer will approve any changes, which may become necessary during construction.

If soils along the primary access road routes are dry during construction, water will be applied to the road surface to facilitate soil compaction and minimize soil loss as a result of wind erosion. Pinnacle Gas Resources, Inc. may utilize dust abatement measures such as watering or chemical treatment of travel ways. Dust abatement for roads on BLM public lands will be considered on a temporary, case-by-case basis with prior approval from the BLM Authorized Officer.

To minimize surface disturbance, only equipment that is appropriate to the scope and scale of the required work will be used. For resource roads that require no dirt work, brush hogging will be implemented to mitigate fire danger prior to any surfacing material application. Access and other construction work will be suspended when ruts in excess of 4" or other resource damage would occur.

The roads depicted on the project map will serve as corridors for the installation of pipelines for a majority of the POD. This infrastructure has been clearly labeled on the project map.

2.2 Engineered Road Design Staking

The minimum required staking for the pre-approval onsite shall be 100 foot centerline staking. The minimum staking for engineered sections of spot upgrade sections requiring cut and fill shall be the following:

Cut/Fill (ft)	Minimum Staking Required
0-2	Centerline Staking on 100 foot intervals
2-5	Centerline Staking on 50 foot Intervals Showing Limits of Disturbance
>5	Slope Staking on 50 foot intervals

2.2.1 Staking will be completed on 100-foot intervals on tangent sections for through-cuts and/or fills less than five (5) feet. Staking will be completed on 50-foot intervals for horizontal and vertical curves, balanced tangent sections, and road sections requiring more than five (5) feet of cut and/or fill.

2.2.2 **Additional staking requirements.** The centerline and locations of structures will be

staked, color-coded and clearly marked for all new roads, including those designed and constructed on steep, broken or mountainous terrain. All roads will have, at a minimum, the centerline staked at a maximum of 300-foot stations or within line of sight. The location for all structures including culverts, cattleguards, and low water crossings, etc., will be staked.

Routes were selected that avoid unnecessary resource impacts and allow for safe, year-round, and environmentally sound access.

2.3 Turnouts

There are no turnouts planned for this project.

2.4 Drainage Design

The access roads will be upgraded and maintained as necessary to prevent soil erosion and accommodate all-weather traffic. These roads will be constructed with water turnouts installed as necessary to provide for proper drainage along the access road route. Every effort will be made to retain natural vegetation on steep slopes around construction areas to mitigate erosion.

2.5 Culverts, Cuts and Fills

Culverts will be a minimum of 18" and will be installed on/along all access roads as necessary or required by the Authorized Officer. The inlet and outlet will be set flush with existing ground and lined up in the center of the draw. The bottom of the pipe will be bedded on good material before backfilling. Backfill with unfrozen material and no rocks larger than two (2) inches in diameter. Pinnacle shall furnish and install culverts of the gauge, diameters, lengths, and materials required in BLM Manual Section 9113 or as approved by the BLM Authorized Officer. Culverts shall be free from corrosion, dents, or other deleterious conditions. Culverts shall be placed on channel bottoms on firm, uniform beds that have been shaped to accept them and will be aligned to minimize corrosion. Backfill shall be thoroughly compacted. No equipment shall be routed over a culvert until backfill depth is adequate to protect the culverts. Care shall be taken to thoroughly compact the backfill under the haunches of the culvert. Corrugated sections will be wacker packed and the backfill shall be brought up evenly in 6" layers on both sides of the culvert. Each layer will be wacker packed. Please see Section 5 *Project Maps*.

Each culvert, road design, etc., is identified by a number, which refers to the quarter/quarter it lies in.

The following table depicts the methodology of naming the culverts:

4 **NW/NW**	**3** **NE/NW**	**2** **NW/NE**	**1** **NE/NE**
5 **SW/NW**	**6** **SE/NW**	**7** **SW/NE**	**8** **SE/NE**
12 **NW/SW**	**11** **NE/SW**	**10** **NW/SE**	**9** **NE/SE**
13 **SW/SW**	**14** **SE/SW**	**15** **SW/SE**	**16** **SE/SE**

For example, a culvert located in the NE/SE of Section 11 will be named the 9-11. If two or more culverts are present in the same quarter/quarter, then an alphabetical suffix will be added to the culvert name. The well names and low water crossings are named in a similar manner.

2.6 Surfacing Material

All access roads, constructed according to the mandatory road design in Appendix 4.4, will be surfaced with gravel, prior to drilling, to an average minimum depth (after compaction) of four (4) inches with grid run scoria or crushed rock. The permitted gravel source is owned by Harmel Jolley and is located in Section 27, Township 24 North, Range 97 West. These surfacing materials will be installed at the discretion of the Authorized Officer.

2.7 Gates, Cattle guards or Fence Cuts – None are required for this project.

2.8 Road Maintenance – primary access road surface(s) and shoulders will be kept in a safe and useable condition and will be maintained in accordance with the original construction standards. All drainage ditches and culverts will be kept clear and free flowing, and will also be maintained in accordance with the original construction standards. The access road right-of-way will be kept free of trash during all operations.

2.9 Construction/Quality Control – All roads constructed or reconstructed by Pinnacle Gas Resources, Inc. will be built to the approved plans, and will comply with all other applicable requirements, stipulations, Conditions of Approval, and referenced standards. The BLM Authorized Officer will approve any changes that may become necessary during construction. Pinnacle is responsible for having a licensed professional engineer certify that the actual construction of the roads meets the design criteria and is

constructed to BLM standards. During the construction phase of the project, an adequate level of inspection by an engineer or a qualified inspector should be available to certify that the road was constructed as designed.

2.10 **Paleontological Resources** – If any paleontological resources are discovered during construction, construction will cease and the Rawlins Field Manager will be notified immediately.

2.11 **Low Water Road Crossings** – No low water road crossings are proposed for the Sweetwater South Federal POD.

2.12 **Disturbance Corridors** – Where feasible, gas and water pipelines and electrical cables will be installed in disturbance corridors to minimize surface disturbance and create less impact on the landscape.

2.13 **Compressor Site Access** – There will be no compressor facilities within the Sweetwater South Federal POD boundary. At a later date however, a compressor may be located at the 1-26-23-97 locations. Also, multiple generators may be located at the 1-35-23-97 location.

3. LOCATION OF EXISTING WELLS

A listing of permitted water wells, and their locations, within one mile of the Sweetwater South Coalbed Methane Federal Plan of Development Project is shown in the Water Management Plan. This listing was obtained from the Wyoming State Engineer's Office (WSEO).

Also shown on the Project Map are the locations of proposed, disposal, drilling, producing, shut-in, monitoring, injection, and abandoned oil and gas wells within one mile of the Sweetwater South Coalbed Methane Federal Plan of Development project.

4. LOCATION OF EXISTING AND/OR PROPOSED FACILITIES

4.1 Existing Facilities

- Tank Batteries - None known
- Production Facilities - See Project Map
- Oil gathering Lines - None known
- Gas gathering Lines - See Project Map

4.2 Proposed Facilities

4.2.1 Production Facilities

Production facilities on each individual well location will be placed on a well pad that will be built to the minimum size required to complete the work and at a maximum size of approximately 200' x 250'. All wells will likely have wellhead enclosures, but if an

enclosure is not used, heat trace and insulation would be used for freeze protection. Pinnacle will be powering its Sweetwater South Federal POD with diesel generators for approximately the first six (6) months of operation. The generators will be on trailers and will result in approximately 0.01 acres of disturbance per trailer. One trailer is needed for the parallel switch gear. Pinnacle currently plans to use up to four (4) trailer/generators for this development and will all be located at the SWS FED 01-35BR-23-97 well. A 350 kW generator will be needed to handle the initial 285 HP start-up load. Once the well has been properly evaluated, it will be configured for production. Pinnacle plans to set up 60 HP motors on each wellhead as they are brought into production. There is, however, a 75HP motor already installed at 01BR-36-23-97. Permanent production facilities for each individual well will consist of the wellhead assembly and a small structure (enclosure) to be erected (placed) over the wellhead for security purposes. Pinnacle may elect to use pump jacks or PC pumps to pull the produced water. The wellhead will be approximately 20'x20' in size but will be increased to 20'x40' if pump jacks are used. Appendix 3.6 *Figures & Diagrams* of the Master Drilling Plan shows a conceptual diagram of a drill rig site layout.

For ease of gas measurement and to lessen the frequency of visits to the wellhead, Pinnacle Gas Resources, Inc. will install telemetry stations at each wellhead when possible (it may not be possible if there is no radio signal at that location). A pumper will still be required to visit each well at least once a week but most of the down-hole information will be transmitted to a central location via the telemetry station.

No Central Delivery Points (CDPs) for gas gathering/metering have been proposed for this POD. It is anticipated that the gas will be measured at each wellhead location utilizing EFM processor gas metering devices.

Construction materials needed for installation of the production facilities will be obtained from the site; any additional materials needed, will be purchased from a local supplier having a permitted source of material in the area.

4.2.2 Central Processing/Metering Facilities

There are no processing facilities planned for the Sweetwater South Federal POD. Produced gas will free flow from the well site to a WGR reciprocating compressor northeast of the POD boundary.

4.2.3 Water Gathering and Discharge

Free water produced from each well will be transported from the wellhead via flow line to a permitted injection well for disposal. Pinnacle is also proposing the use of off-channel ponds. Pearl Development Company has prepared a Permanent Water Management Plan (See Water Management Plan in Section 6 of the POD).

The outfall of each discharge will be lined with rock (rip-rap) or some other suitable material in order to prevent erosion. Entrained water, which is separated from the gas stream at each central production facility, will generally be routed to the closest discharge point.

Map "C" displays the proposed water gathering system and identifies the discharge points for those wells proposed within the Sweetwater South Federal POD.

4.2.4 Gas Gathering and Sales

Gas produced from each well will be transported from the wellhead via buried flow line to the MGR compressor site, located four (4) miles northeast of the POD boundary in the NWNW of Section 17 T23N R96W, where any remaining (entrained) water will be separated from the gas stream via a gas/water separator. The gas will then be compressed and transported via a gas pipeline system to a remote second stage compression facility and then on to sales. Gas from each well will be metered electronically by an EFM system and transported to the initial transportation related compressor site via a flow line. The gas pipelines and accompanying electrical lines (required for supplying power to the pumps at each well bore) will be buried in adjacent trenches directly next to existing access roads to the greatest extent possible to minimize surface disturbances within the field. Locator tape will be buried with underground facilities to aid future location.

Map "A" shows the proposed location of the gas pipeline system within the Pinnacle Gas Resources, Inc.'s Sweetwater South Federal POD.

4.2.5 Pipeline and Flow Line Right-of-Ways

Grader use will be avoided whenever possible when constructing or clearing individual pipeline ROWs. Brush hogs will be used, if necessary, to remove sagebrush and other vegetation to ground level. Ditch Witches or wheeled trenchers will be used whenever possible to reduce surface disturbance. Each ROW will be less than 50 feet wide except in very rough topography where it may be necessary to construct a ROW wider than 50 feet for safety and reclamation purposes.

Bladed materials will be replaced in the cleared route once construction is complete. Pipeline construction will not block or change the natural course of any drainage.

For the Sweetwater South Federal POD, all proposed underground facilities will be installed in corridors wherever possible and will be buried a minimum of six (6) feet. When the trench is backfilled, the fill dirt will be wheel-packed (where necessary) and heaped to mitigate settling. Pipeline channel crossings will be constructed so that the pipe is buried at least four (4) feet below the channel bottom.

Map "A" shows the proposed location of pipeline/flow line ROW within the Sweetwater South Federal POD.

4.2.6 Permanent Structures

All permanent (on-site for six (6) months or longer) above-the-ground structures constructed or installed on the well location (including pumping units, tank batteries, etc.) will be painted "Shale Green", color 5Y 4/2, of the "Standard Environment Colors" or another BLM approved color, except where the *Occupational Safety and Health Act* Rules and Regulations specify the use of special safety colors.

4.2.7 Overhead Electric (Electrical)

Generators will be installed initially. Overhead electric is not proposed until approximately 2009. The BLM will be notified with a sundry when placement decisions are finalized. Overhead electric lines may be located so that they parallel existing corridors to distribute power throughout the field.

4.2.8 Mitigation of Proposed Facilities on Federal Lands

Pinnacle Gas Resources, Inc. will protect the biological and hydrologic features of riparian areas, woody draw, wetland, and floodplains by locating all well pads, compressors, and other non-linear facilities outside of these areas.

Crossings of wetland/riparian areas by linear features, such as pipelines, roads, and power lines will be avoided to the extent practicable. Where crossings cannot be avoided, impacts will be minimized through use of the following measures:

- Site-specific mitigation plans will be developed during the APD, POD or Sundry Notice approval process for all proposed disturbance to wetland/riparian areas.
- Crossings will be constructed perpendicular to wetland/riparian areas, where practical.
- For power lines, the minimum number of poles necessary to cross the areas will be used.
- Wetland areas will be disturbed only during dry conditions if possible.
- No waste material will be deposited below high water lines in riparian areas, flood plains, or in natural drainage ways.
- The lower edge of soil or other material stockpiles will be located outside the active floodplain.
- Drilling mud pits will be located outside of riparian areas, wetlands, and floodplains, where practical. If this cannot be avoided, drill pit liners will be utilized.
- Disturbed channels will be re-shaped to their approximate original configuration or other geomorphologic configuration and properly stabilized where applicable.
- Reclamation of disturbed wetland/riparian areas will begin immediately after project activities are complete.

Prairie Dog colonies will be avoided wherever possible. If any black-footed ferrets are located, the USFWS will be consulted. Absolutely no disturbance will be allowed within prairie dog colonies inhabited by black-footed ferrets.

Moist soils near wetlands, streams, lakes, or springs in the project area will be promptly re-vegetated if construction activities impact the vegetation in these areas. Re-vegetation will be designed to avoid the establishment of noxious weeds.

To mitigate the danger that West Nile Virus poses, Pinnacle Gas Resources, Inc. will

implement a pest management strategy. Pinnacle Gas Resources, Inc. will coordinate its efforts with the recommended procedures of the Rawlins Weed and Pest Division. This will include placing environmentally safe, mosquito insecticide into each water containment facility within the Sweetwater South Federal POD if applicable.

During construction, emissions of particulate matter from well pad and resource road construction will be minimized by applying water, or other dust suppressants, with at least 50 percent control efficiency. Roads and well locations constructed on soils susceptible to and erosion could be appropriately surfaced, or otherwise stabilized, to reduce the amount of fugitive dust generated by traffic or other activities, and dust inhibitors (surfacing materials, non-saline dust suppressants, and water) could be used as necessary on unpaved collector, local and resource roads that present a fugitive dust problem. Please note that, due to its poor quality, produced water from the Sweetwater South project area is not a candidate for dust abatement.

4.3 Pinnacle Gas Resources, Inc. does not anticipate the need to construct a production (emergency) pit on any of the individual well locations. However, Pinnacle would like to leave the 01BR-35-23-97 reserve pit open to be used as an emergency overflow during water injection testing.

4.4 During drilling and subsequent operations, all equipment and vehicles will be confined to the access road and any additional areas that may be specified in the approved Application for Permit to Drill.

5. LOCATION AND TYPE OF DRILLING WATER SUPPLY

Water for drilling the wells will be provided by a nearby existing CBNG well and transported to the drill site by truck. Water volume used in drilling operations is dependent upon the depth of the well and any losses that might occur during drilling. Water for drilling may be taken from a private water well in the NWNE of Section 11 (TR45), T23N R97W (SEO #P156174W) near Hay Reservoir and from SWS State 01BR-36-23-97. A sample analysis report of this water can be found in Appendix 6.2.

No new construction will be required on/along the proposed water haul route(s). Water transfer facilities will be located near proposed areas of disturbance and will not be located within known cultural resource sites or sensitive wildlife areas.

6. CONSTRUCTION MATERIALS

Gravel and/or rock will be purchased from a local supplier having a permitted source of materials of the area. This material will be used for road construction to access the wells, compressor and miscellaneous facilities. Gravel or scoria material will be used in necessary areas such as spot upgrades, crowned and ditched roads, and low water crossings. No construction materials will be taken from Federal or Indian lands without prior approval from the appropriate Surface Management Agency.

7. METHODS FOR HANDLING WASTE DISPOSAL

7.1 **Cuttings** – the drilled cuttings will be deposited into a small earthen reserve pit to be constructed on, or adjacent to, each individual drill pad. The total surface area of impact for the reserve pits will be approximately 70 feet wide by 110 feet long. The reserve pit will be constructed by dozer.

7.2 **Drilling Fluids** – reserve pits will be designed to prevent the collection of surface runoff and will be constructed entirely in cut material. The reserve pit will be on the downhill side of the well bore for non-constructed pads. The reserve pits will be fenced on three non-working sides during drilling, and on the fourth side at the time the rig is removed. The reserve pit and flare pit will be fenced using T-posts and wire panels approximately 50 inches tall. Reserve pits will not be squeezed. Individual reserve pits will be closed as soon as they are dry, but no later than 90 days from the time drilling and completion operations cease. If unforeseen circumstances prevent the closing of the pits within the 90-day time frame, an extension will be requested from the BLM Authorized Officer.

7.3 **Produced Fluids** – water produced from wells within the Sweetwater South Federal POD project area will be reinjected into approved water injection wells or will be discharged into approved ponds. Please see section 6, *Water Management Plan.* Map "C" shows the proposed discharge point.

Any spills of oil, gas, produced water or any other potentially hazardous substance will be cleaned up and immediately removed to an approved disposal site. The BLM Authorized Officer will be contacted about any hazardous substance, oil, or produced water spills.

7.4 **Sewage** – portable, self-contained chemical toilets will be provided at each drilling location for human waste disposal. Upon completion of operations, or as required, the toilet holding tanks will be pumped and the contents thereof disposed of in an approved sewage disposal facility. Sewage disposal will be in strict accordance with WDEQ rules and regulations regarding sewage treatment and disposal.

7.5 **Chemicals/Oil** – any chemical substances or used motor oil (change oil) will be placed in closed containers and disposed of at an authorized disposal site. The reserve pits will not be used as disposal locations.

7.6 **Garbage and Other Waste Material** – all garbage and non-flammable waste materials will be contained in a self-contained, portable dumpster or trash cage to be located at one or two central locations. Upon completion of operations (or as needed), the accumulated trash will he hauled off-site to a WDEQ approved sanitary landfill. No trash will be placed in the reserve pit(s).

7.7 **Drilling Rig** – immediately after removal of the drilling rig, all debris and other waste materials not contained in the trash cage will be cleaned up and removed from each individual well location. No potentially adverse materials or substances will be left on these locations.

7.8 **Open Pits** – any open pits remaining upon conclusion of drilling operations will be promptly fenced with said fencing maintained until such time as the pits have been backfilled.

7.9 **Hazardous Materials** – Pinnacle Gas Resources, Inc. maintains a file, per 29 CFR 1910.1200 (g), containing current Material Safety Data Sheets (MSDS) for all chemicals, compounds, and/or substances which are used during the course of construction, drilling, completion, and production operations for this project. Hazardous materials which may be found at the site include drilling mud and cementing products which are primarily inhalation hazards, fuels (flammable and/or combustible), materials that may be necessary for well completion/stimulation activities, such as flammable or combustible substances and acids/gels (corrosives). Any spills of oil, gas, produced water, or any other potentially hazardous substance will be reported immediately to the BLM and to the responsible parties and will be mitigated immediately through cleanup or removal to an approved disposal site.

The opportunity for *Superfund Amendments and Reauthorization Act* (SARA) listed Extremely Hazardous Substances (EHS) at the site is generally limited to proprietary treating chemicals. All hazardous, EHS, and commercial preparation will be handled in an appropriate manner to minimize the potential for leaks or spills to the environment. The operator and its contractors ensure that all use, production, storage, transport and disposal of hazardous and extremely hazardous materials associated with the drilling, completion and production of wells, and project operations will be in accordance with all applicable existing or hereafter promulgated federal, state and local government rules, regulations and guidelines. All project-related activities involving hazardous materials will be conducted in a manner to minimize potential environmental impacts. A file containing current MSDS for all chemicals, compounds and/or substances which are used in the course of construction, drilling, completion, and production operations is located at the Pinnacle Gas Resources, Inc. field office and on each drilling rig.

8. ANCILLARY FACILITIES

Pinnacle Gas Resources, Inc. does not anticipate the need for any ancillary facilities within the Sweetwater South Federal POD.

9. WELL SITE LAYOUT

9.1 In Appendix 3.6 of the Master Drilling Plan, a conceptual diagram of the well site layout is depicted. The following information describes the field layout staking for a constructed and non-constructed well site:

9.1.1 Constructed pad staking procedure:

- 200' reference stakes on cardinal direction (Minimum of 2 and visible)
- Reserve pit corners marked adjacent to well bore
- Well pad catch points marked

9.1.2 Non-constructed pad staking procedure:

- 100' reference stakes on cardinal direction (Minimum of 2 and visible)
- Corners of drill pit staked adjacent to well bore.

9.1.3 Well stake markings to include:

- Well name
- Well number
- Legal location
- Well footages

9.2 No permanent living facilities are planned on those individual well locations to be included within the Sweetwater South Federal POD. There may be a need for a temporary trailer to be on location during drilling, completion, and start-up operations.

9.3 All equipment and vehicles will be confined to the approved areas in each individual Applications for Permit to Drill (i.e. access roads, well pad areas, pipeline ROW, etc.)

9.4 Production facilities will be installed on each individual well location as described in item 4.2 (Proposed Facilities).

9.5 Pinnacle Gas Resources, Inc. will use a single 20 mil pit liner in each individual reserve pit.

9.6 Prior to the commencement of drilling operations, the reserve pit(s) will be fenced on three (3) sides according to the following minimum standards:

1) T-posts and wire panels approximately 50 inches tall.
2) Standard steel line posts shall be used between the corner braces. The maximum distance between any two (2) posts shall be no greater than sixteen (16) feet.
3) The fourth side of the reserve pit will be fenced immediately upon removal of the drilling rig and the fencing will be maintained until the pit has been backfilled.

9.7 As indicated in 4.2 *Proposed Facilities*, the production facilities will be fenced during the initial evaluation phase of operations to prevent potential damage to the equipment or injury to domestic livestock and/or wildlife. Said fencing will be installed according to the fencing specifications provided in item 9.6 above.

9.8 Any hydrocarbons on the pit will be removed as soon as possible after drilling operations are completed.

10. PLANS FOR RECLAMATION OF THE SURFACE

10.1 The primary surface disturbance associated with drilling and completion operations on those wells proposed in conjunction with the Sweetwater South Federal POD will be

limited to the excavation of the reserve pit, flare pit, construction of the central processing/metering facilities, construction of the 250' x 170' well pad, construction of access routes, construction of water containment facilities, and the installation of the buried flow lines/pipelines necessary for the transportation of produced fluids and gases within the project area. Backfilling, leveling, re-contouring, and reseeding (using the recommended seed mixtures) of these disturbed areas is planned as soon as possible after cessation of drilling and completion operations on the individual well locations. The water containment facility reclamation will begin when the facilities are no longer needed.

10.2 Once the reserve pit has been backfilled, all compacted surfaces on federal lands (including the access road and the well pad areas) will be disked to a depth of 18 to 24 inches in order to break-up the compacted soils and re-establish percolation in these soils.

10.3 All disked surfaces will be reseeded using the recommended seed mixture or a different mixture to be recommended by either the BLM Authorized Officer or the private surface owner(s) as appropriate. No introduced species will be used for the reclamation of disturbed areas on federal surface.

The following seed mixture is recommended on Federal lands.

Seed Mixture Recommended for Use on Disturbed Areas Within the Sweetwater South Federal POD	
Species	**Pounds PLS/Acre**
Grasses	
Slender wheatgrass	2.0
Thickspike wheatgrass-Critana	4.0
Western wheatgrass	2.0
Indian ricegrass	1.0
Bottlebrush squirreltail	1.0
Needle-and-thread	1.0
Shrubs	
Gardner's saltbush	1.0
TOTAL	**12.0**

* Pinnacle Gas Resources, Inc. will use the recommended seed mixture for federal lands as described in the Site Specific Conditions of Approval if they vary from the table above.

10.4 Seed will be drilled on the contour with a seed drill equipped with a depth regulator in order to ensure even depths of planting. Seed will be planted between one-quarter (1/4) to one-half (1/2) inches deep. Where drilling is not possible (too steep or rocky), Pinnacle Gas Resources, Inc. will hand broadcast the seed at double the rate indicated above and rake or chain the area to cover the broadcast seed. Areas with high erosion potential will have special measures applied, as necessary, to ensure successful

reclamation. This will include erosion fabric, hydro seeding, water barring, or other such measure required by the BLM.

10.5 Fall seeding will be completed after September 15th and prior to ground frost. If applicable, spring seeding will be completed after the frost has left the ground and prior to May 15th. The seeding will be repeated until a satisfactory stand, as determined by the Authorized Officer, is achieved. The first evaluation of growth will be made following the completion of the first growing season. No reclamation work will be conducted when soils are frozen or overly wet.

10.6 Scarification and re-seeding activities are considered best in the fall, unless requested otherwise by the BLM Authorized Officer or the private surface owner(s).

10.7 Pipelines and utility lines will be installed parallel, and adjacent, to access roads. The trenches will be placed within the adjacent flat-bottom ditches.

10.8 Pipeline and flow line ROW trenches will be compacted during backfilling and said trenches would be maintained in order to correct settlement and erosion. The trenches will also be heaped above the cut to ensure proper settling. All disturbed surfaces along the pipeline/flow ROW will be reseeded as recommended above.

10.9 Upon final abandonment of each well location and/or central processing facility in conjunction with the Sweetwater South Federal POD, water diversion measures will be installed and both the access roads and well locations will be restored to approximately the original ground contour(s) by pushing the fill material back into the cut and up over the back slope (where applicable and at the landowner(s) request).

10.10 No unnatural depressions will be left that would trap water or form ponds. All disturbed surfaces (including access roads, well pads, water containment facilities and central processing facilities) will be reseeded as recommended above.

11. SURFACE OWNERSHIP

Surface ownership within the POD boundary is federal. The surface ownership of the development project area is depicted on the Project Map. Contact information is provided in Appendix 4.8 *Contact Information.*

12. OTHER INFORMATION

12.1 Water Management Plan

Please see Section 6 of the Plan of Development for information regarding the Water Management Plan.

12.2 Water Well Agreement/Certification

Please see Section 4, Appendix 4.1 of the Plan of Development for information regarding the Water Well Agreement/Certification.

12.3 Cultural Clearance Report

A Class III Cultural Resource Inventory of the proposed drill sites and access roads and other facilities has been completed by Foothills Archaeological Consultants. The necessary reports have been filed with the Bureau of Land Management Rawlins Field Office.

Pinnacle Gas Resources, Inc. will be responsible for informing all persons associated with this project that they will be subject to prosecution for damaging, altering, excavating or removing any archaeological, historical, or vertebrate fossil objects or site(s). If archaeological, historical, or vertebrate fossil materials are discovered, Pinnacle Gas Resources, Inc. will suspend all operations that further disturb such materials and immediately contact the Authorized Officer. Operations will not resume until written authorization to proceed is issued by the Authorized Officer. Within five (5) working days, the Authorized Officer will evaluate the discovery and inform Pinnacle Gas Resources, Inc. of actions that will be necessary to prevent loss of significant cultural or scientific values. Pinnacle Gas Resources, Inc. will not be held accountable for costs associated with evaluating any findings and permission will be granted by the Authorized Officer to go around the found site or sundry new operations that will allow development.

Pinnacle Gas Resources, Inc. will be responsible for the cost of any necessary mitigation required by the Authorized Officer. The Authorized Officer will provide technical and procedural guidelines for the conduct of mitigation. Upon verification from the Authorized Officer that the required mitigation has been completed, Pinnacle Gas Resources, Inc. will be allowed to resume operations.

12.4 Wildlife Habitat Report

Please see Section 7 of the Plan of Development for information regarding the Wildlife Habitat Report.

12.5 Integrated Pest Management Plan for Noxious and Invasive Weeds

Pinnacle Gas Resources, Inc. will be responsible for weed control on disturbed areas within the exterior limits of this permit. Per the Sweetwater County Weed and Pest Control office, noxious and invasive weeds observed within the Sweetwater South Project area include *Canada thistle*, *Russian knapweed*, *Halogeton*, *Black henbane*, and *Hoary cress*. Pinnacle Gas Resources, Inc. is proposing to develop CBM reserves in the same vicinity as some of the aforementioned infestations. The program for weed control will be implemented when Pinnacle Gas Resources, Inc. disturbs the soil surface. The noxious weed control program developed by Pinnacle Gas Resources, Inc. will adhere to BLM requirements.

To minimize the introduction, infestation and spread of noxious weeds and other weeds of concern found within the limits of this permit, Pinnacle Gas Resources, Inc. will educate field personnel and other contractors to identify and be aware of noxious weeds. Precautionary measures, such as washing vehicles and equipment at least weekly and when traveling into and out of the project area, will also be implemented to minimize

seed transportation and dispersal. Noxious weed control measures will be incorporated into the construction of all facilities within the exterior limits of this permit to prevent the introduction or spread of any noxious weeds. Special consideration will be given to areas where noxious weeds are most likely to invade and flourish.

A weed spraying program designed by, and agreed to, by the BLM and Pinnacle Gas Resources, Inc. will be administered on all of the disturbed areas. The program involves monitoring for spring and fall growth of noxious weeds, due to the operations of Pinnacle Gas Resources, Inc., along the roadways, dam sites, well locations, all Right-of-Ways, and any other disturbed areas. The Sweetwater County Weed and Pest Control office has indicated that *Canada thistle, Russian knapweed, Halogeton, Black henbane*, and *Hoary cress* have been noted in the areas of concern. Following weed spraying, the designed seed mixture will be applied to the disturbed area. Weed control shall be conducted in a timely manner in cooperation with all agencies, operators and landowners.

A "*Pesticide Use Proposal*", or PUP (form #WY-04-9222-1), and pesticide label will be submitted by Pinnacle Gas Resources, Inc. to the Authorized Officer prior to the treatment of the noxious weeds found and upon discovery of any new infestations along surfaces Pinnacle Gas Resources, Inc. operates on. Pinnacle Gas Resources, Inc. will confer with the BLM to complete the "*Pesticide Use Proposal*" (form #WY-04-9222-1). A blank example PUP is located in Section 9 *IPM.*

Pinnacle Gas Resources, Inc. will be responsible for the prevention and control of all noxious weeds on all areas of disturbance due to surface operations by Pinnacle Gas Resources, Inc.

12.6 Additional Environmental Information

12.6.1 Right-of-way applications for water lines, gas lines, access roads to well locations, compressor station, water injection wells, and transfer facilities have been applied for at the BLM Rawlins Field Office. Reference Section 10 of this POD book for documentation.

12.6.2 Current land use on the site includes open range livestock grazing and use of the area by wildlife.

12.6.3 The closest occupied dwelling to the federal activities is Harmel Jolley's home, located about 4 miles away from the closest federal CBNG well within the Sweetwater South Federal POD.

12.6.4 The project area is located in Sections 26 and 35 of Township 23 North, Range 97 West in Sweetwater County, Wyoming.

12.6.5 Pinnacle Gas Resources, Inc.'s BLM Bond number is WYB000093.

13. LESSEE'S OR OPERATOR'S REPRESENTATIVE AND CERTIFICATION

Please see Section 4, Appendix 4.1 of the Plan of Development for information regarding the Lessee's or Operator's Representative and Certification.

14. FORMS REQUIRED FOR SURFACE USE PLAN

14.1 Please see Section 6 of the Plan of Development for information regarding the Hydrologic Watershed Field Analysis Summary Sheet.

14.2 Please see Section 4, Appendix 4.2 of the Plan of Development for information regarding the Surface Use Data Summary Form.

14.3 Please see Section 4, Appendix 4.1 of the Plan of Development for information regarding the Self-Certification Statement From Lessee/Operator.

15. CERTIFICATION

I hereby certify that Pinnacle Gas Resources, Inc. will comply with the provisions of the law or the regulation governing the Federal or Indian right of reentry to the surface under 43 CFR 3814.

I also certify that shall use its best efforts to conduct its approved operations in a manner that avoid adverse effects on any properties which are listed, or may be eligible for listing, in the National Register of Historic Places (NRHP). If historic or archaeological materials are uncovered during construction, the operator will immediately stop work that might further disturb such materials, and contact the AO (or his/her representative) at the BLM Rawlins Field Office. Any paleontological resources or fossils discovered as a result of operations associated with these wells will be brought to the attention of the AO or his/her representative immediately. All activities in the vicinity of such discoveries will be suspended until notified to proceed by the AO.

Further, hereby certified that:

A. All potentially affected landowners having properly permitted water wells with the WSEO within each proposed well's Circle of Influence (one-half mile radius) were offered a Water Well Agreement;

B. If a Water Well Agreement is not reached with the landowner, agrees to mitigate the impacts of its CBNG wells in accordance with State of Wyoming water laws; and

C. Has applied for a Permit to Appropriate Groundwater from the WSEO, concurrently with this APD.

Brian Deurloo
Printed Name

Signature

Wyoming Project Manager
Title

Date

16. APPENDICES

1) Appendix 4.1 – Certificates and Statements
2) Appendix 4.2 – Surface Use Data
3) Appendix 4.3 – Road Design
4) Appendix 4.5 – Well Pad Cut & Fill
5) Appendix 4.6 – Surrounding Wells
6) Appendix 4.7 – Best Management Practices
7) Appendix 4.8 – Contact Information
8) Appendix 4.9 – Post Construction Inspection Report

INTEGRATED PEST MANAGEMENT PLAN FOR NOXIOUS AND INVASIVE WEEDS

Pinnacle Gas Resources, Inc. will be responsible for weed control on disturbed areas within the exterior limits of this permit Noxious weeds observed within the Sweetwater South Project area included *Canada thistle*, *Russian knapweed*, *Halogeton*, *Black henbane*, and *Hoary cress*. Pinnacle Gas Resources, Inc. is proposing to develop CBM reserves in the same vicinity as some of the aforementioned infestations. The program for weed control mentioned in the surface use plan will be implemented when Pinnacle Gas Resources, Inc. disturbs the soil surface. The noxious weed control program developed by Pinnacle Gas Resources, Inc. will adhere to BLM requirements.

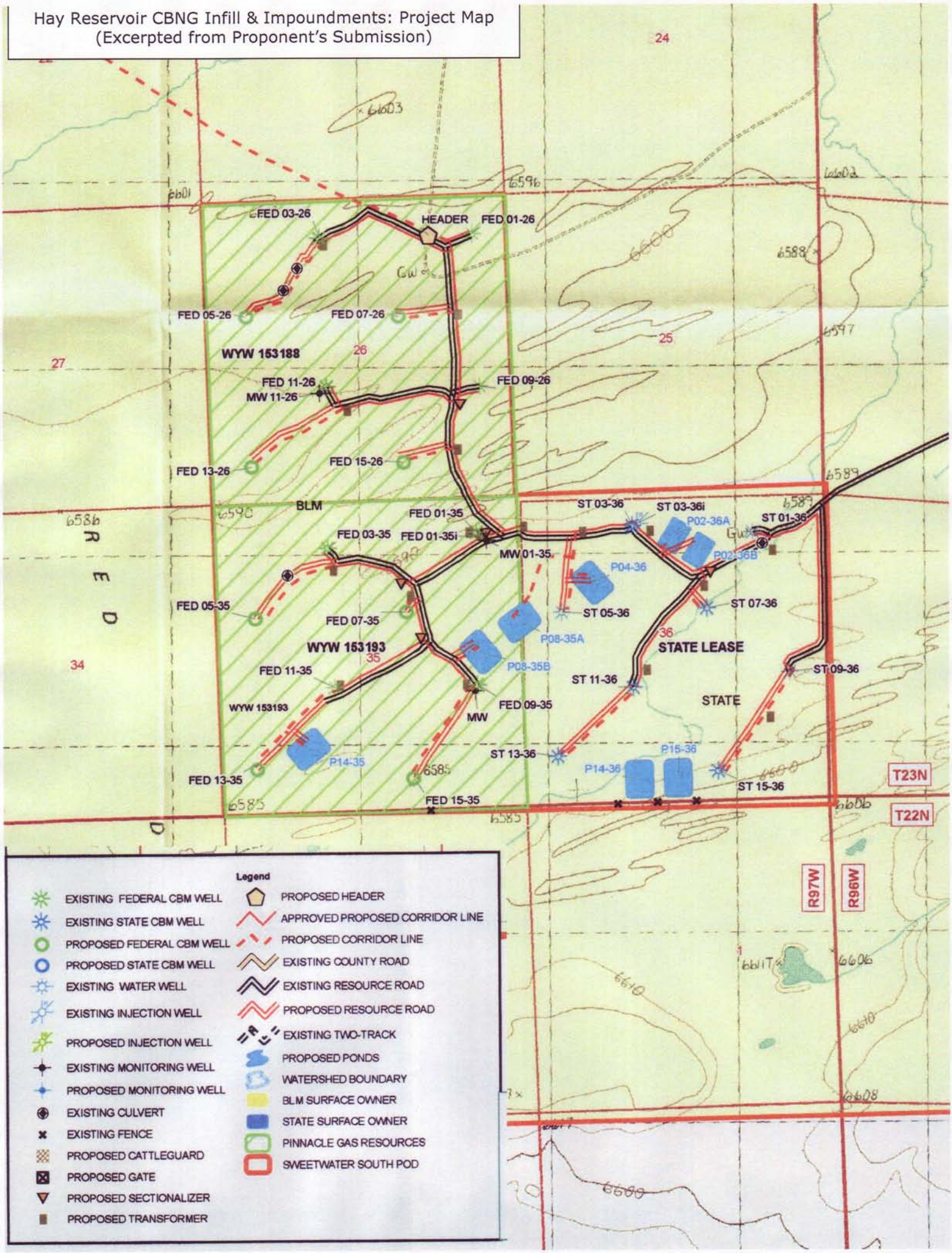
To minimize the introduction, infestation and spread of noxious weeds and other weeds of concern found within the limits of this permit, Pinnacle Gas Resources, Inc. will educate field personnel and other contractors to identify and be aware of noxious weeds. Precautionary measures - such as washing vehicles - may also be implemented to minimize seed transportation and dispersal. Noxious weed control measures will be incorporated into the construction of all facilities within the exterior limits of this permit to prevent the introduction or spread of any noxious weeds. Special consideration will be given to areas where noxious weeds are most likely to invade and flourish.

A weed spraying program designed by, and agreed to, by the BLM and Pinnacle Gas Resources, Inc. will be administered on all of the disturbed areas. The program involves watching for spring and fall growth of noxious weeds, due to the operations of Pinnacle Gas Resources, Inc., along the roadways, dam sites, well locations, all Right-of-Ways, and any other disturbed areas. The Sweetwater County Weed and Pest Control office has indicated that *Canada thistle, Russian knapweed*, *Halogeton*, *Black henbane*, and *Hoary cress* have been noted in the areas of concern. Once the area is deemed clear of noxious weeds, the designed seed mixture will be applied to the disturbed area. Weed control shall be conducted in a timely manner in cooperation with all agencies, operators and landowners.

A "*Pesticide Use Proposal*", or PUP (form #WY-04-9222-1), and pesticide label will be submitted by Pinnacle Gas Resources, Inc. to the Authorized Officer prior to the treatment of the noxious weeds found and upon discovery of any new infestations along surfaces Pinnacle Gas Resources, Inc. operates on. We will confer with the BLM to complete the "*Pesticide Use Proposal*" (form #WY-04-9222-1). A blank example PUP is located following this page.

Pinnacle Gas Resources, Inc. will be responsible for the prevention and control of all noxious weeds on all areas of disturbance due to surface operations by Pinnacle Gas Resources, Inc.

Hay Reservoir CBNG Infill & Impoundments: Project Map
(Excerpted from Proponent's Submission)



B. CBNG Project Surface Use Data Summary Form

Company Name:	Pinnacle Gas Resources, Inc.							**Date:**	1/18/2007
Project Name:	Sweetwater South Federal POD							**County:**	Sweetwater
Number of Wells:			8	**Leases Involved:**	WYW153188, WYW153193				
Township(s) Involved:	**T**	23	**N**	**R**	97	**W**	**Sections:**	26 and 35	
	T		**N**	**R**		**W**	**Sections:**		
							Sections:		

PROPOSED ACTION

	#	Length (mi.)	Width (ft.)	Acres of Disturbance
Proposed Improved Roads – Not within Corridor (including spot upgrade areas):		NA	40	0
List by road segments where construction width varies				
Proposed Improved Roads / Utilities Corridor (define utilities):		2.91	80	28.2
List by road segments where construction width varies				
Proposed 2-Track Roads – Not within Corridor:		NA	30	0
Proposed 2 –Track / Utilities Corridor (define utilities): Gas, Water, Electric		NA	40	0
Proposed 2-Track with Proposed Utility Corridor (define utilities):Gas, Water, Electric		NA	40	0
Proposed Corridor not within Access (define utilities): Water, Gas		2.46	50	14.9 (Proposed ROW)
Proposed Pipeline not within a Corridor:		0.14	50	0.85
Proposed Buried Power Cable not within a Corridor:		NA	20	0
Proposed Overhead Power (within POD boundary):		NA	30	0
Number of Proposed Central Gathering/Metering Facilities:		0		0
Number of Proposed Compressors:	0	0		0
Number of Proposed Impoundments (define whether Off-channel Pits and/or On-channel Reservoirs)	0	8		75.2
Number of Proposed Discharge Points:	0	8		Disturbance included in pit disturbance.

Other (Specify):

DESCRIPTION OF AFFECTED ENVIRONMENT (within POD boundary)	#	Length	Width	Acres of Disturbance
Existing Improved Roads:		5.99	45	32.7
Existing 2-Track Roads not within Corridor:		NA	14	0
Existing 2 –Track / Utilities Corridor (define utilities):		NA	40	0
Existing Corridor not within Access (define utilities):		NA	30	0
Existing Pipeline not within a Corridor:		NA	30	0
Existing Buried Power Cable not within a Corridor:		NA		0
Existing Overhead Power:		NA	30	0
Number of Existing Central Gathering/Metering Facilities:		0		
Number of Existing Compressors:	0	0		0
Number of Existing Impoundments (define whether Off-channel Pits and/or On-channel Reservoirs)	0	0		0
Number of Existing Discharge Points:	0	0		Included in pit disturbance.
Prepared By: Pearl Development Company				
Telephone: (307)672-8090				

* **Disturbance Corridor:** Where feasible, gas and water pipelines and electrical cables will be installed in disturbance corridors. Disturbance corridors combine 2 or more utility lines (water, gas, electric) in common trenches, ideally within access roadways.

GEOMETRIC STANDARDS FOR BUREAU ROADS

EXHIBIT '2'

FUNCTIONAL CLASSIFICATION	EST 20 YR. ADT	TERRAIN	DESIGN SPEED		TRAVELWAY WIDTH		MAXIMUM GRADE	
			PREF.	MIN.	PREF.	MIN.	PREF.	MIN.
Resource	Less than 20	LEVEL & ROLLING	30		14		8	10
		TERRAIN	15		14		8	16

GRAVEL SPECIFICATION:

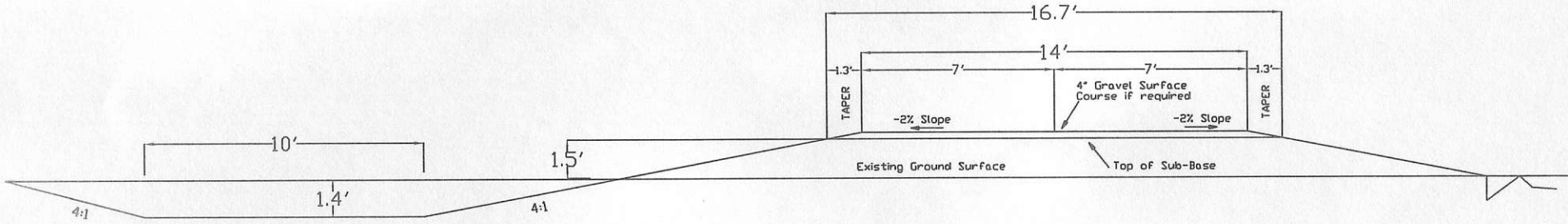
3" minus pit run gravel
(AASHTO M145-49 A-1-a Soil)

Do not place gravel on road until Inspector/Engineer has approved the sub-grade.

Place gravel to full widened width on turnouts, curve widening, and intersection flares.

TYPICAL CROSS SECTIONS

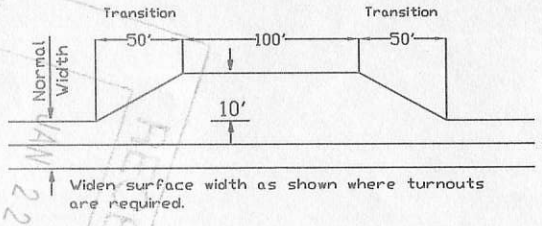
(for Proposed Access Roads)



SUB-GRADE TO BE COMPACTED TO APPROPRIATE DENSITY AS SPECIFIED BY ENGINEER

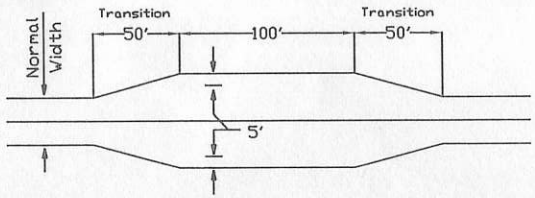
FLAT BOTTOM DITCH (BOTH SIDES)

TURNOUTS REQUIRED



PLAN

TURNOUT - WIDENING ON ONE SIDE (DETAIL)



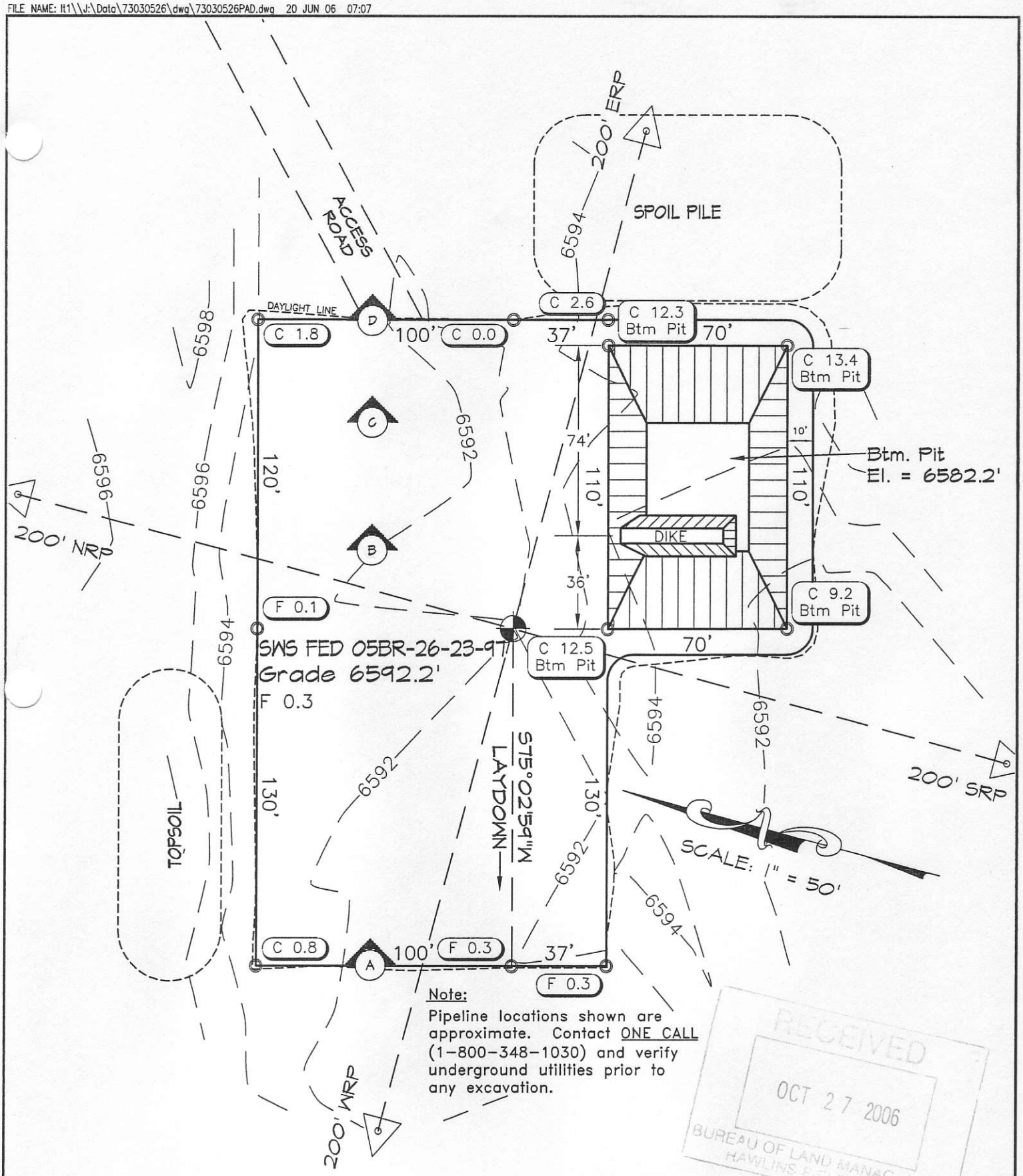
PLAN

TURNOUT - WIDENING ON BOTH SIDE (DETAIL)

PREPARED BY:
PEARL DEVELOPMENT COMPANY
1082 East Brundage Lane
PO Box 783
Sheridan, Wyoming
82801
307-672-8090
www.pearldc.com
"FROM PROJECT CONCEPTION TO OPERATING REALITY"

OWNER / OPERATOR:
PINNACLE GAS RESOURCES, INC.
1 EAST ALGER STREET
SUITE 206
SHERIDAN, WY 82801

FILE NAME: lt1\\J:\Data\73030526\dwg\73030526PAD.dwg 20 JUN 06 07:07



Note:
Pipeline locations shown are approximate. Contact ONE CALL (1-800-348-1030) and verify underground utilities prior to any excavation.

Gas Resources, Inc.

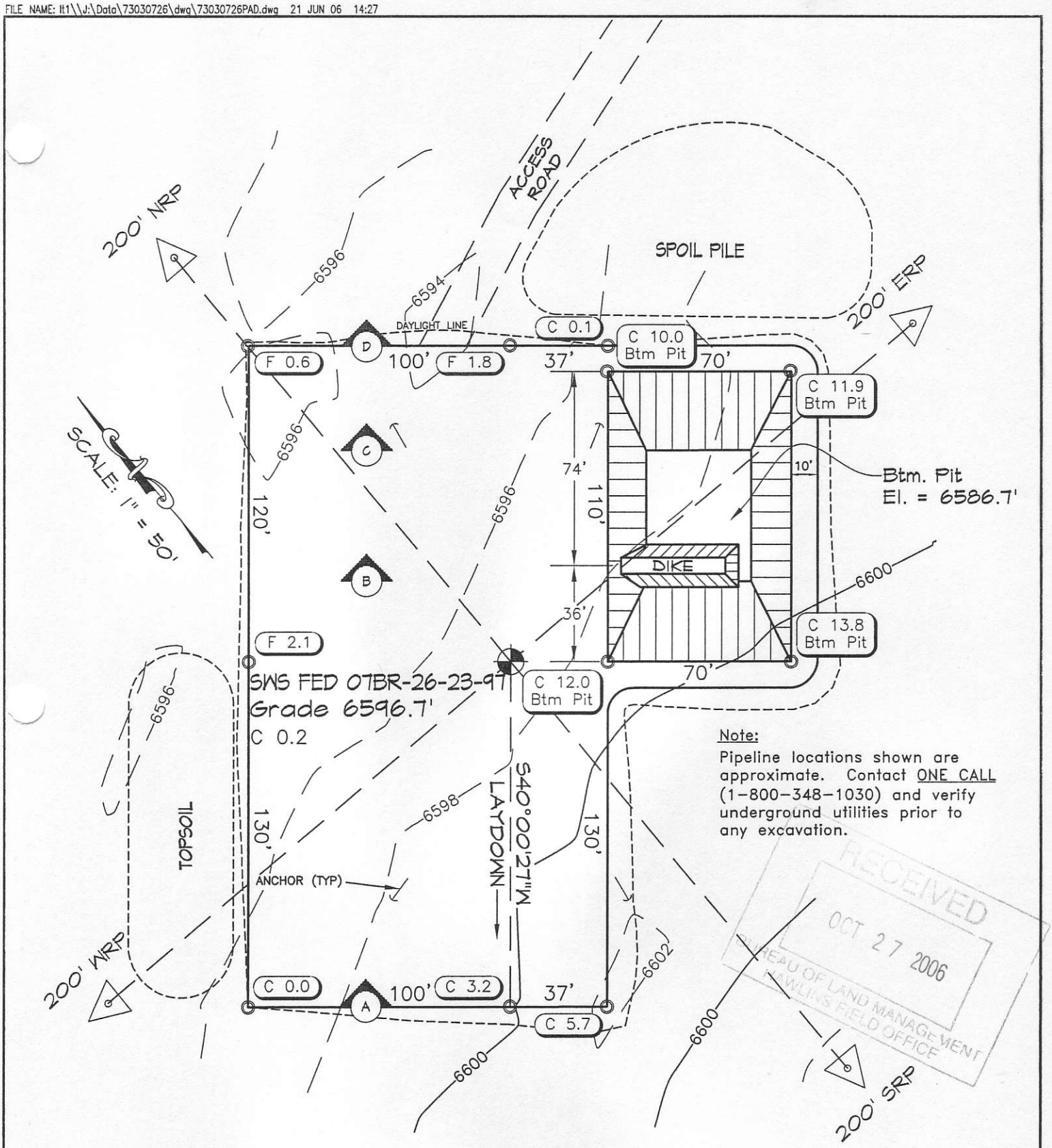
JFC ENGINEERS SURVEYORS
1515 NINTH STREET
ROCK SPRINGS, WY 82901
PHONE (307) 362-7519
FAX (307) 362-7569
http://www.jfc-wyo.com

SWS FED 05BR-26-23-97
SW 1/4, NW 1/4, SEC 26, T23N, R97W
1978' F.N.L. - 660' F.W.L.
SWEETWATER COUNTY, WYOMING

DWN BY: zcf
DATE: 6/19/06
SCALE: 1" = 50'

FIGURE 1

FILE NAME: lt1\\J:\Data\73030726\dwg\73030726PAD.dwg 21 JUN 06 14:27



Note:
Pipeline locations shown are approximate. Contact ONE CALL (1-800-348-1030) and verify underground utilities prior to any excavation.

Pinnacle Gas Resources, Inc.

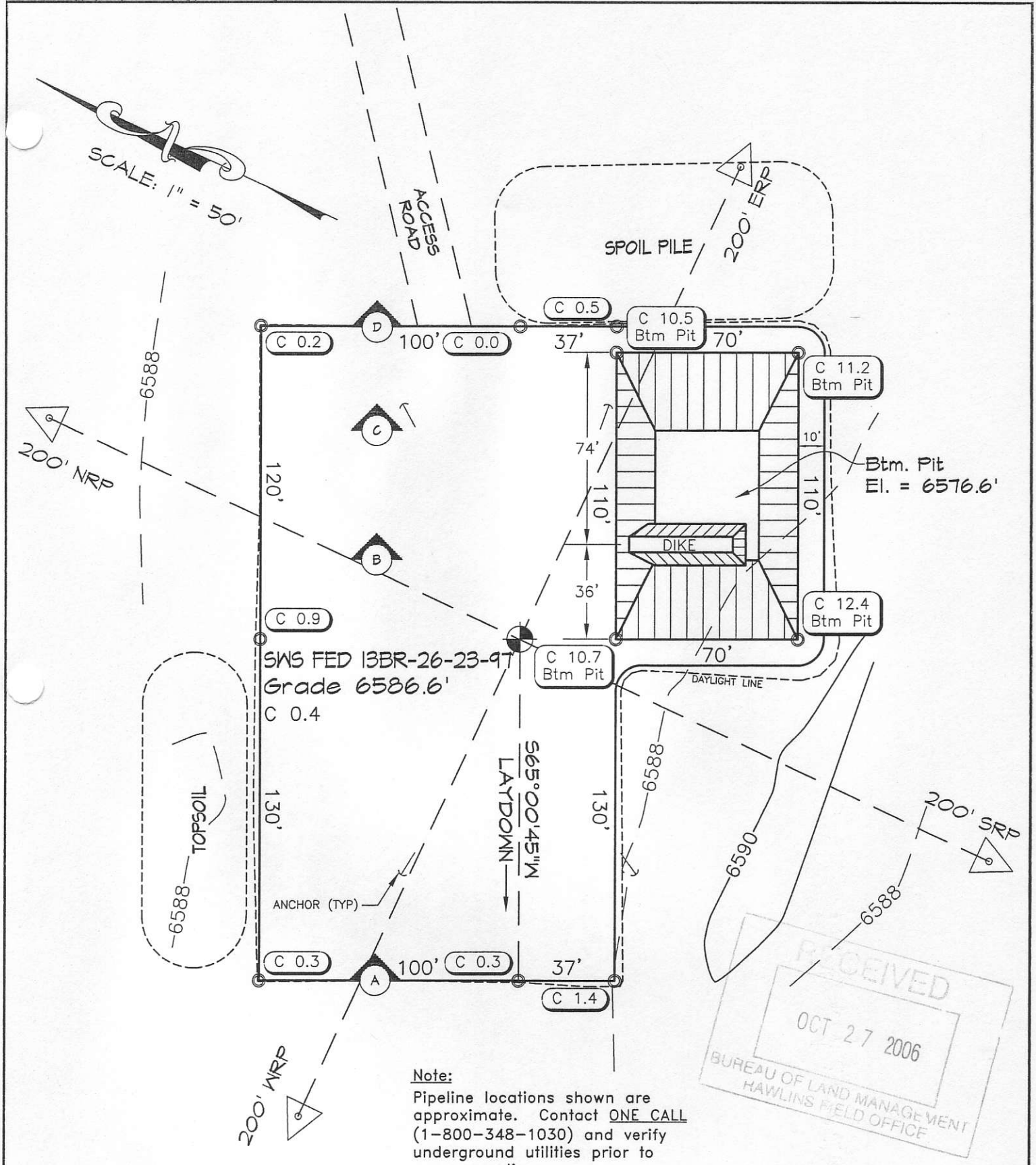
JFC ENGINEERS SURVEYORS
1515 NINTH STREET
ROCK SPRINGS, WY 82901
PHONE (307) 362-7519
FAX (307) 362-7569
http://www.jfc-wyo.com

SWS FED 07BR-26-23-97
SW 1/4, NE 1/4, SEC 26, T23N, R97W
1980' F.N.L. - 1980' F.E.L.
SWEETWATER COUNTY, WYOMING

DWN BY: TCJ
DATE: 06/16/06
SCALE: 1" = 50'

FIGURE 1

FILE NAME: lt1\\J:\Data\73031326\dwg\73031326PAD.dwg 22 JUN 06 12:43



Note:
Pipeline locations shown are approximate. Contact ONE CALL (1-800-348-1030) and verify underground utilities prior to any excavation.

Pinnacle

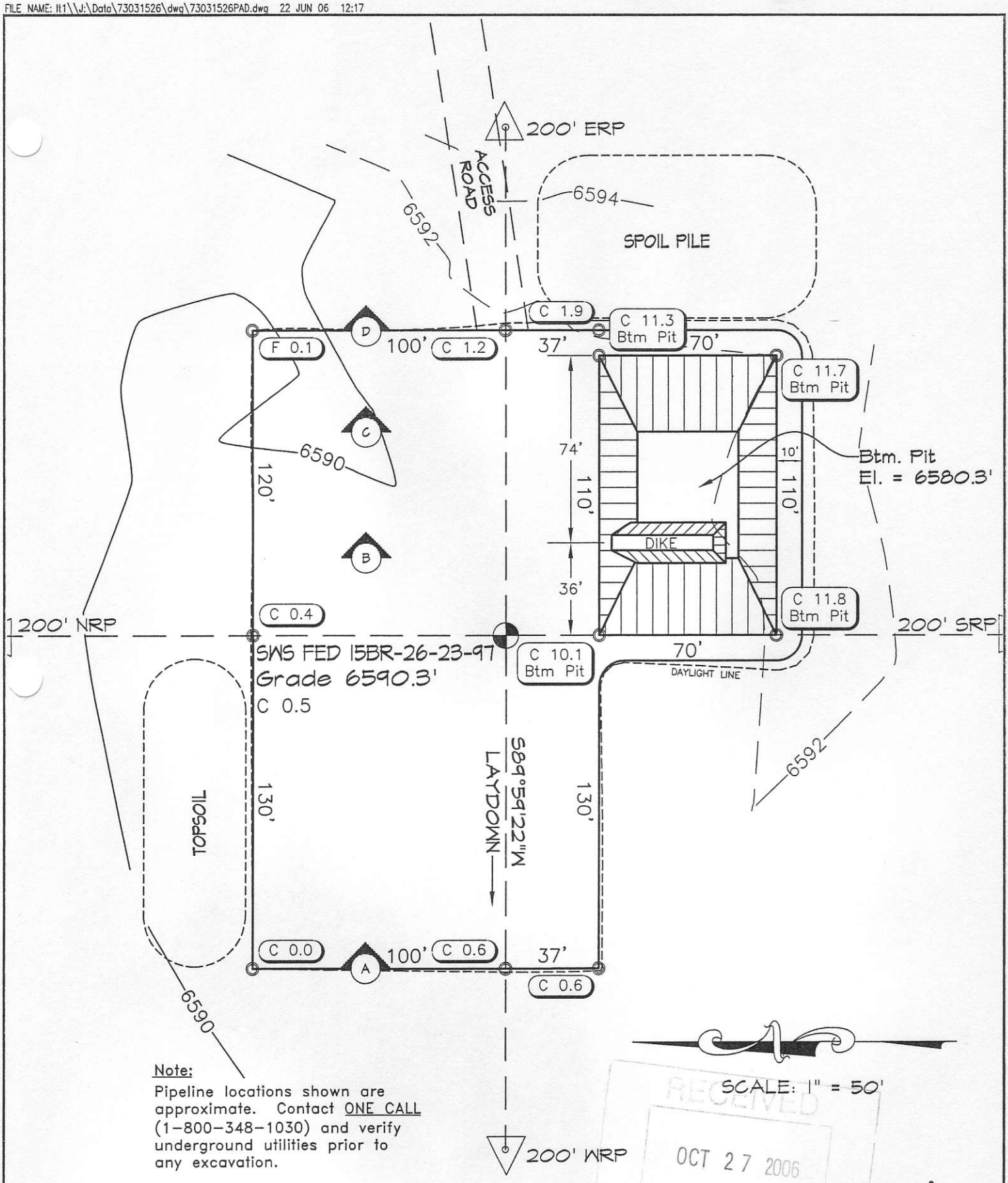
JFC ENGINEERS SURVEYORS
1515 NINTH STREET
ROCK SPRINGS, WY 82901
PHONE (307) 362-7519
FAX (307) 362-7569
http://www.jfc-wyo.com

SWS FED 13BR-26-23-97
SW 1/4, SW 1/4, SEC 26, T23N, R97W
783' F.S.L. - 660' F.W.L.
SWEETWATER COUNTY, WYOMING

DWN BY: zcf
DATE: 6/20/06
SCALE: 1" = 50'

FIGURE 1

FILE NAME: lt1\\J:\Data\73031526\dwg\73031526PAD.dwg 22 JUN 06 12:17



Note:
Pipeline locations shown are approximate. Contact ONE CALL (1-800-348-1030) and verify underground utilities prior to any excavation.

Pinnacle

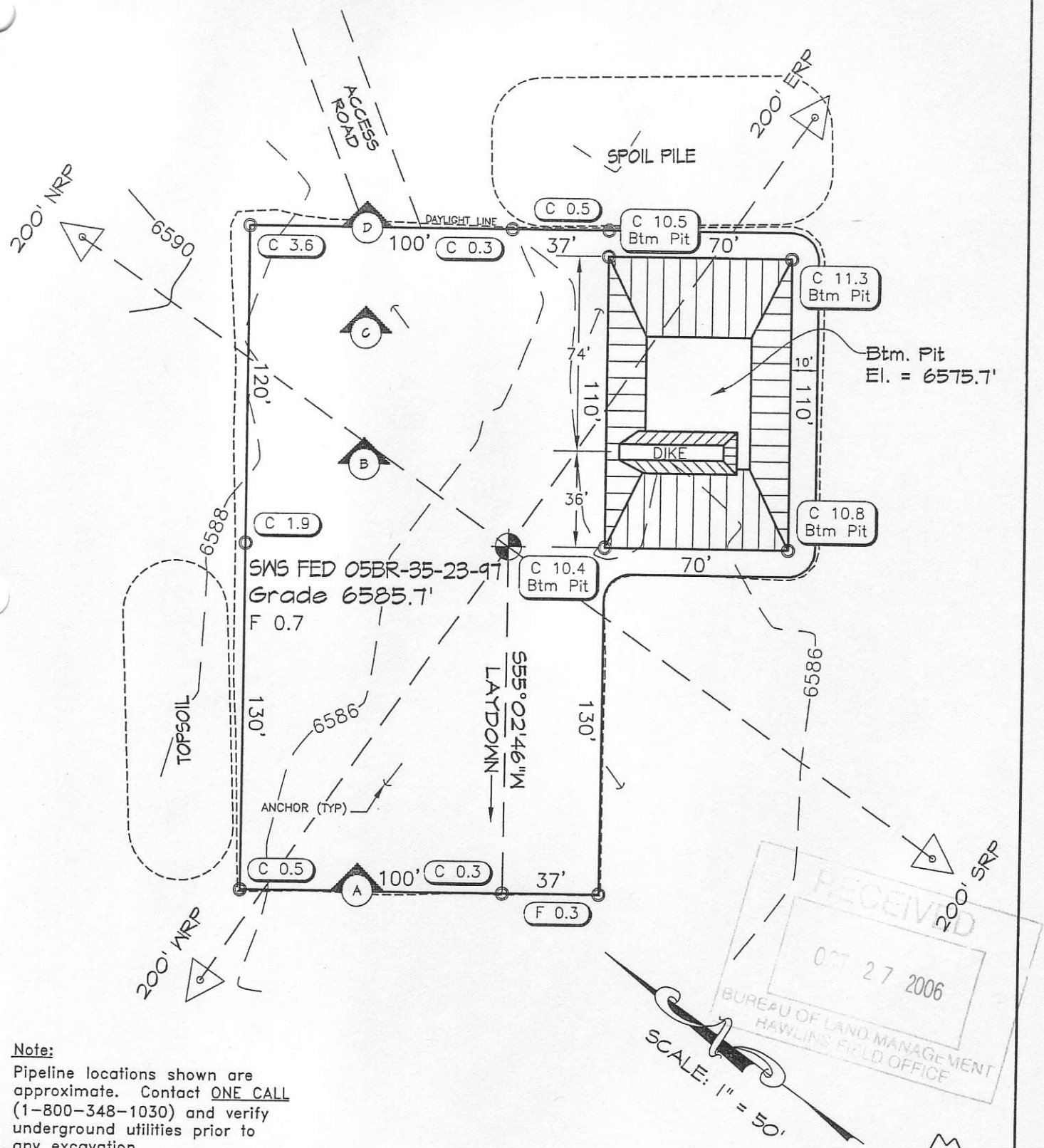
JFC ENGINEERS SURVEYORS
1515 NINTH STREET
ROCK SPRINGS, WY 82901
PHONE (307) 362-7519
FAX (307) 362-7569
http://www.jfc-wyo.com

SWS FED 15BR-26-23-97
SW 1/4, SE 1/4, SEC 26, T23N, R97W
779' F.S.L. - 2012' F.E.L.
SWEETWATER COUNTY, WYOMING

DWN BY: zcf
DATE: 6/20/06
SCALE: 1" = 50'

FIGURE 1

FILE NAME: agf\\J:\Data\73030535\dwg\73030535PAD.dwg 30 JUL 06 12:52



Note:
Pipeline locations shown are approximate. Contact ONE CALL (1-800-348-1030) and verify underground utilities prior to any excavation.

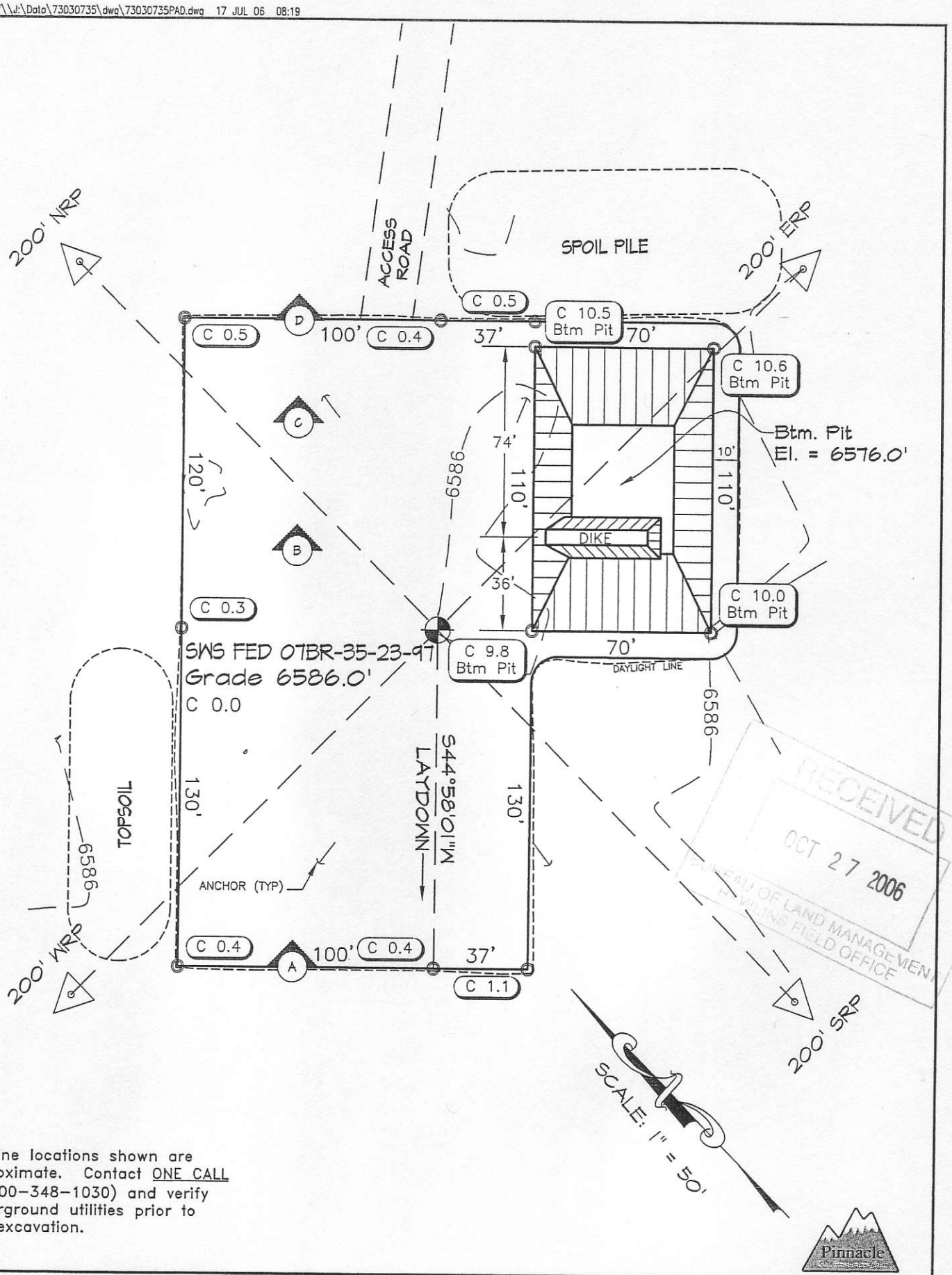
JFC ENGINEERS SURVEYORS
1515 NINTH STREET
ROCK SPRINGS, WY 82901
PHONE (307) 362-7519
FAX (307) 362-7569
http://www.jfc-wyo.com

SWS FED 05BR-35-23-97
SW 1/4, NW 1/4, SEC 35, T23N, R97W
2000' F.N.L. - 670' F.W.L.
SWEETWATER COUNTY, WYOMING

DWN BY: zcf
DATE: 7/18/06
SCALE: 1" = 50'

FIGURE 1

FILE NAME: agf\\J:\Data\73030735\dwg\73030735PAD.dwg 17 JUL 06 08:19



Note:
Pipeline locations shown are approximate. Contact ONE CALL (1-800-348-1030) and verify underground utilities prior to any excavation.

Pinnacle

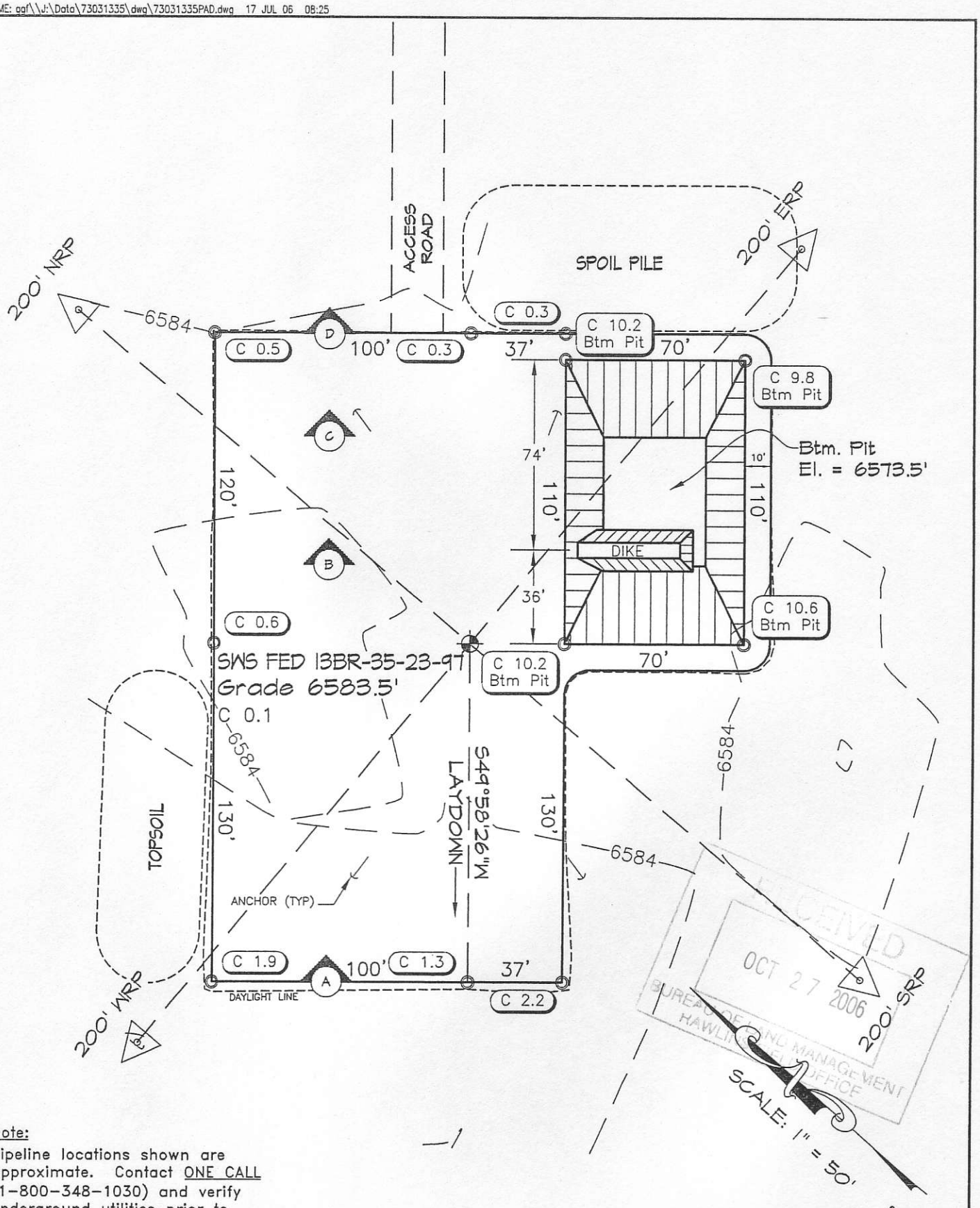
JFC ENGINEERS SURVEYORS
1515 NINTH STREET
ROCK SPRINGS, WY 82901
PHONE (307) 362-7519
FAX (307) 362-7569
http://www.jfc-wyo.com

SWS FED 07BR-35-23-97
SW 1/4, NE 1/4, SEC 35, T23N, R97W
1980' F.N.L. - 1980' F.E.L.
SWEETWATER COUNTY, WYOMING

DWN BY: zcf	
DATE: 7/13/06	
SCALE: 1" = 50'	

FIGURE 1

FILE NAME: ogf\\J:\Data\73031335\dwg\73031335PAD.dwg 17 JUL 06 08:25



Note:
Pipeline locations shown are approximate. Contact ONE CALL (1-800-348-1030) and verify underground utilities prior to any excavation.

Pinnacle

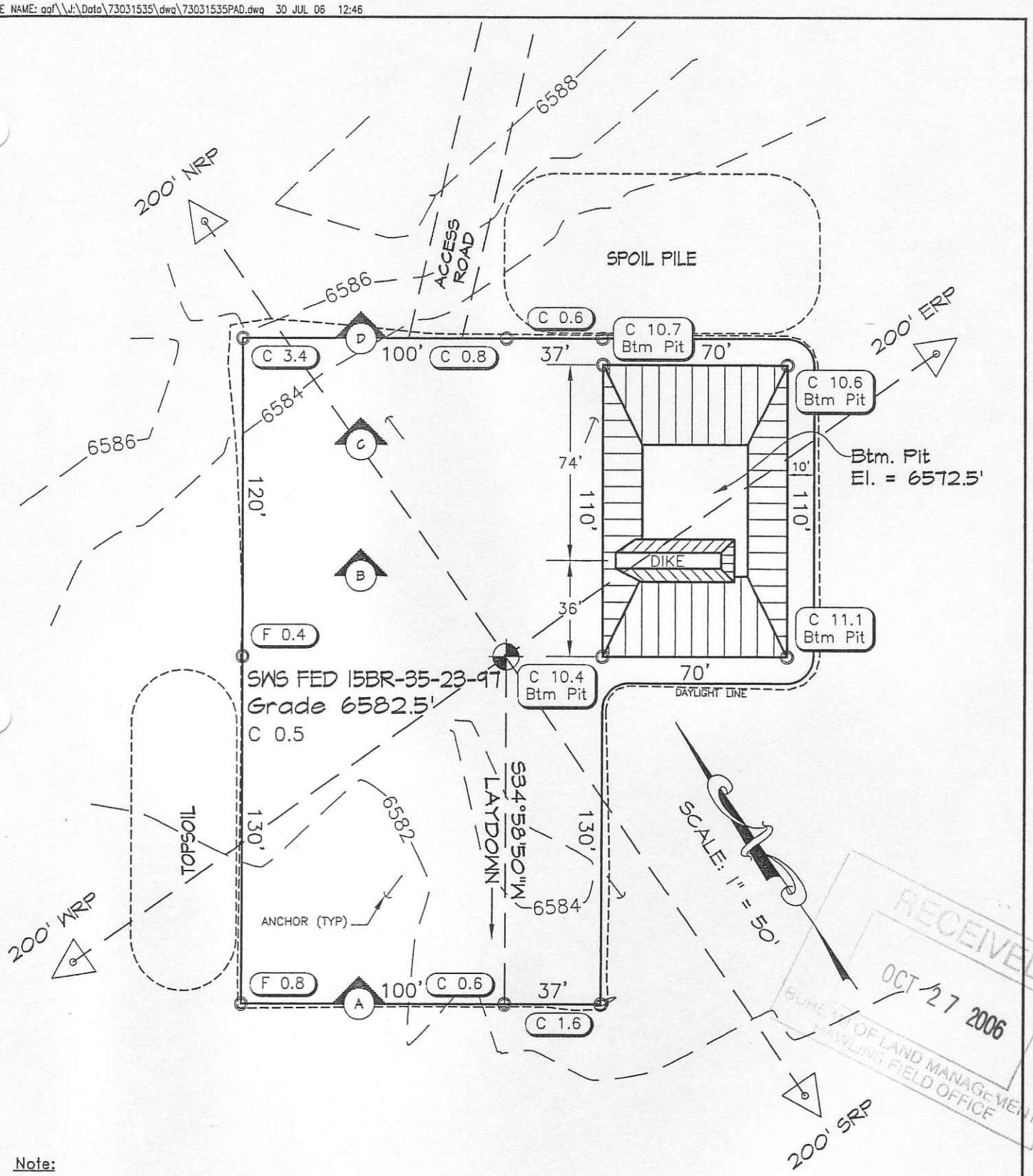
JFC ENGINEERS SURVEYORS
1515 NINTH STREET
ROCK SPRINGS, WY 82901
PHONE (307) 362-7519
FAX (307) 362-7569
http://www.jfc-wyo.com

SWS FED 13BR-35-23-97
SW 1/4, SW 1/4, SEC 35, T23N, R97W
776' F.S.L. - 609' F.W.L.
SWEETWATER COUNTY, WYOMING

DWN BY: zcf
DATE: 7/13/06
SCALE: 1" = 50'

FIGURE 1

FILE NAME: ggf\\J:\Data\73031535\dwg\73031535PAD.dwg 30 JUL 06 12:46



Note:
Pipeline locations shown are approximate. Contact ONE CALL (1-800-348-1030) and verify underground utilities prior to any excavation.

JFC ENGINEERS SURVEYORS
1515 NINTH STREET
ROCK SPRINGS, WY 82901
PHONE (307) 362-7519
FAX (307) 362-7569
http://www.jfc-wyo.com

SWS FED 15BR-35-23-97
SW 1/4, SE 1/4, SEC 35, T23N, R97W
537' F.S.L. - 1963' F.E.L.
SWEETWATER COUNTY, WYOMING

DWN BY: zcf
DATE: 7/14/06
SCALE: 1" = 50'

FIGURE 1

SURROUNDING WELLS AS OF 06 SEPTEMBER 2006
PINNACLE GAS RESOURCES, INC.
SWEETWATER SOUTH FEDERAL POD

PERMIT #	STATUS	TWP	RANGE	SEC.	QTR/QTR	APPLICANT	FACILITY NAME	USES	WELL DEPTH	WELL LOG	COUNTY
P48378W	PUW	23	97	23	SENE	DAVIS OIL COMPANY**USDI, BLM	J T FEDERAL #2	MIS	***	***	Sweetwater
P46937W	PUW	23	97	24	SENW	DAVIS OIL CO.**USDI, BLM	#1 C A T WATER	MIS	***	***	Sweetwater
P68343W	PU	23	97	25	SWSW	USDI, BLM**CO. ARMA GEO.	ENL FLOWING WELL 525T23R96	MIS	1160	***	Sweetwater
P41239W	PUW	23	97	26	SWNE	USDI, BLM** TEXAS OIL & GAS	TEXAS FED G #1	MIS	500	***	Sweetwater
P68343W	PU	23	97	26	SWSW	USDI, BLM**CO. ARMA GEO.	ENL FLOWING WELL 525T23R96	MIS	1160	***	Sweetwater
P68343W	PU	23	97	27	SWSW	USDI, BLM**CO. ARMA GEO.	ENL FLOWING WELL 525T23R96	MIS	1160	***	Sweetwater
39/8/59W	UNA	23	97	35	NENE	PINNACLE GAS RESOURCES, INC.	SWS FED 01BR-35-23-97	CBM,MIS	***	***	Sweetwater
39/9/59W	UNA	23	97	35	NENW	PINNACLE GAS RESOURCES, INC.	SWS FED 03BR-35-23-97	CBM,MIS	***	***	Sweetwater
39/3/61W	UNA	23	97	35	NESE	PINNACLE GAS RESOURCES, INC.	SWS FED 09BR-35-23-97	CBM,MIS	***	***	Sweetwater
39/4/61W	UNA	23	97	35	NESW	PINNACLE GAS RESOURCES, INC.	SWS FED 11BR-35-23-97	CBM,MIS	***	***	Sweetwater
39/1/114W	UNA	23	97	36	SWSW	PINNACLE GAS RESOURCES, INC	SWS STATE 13BR-36-23-97	CBM,MIS	***	***	Sweetwater
39/10/113W	UNA	23	97	36	SWSE	PINNACLE GAS RESOURCES, INC	SWS STATE 15BR-36-23-97	CBM,MIS	***	***	Sweetwater
39/10/59W	UNA	23	97	36	CNE	PINNACLE GAS RESOURCES, INC.	SWS STATE 01BR-36-23-97	CBM,MIS	***	***	Sweetwater
39/2/114W	UNA	23	97	36	SWNW	PINNACLE GAS RESOURCES, INC	SWS STATE 05BR-36-23-97	CBM,MIS	***	***	Sweetwater
39/3/114W	UNA	23	97	36	SWNE	PINNACLE GAS RESOURCES, INC	SWS STATE 07BR-36-23-97	CBM,MIS	***	***	Sweetwater
39/5/59W	UNA	23	97	36	NENW	PINNACLE GAS RESOURCES, INC.	SWS STATE 03BR-36-23-97	CBM,MIS	***	***	Sweetwater
39/6/59W	UNA	23	97	36	NESE	PINNACLE GAS RESOURCES, INC.	SWS STATE 09BR-36-23-97	CBM,MIS	***	***	Sweetwater
39/7/59W	UNA	23	97	36	NESW	PINNACLE GAS RESOURCES, INC.	SWS STATE 11BR-36-23-97	CBM,MIS	***	***	Sweetwater
P52346W	PUW	23	97	36	NENE	SANTA FE ENERGY COMPANY	1-36 WW	MIS	***	***	Sweetwater

STO = Stock Well
DOM = Domestic Well
CBM = Coal Bed Methane Well
MON = Monitoring Well

APPENDIX C

WATER MANAGEMENT PLAN

Pinnacle Gas Resources, Inc.
Sweetwater South Federal POD
Sweetwater County, Wyoming

Plan of Development (POD) – Interim Coalbed Methane Wells

This Water Management Plan (WMP) addresses Pinnacle Gas Resources, Inc.'s (Pinnacle) proposed Sweetwater South Plan of Development (POD) in Sweetwater County, Wyoming. Surface ownership is federal. This plan incorporates state and federal mineral development. Pinnacle is currently permitting and constructing the state mineral development. At present there are 16 state and federal production wells and two (2) injection wells drilled in the Sweetwater South project area. A Water Management Plan Map is included as Map C in the Sweetwater South Federal POD book, "Section 5 - Project Maps".

One may access the Sweetwater South Federal POD by exiting Interstate 80 at Sweetwater County Road 67 (Tipton Road), approximately 56 miles west of Rawlins, Wyoming. Travel 22.5 miles north and then travel west 2.75 miles to the northeast corner of Section 35. The Sweetwater South Federal POD development proposal consists of 8 wells at 8 locations with attendant developments and facilities as shown on the Project Map (see Project Map in Section 5). These eight (8) wells, identified in Appendix 3.1 *Proposed Well List*, are coalbed natural gas (CBNG) exploration/development wells. The listed wells and corresponding leases are located within the Sweetwater South Coalbed Methane Federal Plan of Development Project area.

Pinnacle will comply with all applicable laws, standards and criteria set forth by all appropriate Federal, State and Local authorities including Wyoming State Engineers Office (WSEO), Wyoming Department of Environmental Quality (WDEQ), Wyoming Oil and Gas Conservation Commission (WOGCC), Bureau of Land Management (BLM), Environmental Protection Agency (EPA) and U.S. Army Corps of Engineers (Corps). Regarding the proposed pits, the BLM Right-of-Way is currently in place and bonding is coordinated through the Office of State Lands and Investments (OSLI) for the pits in Section 36; 14-A permits will be obtained through the WOGCC. Pits in Sections 26 and 35 are subject to approval and bonding by the BLM. Pinnacle has requested, and been granted, an exception to leave the groundwater monitoring wells open as requested by the BLM; no additional permitting is required with the WDEQ.

1.SITE DESCRIPTION

The Sweetwater South POD is located in Sections 26, 35, and 36 of Township 23N, Range 97W in Sweetwater County, Wyoming. Pinnacle plans to construct eight (8) additional CBNG wells on a total of eight (8) well pads on Federal leasehold in Sections 26 and 35

T23N, R97W. Each well will produce from the Big Red coal seam. The POD is located on BLM federal lands.

1.1 Existing Land and Water Use

The Sweetwater South project area includes 16 state and federal wells; the eight (8) proposed CBM wells lie on federal surface. Production of livestock and wildlife foraging are the most common land uses in the area.

Existing wells within a 1-mile radius of the POD are presented in Appendix 4.6. Historically, the primary use of wells in the area was for stock watering. More recently a number of wells have been installed by Pinnacle as monitoring points for evaluating groundwater characteristics.

There are no known springs mapped or known to exist within the POD area. A search of stock reservoirs in the Sweetwater South Federal POD that are registered with the Wyoming State Engineer's Office was completed and no reservoirs existed in the Sweetwater South POD project area.

2. WATER MANAGEMENT ALTERNATIVES ANALYSIS

Pinnacle conducted an analysis of alternative produced water management options. For a discussion of other water management options analyzed for the Sweetwater South Federal POD area, please see Appendix 6.7 *Water Management Alternatives.* Early conversations with the Rawlins BLM Office analyzed the use of evaporation ponds. After visiting several existing off-channels ponds and gathering information from other operators, Pinnacle determined the best water management alternative was off-channel containment facilities for the purpose of storage with intermittent evaporation. Portable evaporation units will be utilized in the summer months. The two (2) injection wells will be used to make up the remaining water balance.

A summary of the alternatives considered and the stage to which each was evaluated is provided in Table 6-2. Water management options, including eight (8) off-channel containment structures in seven (7) locations and two (2) injection wells, are being pursued by Pinnacle as a result of the analysis. Off-channel containment structures will be the primary method of produced-water disposal for the project. Ponds utilizing evaporation units will be equipped with a Super Polecat Evaporator by SMI and will be situated so that the plume travels with the wind direction and maximum coverage of the pond is achieved. The evaporator will be powered by the same generator system that powers the wells and will be inspected and maintained by Pinnacle. During high-wind conditions and if visual inspection of the plume indicates that produced water is traveling outside the pond boundaries, the evaporator will be shut down and, if needed, the pond berms will be built up. The SMI Evaporator pumps will be logically controlled according to input from 5 meter wind gauges. Wind speed will be used as a high level shut-down to keep the plume from blowing off of the pond boundaries. These pumps will be controlled by means of a variable-frequency drive to turn the pumps down or they will be shut down via high wind alarm levels directly from the

datalogger. The high wind level is currently estimated at 15 miles per hour. The high wind alarm level will be verified in the field according to plume overshoot.

Pinnacle will collect evaporation data from the water storage ponds in an effort to aid the agencies involved in determining the viability of this, and future, development projects. The data will be provided to the BLM and the Office of State Lands and Investments.

The feasibility of injection is currently under evaluation by Pinnacle, with injection proposed in two wells: the SWS FED 01BR-35-23-97i and the SWS STATE 03BR-36-23-97i. Pinnacle expects that the injection wells will be capable of taking approximately 1400 bbl/day (41 gpm) combined. The length of time these injection wells will be able to sustain 1400 bbls/day is unknown. Pinnacle will provide the Rawlins BLM Field Office with an assessment of the potential, and the limitations, of water disposal by injection.

TABLE 6-1. SUMMARY OF INJECTION WELLS

Well Name	Sec	Tws	Rng	QT/QT	API#
SWS FED 01BR-35-23-97i	35	23N	97W	NENE	49-037-25383
SWS STATE 03BR-36-23-97i	36	57N	76W	NENW	49-037-25617

2.1 Other Alternatives

Pinnacle plans to develop sufficient pit capacity to manage all produced water from this POD.

Please see Table 6-3 for the list of potential ponds sites that will be evaluated for the Sweetwater South POD wells. The ponds at these locations will have a total capacity of approximately 800 ac/ft. If injection proves successful, or if production rates decline faster than originally assumed, pond development will be scaled back. For a discussion of other water management options analyzed for the Sweetwater South Federal POD area, please see Appendix 6.7 *Water Management Alternatives.*

3. EXISTING AND PROPOSED DISCHARGES

Based on water production rates from the Sweetwater South state project area, the maximum production rate from the Big Red coal seam to be produced in the Sweetwater South POD area for the initial year of production is expected to be approximately 1200 bbl/day (35 gpm). The maximum projected flow from the 8 federal well pads is estimated to be 9,600 bbl/day (280 gpm). Along with storage for the eight (8) proposed federal wells addressed in this POD, Pinnacle will also be using these ponds as storage for eight (8) previously approved federal wells and eight (8) approved state wells from Section 36, T23N R97W. The maximum production rate for all 24 wells will be approximately 28,800 bbl/day (840 gpm).

Once all twenty-four (24) wells in the Sweetwater South Project Area are in production, Pinnacle will obtain a blended effluent sample for analysis. See Appendix 6.2 *Water Quality Analyses* for a list of parameters.

The water produced from the 8 federal well pads would be discharged to any or all or the ponds and injection wells. Pinnacle is proposing to construct eight (8) ponds all with an approximate capacity of 100 ac-ft. Twelve (12) potential sites have been evaluated and are listed in Table 6.3 and are shown on Map C, Water Management Map. The eight (8) ponds will be constructed on federal surface over federal minerals (Sections 26 and 35) and on federal surface over state minerals (Section 36). Pinnacle may identify and develop other off-channel containment facilities that would be added to the Sweetwater South POD through sundry notice, and would be permitted as appropriate through Wyoming state agencies.

TABLE 6-2. SUMMARY OF ALTERNATIVE WATER MANAGEMENT APPROACHES.

Alternative	**Level of Analysis**	**In WMP?**	**Comments**
Off-channel ponds	• Site Reconnaissance	Yes- Site evaluations and Permit process underway	Ponds will be lined and be constructed with leak detection systems consisting of a series of drain tile laterals, under the pit, draining into a sump.
Class II Injection wells	• Geologic analysis • Engineering, testing & cost evaluation	Yes –See Table 6-2	Two injection wells have been permitted through and WOGCC and drilled by Pinnacle.
Class V shallow injection systems (horizontal pipe networks)	• Soils & hydraulic analysis • Engineering & cost evaluation	No	Technology in pilot phase elsewhere Uncertain regulatory compliance and cost-effectiveness
Irrigation	• Field soils reconnaissance & mapping • Landowner input	No	With landowner consent, side roles may be developed on suitable land in or near the POD area.
On-channel Reservoirs	• Site reconnaissance	No	
Treatment and discharge	• General engineering & cost estimates • Regulatory review	No	Very cost prohibitive.
Direct discharge to channels	Regulatory review	No	
Misters	• Conceptual analysis • Evaluation of analogs	Yes	

TABLE 6-3: SWEETWATER SOUTH FEDERAL POD – POND LOCATIONS

Outfall/Pond Name	Existing/ Proposed	Lease	Location	GPS Coordinates (NAD 83)		Contributing Wells	Max Flow Rate (gpm)
				Lat.	Long.		
P02-36-23-97A	Proposed	State	T23N, R97W, S36, NWNE	41.928527512	-108.326132174	all wells	168
P02-36-23-97B	Proposed	State	T23N, R97W, S36, NWNE	41.928462722	-108.324400441	all wells	168
P04-36-23-97	Proposed	State	T23N, R97W, S36, NWNW	41.926802118	-108.332573525	all wells	168
P14-36-23-97	Proposed	State	T23N, R97W, S36, SESW	41.917003928	-108.330018102	all wells	168
P15-36-23-97	Proposed	State	T23N, R97W, S36, SWSE	41.917468538	-108.327325692	all wells	168
P08-35-23-97A	Proposed	WYW153193	T23N, R97W, S35, SENE	41.924897422	-108.337698934	all wells	168
P08-35-23-97B	Proposed	WYW153193	T23N, R97W, S35, SENE	41.923634927	-108.339975246	all wells	168
P14-35-23-97	Proposed	WYW153193	T23N, R97W, S35, SESW	41.919269716	-108.351406068	all wells	168

4. WATERSHED CHARACTERISTICS

Production in the project area will occur within the closed Continental Divide Basin. None of the produced water will reach the Colorado River drainage.

5. WATERSHED ANALYSIS

All produced-water will be reinjected or discharged to off-channel containment structures. With WOGCC and WDEQ approval, produced water and evapoconcentrated brine will also be re-injected. The containment structures are placed out of drainages and are bermed on all sides to prohibit surface water run-off from entering the structure. The containment structures will also be fenced to protect wildlife and stock in the area. Fences will be constructed using standard wood posts, no more than sixteen (16) feet apart, between corner braces and strung with five strands of barbed wire. The fences will be approximately 50 inches high.

No surface discharge of CBNG-produced water is proposed in the Sweetwater South Federal POD. Because no water will be added to the surface water flow systems, pre-existing culverts and crossings are not analyzed herein. The watershed analysis provides a general description of watersheds within the POD and gives specific consideration of proposed roads, culvert installations and low water crossings.

Hydrologic watershed field analysis sheets for the watershed within the POD are located in Appendix 6-1. Peak flow analysis was conducted using the method of Miller (2003). Results of the peak flow analyses are summarized in Table 6-4.

TABLE 6-4: PEAK STREAM-FLOW ANALYSIS USING THE METHOD OF MILLER, 2003: PEAK-FLOW CHARACTERISTICS OF WYOMING STREAMS.

Watershed	Area [mi^2]	Return Period [yr]	Peak Discharge [cfs]
Continental Divide Basin	94.07	2	149.79
		10	524.15
		25	804.10

5.1 Culverts

There are four (4) proposed Federal culverts within the POD (See Section 5 *Project Maps* and Appendix 6.4 *Drainage Structures and Crossings* for locations). Additionally, relief culverts along proposed roads may be necessary to minimize erosion potential and will be added on an as-needed basis. Typical culvert construction is shown in Appendix 4.3 of the Surface Use Plan (SUP) of the Sweetwater South Federal POD book.

5.2 Low Water Crossings

There are no proposed Federal low water crossings within the POD. A Typical low water crossing construction is shown in Appendix 4.3 of the Surface Use Plan of the Sweetwater South Federal POD book.

5.3 Erosional Features

No existing erosional features were identified that will be impacted by the Sweetwater South POD. No surface water discharge is proposed in this POD. No headcuts will be constructed or improved as part of this POD unless instructed by the BLM authorized officer.

Activities that require in-channel fill will be in compliance with U.S. Army Corps of Engineers (USACOE) regulations. A statement of that compliance, along with details of the in-channel disturbance will be submitted to the USACOE within 30 days of completion of the crossings.

6. WATER QUALITY

6.1 Produced Water Quality

The water produced from the Sweetwater South POD Area will be from the Big Red coal seam. A water quality sample was obtained from the SWS State 01BR-36-23-97 and SWS State 11BR-16-23-97. These samples are considered representative of the water quality that will be produced. The results of the water quality analysis are included in Appendix 6.2.

7. FACILITY DESIGN

Off-channel containment structures are the primary facilities that will be installed as part of the Sweetwater South POD in order to handle produced water. The ponds will be lined with a single 45 mil liner and contain a leak detection system. The leak detection system will be installed under each lined reservoir in the Sweetwater South field. The leak detection system will consist of four evenly spaced laterals buried beneath the bottom footprint of the reservoir. The laterals will be buried with a minimum of 0.5 feet of cover and then trenched/buried to drain with a minimum slope of 0.5% to a manhole. The piping will consist of 4" perforated P.V.C. schedule 40 with sock (or equivalent). A manhole will be set on the backside toe of the reservoir, which will be the central gathering point for the leak detection system. Compaction around the manhole will be performed in one-foot lifts, and will meet 95% proctor density specifications. The manhole will be buried at enough depth to allow for a minimum of a 2-foot sump (storage) beneath the incoming lateral system. All piping buried from the inside toe of the reservoir to the manhole will be 4" P.V.C. schedule 40 (or equivalent), and will be backfilled with virgin soil. Two anti seep collars will be installed around the pipe beneath berms and packed with bentonite. All piping buried under the bottom of the

footprint of the reservoir will need to be backfilled and compacted with 1 ½ minus washed rock/gravel. The leak detection system will be inspected quarterly during the first year of use and then semi-annually for the remainder of the life of the project.

The soil beneath the pit will be used as a secondary liner. The soils in this area are described as "lean clays" with an average hydraulic conductivity of 4.0E-08 cm/s; – moisture will move downward through the soil profile at a rate of only 0.5 inch per year.

Installation of synthetic liners:

Manufactured liners shall be installed over smooth fill sub grade which is free of pockets, loose rocks, or other material that could damage the liner. Inspector/engineer shall visually inspect surface before installing the liner. All rocks greater than 2" diameter will be removed from the surface before installation. Should there be a large quantity of rock, then the material will be sieved with a 2" screen to remove the larger rocks before the liner can be installed. Should the soil be too rocky and jagged, the engineer reserves the right, with approval of the BLM Authorized Officer, to install a layer of washed sand as sub grade to the liner. The liner will be installed and fused with a minimum of 2' overlap at the seams. The liner will also be keyed in at the top of the berm with compacted fill (see key-in detail in the designs).

Freeboard:

The ponds were designed with a minimum of 2 feet of free board according to BLM standards (Onshore Order #7). Pinnacle will insure that this minimum freeboard is available throughout the life of the project (by either isolating water to the ponds, evaporation, injection, or shutting in wells).

The wind and wave height was calculated from the given pond design geometry. To perform the calculation Pearl used an equation from a technical paper entitled "Freeboard Allowances for Waves in Inland Reservoirs" by Messrs. Thorndike Saville, Jr., Elmo W. McClendon, and Albert L. Cochran that was published in the Journal of the Waterways and Harbors, *Division of the Proceedings for the American Society of Civil Engineers*, May 1962. The equation relates wind speed, acceleration due to gravity, wave height, and effective fetch length. This equation can be seen below:

$$\frac{gh}{V^2} = 0.0026\left[\frac{gF}{V^2}\right]^{0.47}$$

The effective fetch length was determined by a trial-and-error process using the pond geometry and assumed wind directions at 6 degree intervals. The equation used can be seen below and is also sited in the article entitled "Freeboard Allowances for Waves in Inland Reservoirs":

$$Fe = \frac{\sum \chi \alpha COS\alpha}{13.512}$$

Based on this trial-and-error process and the geometry of the ponds, the effective length was calculate to be 542.72 feet (which was the largest fetch length calculated from the 3 trials). The wind speed required to create a two foot wave based on the pond geometry at Sweetwater South is approximately 125 mph. These calculations show that the freeboard of 2 feet should be sufficient and overtopping will not be an issue.

The ponds will be protected by a five (5) strand barbed wire perimeter fence but will not be netted. Pinnacle is proposing this action for two reasons: 1.) Water production rates and evaporation rates have dictated that proposed ponds must serve primarily as storage ponds and secondarily as evaporation ponds. The ponds lose their storage capacity if designed for netting resulting in an order of magnitude increase in surface disturbance. 2.) Per discussions with operators and consultants in the Pinedale Anticline area, ponds without netting have been approved by the Wyoming DEQ office and have been successful water storage facilities without impacting migratory birds. Pinnacle understands that the BLM Pinedale field office representatives have visited the AntiCline Disposal, LLC (ACD) treatment facility on many occasions and were satisfied with their operations. ACD has been in operation since 2002. They have very similar water quality to Pinnacle's produced water and have never netted their facility. ACD's facility is situated much nearer to the Central Flyway and has never taken a migratory bird (evidence of a rodent skull was found during one clean-out).

Although the ponds will not be netted, Pinnacle recognizes the need to keep birds from using the ponds and has selected added preventative measures in an effort to maximize deterrent results. Pinnacle proposes to install railroad ties on two sides of each pond and string 620' of cable, on a 300' pulley system, across the pond attaching the cable to the railroad ties. Flags will be attached to the cable and the pulley system will allow the flags to be easily replaced, aiding maintenance of the system. Additionally, Pinnacle will station raptor models on one side of each pit. The models, called Screech Owls, sit on a swivel base designed to move in the wind and a photo cell activates the four scare sounds during daylight hours. Pinnacle will take full responsibility for any take of migratory birds.

Construction diagrams for the off-channel containment structures are presented in Appendix 6.3. Interior and exterior berm slopes are 4H:1V. The design high-water level is two (2) feet below the top of berm, allowing two (2) feet of freeboard. Typical berm top width is 15 feet. Soil will be removed and used to build the pit berms during construction. During reclamation, the bermed soil will be used to reconstruct the contour of the landscape.

24 hr/50 yr storm event:

The water storage ponds would be located in the middle of the Great Divide basin, which is classified as a closed basin. Any precipitation that occurs within the basin/watershed will not leave the basin. The sub-watershed area (North Red Desert Basin) that could potentially contribute to the proposed ponds is estimated at approximately 84732 Acres. A 24 hour/50 year storm event could produce a rainfall intensity of approximately 2.2 inches. The soils around the Sweetwater South POD are lean clays that allow for a high curve number, or a very slow infiltration rate/faster run off rate. If a 24 hour/50 year storm event were to occur, Pinnacle estimates that there could be approximately 2-6 inches of standing water, depending on the topography. The ponds are being proposed in fairly flat areas throughout the POD.

Of concern are how the leak detection system would be protected and how to ensure that the salts would remain sequestered if a storm event of that intensity were to occur. When the wells are in operation, the ponds will be able to handle the standing water around the berms. The ponds are built to a 4:1 slope and will be compacted to 95% proctor density. The back side of the berms will also be seeded. Pearl is confident that with the slopes provided, the vegetation, the compaction, and the height above original ground that the berms integrity during a storm event shall not be compromised.

CE&MT Laboratories (Gillette) performed a permeability test on the soils sampled at Sweetwater South POD. The soil sample was taken near the 09BR-35-23-97 well location, at an interval of 0-10 feet. The permeability of this soil was tested to ASTM D5084 specifications and showed a hydraulic conductivity of 4.0E-08 cm/sec. These results show that the soils near that location are very impermeable. With the low permeability rate and the evaporation rates shown for passive pan evaporation, it is reasonable to assume that precipitation from a run off will evaporate faster than it could infiltrate the soil to any measurable depth. Based on this information, Pinnacle believes that the leak detection system will not be compromised due to infiltration. When the ponds are reclaimed, a 20-mil liner will be placed over the top of the salt cake. This salt cake is estimated to displace 4.7 acre-ft per pond which equates to approximately 1.36 feet of storage, if the production assumptions hold true. The fused liner, along with a clay cap contoured to prevent standing water over the reclaimed ponds, will provide adequate protection from water infiltration and salt migration. The leak detection will remain in place to monitor these sites for leakage. The system will be monitored quarterly for the first year following reclamation and then semi-annually for the next five (5) years. If, after this time period, no problems are found, monitoring will cease. If water should be found in the leak detection system, the water will be sampled to verify water quality and repairs and improvements will be made to the site. If this proves not to be possible, the salts will be removed and disposed of at an approved.

7.1 Downstream Impacts

No produced water will be discharged to surface water. Therefore, no downstream impacts are expected as a result of activities proposed in this POD.

8. MONITORING AND MITIGATION

8.1 Containment Structures

Pinnacle will conduct, at a minimum, bi-monthly inspection and monitoring of all off-channel containment facilities, including the leak detection system. Outfalls will be inspected for signs of erosion. The perimeter of each structure will be inspected for break out of impounded waters to the surface. Water level in the ponds will be noted. Containment structures that do not perform as designed will be taken off-line and repaired if possible or abandoned and reclaimed if repair is not possible. Ponds will also be fenced for the protection of wildlife in the area, as required by the BLM Rawlins Field Office.

Additionally, should the required freeboard not be met and the pond capacity exceeded, water production will cease and wells will be shut-in until the water level reaches a safe limit.

8.2 Groundwater

Ground water monitoring wells were drilled in several locations in SWS project area (see project map for locations). The purpose of the groundwater monitoring wells is to provide the initial indication of the depth-to-water level, stratigraphy, lithology, and water quality characteristics of the uppermost aquifers across the POD. Initial monitoring results were submitted to WDEQ's Groundwater Pollution Control Program. All ponds on federal surface and ponds overlying federal minerals will be lined. The ground water quality in State Section 16 T23N R97W has been characterized as Class IV and Pinnacle is currently evaluating the possibility of unlined ponds in that area.

Pinnacle is proposing a water and gas pipeline corridor from Section 26 T23N R97W to state Section 16 T23N R97W in order to maximize water management flexibility. Please see Section 11 *Right-of-Way Applications* for a copy of the ROW application submitted to the Rawlins BLM Field Office on October 31, 2006. Any water management alternatives proposed in state Section 16, T23N R97W, may be added to the Sweetwater South Federal POD water management plan via Sundry Application to the BLM. Please see Appendix 6.2 for the Ground Water Monitoring Well data.

8.3 Roads, Culverts and Low Water Crossings

Pinnacle's Storm Water Pollution Prevention Plan (SWPPP) for major construction activities requires bi-weekly monitoring. Monitoring is also required following major storms and/or runoff events. Corrective action will be taken to mitigate any problems noted in inspections.

9. RECLAMATION

All facilities addressed in the water management plan will be reclaimed in accordance with specifications outlined in the Surface Use Plan (see Section 2 of the Sweetwater

South Federal POD book). Whenever possible, surface structures deemed unnecessary due to reduced water production will, with prior approval, be phased out and reclaimed. Water will be re-routed to other existing discharge locations. Because the proposed ponds will be lined, Pinnacle is expecting little to no soil damage. Brine from the proposed ponds will either be trucked to an appropriate disposal site or injected at the injection wells in the project area. Pinnacle is currently in the process of requesting approval of the WOGCC to use the existing injection wells for this use. The BLM will be notified via sundry notice before any surface-disturbing reclamation takes place.

In order to mitigate the possibility of overspray from the evaporation system, Pinnacle will use the excavated soil to build berms capable of containing any overspray.

Following evaporation of the water from the storage ponds, Pinnacle plans to fold, weld, and bury the liners in place, effectively disposing of the remaining solid salts so that they will be prevented from returning to the surface. The following discussion addresses the issue of anticipated solids deposition in the produced water storage ponds:

The potential solids deposition in the proposed lined storage ponds in the Sweetwater South Federal POD has been modeled and the analysis can be found in Section? Appendix 6.3 *Water Containment Facilities.*

Based on the solids deposition information, at the end of the Project, Pinnacle is convinced that the pond liners would be sufficient size to effectively dispose of any precipitated salts and ensure that no salts would come into contact with the native soil. The liner would be large enough to wrap the entire salt cake and would be welded (seamed) shut. The liner area has been calculated as 350,000 ft^2 per pond. In the unlikely event that the solid cake has a surface area larger than the liner area, an additional liner of equivalent weight would be welded to the existing liner to create a continuous, uniform barrier between salt and soil.

10. BONDING

The reclamation costs for the off-channel containment structures were estimated by Pearl Development Company. Reclamation costs are provided in Appendix 6.3, *Water Containment Facilities.*

11. LITERATURE CITED

1) Miller, Kirk A., 2003, Peak-Flow Characteristics of Wyoming Streams, U.S. Geological Survey Water-Resources Investigations Report 03-4107.

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING AND OPERATIONS

Bond Request: **Sweetwater South 08-35-23-97/B Storage Pond**

Lease: **State**

Description: **To provide water storage for Sweetwater South for CBM produced water**

Issue:	For Approval
Rev.:	A
Rev. Date:	14-Jun-07
By:	DRL

Reservoir Reclamation Cost Estimate

		Productivity		Unit Cost	Reclamation Amount
1	Reservoir Capacity	97.00	ac-ft		
2	Remove Top Soil *	2,768	cy	$ 2.90	$ 8,027
3	Replace Top Soil *	2,768	cy	$ 2.90	$ 8,027
4	Excavation (Remove & Contour) *	79,077	cy	$ 2.90	$ 229,323
5	Fence removal	2,200	ft	$ 1.00	$ 2,200
6	Remove outfall	1	each	$ 2,000.00	$ 2,000
7	Seeding	9.00	acres	$ 400	$ 3,600
8	20-mil HDPE capping liner**	210000.00	sq. ft.	0.32	$ 67,200
9	Engineering	8	days	$ 750	$ 6,000
10	Supervision	10	days	$ 750	$ 7,500
11	Mob/Demob	2	each	$ 2,500	$ 5,000
12	Leak Detection monitoring after reclaimation***	14	each	$ 200	$ 2,800
Total Bond Request					**$ 341,678**

* Notes: Pinnacle to reclaim site to original contours. No dirt work needed.

**Liner cost includes material and labor.

***Pinnacle will monitor quarterly for the first year after reclaimation and semi-annually five years after that, no more monitoring after 5 years if no problems are found.

File: 40-0034 8.02.01.01

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING AND OPERATIONS

Bond Request: **Sweetwater South 08-35-23-97/A Storage Pond**

Lease: **State**

Description: **To provide water storage for Sweetwater South for CBM produced water**

Issue: For Approval
Rev.: A
Rev. Date: 14-Jun-07
By: DRL

Reservoir Reclamation Cost Estimate

		Productivity		Unit Cost	Reclamation Amount
1	Reservoir Capacity	97.00	ac-ft		
2	Remove Top Soil *	2,516	cy	$ 2.90	$ 7,296
3	Replace Top Soil *	2,516	cy	$ 2.90	$ 7,296
4	Excavation (Remove & Contour) *	104,156	cy	$ 2.90	$ 302,052
5	Fence removal	2,200	ft	$ 1.00	$ 2,200
6	Remove outfall	1	each	$ 2,000.00	$ 2,000
7	Seeding	8.00	acres	$ 400	$ 3,200
8	20-mil HDPE capping liner**	210000.00	sq. ft.	0.32	$ 67,200
9	Engineering	8	days	$ 750	$ 6,000
10	Supervision	10	days	$ 750	$ 7,500
11	Mob/Demob	2	each	$ 2,500	$ 5,000
12	Leak Detection monitoring after reclaimation***	14	each	$ 200	$ 2,800
Total Bond Request					**$ 412,545**

* Notes: Pinnacle to reclaim site to original contours. No dirt work needed.

**Liner cost includes material and labor.

***Pinnacle will monitor quarterly for the first year after reclaimation and semi-annually five years after that, no more monitoring after 5 years if no problems are found.

File: 40-0034 8.02.01.01

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING AND OPERATIONS

Bond Request: **Sweetwater South 14-35-23-97 Storage Pond**

Lease: **State**

Description: **To provide water storage for Sweetwater South for CBM produced water**

Issue: For Approval
Rev.: A
Rev. Date: 14-Jun-07
By: DRL

Reservoir Reclamation Cost Estimate

		Productivity		Unit Cost	Reclamation Amount
1	Reservoir Capacity	97.00	ac-ft		
2	Remove Top Soil *	2,763	cy	$ 2.90	$ 8,013
3	Replace Top Soil *	2,763	cy	$ 2.90	$ 8,013
4	Excavation (Remove & Contour) *	81,340	cy	$ 2.90	$ 235,886
5	Fence removal	2,200	ft	$ 1.00	$ 2,200
6	Remove outfall	1	each	$ 2,000.00	$ 2,000
7	Seeding	9.00	acres	$ 400	$ 3,600
8	20-mil HDPE capping liner**	210000.00	sq. ft.	$0.32	$ 67,200
9	Engineering	8	days	$ 750	$ 6,000
10	Supervision	10	days	$ 750	$ 7,500
11	Mob/Demob	2	each	$ 2,500	$ 5,000
12	Leak Detection monitoring after reclaimation***	14	each	$ 200	$ 2,800
Total Bond Request					**$ 348,211**

* Notes: Pinnacle to reclaim site to original contours. No dirt work needed.
**Liner cost includes material and labor.
***Pinnacle will monitor quarterly for the first year after reclaimation and semi-annually five years after that, no more monitoring after 5 years if no problems are found.

File: 40-0034 8.02.01.01

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING AND OPERATIONS

Bond Request: **Sweetwater South 14-36-23-97 Storage Pond**

Lease: **State**

Description: **To provide water storage for Sweetwater South for CBM produced water**

Issue:	For Approval
Rev.:	A
Rev. Date:	14-Jun-07
By:	DRL

Reservoir Reclamation Cost Estimate

		Productivity		Unit Cost	Reclamation Amount
1	Reservoir Capacity	97.00	ac-ft		
2	Remove Top Soil *	2,745	cy	$ 2.90	$ 7,961
3	Replace Top Soil *	2,745	cy	$ 2.90	$ 7,961
4	Excavation (Remove & Contour) *	78,900	cy	$ 2.90	$ 228,810
5	Fence removal	2,200	ft	$ 1.00	$ 2,200
6	Remove outfall	1	each	$ 2,000.00	$ 2,000
7	Seeding	9.00	acres	$ 400	$ 3,600
8	20-mil HDPE capping liner**	210000.00	sq. ft.	$0.32	$ 67,200
9	Engineering	8	days	$ 750	$ 6,000
10	Supervision	10	days	$ 750	$ 7,500
11	Mob/Demob	2	each	$ 2,500	$ 5,000
12	Leak Detection monitoring after reclaimation***	14	each	$ 200	$ 2,800
Total Bond Request					**$ 341,031**

* Notes: Pinnacle to reclaim site to original contours. No dirt work needed.

**Liner cost includes material and labor.

***Pinnacle will monitor quarterly for the first year after reclaimation and semi-annually five years after that, no more monitoring after 5 years if no problems are found.

Professional Engineer (Civil)
Date 6/18/07
WYOMING

File: 40-0034 8.02.01.01

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING AND OPERATIONS

Bond Request: **Sweetwater South 02-36-23-97A/B Storage Pond**

Lease: **State**

Description: **To provide water storage for Sweetwater South for CBM produced water**

Issue:	For Approval
Rev.:	A
Rev. Date:	14-Jun-07
By:	DRL

Reservoir Reclamation Cost Estimate

		Productivity		Unit Cost	Reclamation Amount
1	Reservoir Capacity	194.00	ac-ft		
2	Remove Top Soil *	5,225	cy	$ 2.90	$ 15,153
3	Replace Top Soil *	5,225	cy	$ 2.90	$ 15,153
4	Excavation (Remove & Contour) *	146,025	cy	$ 2.90	$ 423,473
5	Fence removal	4,400	ft	$ 1.00	$ 4,400
6	Remove outfall	2	each	$ 2,000.00	$ 4,000
7	Seeding	18.00	acres	$ 400	$ 7,200
8	20-mil HDPE capping liner**	420000.00	sq. ft.	0.32	$ 134,400
9	Engineering	8	days	$ 750	$ 6,000
10	Supervision	10	days	$ 750	$ 7,500
11	Mob/Demob	2	each	$ 2,500	$ 5,000
12	Leak Detection monitoring after reclaimation***	14	each	$ 200	$ 2,800
Total Bond Request					**$ 625,078**

* Notes: Pinnacle to reclaim site to original contours. No dirt work needed.

**Liner cost includes material and labor.

***Pinnacle will monitor quarterly for the first year after reclaimation and semi-annually five years after that, no more monitoring after 5 years if no problems are found.

File: 40-0034 8.02.01.01

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING AND OPERATIONS

Bond Request: **Sweetwater South 04-36-23-97 Storage Pond**

Lease: **State**

Description: **To provide water storage for Sweetwater South for CBM produced water**

Issue:	For Approval
Rev.:	A
Rev. Date:	14-Jun-07
By:	DRL

Reservoir Reclamation Cost Estimate

		Productivity		Unit Cost	Reclamation Amount
1	Reservoir Capacity	97.00	ac-ft		
2	Remove Top Soil *	2,747	cy	$ 2.90	$ 7,966
3	Replace Top Soil *	2,747	cy	$ 2.90	$ 7,966
4	Excavation (Remove & Contour) *	78,894	cy	$ 2.90	$ 228,793
5	Fence removal	2,200	ft	$ 1.00	$ 2,200
6	Remove outfall	1	each	$ 2,000.00	$ 2,000
7	Seeding	9.00	acres	$ 400	$ 3,600
8	20-mil HDPE capping liner**	210000.00	sq. ft.	0.32	$ 67,200
9	Engineering	8	days	$ 750	$ 6,000
10	Supervision	10	days	$ 750	$ 7,500
11	Mob/Demob	2	each	$ 2,500	$ 5,000
12	Leak Detection monitoring after reclaimation***	14	each	$ 200	$ 2,800
Total Bond Request					**$ 341,025**

* Notes: Pinnacle to reclaim site to original contours. No dirt work needed.

**Liner cost includes material and labor.

***Pinnacle will monitor quarterly for the first year after reclaimation and semi-annually five years after that, no more monitoring after 5 years if no problems are found.

File: 40-0034 8.02.01.01

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING AND OPERATIONS

Bond Request: **Sweetwater South 15-36-23-97 Storage Pond**

Lease: **State**

Description: **To provide water storage for Sweetwater South for CBM produced water**

Issue:	For Approval
Rev.:	A
Rev. Date:	14-Jun-07
By:	DRL

Reservoir Reclamation Cost Estimate

		Productivity		Unit Cost	Reclamation Amount
1	Reservoir Capacity	97.00	ac-ft		
2	Remove Top Soil *	2,710	cy	$ 2.90	$ 7,859
3	Replace Top Soil *	2,710	cy	$ 2.90	$ 7,859
4	Excavation (Remove & Contour) *	76,984	cy	$ 2.90	$ 223,254
5	Fence removal	2,200	ft	$ 1.00	$ 2,200
6	Remove outfall	1	each	$ 2,000.00	$ 2,000
7	Seeding	9.00	acres	$ 400	$ 3,600
8	20-mil Capping Liner**	210000.00	sq. ft.	$ 0.32	$ 67,200
9	Engineering	8	days	$ 750	$ 6,000
10	Supervision	10	days	$ 750	$ 7,500
11	Mob/Demob	2	each	$ 2,500	$ 5,000
12	Leak Detection monitoring after reclaimation***	14	each	$ 200	$ 2,800
Total Bond Request					**$ 335,272**

* Notes: Pinnacle to reclaim site to original contours. No dirt work needed.

**Liner cost includes material and labor

***Pinnacle will monitor quarterly for the first year after reclaimation and semi-annually five years after that, no more monitoring after 5 years if no problems are found.

File: 40-0034 8.02.01.01

APPENDIX 6.1

HYDROLOGIC WATERSHED FIELD ANALYSIS SHEETS

HYDROLOGIC WATERSHED FIELD ANALYSIS SUMMARY SHEET

POD Name: **SWEEWATER SOUTH FEDERAL POD**
Company: **Pinnacle Gas Resources Inc.**
Watershed involved: **Continental Divide Closed Basin**
Watershed Area : **60,206 acres**

Average Watershed Slope, ft./mi.: **3.87**

Existing Channel Information
Average Bank Full Width, ft.: **5 ft.**

Average Channel Slope, feet/foot: **.0007 feet/foot**

Average Channel Width, ft. and Depth, ft.: **W 5 ft., D 3 ft.**

General Channel Condition: **Stable**

Peak Flow Analysis: The method for determining peak flow is outlined in *Peak-Flow Characteristics of Wyoming Streams* (Miller, 2003, USGS-WRIR 03-4107).

Recurrence Interval (Years)	**Exceedance Probability(%)**	**Peak Flow, cfs** (at POD boundary or reservoir outlet)	**Contributing Area, sq mi**	**Peak Flow at Watershed Outlet, (cfs)**
2	50	149.79	94.07	149.79
10	10	524.15	94.07	524.15
25	4	804.10	94.07	804.10

ENERGY LABORATORIES, INC. *2393 Salt Creek Highway (82601)* P.O. Box 3258 * Casper, WY 82602
Toll Free 888.235.0515 * 307.235.0515 * Fax 307.234.1639 * casper@energylab.com

LABORATORY ANALYTICAL REPORT

Client: Kennedy Oil
Project: Sweetwater
Lab ID: C03110285-002
Client Sample ID: KSSWS 1-36
SWS State 01BR 36-23-97

Report Date: 04/14/04
Collection Date: 11/07/03 11:30
Date Received: 11/07/03
Matrix: Aqueous

Analyses	Result	Units	Qual	MCL/ RL QCL	Method	Analysis Date / By
MAJOR IONS						
Alkalinity. Total as CaCO3	1940	mg/L		1 0	A2320 B	11/11/03 12:31 / slb
Bicarbonate as HCO3	2360	mg/L		1 0	A2320 B	11/11/03 12:31 / slb
Calcium	66 8	mg/L		1 0	E200 7	11/12/03 19:28 / cp
Chloride	12000	mg/L		1 0	A4500-Cl B	11/11/03 13:20 / jl
Fluoride	2 4	mg/L		0 1	A4500-F C	11/10/03 12:29 / slb
Magnesium	19 9	mg/L		1 0	E200.7	11/12/03 19:28 / cp
Potassium	77.2	mg/L		1 0	E200.7	11/12/03 19:28 / cp
Sodium	8020	mg/L		1 0	E200 7	11/12/03 19:17 / cp
Sulfate	ND	mg/L		1 0	E200 7	11/12/03 19:28 / cp
PHYSICAL PROPERTIES						
Conductivity	35900	umhos/cm		1.0	A2510 B	11/11/03 08:34 / dd
pH	8 29	s u		0 010	A2320 B	11/11/03 12:31 / slb
Solids. Total Dissolved TDS @ 180 C	20600	mg/L		10	A2540 C	11/10/03 10:00 / js
Sodium Adsorption Ratio (SAR)	220	unitless		0.10	Calculation	11/14/03 12:04 / ks
Calcium, SAR	3 34	meq/L		0 050	E200.7	11/12/03 19:28 / cp
Magnesium. SAR	1 65	meq/L		0 080	E200 7	11/12/03 19:28 / cp
Sodium, SAR	349	meq/L		0 040	E200 7	11/12/03 19:17 / cp
DATA QUALITY						
A/C Balance (± 5)	-2 86	%			Calculation	11/14/03 12:12 / ks
Anions	377	meq/L			Calculation	11/14/03 12:12 / ks
Cations	356	meq/L			Calculation	11/14/03 12:12 / ks
Solids, Total Dissolved Calculated	21300	mg/L			Calculation	11/14/03 12:12 / ks
TDS Balance (0 80 - 1 20)	0.970	dec %			Calculation	11/14/03 12:12 / ks

Report Definitions: RL - Analyte reporting limit. QCL - Quality control limit. MCL - Maximum contaminant level. ND - Not detected at the reporting limit.

Inter·Mountain Laboratories, Inc.
1673 Terra Avenue
Sheridan, WY 82801

Sample Analysis Report

CLIENT: Pinnacle Gas Resources, Inc.
1 East Alger
Suite 206
Sheridan, WY 82801

Date Reported: 3/27/2006
Report ID: S0603232001

Work Order: S0603232
Project: Kennedy-Rawlins
Collection Date: 3/15/2006 12:20 PM
Lab ID: S0603232-001
Date Received: 3/16/2006 2:00 PM
Client Sample ID: SW 23-16
Sampler: Rich Sweeny
Matrix: Water

SWS Stock 11BR-16-23-97

Analyses	Result	PQL	Qual	Units	Date Analyzed/Init	Method
General Parameters						
pH	7.9	0.1		s.u.	03/21/2006 1752 WN	EPA 150.1
Electrical Conductivity	47600	5		µmhos/cm	03/21/2006 1752 WN	SM 2510B
Total Dissolved Solids (180)	30200	10		mg/L	03/20/2006 1016 EB	SM 2540
Alkalinity, Total (As CaCO3)	1840	5		mg/L	03/21/2006 1752 WN	SM 2320B
Hardness, Calcium/Magnesium (As CaCO3)	382	1		mg/L	03/23/2006 933 KB	SM 2340B
Cyanide, Total	ND	5		µg/L	03/24/2006 019 RM	EPA 335.4
Phenolics, Total Recoverable	10	10		µg/L	03/24/2006 1151 RM	EPA 420.2
Radium 226	25.2 ± 1.3	0.2		pCi/L	03/26/2006 1609 SH	SM 7500 RA B
TPH 418.1	10	1		mg/L	03/27/2006 948 SH	EPA 418.1
Sodium Adsorption Ratio	247	0.1			03/23/2006 933 KB	Calculation
Anions						
Alkalinity, Bicarbonate as HCO3	2240	5		mg/L	03/21/2006 1752 WN	SM 2320B
Chloride	15700	5		mg/L	03/22/2006 1938 LK	EPA 300.0
Fluoride	1.8	0.1		mg/L	03/21/2006 1752 WN	SM 4500FC
Sulfate	ND	10		mg/L	03/22/2006 1947 LK	EPA 300.0
tions						
Calcium	102	1		mg/L	03/21/2006 1304 TC	EPA 200.7
Magnesium	31	1		mg/L	03/21/2006 1304 TC	EPA 200.7
Potassium	130	1		mg/L	03/21/2006 1304 TC	EPA 200.7
Sodium	11100	1		mg/L	03/21/2006 1304 TC	EPA 200.7
Cation/Anion-Milliequivalents						
Bicarbonate as HCO3	36.79	0.01		meq/L	03/23/2006 933 KB	SM 1030F
Chloride	443.69	0.01		meq/L	03/23/2006 933 KB	SM 1030F
Fluoride	0.09	0.01		meq/L	03/23/2006 933 KB	SM 1030F
Sulfate	ND	0.01		meq/L	03/23/2006 933 KB	SM 1030F
Calcium	5.10	0.01		meq/L	03/23/2006 933 KB	SM 1030F
Magnesium	2.54	0.01		meq/L	03/23/2006 933 KB	SM 1030F
Potassium	3.32	0.01		meq/L	03/23/2006 933 KB	SM 1030F
Sodium	483.85	0.01		meq/L	03/23/2006 933 KB	SM 1030F

These results apply only to the samples tested.

Qualifiers:
- * Value exceeds Maximum Contaminant Level
- E Value above quantitation range
- J Analyte detected below quantitation limits
- ND Not Detected at the Reporting Limit
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- L Analyzed by a contract laboratory
- S Spike Recovery outside accepted recovery limits

Reviewed by: _____
Wade Nieuwsma, Project Manager

Inter·Mountain Laboratories, Inc.
1673 Terra Avenue
Sheridan, WY 82801

Sample Analysis Report

CLIENT: Pinnacle Gas Resources, Inc.
1 East Alger
Suite 206
Sheridan, WY 82801

Project: Kennedy-Rawlins
Lab ID: S0603232-001
Client Sample ID: SW 23-16
Matrix: Water

Date Reported: 3/27/2006
Report ID: S0603232001

Work Order: S0603232
Collection Date: 3/15/2006 12:20 PM
Date Received: 3/16/2006 2:00 PM
Sampler: Rich Sweeny

Analyses	Result	PQL	Qual	Units	Date Analyzed/Init	Method
Dissolved Metals						
Boron	1700	100		µg/L	03/20/2006 1846 TC	EPA 200.7
Cadmium	1.3	0.1		µg/L	03/27/2006 1015 MS	EPA 200.8
Chromium	ND	1		µg/L	03/20/2006 1846 TC	EPA 200.7
Copper	132	1		µg/L	03/27/2006 1015 MS	EPA 200.8
Iron	ND	30		µg/L	03/20/2006 1846 TC	EPA 200.7
Lead	12	2		µg/L	03/27/2006 1015 MS	EPA 200.8
Manganese	70	10		µg/L	03/20/2006 1846 TC	EPA 200.7
Mercury	ND	1		µg/L	03/23/2006 1035 PQ	EPA 245.1
Nickel	ND	10		µg/L	03/20/2006 1846 TC	EPA 200.7
Silver	ND	3		µg/L	03/27/2006 1015 MS	EPA 200.8
Zinc	470	10		µg/L	03/20/2006 1846 TC	EPA 200.7
Total Metals (200.2)						
Aluminum	3080	50		µg/L	03/24/2006 1408 TC	EPA 200.7
Antimony	8	5		µg/L	03/27/2006 1012 MS	EPA 200.8
Arsenic	70	1		µg/L	03/27/2006 1012 MS	EPA 200.8
Barium	86300	100		µg/L	03/27/2006 1012 MS	EPA 200.8
Beryllium	ND	0.9		µg/L	03/24/2006 1408 TC	EPA 200.7
Selenium	28	5		µg/L	03/27/2006 1012 MS	EPA 200.8
Thallium	10	10		µg/L	03/27/2006 1012 MS	EPA 200.8

These results apply only to the samples tested.

Qualifiers:

*	Value exceeds Maximum Contaminant Level
E	Value above quantitation range
J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit
B	Analyte detected in the associated Method Blank
H	Holding times for preparation or analysis exceeded
L	Analyzed by a contract laboratory
S	Spike Recovery outside accepted recovery limits

Reviewed by: _____
Wade Nieuwsma, Project Manager

ENERGY LABORATORIES, INC. * 1105 West First Street * Gillette, WY 82716
Toll Free 866.686.7175 * 307.686.7175 * Fax 307.682.4625 * gillette@energylab.com

LABORATORY ANALYTICAL REPORT

Client: Kennedy Oil
Project: South SW State 23-16
Samp FRQ/Type:
Lab ID: G04120375-001
Client Sample ID: South SW State 23-16
Location: SWS 11BR16 23-97

Report Date: 01/04/05
Collection Date: 12/24/04 15:00
DateReceived: 12/27/04
Sampled By: Ray McConnell
Matrix: AQUEOUS

Analyses	Result	Units	Qualifiers	RL	QCL	Method	Analysis Date / By
MAJOR IONS							
Bicarbonate as HCO3	2130	mg/L		5		A2320 B	12/27/04 21:34 / daa
Chloride	16500	mg/L	D	10		E300 0	12/28/04 16:31 / tlf
Sulfate	ND	mg/L		1		E300 0	12/29/04 19:27 / tlf
MAJOR IONS, TOTAL							
Calcium	114	mg/L	D	5		E200.7	12/30/04 15:18 / rlh
Magnesium	24	mg/L	D	4		E200 7	12/30/04 15:18 / rlh
Sodium	10800	mg/L	D	20		E200 7	12/30/04 15:18 / rlh
MAJOR IONS, TOTAL MILLIEQUIVALENTS							
Calcium, meq	5 7	meq/L	D	0 2		E200 7	12/30/04 15:18 / rlh
Magnesium. meq	2 0	meq/L	D	0.3		E200 7	12/30/04 15:18 / rlh
Sodium, meq	472	meq/L	D	0 7		E200 7	12/30/04 15:18 / rlh
METALS, DISSOLVED							
Cadmium	0.1	ug/L		0 1		E200 8	12/29/04 20:31 / jw
Copper	13	ug/L		1		E200.8	12/29/04 20:31 / jw
Iron	181	ug/L	D	200		E200 7	12/28/04 11:43 / rlh
Lead	ND	ug/L		2		E200.8	12/29/04 20:31 / jw
Manganese	602	ug/L	D	50		E200.7	12/28/04 11:43 / rlh
Mercury	ND	ug/L		0 06		E200 8	12/30/04 21:37 / car
Zinc	21	ug/L		10		E200 8	12/29/04 20:31 / jw
METALS, TOTAL							
Aluminum	439	ug/L		50		E200 8	12/31/04 10:24 / car
METALS, TOTAL RECOVERABLE							
Arsenic	2 7	ug/L	D	0 4		E200 8	12/29/04 10:52 / jw
Barium	99000	ug/L		100		E200 7	12/29/04 14:50 / rlh
Selenium	ND	ug/L		5		E200 8	12/29/04 10:52 / jw
NON-METALS							
Alkalinity, Total as CaCO3	1740	mg/L		5		A2320 B	12/27/04 21:34 / daa
Hardness, Total as CaCO3	380	mg/L		10		A2340 B	01/03/05 15:54 / cw
Sodium Adsorption Ratio, Total (SAR)	241	unitless		0 1		Calculation	01/03/05 15:54 / cw
Solids. Total Dissolved TDS @ 180 C	28000	mg/L		20		A2540 C	12/30/04 11:53 / daa

Report Definitions:
RL - Analyte reporting limit
QCL - Quality control limit
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level
ND - Not detected at the reporting limit

Patty Tibbetts
Quality Assurance Manager

Ground Water Monitoring Well Data

Table 1
Ground Water Quality Summary
Pinnacle-Sweetwater South

Parameter	Class I	Class II	Class III	Fed 09-35 South
pH, s.u.	6.5-9.0	4.5-9.0	6.5-8.5	8.6
Electrical Conductivity, umhos/cm	x	x	x	2230
Total Dissolved Solids (180), mg/l	500	2000	5000	1480
Total Dissolved Solids (calc), mg/l	x	x	x	1560
Alkalinity, Total (as CaCO3), mg/l	x	x	x	565
Nitrogen, Ammonia (as N), mg/l	0.58	x	x	2.1
Radium 226	*5pCi/l	*5pCi/l	*5pCi/l	
Sodium Adsorption Ratio	x	8	x	31.4
Anions, mg/l				
Alkalinity, Bicaronate as HCO3, mg/l	x	x	x	632
Chloride, mg/l	250	100	2000	83
Fluoride, mg/l	1.4-2.4[7]	x	x	2.3
Nitrogen, Nitrate-Nitrate (as N), mg/l	10	x	x	1.02
Sulfate, mg/l	250	200	3000	527
Cations, mg/l				
Calcium, mg/l	x	x	x	11
Magnesium, mg/l	x	x	x	9
Potassium, mg/l	x	x	x	10
Sodium, mg/l	x	x	x	579
Cation/Anion-Milliequivalents (meg/l)				
Bicarbonate as HCO3	x	x	x	10.35
Chloride	x	x	x	2.32
Fluoride	x	x	x	0.11
Nitrate + Nitrate as N	x	x	x	0.07
Sulfate	x	x	x	10.98
Calcium	x	x	x	0.54
Magnesium	x	x	x	0.97
Potassium	x	x	x	0.25
Sodium	x	x	x	26.64
Total Metal, mg/l (200.2)				
Aluminum	x	5.0	5	195
Arsenic	0.05	0.1	0.2	0.139
Barium	1.0	x	x	4.2
Beryllium	x	0.1	x	0.0032
Boron	0.75	0.75	5	0.1
Cadmium	0.01	0.01	0.05	0.0099
Chromium	0.05	0.1	0.05	0.359
Cobalt	x	0.2	1	0.17
Copper	1	5	0.5	0.527
Iron	0.3	5	x	278
Lead	0.05	5	0.1	0.358
Lithium	x	2.5	x	0.7
Manganese	0.05	0.2	x	7.49
Mercury	0.002	x	0.00005	ND
Nickle	x	0.2	x	0.39
Selenium	0.01	0.02	0.05	ND
Silver	0.05	x	x	0.015
Uranium	5	5	5	0.045
Vanadium	x	0.1	0.1	0.33
Zinc	5	2	25	1.19
				Class IV

*Chapter 8 Class I, II, &III parameter limit based upon combined total of Radium 226 and Radium 228

	Above Class I
	Above Class II
	Above Class III

Table 1
Ground Water Quality Summary
Pinnacle-Sweetwater South

Parameter	Class I	Class II	Class III	Fed 01-35 South
pH, s.u.	6.5-9.0	4.5-9.0	6.5-8.5	8.4
Electrical Conductivity, umhos/cm	x	x	x	4450
Total Dissolved Solids (180), mg/l	500	2000	5000	2950
Total Dissolved Solids (calc), mg/l	x	x	x	2860
Alkalinity, Total (as CaCO3), mg/l	x	x	x	750
Nitrogen, Ammonia (as N), mg/l	0.58	x	x	1.8
Radium 226	*5pCi/l	*5pCi/l	*5pCi/l	
Sodium Adsorption Ratio	x	8	x	24.2
Anions, mg/l				
Alkalinity, Bicaronate as HCO3, mg/l	x	x	x	895
Chloride, mg/l	250	100	2000	267
Fluoride, mg/l	1.4-2.4[7]	x	x	2.2
Nitrogen, Nitrate-Nitrate (as N), mg/l	10	x	x	0.14
Sulfate, mg/l	250	200	3000	1120
Cations, mg/l				
Calcium, mg/l	x	x	x	24
Magnesium, mg/l	x	x	x	55
Potassium, mg/l	x	x	x	7
Sodium, mg/l	x	x	x	941
Cation/Anion-Milliequivalents (meg/l)				
Bicarbonate as HCO3	x	x	x	14.67
Chloride	x	x	x	7.52
Fluoride	x	x	x	0.11
Nitrate + Nitrate as N	x	x	x	0.01
Sulfate	x	x	x	23.21
Calcium	x	x	x	0.72
Magnesium	x	x	x	4.49
Potassium	x	x	x	0.18
Sodium	x	x	x	40.92
Total Metal, mg/l (200.2)				
Aluminum	x	5.0	5	4.54
Arsenic	0.05	0.1	0.2	0.014
Barium	1.0	x	x	ND
Beryllium	x	0.1	x	ND
Boron	0.75	0.75	5	0.2
Cadmium	0.01	0.01	0.05	0.0003
Chromium	0.05	0.1	0.05	0.008
Cobalt	x	0.2	1	ND
Copper	1	5	0.5	0.011
Iron	0.3	5	x	6.89
Lead	0.05	5	0.1	0.006
Lithium	x	2.5	x	ND
Manganese	0.05	0.2	x	0.15
Mercury	0.002	x	0.00005	ND
Nickle	x	0.2	x	ND
Selenium	0.01	0.02	0.05	ND
Silver	0.05	x	x	ND
Uranium	5	5	5	0.005
Vanadium	x	0.1	0.1	ND
Zinc	5	2	25	0.04
				Class III

*Chapter 8 Class I, II, &III parameter limit based upon combined total of Radium 226 and Radium 228

	Above Class I
	Above Class II
	Above Class III

	Above Class I
	Above Class II
	Above Class III

Table 1
Ground Water Quality Summary
Pinnacle-Sweetwater South

Parameter	Class I	Class II	Class III	State 09-16
pH, s.u.	6.5-9.0	4.5-9.0	6.5-8.5	8.2
Electrical Conductivity, umhos/cm	x	x	x	8630
Total Dissolved Solids (180), mg/l	500	2000	5000	7200
Total Dissolved Solids (calc), mg/l	x	x	x	7110
Alkalinity, Total (as CaCO3), mg/l	x	x	x	451
Nitrogen, Ammonia (as N), mg/l	0.58	x	x	0.7
Radium 226	*5pCi/l	*5pCi/l	*5pCi/l	
Sodium Adsorption Ratio	x	8	x	31.6
Anions, mg/l				
Alkalinity, Bicaronate as HCO3, mg/l	x	x	x	550
Chloride, mg/l	250	100	2000	76
Fluoride, mg/l	1.4-2.4[7]	x	x	2.4
Nitrogen, Nitrate-Nitrate (as N), mg/l	10	x	x	11.4
Sulfate, mg/l	250	200	3000	4370
Cations, mg/l				
Calcium, mg/l	x	x	x	67
Magnesium, mg/l	x	x	x	168
Potassium, mg/l	x	x	x	19
Sodium, mg/l	x	x	x	2130
Cation/Anion-Milliequivalents (meg/l)				
Bicarbonate as HCO3	x	x	x	9.01
Chloride	x	x	x	2.14
Fluoride	x	x	x	0.12
Nitrate + Nitrate as N	x	x	x	0.81
Sulfate	x	x	x	90.92
Calcium	x	x	x	3.34
Magnesium	x	x	x	13.8
Potassium	x	x	x	0.48
Sodium	x	x	x	92.49
Total Metal, mg/l (200.2)				
Aluminum	x	5.0	5	147
Arsenic	0.05	0.1	0.2	0.107
Barium	1.0	x	x	0.6
Beryllium	x	0.1	x	0.0047
Boron	0.75	0.75	5	0.6
Cadmium	0.01	0.01	0.05	0.003
Chromium	0.05	0.1	0.05	0.341
Cobalt	x	0.2	1	0.09
Copper	1	5	0.5	0.247
Iron	0.3	5	x	216
Lead	0.05	5	0.1	0.157
Lithium	x	2.5	x	0.7
Manganese	0.05	0.2	x	4.97
Mercury	0.002	x	0.00005	ND
Nickle	x	0.2	x	0.25
Selenium	0.01	0.02	0.05	0.031
Silver	0.05	x	x	ND
Uranium	5	5	5	0.263
Vanadium	x	0.1	0.1	0.24
Zinc	5	2	25	0.71
				Class IV

*Chapter 8 Class I, II, &III parameter limit based upon combined total of Radium 226 and Radium 228

	Above Class I
	Above Class II
	Above Class III

Table 1
Ground Water Quality Summary
Pinnacle-Sweetwater South

Parameter	Class I	Class II	Class III	Fed 11-26 South
pH, s.u.	6.5-9.0	4.5-9.0	6.5-8.5	8.5
Electrical Conductivity, umhos/cm	x	x	x	3050
Total Dissolved Solids (180), mg/l	500	2000	5000	2110
Total Dissolved Solids (calc), mg/l	x	x	x	2220
Alkalinity, Total (as CaCO3), mg/l	x	x	x	671
Nitrogen, Ammonia (as N), mg/l	0.58	x	x	1.9
Radium 226	*5pCi/l	*5pCi/l	*5pCi/l	
Sodium Adsorption Ratio	x	8	x	27.6
Anions, mg/l				
Alkalinity, Bicaronate as HCO3, mg/l	x	x	x	767
Chloride, mg/l	250	100	2000	87
Fluoride, mg/l	1.4-2.4[7]	x	x	2.1
Nitrogen, Nitrate-Nitrate (as N), mg/l	10	x	x	0.3
Sulfate, mg/l	250	200	3000	857
Cations, mg/l				
Calcium, mg/l	x	x	x	20
Magnesium, mg/l	x	x	x	28
Potassium, mg/l	x	x	x	18
Sodium, mg/l	x	x	x	812
Cation/Anion-Milliequivalents (meg/l)				
Bicarbonate as HCO3	x	x	x	12.57
Chloride	x	x	x	2.43
Fluoride	x	x	x	0.1
Nitrate + Nitrate as N	x	x	x	0.02
Sulfate	x	x	x	15.93
Calcium	x	x	x	1
Magnesium	x	x	x	2.26
Potassium	x	x	x	0.48
Sodium	x	x	x	35.3
Total Metal, mg/l (200.2)				
Aluminum	x	5.0	5	9.86
Arsenic	0.05	0.1	0.2	0.011
Barium	1.0	x	x	ND
Beryllium	x	0.1	x	ND
Boron	0.75	0.75	5	ND
Cadmium	0.01	0.01	0.05	0.0002
Chromium	0.05	0.1	0.05	0.017
Cobalt	x	0.2	1	ND
Copper	1	5	0.5	0.015
Iron	0.3	5	x	12.6
Lead	0.05	5	0.1	0.007
Lithium	x	2.5	x	ND
Manganese	0.05	0.2	x	0.2
Mercury	0.002	x	0.00005	ND
Nickle	x	0.2	x	0.01
Selenium	0.01	0.02	0.05	ND
Silver	0.05	x	x	ND
Uranium	5	5	5	0.004
Vanadium	x	0.1	0.1	ND
Zinc	5	2	25	0.05
				Class IV

*Chapter 8 Class I, II, &III parameter limit based upon combined total of Radium 226 and Radium 228

	Above Class I
	Above Class II
	Above Class III

Table 1
Ground Water Quality Summary
Pinnacle-Sweetwater South

Parameter	Class I	Class II	Class III	State 11-16 Central
pH, s.u.	6.5-9.0	4.5-9.0	6.5-8.5	8.3
Electrical Conductivity, umhos/cm	x	x	x	3070
Total Dissolved Solids (180), mg/l	500	2000	5000	2300
Total Dissolved Solids (calc), mg/l	x	x	x	2450
Alkalinity, Total (as CaCO3), mg/l	x	x	x	319
Nitrogen, Ammonia (as N), mg/l	0.58	x	x	2.9
Radium 226	*5pCi/l	*5pCi/l	*5pCi/l	
Sodium Adsorption Ratio	x	8	x	1.0
Anions, mg/l				
Alkalinity, Bicaronate as HCO3, mg/l	x	x	x	388
Chloride, mg/l	250	100	2000	28
Fluoride, mg/l	1.4-2.4[7]	x	x	0.7
Nitrogen, Nitrate-Nitrate (as N), mg/l	10	x	x	0.07
Sulfate, mg/l	250	200	3000	1400
Cations, mg/l				
Calcium, mg/l	x	x	x	73
Magnesium, mg/l	x	x	x	53
Potassium, mg/l	x	x	x	15
Sodium, mg/l	x	x	x	694
Cation/Anion-Milliequivalents (meg/l)				
Bicarbonate as HCO3	x	x	x	6.31
Chloride	x	x	x	0.74
Fluoride	x	x	x	0.03
Nitrate + Nitrate as N	x	x	x	ND
Sulfate	x	x	x	25.49
Calcium	x	x	x	3.75
Magnesium	x	x	x	4.39
Potassium	x	x	x	0.39
Sodium	x	x	x	30.84
Total Metal, mg/l (200.2)				
Aluminum	x	5.0	5	56.7
Arsenic	0.05	0.1	0.2	0.043
Barium	1.0	x	x	0.4
Beryllium	x	0.1	x	ND
Boron	0.75	0.75	5	0.1
Cadmium	0.01	0.01	0.05	0.0015
Chromium	0.05	0.1	0.05	0.131
Cobalt	x	0.2	1	0.04
Copper	1	5	0.5	0.101
Iron	0.3	5	x	101
Lead	0.05	5	0.1	0.056
Lithium	x	2.5	x	0.3
Manganese	0.05	0.2	x	2.39
Mercury	0.002	x	0.00005	ND
Nickle	x	0.2	x	0.11
Selenium	0.01	0.02	0.05	ND
Silver	0.05	x	x	ND
Uranium	5	5	5	0.007
Vanadium	x	0.1	0.1	0.1
Zinc	5	2	25	0.3
				Class IV

*Chapter 8 Class I, II, &III parameter limit based upon combined total of Radium 226 and Radium 228

	Above Class I
	Above Class II
	Above Class III

CONSOLIDATED ENGINEERS & MATERIALS TESTING, INC.

GEOTECHNICAL ENGINEERING MATERIALS LABORATORY
GEOLOGY CONSTRUCTION ENGINEERING

October 9, 2006
Project No. A06-1743-A

Pearl Development Company
Mr. Dave Nicolarsen
1082 East Brundage Lane
Sheridan WY 82801

Project: Pinnacle Sweetwater Project
Permeability Testing

Dear Mr. Nicolarsen:

At your request, we conducted Flexible Wall Permeability in general accordance with ASTM D5084. Soil samples were acquired by Pearl Development personnel and delivered to our laboratory on or about September 15, 2006. Permeability test results are tabulated on the attached "Permeability Test" sheet. All results were initially transmitted to you via email upon completion.

The permeability test sample was remolded to an average dry density that was determined in the laboratory using a wax density test method. To facilitate remolding, the test sample was moisture conditioned to higher moisture content for testing while targeting the in-situ dry density. The moisture density data was as follows:

Sample	Wet Density (pcf)	Dry Density (pcf)	Moisture Content (%)
1	92	88	4.3
2	97	93	4.3
3	83	80	4.3
permeability test sample	101	86	18.7

Please contact our office if you have any questions or if we can be of further assistance.

Sincerely,

Rachel Robinson
Staff Geologist

Taunya Ernst, P.E.
Geotechnical Services Manager

attachments: Permeability Test

RR/TE/cj
A06-1743-A/PINNACLEPERMCOV10-9-06.DOC

P.O. Box 4098
Gillette, WY 82717-4098
307-686-6409
307-686-6501 (fax)

3677 N. Highway 126, Suite A
Farr West, UT 84404
801-732-1255
801-732-1256 (fax)

PERMEABILITY TEST
ASTM D5084
(permeation of sample)

Project No.: A06-1743-A
Sample ID: 09-35@0-10
Tested by: RR
Date Tested: 10/4/2006
Sample Number:

Client: Pearl Development Corporation
Project Location: Pinnacle
Sample Description: Light brown LEAN CLAY
Initial Dry Density: 85.5 pcf @ 18.7%
Final Moisture Content: 40.1%

X Remolded
Undisturbe

Hydraulic Gradient 18.8
System Constant, C 0.440 (cm2)

Chamber 51.5 (psi)
Upper 49 (psi)
Lower 50.5 (psi)

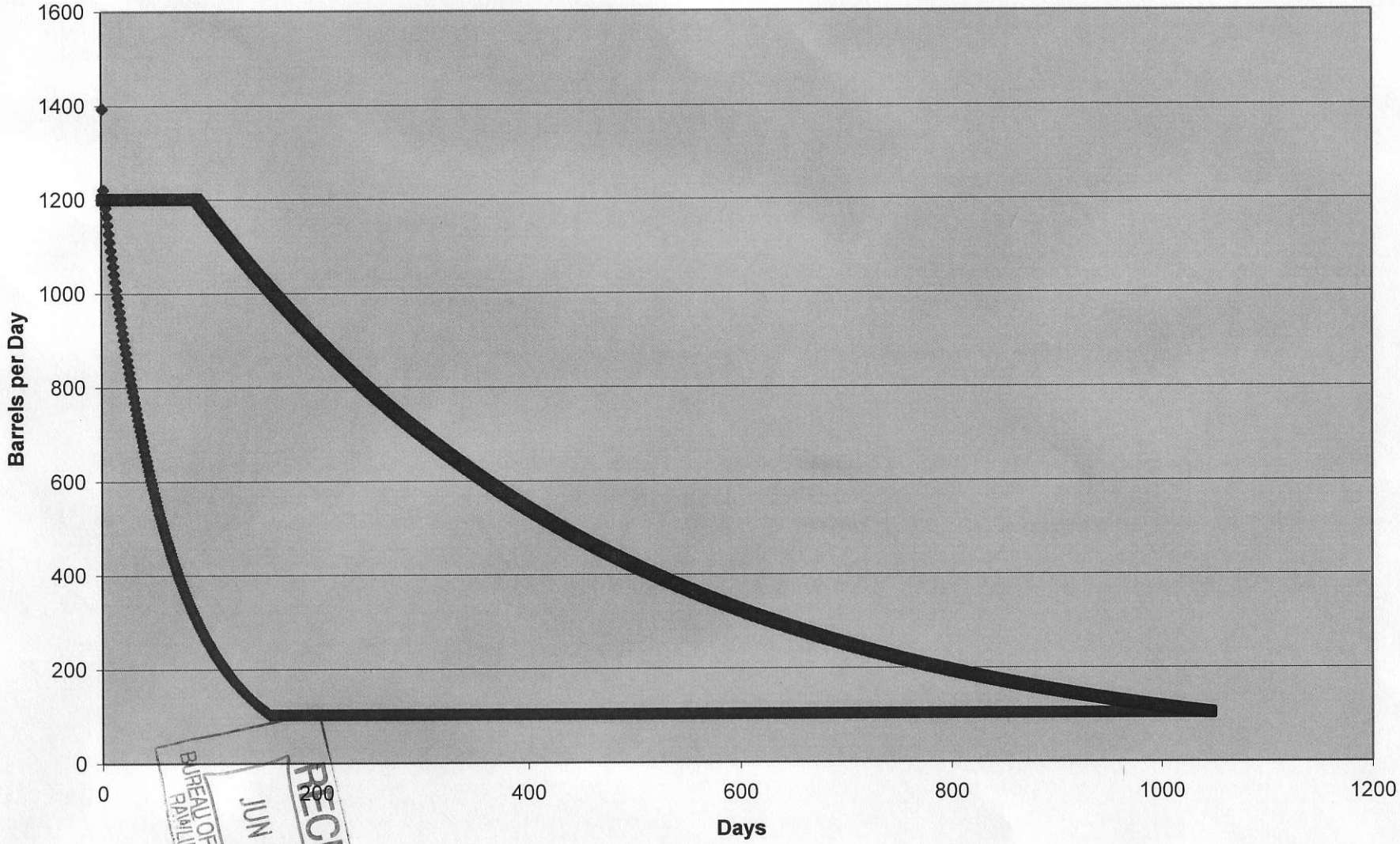
a influent b 0.88 cm2
Final Lengt 5.61 cm
Final Area, 18.68 cm2

Date	Time (s)	Temperature		Burette Readings		Incremental Flow			Head Difference 1 h (t)	Preliminary2 kA/L (cm2/sec)	Final3 k20 (x10-) (cm/sec)	ASTM D5084 Method C k20 (cm/sec)
		°C	RT	Upper VU (t) (cc)	Lower VL (t) (cc)	Inflow (lower) (cc)	Outflow (upper) (cc)	Ratio In/Out				
10/4/2006	0	20.0	1.005	24.3	0.2							
	64440	20.0	1.005	23.9	4.2	4.0	0.4	10.00	114.9			
	74400	20.0	1.005	23.6	5.1	0.9	0.3	3.00	114.3	2.3E-07	7.0E-08	7.0E-08
	82260	20.0	1.005	23.4	5.4	0.3	0.2	1.50	114.0	1.2E-07	3.7E-08	3.7E-08
	90000	20.0	1.005	23.2	5.8	0.4	0.2	2.00	113.7	1.5E-07	4.5E-08	4.5E-08
	93600	20.0	1.005	23.1	5.9	0.1	0.1	1.00	113.6	1.1E-07	3.2E-08	3.2E-08
	150780	20.0	1.005	21.5	8.3	2.4	1.6	1.50	111.6	1.4E-07	4.1E-08	4.1E-08
	158040	20.0	1.005	21.3	8.6	0.3	0.2	1.50	111.4	1.4E-07	4.1E-08	4.1E-08
	168360	20.0	1.005	21.0	9.0	0.4	0.3	1.33	111.0	1.3E-07	4.0E-08	4.0E-08
	178860	20.0	1.005	20.7	9.4	0.4	0.3	1.33	110.7	1.3E-07	4.0E-08	4.0E-08

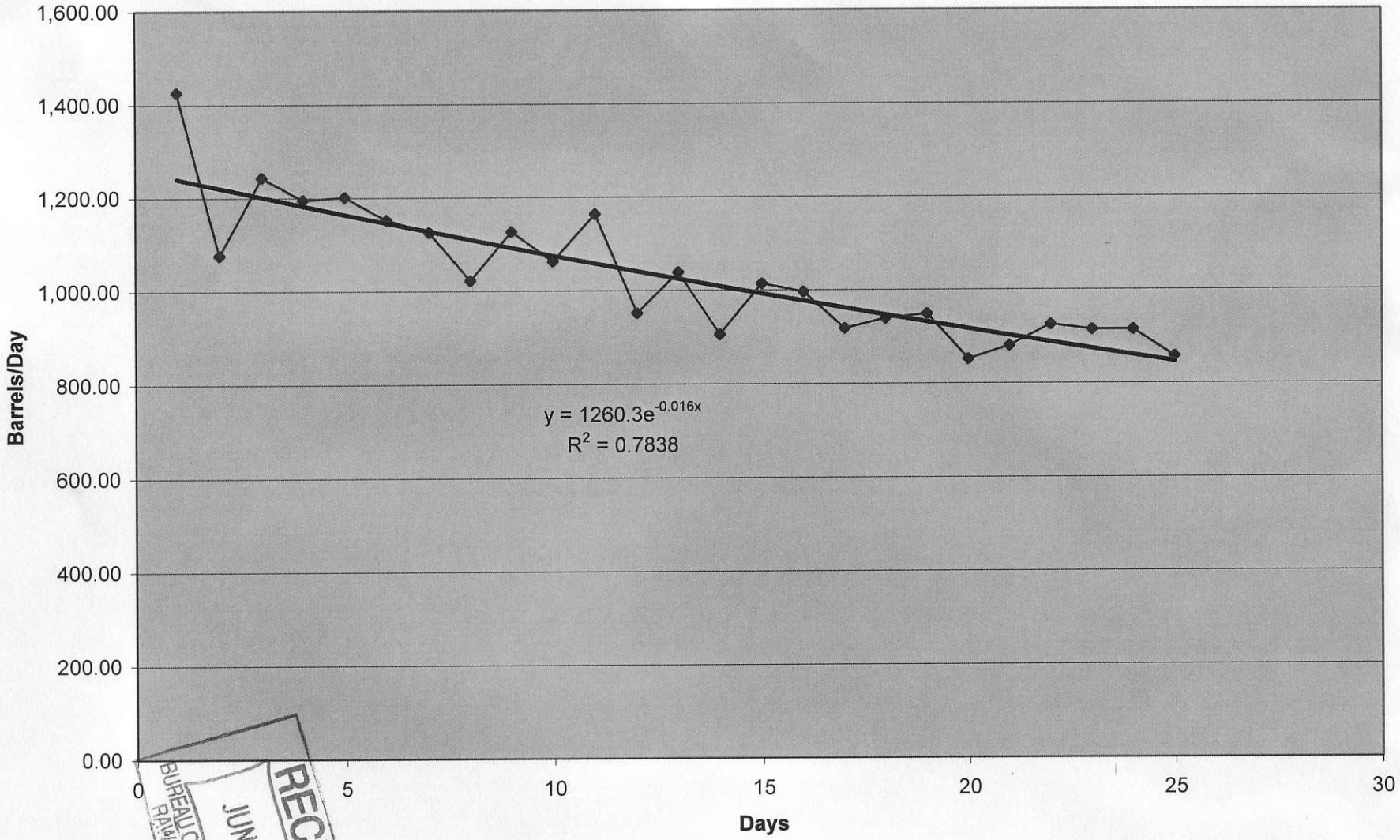
Permeant liquid: standard water

kavg = 4.0E-08 cm/s

Modeled Flow vs Extrapolated Flow (One Well)



Pinnacle Production Values (1 Well) - April 2007



Technical Memorandum

To: Brian Deurloo, Pinnacle Gas Resources, Inc.

From: Jake Crissup, ALL Consulting
Bruce Langhus, ALL Consulting

CC: Gordon Olson, Pinnacle Gas Resources, Inc., Brent Marchant, Pinnacle Gas Resources, Inc.
Dan Arthur, ALL Consulting

Date: June 23, 2006

Re: Water Management Options in Sweetwater CBNG Project Area

Introduction

ALL Consulting (ALL) has prepared this technical memorandum for Pinnacle Gas Resources, Inc. (Pinnacle) in order to present the potential long term alternatives for produced water management in the Sweetwater CBNG Project area in the Greater Green River Basin of Wyoming. This memo consists of a brief summary of the known and assumed variables that were utilized to analyze the technical feasibility and comparative economic analysis of the various water management alternatives.

Summary of Known Variables and Assumptions

Water quality and quantity are the two most pivotal variables when considering a produced water management plan. Water sample analyses indicate that the water quality has a relatively high Total Dissolved Solids (TDS), ranging from 20,000 mg/L to over 30,000 mg/L TDS. The primary anions that account for this high TDS are sodium and chloride. Bicarbonate also has a significant presence in the water. The estimated initial water production is around 1,200 Barrels/day per well (about 35 gallons per minute per well). According to decline estimates provided by Pinnacle, the water production declines at a rate consistent with the following equation:

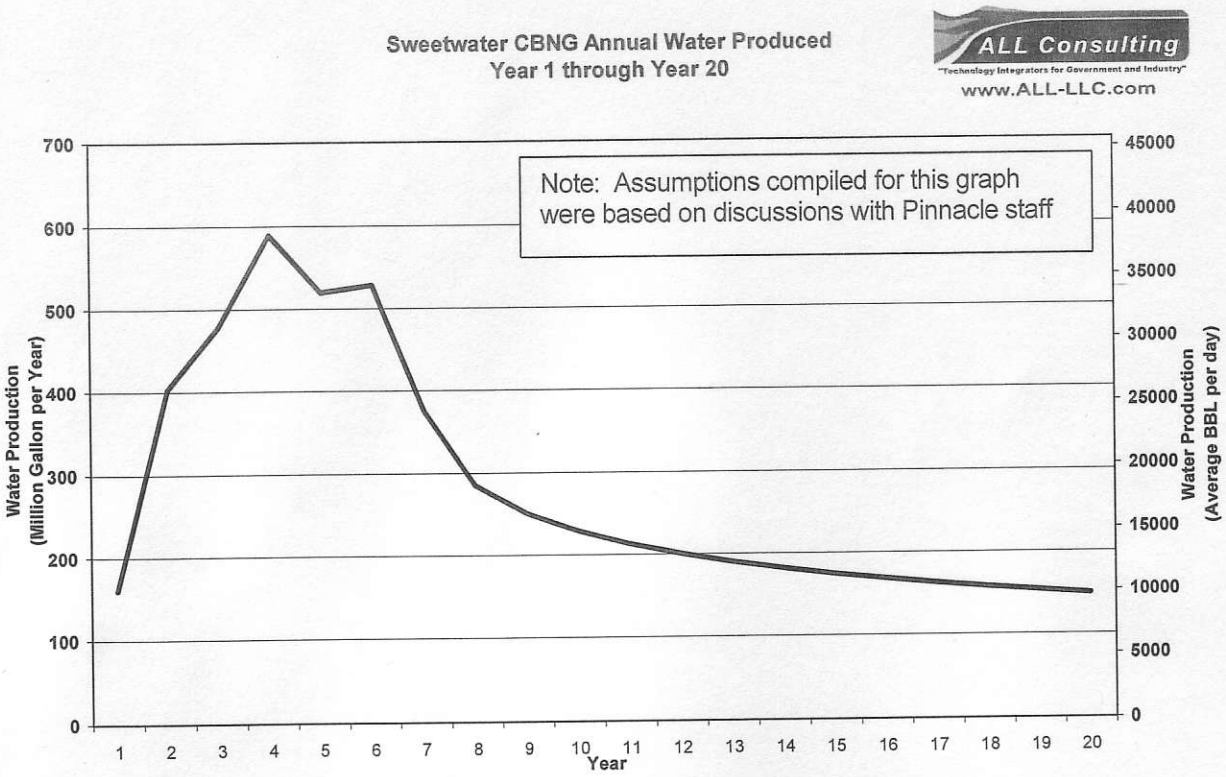
$$Q(t) = 15.927\ t^{-0.4079}$$

Where:
t = time in months
Q(t) = the water production rate in gallons per minute

This equation has a correlation $R^2 = 0.93$ when compared to the water production decline data provided by Pinnacle. For comparison, a correlation $R^2 = 1$ is considered a perfect match, and generally any R^2 above 0.8 is considered a reliable predictor of actual conditions. As water is produced, however, this equation may or may not prove to be accurate.

This production decline equation was coupled with the projected wells to be brought online over the next 6 years. Based on discussions with Pinnacle, it was assumed that 48 wells would be brought online in 2006, 64 would be brought online each year in 2007, 2008, and 2009, and 40 would be brought online each year in 2010 and 2011 (a total of 320 wells over 6 years). The following graph (Figure 1) was generated, which depicts the total annual volume of water produced, as well as the average barrels of water produced per day each year. Water volumes peak in Year 4 (2009) at close to 600 million gallons of water (on average, 40,000 barrels per day). The highest projected monthly production is 61 million gallons (on average, 48,400 barrels per day), and occurs in Oct and Nov of 2009.

Figure 1



Typically, water of this quality (TDS greater than 20,000) is best managed through re-injection. However, this does not appear to be entirely feasible as the injection rate of the existing injection wells appears to be less than 1 barrel per minute (estimated to be between 0.5 and 0.6 barrel per minute, or around 700 barrels per day). An injection rate of 0.6 BBL/minute was used for the analyses in this memo.

Under the conditions outlined above, it is imperative that the water management plan be flexible enough to handle peak volumes while also not being overly designed so that the infrastructure of the water management plan is not applicable during the years when production rates are declining in the field. To do this, it is important to have a portfolio of water management techniques that can be leveraged over the life of the project.

Water Management Options

Class II Disposal Injection

In order to handle the anticipated peak amount of water produced, at least 43 injection wells would be required if injection was the "sole" management practice. This is assuming each production well will, on average, follow the water production decline curve and have a temporary pit next to it that will augment the water management to some degree with evaporation. This is roughly 1 injection well for every 7.5 production wells on the entire project.

The graph below (Figure 2) shows the water produced over the life of the project, and how the water is managed is injection is the "sole source" of water management. It should be pointed out that there is some "temporary" storage in the pits adjacent to the well pads, but these pits cannot be relied on for long term water management.

Figure 2

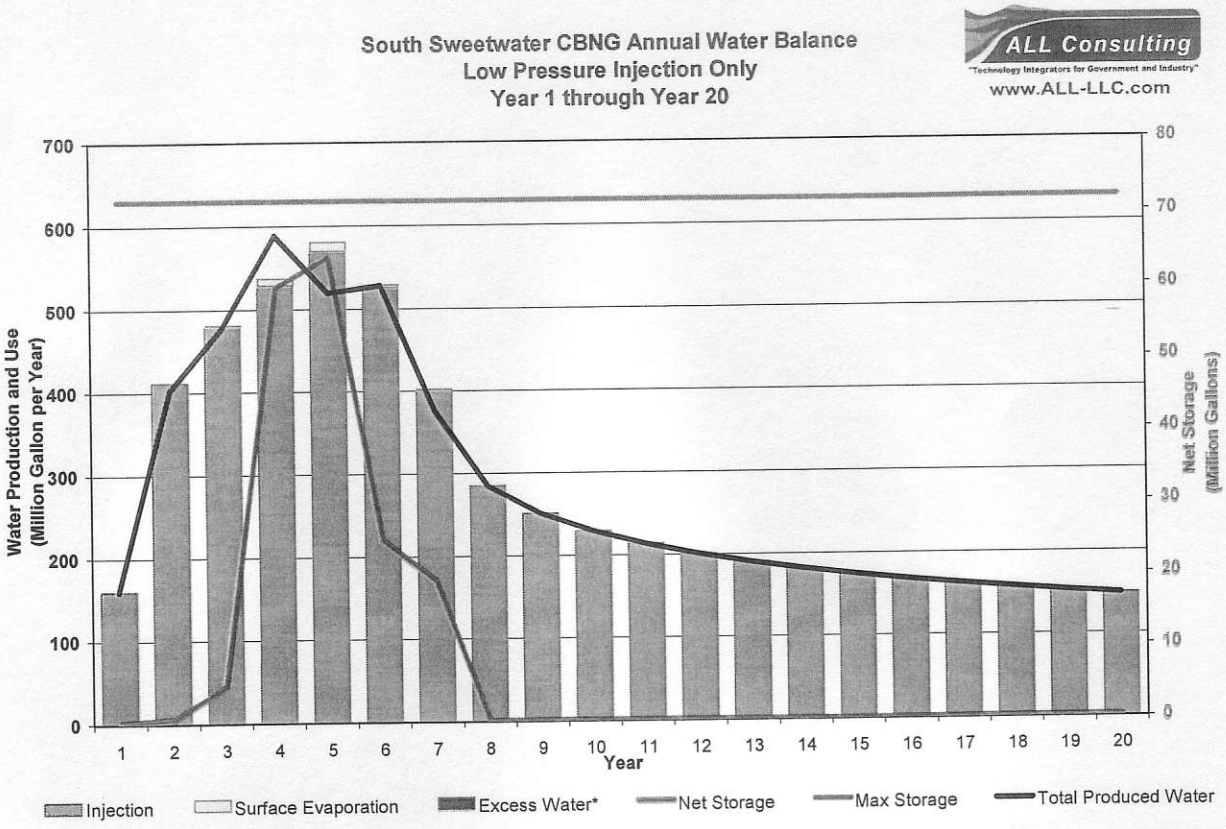
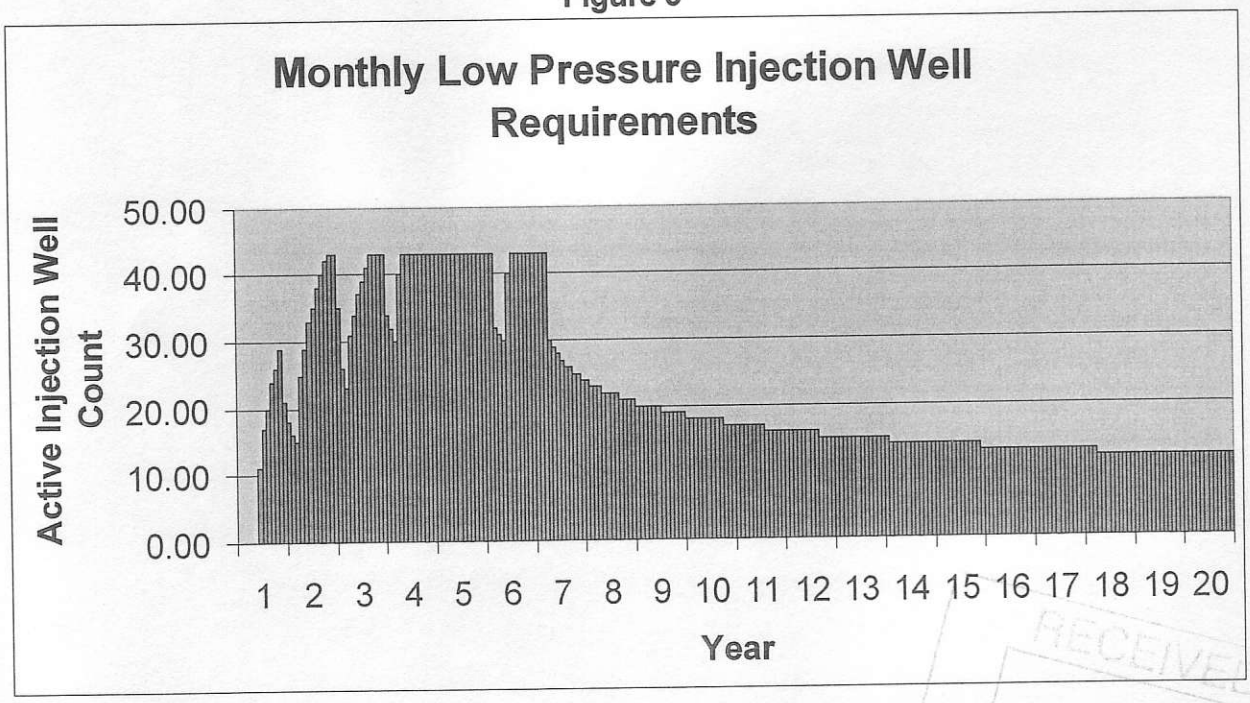


Figure 3



The graph above (Figure 3) shows the required number of low pressure injection wells on a month by month basis over the 20 year life of the project. This graph shows that the total injection well count will need to be in place and operating by the end of the second year in order to manage the anticipated amount of water. This is not a good scenario to be in, especially considering the fact that production wells are anticipated being drilled into the next 6 years and there is limited rig availability. Therefore, it is important to either perform work on the injection wells to improve injection rates, or lower the required volume of water to be injected through enhanced evaporation. Furthermore, this assumes that the wells will accept water at a constant rate of 0.6 barrels per minute, which is likely to decline over time as the injection zone becomes saturated. It is unknown how fast the injection rate will decline, and it may be possible for the initial injection rate to be higher by acid treating and/or fracing the injection well.

If the injection rate can be enhanced, either by treating and/or fracing the injection wells, or by injecting at a pressure higher than the frac pressure, then the number of required injection wells could be reduced significantly. After reviewing the step rate diagnostic test performed by Kennedy in 2003, ALL believes it may be possible to inject above the frac pressure and achieve an initial injection rate of 5 barrels/minute. Assuming this injection rate is sustainable, it may be possible to minimize the number of injection wells required to six. Figures 4 and 5 present the water balance and monthly required injection well count for this scenario. This would be an "ideal" situation, and may not be technically feasible to sustain, however, additional injection wells could be added on an as needed basis. It should also be noted that this option carries a certain degree of risk and it is likely that a monitoring program would be required to ensure no impacts on any aquifers considered as USDWs. For example, if the monitoring program indicates that a USDW is being impacted, this option may have to be abandoned entirely.

Figure 4

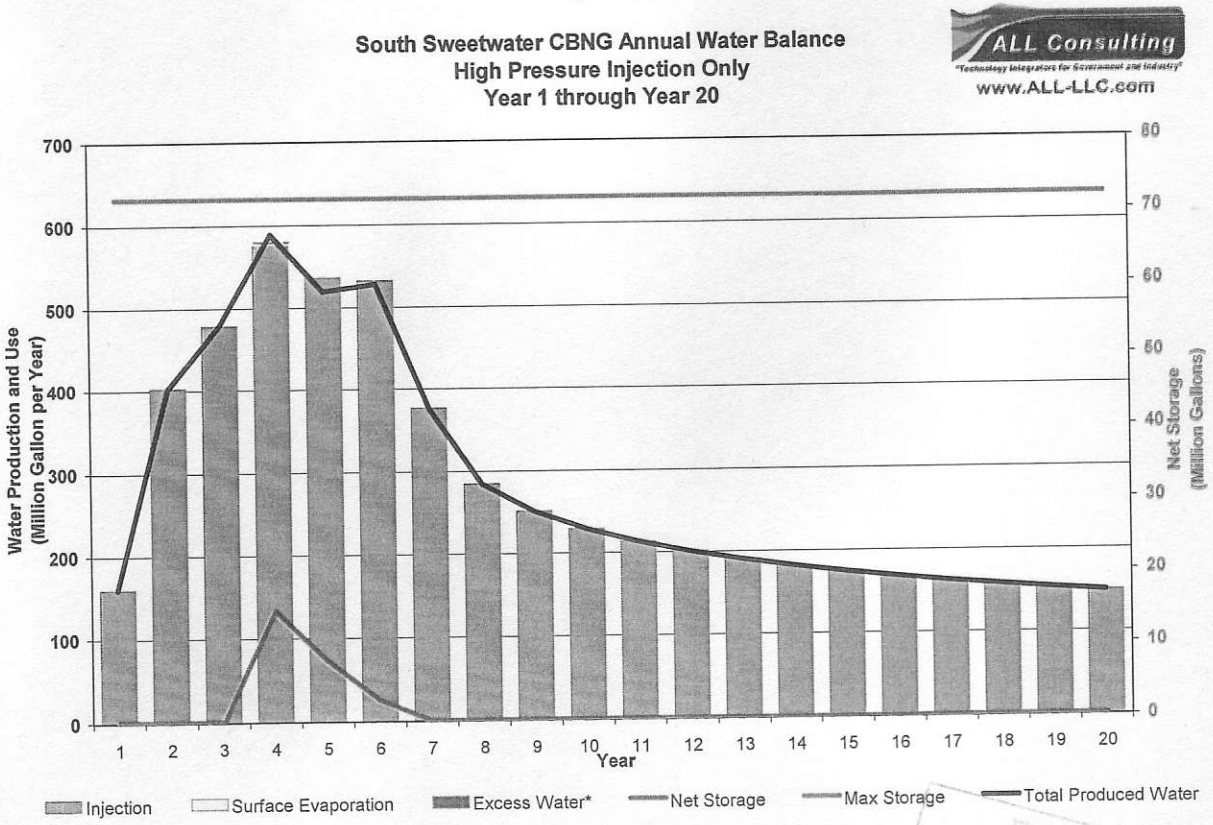
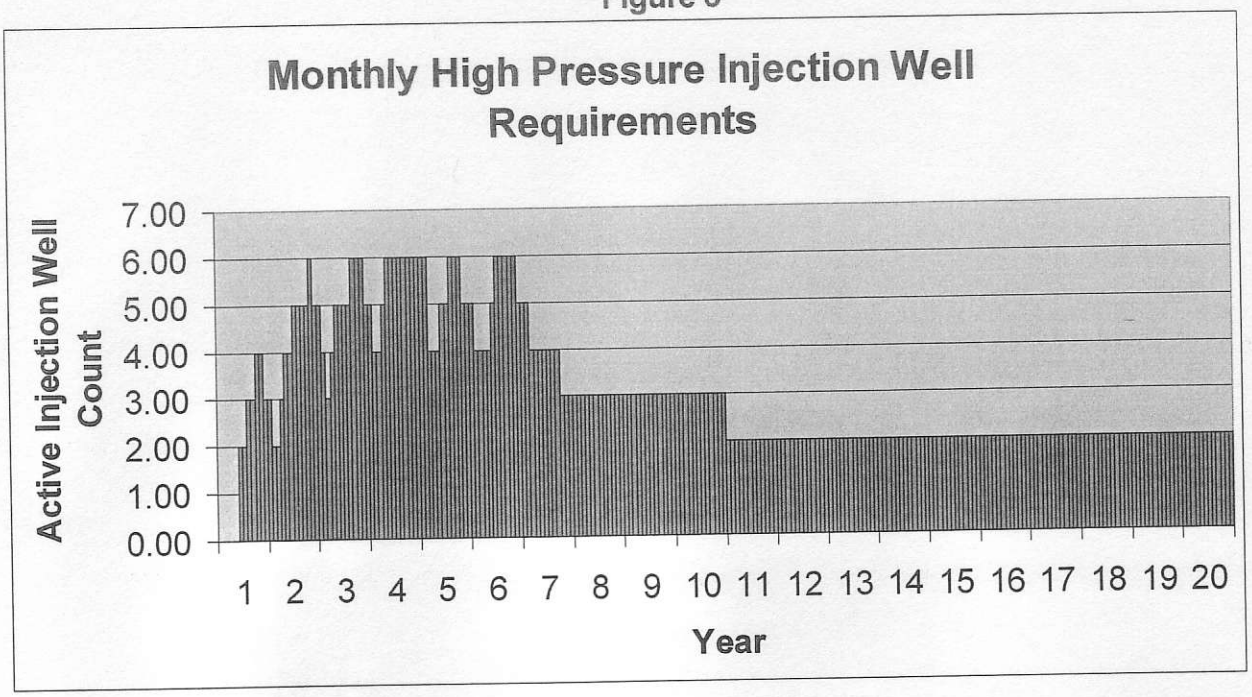


Figure 5



Enhanced Evaporation

Enhanced evaporation can have a significant impact on the volume of water that needs to be injected, thus lowering the cost of the overall project due to the fact that an enhanced evaporation pit is much more cost efficient to construct than an injection well. Based on the assumptions listed above, the required number of injection wells can be significantly reduced (10 injection wells versus 43) by constructing approximately 21 enhanced evaporation pits that are approximately 12.6 AF each (300' by 300' by 6' deep, for a total of 265 AF). The dimensions of the evaporation pits were based off of the dimensions of the existing pit that Kennedy constructed on Section 16 in Township 23 Range 97. It should be noted that all of the pits would need to be constructed and lined by the end of the first year and all of the injection wells would need to be constructed by the end of the second year. Each pit would have 2 aerators on them to enhance evaporation. The aerators would serve to enhance the evaporation by atomizing the water and spraying it into the air above the pit, and they would be run all year. Depending on site specific conditions, vendors report 20% (winter months) to 80% (summer months) of the water run through the aerators will be evaporated. Each aerator can operate at 70 gallons of water per minute. A 460V 3 phase power source is required to operate these aerators. If this power comes from a generator, then an estimated 35 gallons of diesel is required to run the generator each day per unit. For 42 aerators operating year round, this would require over half a million gallons of diesel per year if electricity is not available at the evaporation pits.

The following graph (Figure 6) shows how the water is managed when enhanced evaporation is coupled with injection. It should be noted in Figure 6 that the only time injection wells are operated is during months where there is more water produced than what is evaporated (winter months). This leads to less impact to the receiving aquifer, and ultimately a longer life for the injection wells.

Figure 7 shows the number of injection wells required each month over the course of a 20 year life span. As shown, with a constant injection rate of 0.6 barrel/minute, 10 injection wells will be required at the end of Year 2. All 10 wells would need to be operated during the winter months (when enhanced evaporation is not as effective) up until Year 6. At that point, the number of required injection wells essentially drops to zero after year 7, as all of the water produced would be handled through enhanced evaporation. Furthermore, the number of

injection wells required could be even less if injection rates are improved through acid treating, fracing and/or injecting at high pressures.

Figure 6

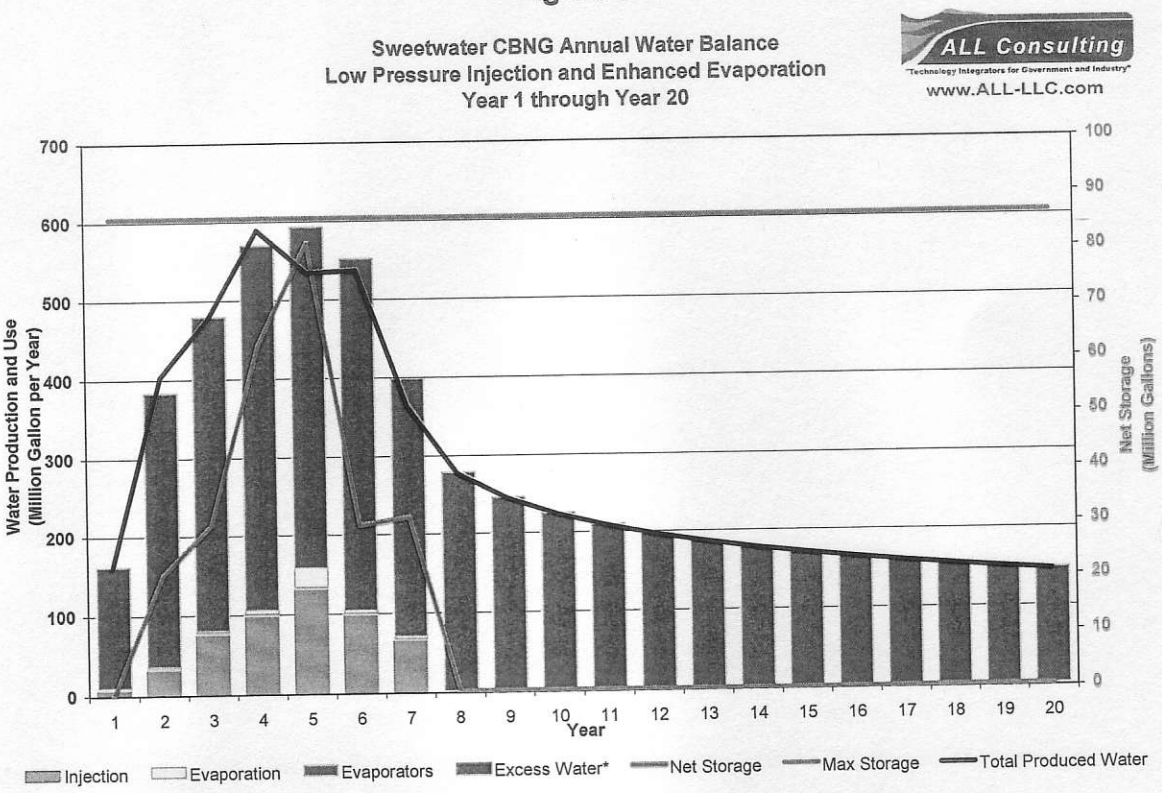


Figure 7
Monthly Low Pressure Injection Well Requirements With Enhanced Evaporation

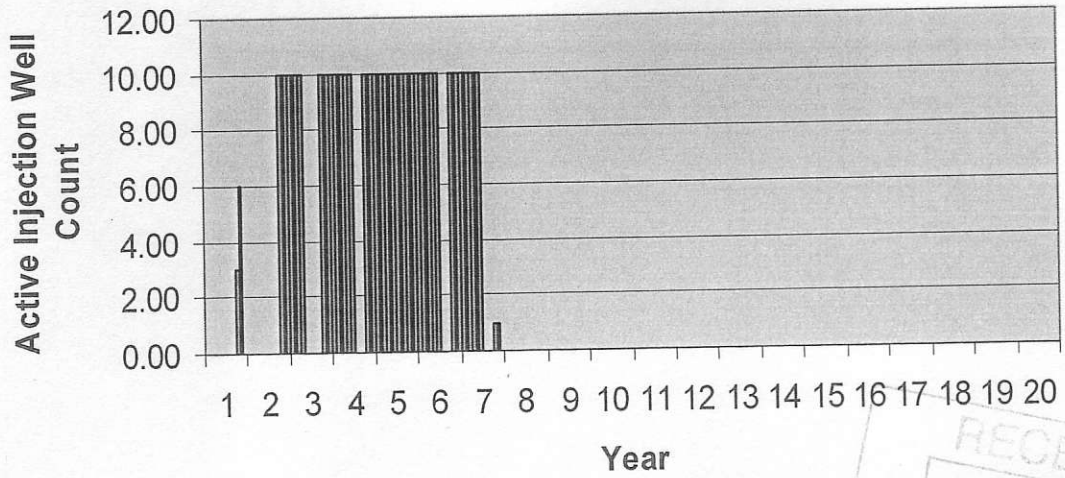


Figure 8

Monthly Enhanced Evaporation Requirements

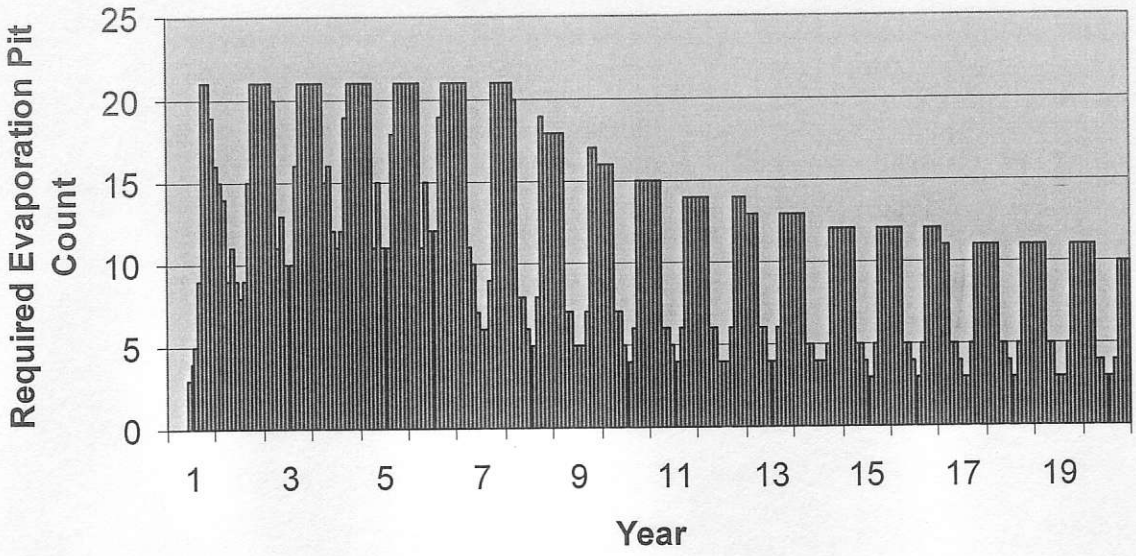


Figure 8 shows the number of evaporation pits required on a month to month basis over the 20 year life of the project. Similar to the injection well requirements, the maximum number of evaporation pits is required during the winter months from Year 1 through Year 7. During the summer months the effectiveness of the aerators is noted by the fact that the evaporation pits do not have to run at full capacity to manage all of the water. The number of required pits could conceivably decrease if the dimensions of each pit were increased.

Water Treatment

Applicable water treatment options are limited based on the known Total Dissolved Solids (TDS) of the water along with the initial water production rate. Table 1 provides a summary of the water treatment technologies considered for the Sweetwater CBNG Project.

As stated in Table 1, the Higgins Loop ion exchange process that is common in the PRB was deemed not economical for the produced water in the Big Red Coal due to the high level of chlorides, thus secondary treatment would be required. Other desalinization treatment processes, such as electro-dialysis, were deemed not economical as they require raw water with a TDS of less than 10,000 mg/L to be effective, thus pre-treatment would be required. Due to the initial production rate of the produced water, rapid spray evaporation (RSE) was not considered economical as RSE consumes a large amount of energy/BBL treated. However, RSE is discussed later in this memo as an option for managing the concentrated reject water to a solid.

The three treatment processes that seem to be most economical are 1) the Armel/HB Oxidation Reactor with secondary and tertiary treatments (such as RO and RSE), 2) reverse osmosis as a stand alone water treatment, and 3) Freeze Thaw Evaporation (FTE).

Table 1. Summary of Water Treatment Technologies Reviewed

Technology	Advantages	Disadvantages	Waste Stream/ Percent Efficiency	Challenges/ Issues
Desalinization Technologies				
Ion exchange (Higgins Loop)	low energy required, possible continuous regeneration of resin, efficient, mobile treatment possible	pre and post treatment require for high efficiency, produce effluent concentrate	regeneration waste	EMIT reports that their process would need secondary treatment for chlorides and that treatment would cost over $1/BBL
Electro-dialysis	clean technology, no chemical addition, mobile treatment possible, less pretreatment	less efficient with high concentration influent, require membrane regeneration		TDS values less than 10,000 mg/L required for these technologies to be considered effective, therefore pre-treatment would be necessary, thus increasing the cost to treat the water
Capacitive Deionization	low energy required, higher throughput	expensive electrodes, fouling		
Electrochemical Activation	simultaneously salt and microbial removal, reduce fouling	expensive electrodes		
Electro-Deionization	removes of weakly ionized species, high removal rate, mobile treatment possible	regeneration of ion exchange resins, pre/post treatment necessary	regeneration waste, filtrate waste from post-treatment stage	
Rapid Spray Evaporation (RSE)	high quality treated water, higher conversion efficiency	high energy required for heating air, required handling of solids	waste in sludge form at the end of evaporation	High energy costs make uneconomical for raw water based on volume, but may be applicable to eliminate reject water
Freeze Thaw Evaporation (FTE)	Minimal energy required, natural process	lower conversion efficiency, long operation cycle	concentrated brine at the end of evaporation that can be made solid	Large area of land required to handle water. Approx 10 acres for 1000 BBL/Day managed
HB Oxidation Reactor (NEWS)	aggressive oxidation of monovalent salts followed by precipitation of the contaminants	high energy requirement, may require secondary RO to polish water	waste in sludge form	Pilot results from Pinedale anticline seem favorable, but full scale implement-ability is not proven
Membrane Technology				
Reverse Osmosis (RO)	removes monovalent salts, dissolved contaminants etc., compact modules	high pressure requirements, even trace amounts of oil & grease can cause membrane fouling, may require pre-treatment to reduce fouling	concentrated waste from membrane backwash during membrane cleaning, concentrate stream from the filtration operation	Without a pre-treatment fouling will be a concern, and there is likely to be a 60% brine stream by volume, or more. With pre-treatment costs will be higher, but the brine stream will be more concentrated

Armel/HB Oxidation Reactor

The Armel/HB Oxidation Reactor is the main chemical/physical step that is part of a multi-step treatment technology that is being applied in the Pinedale Field and in the Powder River Basin west of Gillette, under various conditions. Prior research conducted on this technology leads us to believe it may have applications to this project. Newpark Environmental Water Solutions (NEWS) deems the technology proprietary, and they operate the two existing plants under contract on a per barrel cost to the operators who are using it. ALL has spoken with Ron Lincz (NEWS personnel) in terms of understanding the applicability and cost of their process to the produced water stream in the Sweetwater CBNG project. Preliminary discussions with Ron indicated that based on the performance of their existing water plants, and the quality of the water in the Sweetwater project, that secondary (reverse osmosis) and tertiary (RSE or a crystallizer) treatment would also be required to meet a 5,000 TDS discharge requirement. ALL provided water quality analyses and the projected water quantities to NEWS and Ron indicated he would look at it closer to determine a solid cost estimate along with the technical feasibility of treating the water. He did provide a rough estimate, based on our phone conversation at $2.00/BBL. This includes all facets of the management of the water (permitting, constructing the water treatment plant with secondary reverse osmosis, managing the reject water with a crystallizer, disposing of the solid cake, etc). The economics of this rate are provided in the economic analysis. NEWS did indicate that treatment costs could be lowered on a per barrel basis under various circumstances that could be negotiated in a contract.

Reverse Osmosis

Reverse Osmosis (RO) can be used either as a primary treatment, or as a secondary treatment to the Armel Reactor discussed above. RO applies an operating pressure higher than the osmotic pressure of salt present in the water to drive pure water through the membrane, thereby rejecting the salts. It is reversal of the osmosis process where water flows from the higher concentration solution to the lower concentration solution to attain natural equilibrium. Several RO options are available, from mobile trailer-mounted units, to a large scale plant. The mobile units are not capable of handling the volume and quality of the water in question, so it is more feasible to rely on a large scale, design-built plant. Operational costs can be high as membrane fouling from oil & grease, iron bacteria, and other constituents can be a concern.

Freeze Thaw Evaporation (FTE)

This technology is currently being used in the Red Desert area by Samson to treat 1000 barrels of water per day (annual average). The system utilizes the natural seasons of the Red Desert to 1) evaporate water through spray evaporation in both summer and winter months and 2) in winter months the spray that does not evaporate freezes to a freeze pad. Due to the freezing point of water with high TDS being lower than pure water, the water that does not freeze in the winter months is separated from the water that does freeze. The concentrated brine is diverted to a holding pond and the water that is frozen is able to be put to be put to beneficial use (stock watering, land application, etc) as it thaws in the summer months. The existing facility that manages 1000 barrels of water per day requires 10 individual 1 acre pits. Each pit is lined and is 13 feet deep, with 3 feet of freeboard when the pit is at full capacity (ie a total of 100 AF of storage). In order to manage the maximum amount of water produced from the project, 400 of these pits would need to be constructed (to handle the peak of 40,000 barrels/day). Due to the large land requirements, this technology may be more appropriate on a smaller scale to augment injection and reclaim some of the water for beneficial use. For example, if 100 of these pits were constructed, they could feasibly manage 10,000 barrels of water per day, which is roughly what is expected to be produced towards the end of the projects life (year 20). During periods of full capacity, the excess water could be injected or handled in enhanced evaporation ponds.

Reject Water Management

In the event that a water treatment process is utilized, a concentrated brine stream, commonly referred to as "reject" water, will be generated. Due to current regulations, this reject water cannot be disposed of in a Class II injection well. It either needs to be injected into a Class I injection well, or it needs to be dried out to a solid waste and disposed of accordingly.

Class I Injection

Currently the WOGCC reports that the two Class I injection wells in the state of Wyoming are running at full capacity, therefore, a Class I injection well would need to be permitted and constructed to manage the concentrated reject water. Permitting activities are anticipated to cost between $60,000 and $80,000, and could last from 8 months to over a year. The construction of the Class I well will be dependant on drilling depth and conditions. A well that is 10,000 feet deep may cost somewhere near $1.8 million dollars, while a well in the 12,000 to 15,000 depth range may cost over $3 million. **Both the cost and time required for this option make it very unattractive, as there is a chance that a suitable injection zone may not be found.**

Zero Discharge

A Crystallizer and/or a Rapid Spray Evaporator (RSE) can be utilized to concentrate the waste stream and eliminate the need for a liquid discharge. Conversion of reject water into solids/salts form can be accomplished by using a crystallizer. The crystallizer further concentrates the reject water stream by extracting water and re-circulating it through the treatment process. Total volume of the reject water is reduced while the associated TDS increases significantly. The resultant concentrate (sludge-water) flows through a RSE. Liquids are evaporated and the dissolved solids remain in sludge state. Handling and disposal of the reduced volume of waste in sludge form is easier, but the disposal of solid waste must avoid contamination of surface soils or groundwater by disposing of it in a lined cell.

For FTE, the brine stream is sent to a separate pit where it is passively evaporated. As the concentration of the concentrated brine increases, the evaporation rate also increases. This has been noted at the above mentioned project in the Red Desert area.

Comparative Economic Analysis

Assuming that over 20 years a total of 132.7 million barrels of water are produced from this project, five comparative economic models were created based on cost information gathered from Pinnacle and from various vendors. The results of the economic models are presented in Tables 3, 4, 5, 6, and 7. Although these cost estimates are presented in a range of values, they should not be used for budgetary purposes, but rather in relative terms to understand how they may compare to one another. Total cost includes the upfront capital cost and the annual operational cost over the next 20 years. Net Present Value (NPV) and inflation were not considered in the analysis as they will impact each model in a relatively similar manner, so they were deemed unnecessary for a comparative analysis.

Table 3 presents the "Low Pressure Injection Only" option if the water is injected at a rate of 0.6 barrels/minute below the frac pressure, Table 4 presents the "High Pressure Injection Only" option if the water is injected at a rate of 5 barrels/minute above the frac pressure, Table 5 presents the "Enhanced Evaporation and Low Pressure Injection" option, Table 6 presents the rough cost estimated from NEWS to treat the water, discharge the clean water to open playas, and solidify the reject water through a crystallizer, and Table 7 presents the rough cost estimate to construct and operate a FTE treatment system that could handle all of the water produced.

The treatment options may need to be further explored with the BLM, as they may not allow the water to be discharged to the surface even if it is treated to 5,000 TDS. Furthermore, with NEWS initial cost estimate an order of magnitude more expensive than other options; it appears that treatment of the water with this technology is not an economically feasible option at this time.

Table 3. Injection Only (Below Frac Pressure) Cost Estimate

	Capital Cost				20 Year Operational Cost			Total Cost
	Unit Cost		Units	Subtotal	Unit Cost		Subtotal	
Reservoir Construction	$2,000-$2,500	per AF	220	$440,000 - $550,000	1%	cap cost per year	$88,000 - $110,400	$528,000 - $660,400
Injection Wells	$500,000-$600,000	per well	43	$21,500,000 - $25,800,000	$0.10 - $0.15	per BBL	$13,300,000 - $20,000,000	$34,800,000 - $45,800,000
Total Cost				$21,940,000 - $26,350,000			$13,388,000 - $20,110,400	**$35,328,000 - $46,460,400**

Table 4. High Pressure Injection Only Cost Estimate

	Capital Cost				20 Year Operational Cost			Total Cost
	Unit Cost		Units	Subtotal	Unit Cost		Subtotal	
Reservoir Construction	$2,000-$2,500	per AF	220	$440,000 - $550,000	1%	cap cost per year	$88,000 - $110,400	$528,000 - $660,400
Injection Wells	$500,000-$750,000	per well	6	$3,000,000 - $4,500,000	$0.10 - $0.25	per BBL	$13,300,000 - $33,200,000	$16,300,000 - $37,700,000
Total Cost				$3,440,000 - $5,050,000			$13,388,000 - $33,310,400	**$16,828,000 $38,360,40(**

Table 5. Enhanced Evaporation and Injection Cost Estimate

	Capital Cost				20 Year Operational Cost			Total Cost
	Unit Cost		Units	Subtotal	Unit Cost		Subtotal	
Reservoir Construction	$2,000-$2,500	per AF	265	$530,000 - $662,500	3%	cap cost per year	$317,500 - $397,000	$847,500 - $1,059,500
ection Wells	$500,000-$600,000	per well	10	$5,000,000 - $6,000,000	$0.10 - $0.15	per BBL	$13,300,000 - $20,000,000	$18,300,000 - $26,000,000
vaporators	$20,700 - $23,000	per evaporator	42	$869,400 - $966,000	$0.15-$0.20	per BBL	$18,000,000 - $24,000,000	$18,869,400 - $24,966,000
Total Cost				$6,399,400 - $7,628,500			$31,617,500 - $44,397,000	**$38,016,900 - $52,025,500**

Table 6. Newpark Rough Cost Estimate – Water is Managed on a Contract Basis

	Capital Cost				20 Year Operational Cost			Total Cost
	Unit Cost		Units	Subtotal	Unit Cost		Subtotal	
Reservoir Construction	$2,000-$2,500	per AF	220	$440,000 - $550,000	1%	cap cost per year	$88,000 - $110,400	$528,000 - $660,400
Treatment System	$0	per system	1	$0	$2.00 - $2.50	per BBL	$266,000,000- $333,000,000	$266,000,000- $333,000,000
Total Cost				$440,000 - $550,000			$266,088,000 - $333,110,400	**$266,528,000 $333,660,40(**

Table 7. FTE Rough Cost Estimate – System capital cost included in construction of reservoirs

	Capital Cost				20 Year Operational Cost			Total Cost
	Unit Cost		Units	Subtotal	Unit Cost		Subtotal	
Reservoir Construction	$2,000-$2,500	per AF	4,000	$8,000,000 - $10,000,000	1%	cap cost per year	$ 1,600,000 - $2,000,000	$9,600,000 - $12,000,000
Treatment System	$0	per system	0	$0	$0.50 - $1.50	per BBL	$67,000,000 - $200,000,000	$67,000,000 - $200,000,000
Total Cost				$8,000,000 - $10,000,000			$68,600,000 - $202,000,000	**$76,600,000 - $212,000,000**

Path Forward

Based on the findings presented in this Technical Memo, ALL would like to provide the following as suggested items to tend to as Pinnacle moves forward with the development of the Sweetwater CBNG project:

1. *Determine viability of injection at the project, including testing of existing injection wells drilled by Kennedy*

ALL understands that activities towards achieving this may currently be in progress, or Pinnacle plans to begin them shortly after July 10th. This appears to be the first and most critical step in developing a comprehensive water management plan. ALL can estimate the impacts of the skin to further enhance Pinnacle's effectiveness when treating both the existing and proposed injection wells.

2. *Evaluate other potential injection options, such as Ft. Union sands or unproductive coals*

Discussions with WOGCC staff indicate that there is limited availability of injection zones in the area as other operators have gone as deep as 13,000 feet and not found a suitable injection zone, so this may not be a productive exercise, however, at Pinnacle's request, ALL can review drill logs to determine if there are other suitable injection zones. Other opportunities may also exist for water injection:

- In addition to PGR's wells, there is oil and gas development in the immediate area that could be of use for water management. The Hay Reservoir Field (24N-97W) contains approximately 90 wells including at least one Temporarily Abandoned (TA) well. This oil and gas field has produced little water and apparently has not needed a disposal well, nevertheless, a TA'd well may be purchasable and could be converted into a disposal well. Current ownership of the wells in this field is unknown although Encana is a major operator.

- The nearest oilfield with injection wells appears to be Patrick Draw in 18N-99W. This field includes approximately 28 injection wells; the operator (Anadarko) may choose to use CBNG water from PGR to enhance part of their injection activity. This would entail a 15 to 20-mile pipeline, however. A 10-inch water pipeline might be installed for approximately $430,000 per mile. The 20-mile line might total $9 million which may or may not be an improvement over the cost of 50 new injection wells.

3. *Investigate the option of permitting injection at pressures exceeding natural fracture gradients*

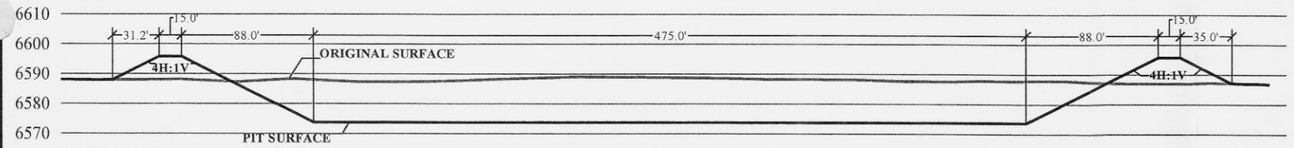
ALL estimates that based on the information provided from Kennedy's step test performed in 2003 that injection could be permitted to as high as 5 barrels per minute (7,200 barrels per day). This would require some work with the WOGCC, and gathering additional information on the two existing injection wells and the newly drilled injection well would help facilitate that. This would also require a better understanding of the underground sources of drinking water (USDW) in the area that could possibly be impacted if water is injected above the fracture gradient, and it is likely that a comprehensive monitoring program would be required to ensure impacts could be quickly identified and mitigated. In the event the high pressure injection does impact a USDW, this option would likely have to be abandoned.

4. *Seek to maximize the use of evaporation pits equipped with evaporation accelerators (e.g., misters).*

Janelle Wrigley (Rawlins FO ROW Specialist) said that we can transfer federal water onto state land for evaporation and injection. She said if we want to transfer water from federal to federal for injection it would either require a $0.05/BBL fee, or a waiver that would have to be granted from the Wyoming BLM office (she does not have the authority to approve this on the FO level). If it is Pinnacle's intention to build pits on state land and transfer the water to those pits, a formal request for ROW would need to be made with BLM for the portions of the pipeline that crosses federal surface.

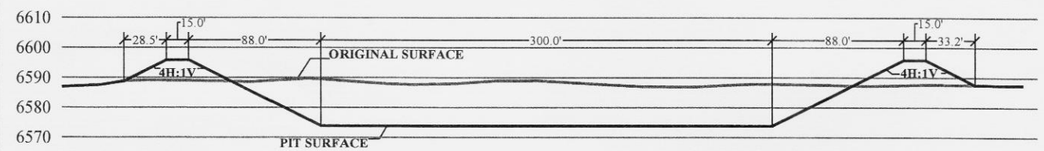
5. As a longer term solution, continue evaluation of water treatment options.

Although it appears that water treatment is not economically viable, discussions should be pursued toward this option. As new technologies emerge and treatment options are better understood, an economically viable option may present itself. Preliminary discussions with John Boysen (Crystal Solutions, Inc) indicated that he is working with the DOE and with another company that specializes in the extraction of methane hydrates from deep in the ocean on a technology that would enhance FTE and make it more viable. The technology is early in concept phase at this point, but John is interested in obtaining a few barrels of Pinnacle's CBNG water for pilot scale treatment tests, and potentially a field application test in the summer of 2007.



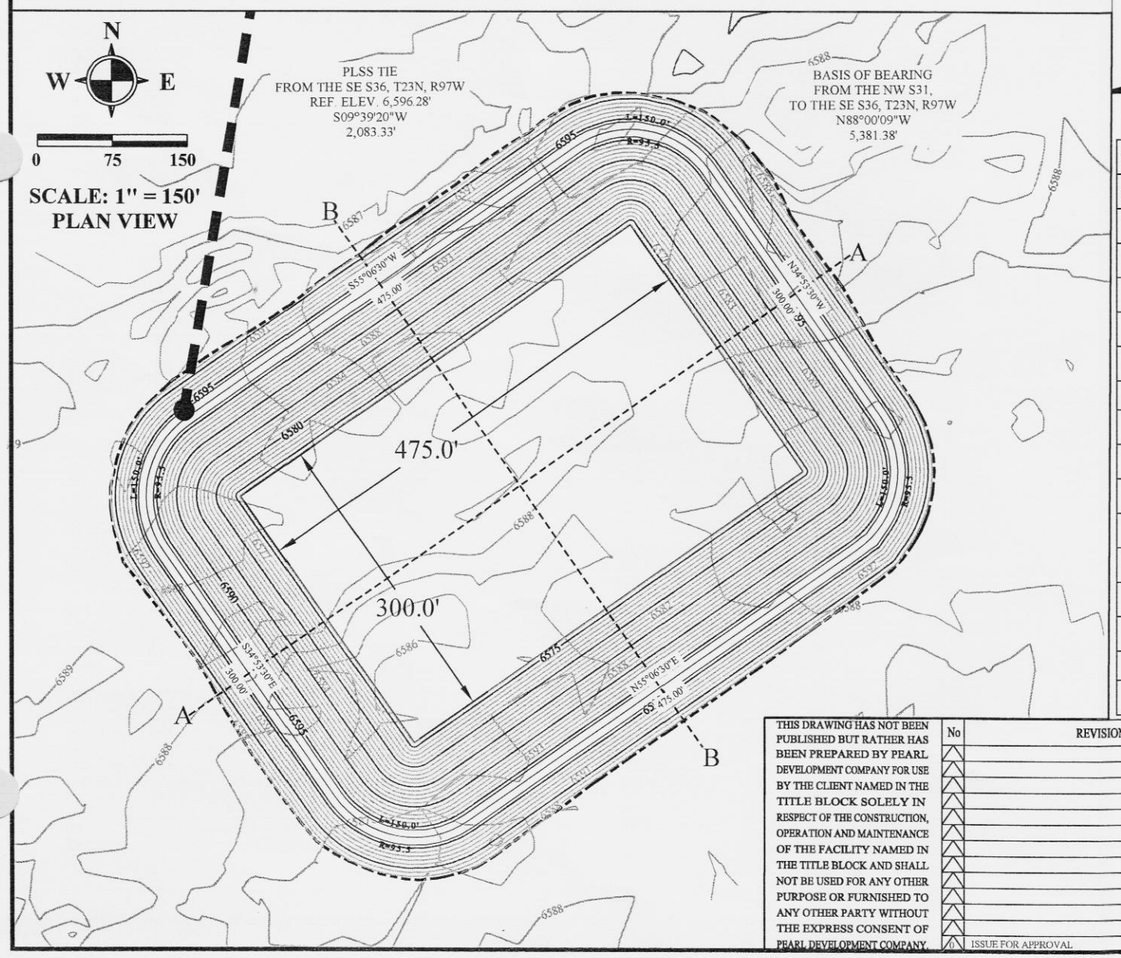
SECTION A-A

TOP OF PIT: 6,595.8' ALL INTERIOR SLOPES AND EXTERIOR FILL: 4H:1V
BOTTOM OF PIT: 6,573.8' EXTERIOR CUT: 3H:1V 1" = 100' Horizontal 1" = 50' Vertical



SECTION B-B

TOP OF PIT: 6,595.8' ALL INTERIOR SLOPES AND EXTERIOR FILL: 4H:1V
BOTTOM OF PIT: 6,573.8' EXTERIOR CUT: 3H:1V 1" = 100' Horizontal 1" = 50' Vertical



GENERAL NOTES:

1) REMOVE AND REPLACE TOPSOIL, 2" +/- DEPTH.

2) PRIMARY COMPACTED FILL WITHIN THE RESERVOIR EMBANKMENTS SHALL BE PLACED AT 95% OF STANDARD PROCTOR, AT +/- 2% OPTIMUM MOISTURE. NO ROCKS WITH A DIAMETER GREATER THAN EIGHT (8) INCHES SHALL BE PLACED WITHIN FIFTEEN (15) FEET HORIZONTALLY OF THE INSIDE FACE OF THE EMBANKMENT. EXCESS MATERIAL, IF ANY, SHALL BE WASTED ON THE EXTERIOR PIT SLOPES.

3) OWNER WILL CONDUCT COMPACTION TESTING. ANY AREA NOT MEETING THE COMPACTION REQUIREMENTS SHALL BE REMOVED, RECOMPACTED AND MOISTENED AS NECESSARY, AT THE CONTRACTOR'S EXPENSE.

4) THE ORIGINAL GROUND IN COMPACTED FILL AREAS SHALL BE SCARIFIED, MOISTENED AND COMPACTED PER ITEM 2 ABOVE TO 8" DEPTH. COST TO BE INCLUDED IN COMPACTED FILL.

5) THE RESERVOIR SHALL HAVE 4H:1V SLOPES ON THE INTERIOR AND EXTERIOR OF THE COMPACTED FILL. TOP WIDTH OF THE COMPACTED EMBANKMENT SHALL BE A MINIMUM OF FIFTEEN (15) FEET. THE MAXIMUM WATER DEPTH OF THE PIT SHALL BE TWENTY (20) FEET, WITH TWO (2) FEET OF FREE BOARD.

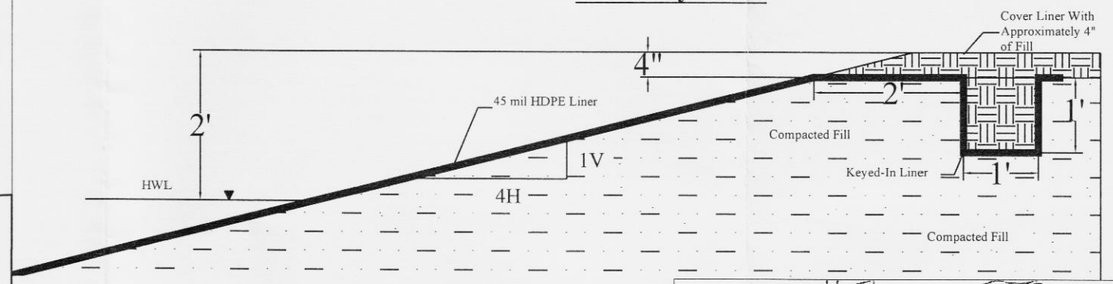
6) ESTIMATED QUANTITIES.

A) R&R TOPSOIL:	2,516 BCY
B) EXCAVATION:	104,156 BCY
C) COMPACTED FILL:	43,576 BCY (1.15 SHRINK)
D) FENCING ON TOP OF PIT:	2200 LF
E) SEEDING:	8.0 ACRES
F) 45 MIL HDPE LINER	350,000 S.F. / POND
G) DISTURBANCE AREA	9.4 ACRES

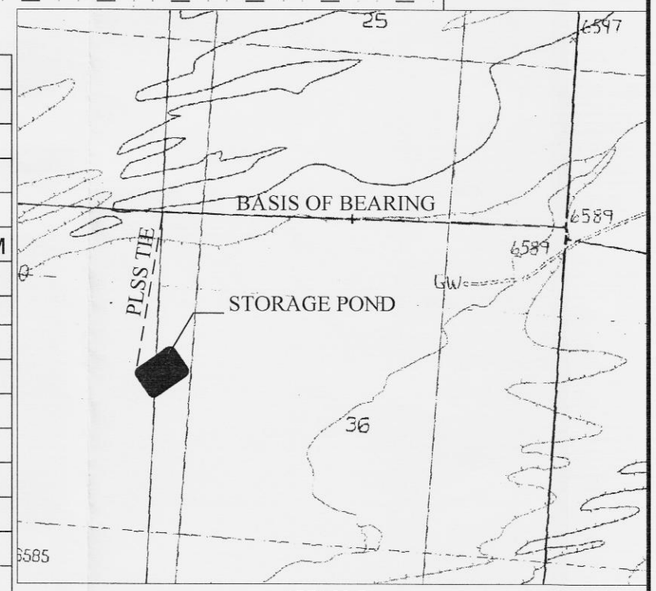
7) ALL SIX PONDS WILL BE LINED WITH A 45 MIL HDPE LINER TO PROVIDE TOTAL CONTAINMENT. LINER WILL BE INSTALLED TO RECOMMENDED MANUFACTURERS INSTALLATION PROCEDURES/GUIDELINES.

8) MANUFACTURED LINERS SHALL BE INSTALLED OVER SMOOTH FILL SUB GRADE WHICH IS FREE OF POCKETS, LOOSE ROCKS, OR OTHER MATERIAL THAT COULD DAMAGE THE LINER. INSPECTOR/ENGINEER SHALL VISUALLY INSPECT SURFACE BEFORE INSTALLING THE LINER. ALL ROCKS GREATER THAN 2" DIAMETER WILL BE REMOVED FROM THE SURFACE BEFORE INSTALLATION. SHOULD THERE BE A LARGE QUANTITY OF ROCK, THEN THE MATERIAL WILL BE SIEVED WITH A 2" SCREEN TO REMOVE THE LARGER ROCKS BEFORE THE LINER CAN BE INSTALLED.

Liner Key Detail



STORAGE POND CAPACITY TABLE				
23-Oct-06				
		INCREMENTAL	CUMULATIVE	
	AREA	CAPACITY	CAPACITY	
ELEV	(AC)	(ACRE/FT)	(ACRE/FT)	
6573.8	3.27	0.00	0.00	BOTTOM
6575	3.44	4.03	4.0	
6577	3.74	7.18	11.2	
6579	4.04	7.78	19.0	
6581	4.36	8.40	27.4	
6583	4.68	9.03	36.4	
6585	5.01	9.69	46.1	
6587	5.35	10.36	56.5	
6589	5.70	11.05	67.5	
6591	6.06	11.76	79.3	
6593.8	6.58	17.70	97.0	HWL
6595.8	6.96	13.54	110.5	TOP



AREA MAP
SCALE: 1" = 2,000'

No	REVISIONS	BY	CHKD	PM	DATE
0	ISSUE FOR APPROVAL	BGK	MRD	MRD	23 OCT 2006

DEPARTMENTS	BY	DATE
DRAWN	BGK	23 OCT 2006
SURVEYED		
CIV./STRUCT.		
ENVIR./PERMITTING		
PIPE HYDRAULICS		
ROAD CONS. MNGR.		
ELECT. CONS. MNGR.		
PIPE CONS. MNGR.		
DRILLING MNGR.		
LANDMAN		
PROJECT MANAGER		
CLIENT REP.		

PREPARED BY:
PEARL FIELD SERVICES
1082 East Brundage Lane
PO Box 783
Sheridan, Wyoming USA
307-672-8090
www.pearldc.com

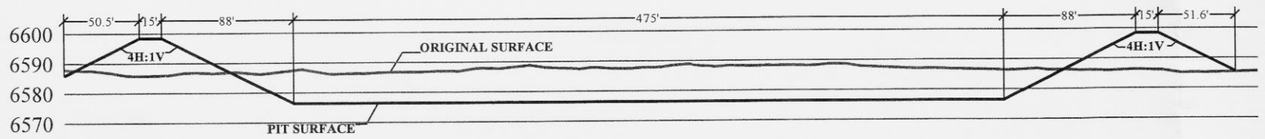
"FROM PROJECT CONCEPTION TO OPERATING REALITY"

OWNER / OPERATOR:
Pinnacle Gas Resources, Inc.

SWEETWATER SOUTH FIELD
08-35A-23-97 STORAGE POND
SEC 35, T23N, R97W, 6TH P.M.
SWEETWATER COUNTY, WYOMING

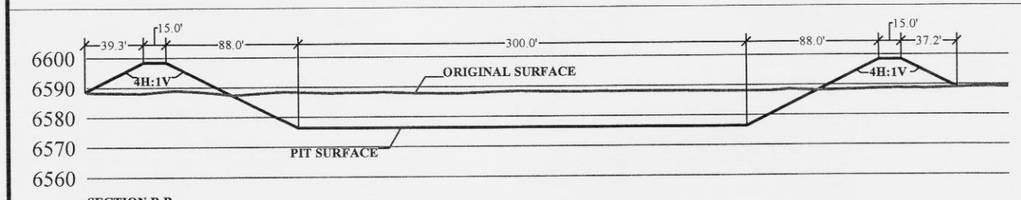
PROJ. NUMBER	DRAWING NUMBER	SCALE	REVISION
40-0034	9600	AS SHOWN	0

Z:\Site\Sweetwater\CAD\Pit & Reservoir Designs\South Sweetwater Reservoirs\dwg\evappond#1



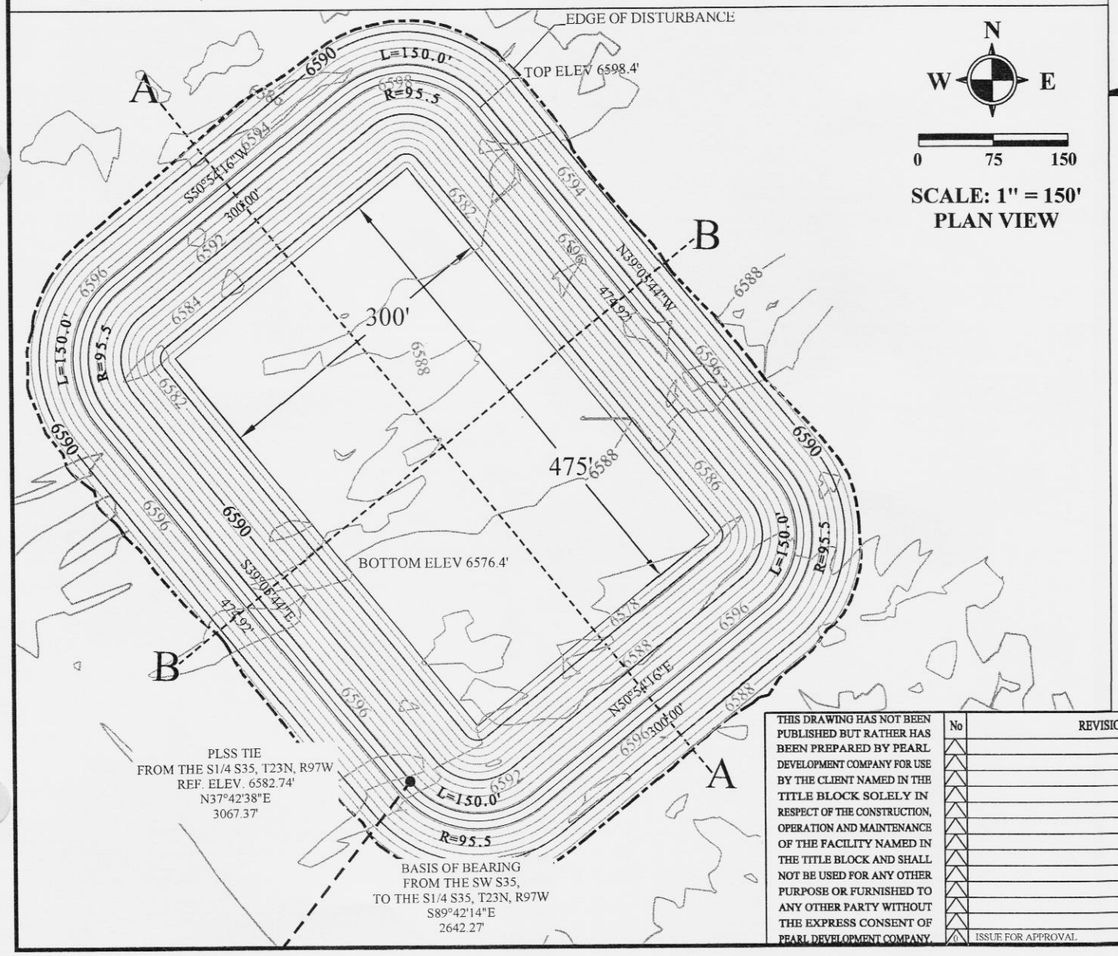
SECTION A-A

TOP OF PIT: 6,598.4' ALL INTERIOR SLOPES AND EXTERIOR FILL: 4H:1V
BOTTOM OF PIT: 6,576.4' EXTERIOR CUT: 3H:1V 1" = 100' Horizontal 1" = 50' Vertical



SECTION B-B

TOP OF PIT: 6,598.4' ALL INTERIOR SLOPES AND EXTERIOR FILL: 4H:1V
BOTTOM OF PIT: 6,576.4' EXTERIOR CUT: 3H:1V 1" = 100' Horizontal 1" = 50' Vertical



SCALE: 1" = 150'
PLAN VIEW

GENERAL NOTES:

1) REMOVE AND REPLACE TOPSOIL, 2" +/- DEPTH.

2) PRIMARY COMPACTED FILL WITHIN THE RESERVOIR EMBANKMENTS SHALL BE PLACED AT 95% OF STANDARD PROCTOR, AT +/- 2% OPTIMUM MOISTURE. NO ROCKS WITH A DIAMETER GREATER THAN EIGHT (8) INCHES SHALL BE PLACED WITHIN FIFTEEN (15) FEET HORIZONTALLY OF THE INSIDE FACE OF THE EMBANKMENT. EXCESS MATERIAL, IF ANY, SHALL BE WASTED ON THE EXTERIOR PIT SLOPES.

3) OWNER WILL CONDUCT COMPACTION TESTING. ANY AREA NOT MEETING THE COMPACTION REQUIREMENTS SHALL BE REMOVED, RECOMPACTED AND MOISTENED AS NECESSARY, AT THE CONTRACTOR'S EXPENSE.

4) THE ORIGINAL GROUND IN COMPACTED FILL AREAS SHALL BE SCARIFIED, MOISTENED AND COMPACTED PER ITEM 2 ABOVE TO 8" DEPTH. COST TO BE INCLUDED IN COMPACTED FILL.

5) THE RESERVOIR SHALL HAVE 4H:1V SLOPES ON THE INTERIOR AND EXTERIOR OF THE COMPACTED FILL. TOP WIDTH OF THE COMPACTED EMBANKMENT SHALL BE A MINIMUM OF FIFTEEN (15) FEET. THE MAXIMUM WATER DEPTH OF THE PIT SHALL BE TWENTY (20) FEET, WITH TWO (2) FEET OF FREE BOARD.

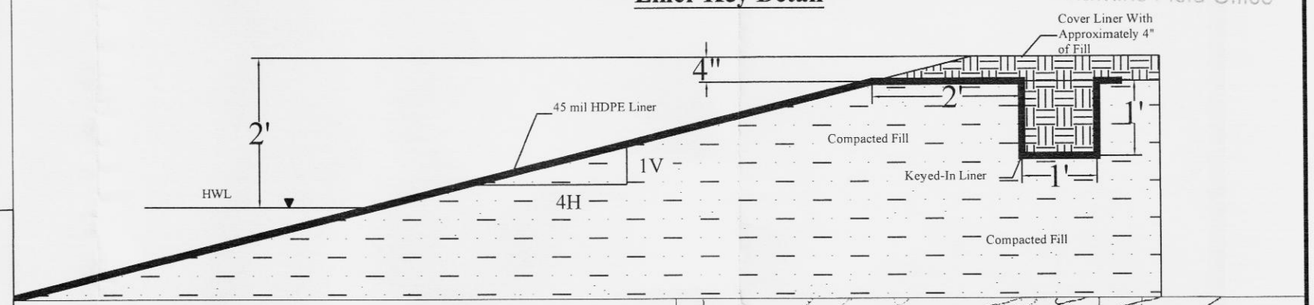
6) ESTIMATED QUANTITIES:

A) R&R TOPSOIL:	2,768 BCY
B) EXCAVATION:	79,077 BCY
C) COMPACTED FILL:	66,319 BCY (1.15 SHRINK)
D) FENCING ON TOP OF PIT:	2200 LF
E) SEEDING:	9.0 ACRES
F) 45 MIL HDPE LINER	340,110 S.F. / POND
G) DISTURBANCE AREA	10.2 ACRES

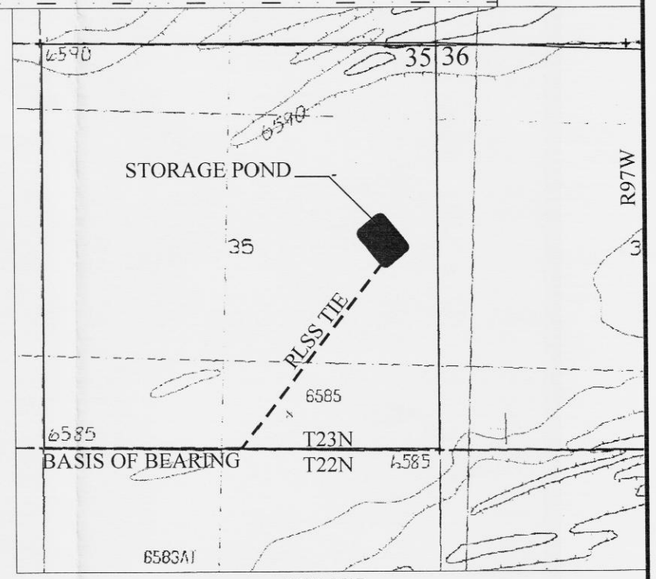
7) ALL SIX PONDS WILL BE LINED WITH A 45 MIL HDPE LINER TO PROVIDE TOTAL CONTAINMENT. LINER WILL BE INSTALLED TO RECOMMENDED MANUFACTURERS INSTALLATION PROCEDURES/GUIDELINES.

8) MANUFACTURED LINERS SHALL BE INSTALLED OVER SMOOTH FILL SUB GRADE WHICH IS FREE OF POCKETS, LOOSE ROCKS, OR OTHER MATERIAL THAT COULD DAMAGE THE LINER. INSPECTOR/ENGINEER SHALL VISUALLY INSPECT SURFACE BEFORE INSTALLING THE LINER. ALL ROCKS GREATER THAN 2" DIAMETER WILL BE REMOVED FROM THE SURFACE BEFORE INSTALLATION. SHOULD THERE BE A LARGE QUANTITY OF ROCK, THEN THE MATERIAL WILL BE SIEVED WITH A 2" SCREEN TO REMOVE THE LARGER ROCKS BEFORE THE LINER CAN BE INSTALLED.

Liner Key Detail



STORAGE POND CAPACITY TABLE				
23-Jan-07				
		INCREMENTAL	CUMULATIVE	
	AREA	CAPACITY	CAPACITY	
ELEV	(AC)	(ACRE/FT)	(ACRE/FT)	
6576.4	3.27	0.00	0.00	BOTTOM
6578	3.50	5.42	5.4	
6580	3.80	7.30	12.7	
6582	4.10	7.90	20.6	
6584	4.42	8.52	29.1	
6586	4.74	9.16	38.3	
6588	5.08	9.82	48.1	
6590	5.42	10.50	58.6	
6592	5.77	11.19	69.8	
6594	6.13	11.91	81.7	
6596	6.50	12.64	94.4	
6596.4	6.58	2.62	97.0	HWL
6598.4	6.96	13.54	110.5	TOP



AREA MAP
SCALE: 1" = 2,000'

THIS DRAWING HAS NOT BEEN PUBLISHED BUT RATHER HAS BEEN PREPARED BY PEARL DEVELOPMENT COMPANY FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION, OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK AND SHALL NOT BE USED FOR ANY OTHER PURPOSE OR FURNISHED TO ANY OTHER PARTY WITHOUT THE EXPRESS CONSENT OF PEARL DEVELOPMENT COMPANY.

No	REVISIONS	BY	CHKD	PM	DATE
0	ISSUE FOR APPROVAL	BGK	MRD	MRD	23 JAN 2006

DEPARTMENTS	BY	DATE
DRAWN	BGK	23 JAN 2006
SURVEYED		
CIV./STRUCT.		
ENVIR./PERMITTING		
PIPE HYDRAULICS		
ROAD CONS. MNGR.		
ELECT. CONS. MNGR.		
PIPE CONS. MNGR.		
DRILLING MNGR.		
LANDMAN		
PROJECT MANAGER		
CLIENT REP.		

PREPARED BY:
PEARL FIELD SERVICES
1082 East Brundage Lane
PO Box 783
Sheridan, Wyoming USA
307-672-8090
www.pearldc.com

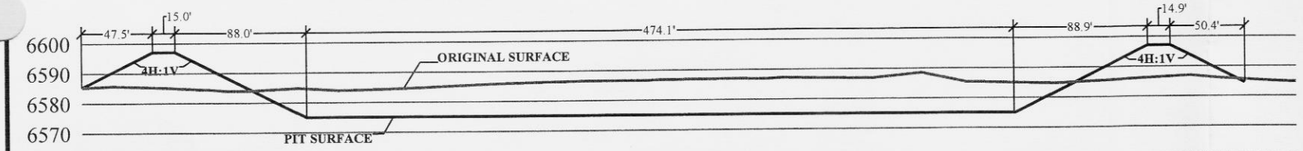
"FROM PROJECT CONCEPTION TO OPERATING REALITY"

OWNER / OPERATOR:
Pinnacle Gas Resources, Inc.

SWEETWATER SOUTH FIELD
08-35B-23-97 STORAGE POND
SEC 35, T23N, R97W, 6TH P.M.
SWEETWATER COUNTY, WYOMING

PROJ. NUMBER	DRAWING NUMBER	SCALE	REVISION
40-0034	9603	AS SHOWN	0

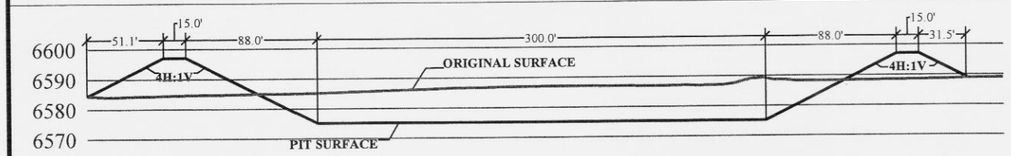
Z:\Site\Sweetwater\CAD\Pit & Reservoir Designs\08-35-23-97\dwg---



SECTION A-A

TOP OF PIT: 6,597.1'
BOTTOM OF PIT: 6,575.1'

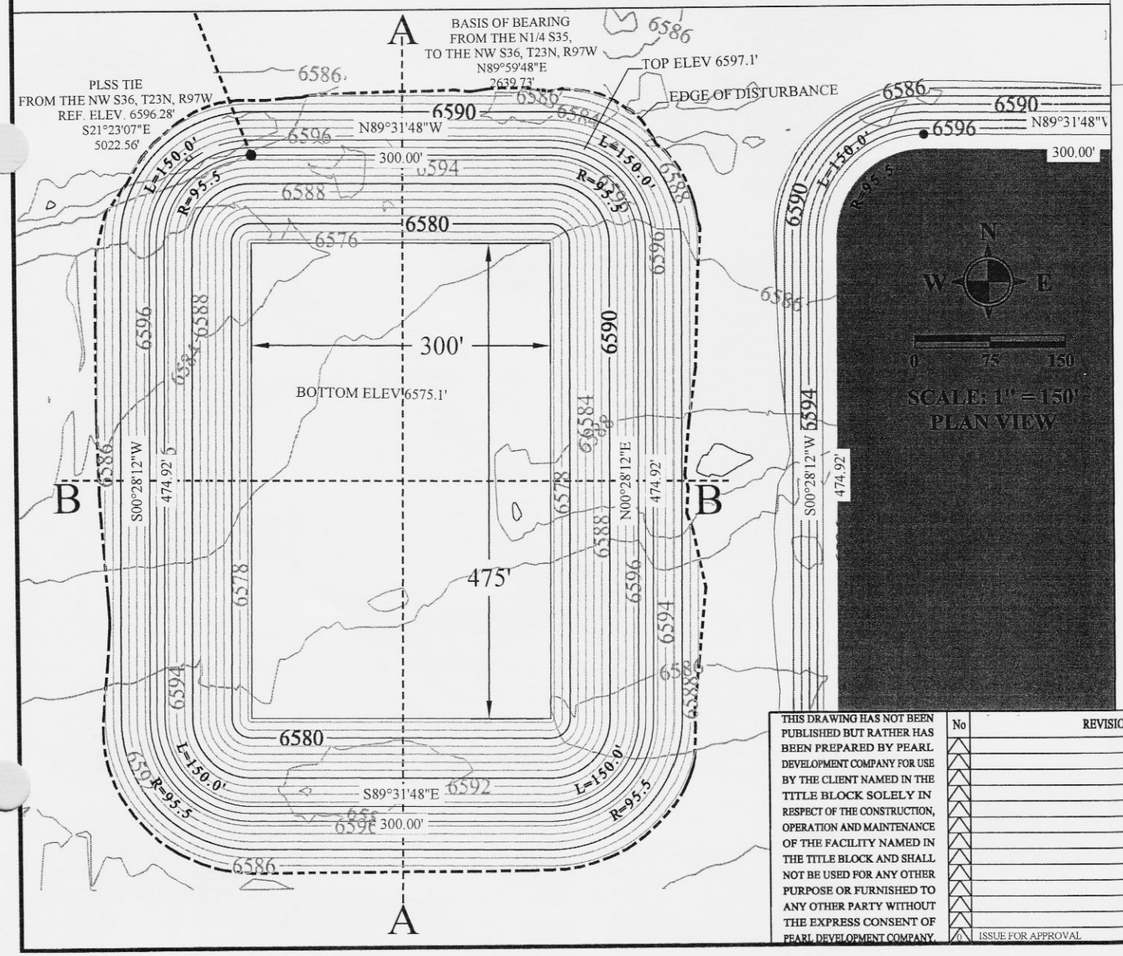
ALL INTERIOR SLOPES AND EXTERIOR FILL: 4H:1V
EXTERIOR CUT: 3H:1V 1" = 100' Horizontal 1" = 50' Vertical



SECTION B-B

TOP OF PIT: 6,597.1'
BOTTOM OF PIT: 6,575.1'

ALL INTERIOR SLOPES AND EXTERIOR FILL: 4H:1V
EXTERIOR CUT: 3H:1V 1" = 100' Horizontal 1" = 50' Vertical



GENERAL NOTES:

1) REMOVE AND REPLACE TOPSOIL, 2" +/- DEPTH.

2) PRIMARY COMPACTED FILL WITHIN THE RESERVOIR EMBANKMENTS SHALL BE PLACED AT 95% OF STANDARD PROCTOR, AT +/- 2% OPTIMUM MOISTURE. NO ROCKS WITH A DIAMETER GREATER THAN EIGHT (8) INCHES SHALL BE PLACED WITHIN FIFTEEN (15) FEET HORIZONTALLY OF THE INSIDE FACE OF THE EMBANKMENT. EXCESS MATERIAL, IF ANY, SHALL BE WASTED ON THE EXTERIOR PIT SLOPES.

3) OWNER WILL CONDUCT COMPACTION TESTING. ANY AREA NOT MEETING THE COMPACTION REQUIREMENTS SHALL BE REMOVED, RECOMPACTED AND MOISTENED AS NECESSARY, AT THE CONTRACTOR'S EXPENSE.

4) THE ORIGINAL GROUND IN COMPACTED FILL AREAS SHALL BE SCARIFIED, MOISTENED AND COMPACTED PER ITEM 2 ABOVE TO 8" DEPTH. COST TO BE INCLUDED IN COMPACTED FILL.

5) THE RESERVOIR SHALL HAVE 4H:1V SLOPES ON THE INTERIOR AND EXTERIOR OF THE COMPACTED FILL. TOP WIDTH OF THE COMPACTED EMBANKMENT SHALL BE A MINIMUM OF FIFTEEN (15) FEET. THE MAXIMUM WATER DEPTH OF THE PIT SHALL BE TWENTY (20) FEET, WITH TWO (2) FEET OF FREE BOARD.

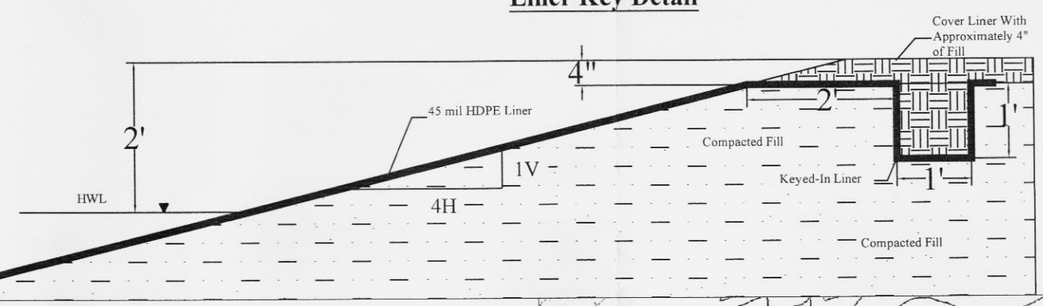
6) ESTIMATED QUANTITIES:

A) R&R TOPSOIL:	2745 BCY
B) EXCAVATION:	76,156 BCY
C) COMPACTED FILL:	65,699 BCY (1.15 SHRINK)
D) FENCING ON TOP OF PIT:	2200 LF
E) SEEDING:	9.0 ACRES
F) 45 MIL HDPE LINER	340,110 S.F. / POND
G) DISTURBANCE AREA	10.2 ACRES

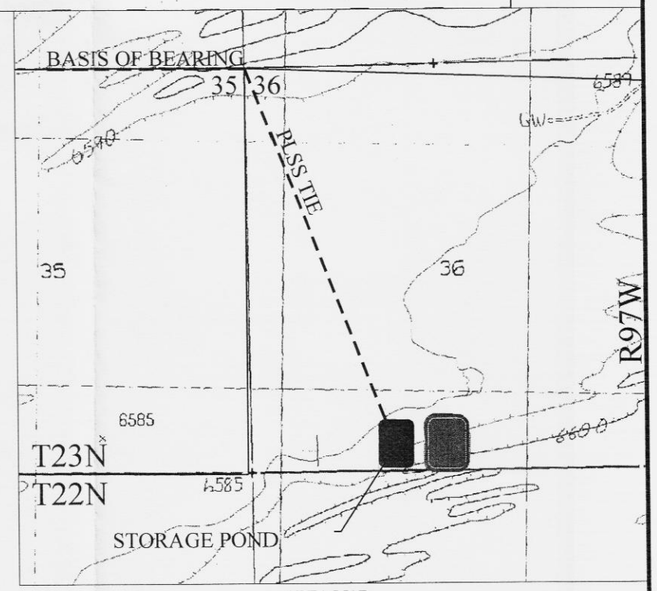
7) ALL SIX PONDS WILL BE LINED WITH A 45 MIL HDPE LINER TO PROVIDE TOTAL CONTAINMENT. LINER WILL BE INSTALLED TO RECOMMENDED MANUFACTURERS INSTALLATION PROCEDURES/GUIDELINES.

8) MANUFACTURED LINERS SHALL BE INSTALLED OVER SMOOTH FILL SUB GRADE WHICH IS FREE OF POCKETS, LOOSE ROCKS, OR OTHER MATERIAL THAT COULD DAMAGE THE LINER. INSPECTOR/ENGINEER SHALL VISUALLY INSPECT SURFACE BEFORE INSTALLING THE LINER. ALL ROCKS GREATER THAN 2" DIAMETER WILL BE REMOVED FROM THE SURFACE BEFORE INSTALLATION. SHOULD THERE BE A LARGE QUANTITY OF ROCK, THEN THE MATERIAL WILL BE SIEVED WITH A 2" SCREEN TO REMOVE THE LARGER ROCKS BEFORE THE LINER CAN BE INSTALLED.

Liner Key Detail



STORAGE POND CAPACITY TABLE				
25-Jan-07				
		INCREMENTAL	CUMULATIVE	
	AREA	CAPACITY	CAPACITY	
ELEV	(AC)	(ACRE/FT)	(ACRE/FT)	
6575.1	3.27	0.00	0.00	BOTTOM
6576	3.40	3.00	3.0	
6578	3.69	7.09	10.1	
6580	4.00	7.69	17.8	
6582	4.31	8.30	26.1	
6584	4.63	8.94	35.0	
6586	4.96	9.59	44.6	
6588	5.30	10.26	54.9	
6590	5.65	10.95	65.8	
6592	6.01	11.65	77.5	
6594	6.37	12.38	89.9	
6595.1	6.58	7.12	97.0	HWL
6596	6.75	6.00	103.0	
6597.1	6.96	7.54	110.5	TOP



AREA MAP
SCALE: 1" = 2,000'

No	REVISIONS	BY	CHKD	PM	DATE
0	ISSUE FOR APPROVAL	BGK	MRD	MRD	25 JAN 2006

DEPARTMENTS	BY	DATE
DRAWN	BGK	25 JAN 2006
SURVEYED		
CIV./STRUCT.		
ENVIR./PERMITTING		
PIPE HYDRAULICS		
ROAD CONS. MNGR.		
ELECT. CONS. MNGR.		
PIPE CONS. MNGR.		
DRILLING MNGR.		
LANDMAN		
PROJECT MANAGER		
CLIENT REP.		

PREPARED BY:
PEARL FIELD SERVICES
1082 East Brundage Lane
PO Box 783
Sheridan, Wyoming USA
307-672-8090
www.pearldc.com

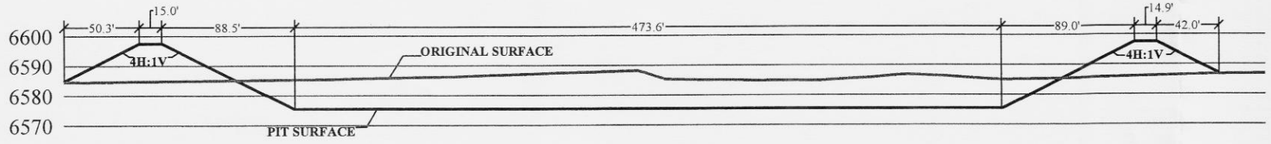
"FROM PROJECT CONCEPTION TO OPERATING REALITY"

OWNER / OPERATOR:
Pinnacle Gas Resources, Inc.

SWEETWATER SOUTH FIELD
14-36-23-97 STORAGE POND
SEC 36, T23N, R97W, 6TH P.M.
SWEETWATER COUNTY, WYOMING

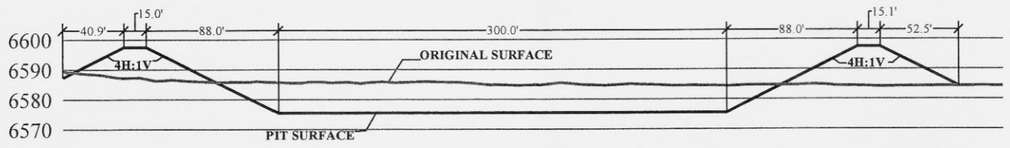
PROJ. NUMBER	DRAWING NUMBER	SCALE	REVISION
40-0034	9607	AS SHOWN	0

Z:\Site\Sweetwater\CAD\Pit & Reservoir Designs\14&15-36-23-97\dwg---



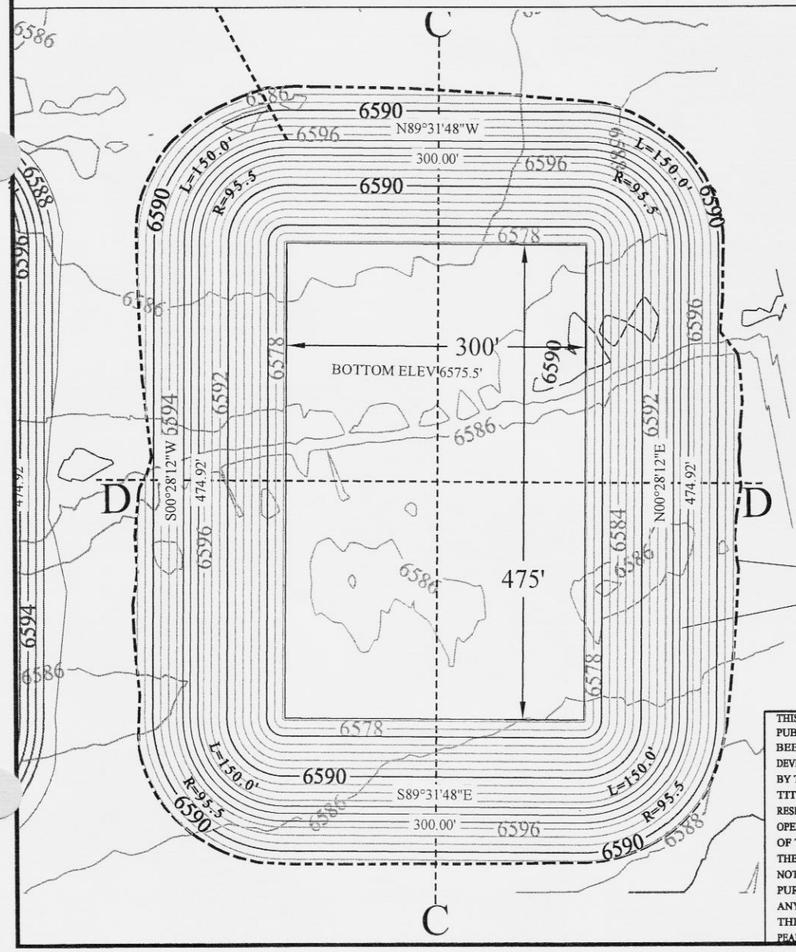
SECTION C-C

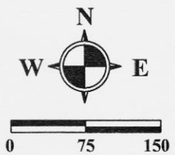
TOP OF PIT: 6,597.5' ALL INTERIOR SLOPES AND EXTERIOR FILL: 4H:1V
BOTTOM OF PIT: 6,575.5' EXTERIOR CUT: 3H:1V 1" = 100' Horizontal 1" = 50' Vertical



SECTION D-D

TOP OF PIT: 6,597.5' ALL INTERIOR SLOPES AND EXTERIOR FILL: 4H:1V
BOTTOM OF PIT: 6,575.5' EXTERIOR CUT: 3H:1V 1" = 100' Horizontal 1" = 50' Vertical





SCALE: 1" = 150'
PLAN VIEW

GENERAL NOTES:

1) REMOVE AND REPLACE TOPSOIL, 2" +/- DEPTH.

2) PRIMARY COMPACTED FILL WITHIN THE RESERVOIR EMBANKMENTS SHALL BE PLACED AT 95% OF STANDARD PROCTOR, AT +/- 2% OPTIMUM MOISTURE. NO ROCKS WITH A DIAMETER GREATER THAN EIGHT (8) INCHES SHALL BE PLACED WITHIN FIFTEEN (15) FEET HORIZONTALLY OF THE INSIDE FACE OF THE EMBANKMENT. EXCESS MATERIAL, IF ANY, SHALL BE WASTED ON THE EXTERIOR PIT SLOPES.

3) OWNER WILL CONDUCT COMPACTION TESTING. ANY AREA NOT MEETING THE COMPACTION REQUIREMENTS SHALL BE REMOVED, RECOMPACTED AND MOISTENED AS NECESSARY, AT THE CONTRACTOR'S EXPENSE.

4) THE ORIGINAL GROUND IN COMPACTED FILL AREAS SHALL BE SCARIFIED, MOISTENED AND COMPACTED PER ITEM 2 ABOVE TO 8" DEPTH. COST TO BE INCLUDED IN COMPACTED FILL.

5) THE RESERVOIR SHALL HAVE 4H:1V SLOPES ON THE INTERIOR AND EXTERIOR OF THE COMPACTED FILL. TOP WIDTH OF THE COMPACTED EMBANKMENT SHALL BE A MINIMUM OF FIFTEEN (15) FEET. THE MAXIMUM WATER DEPTH OF THE PIT SHALL BE TWENTY (20) FEET, WITH TWO (2) FEET OF FREE BOARD.

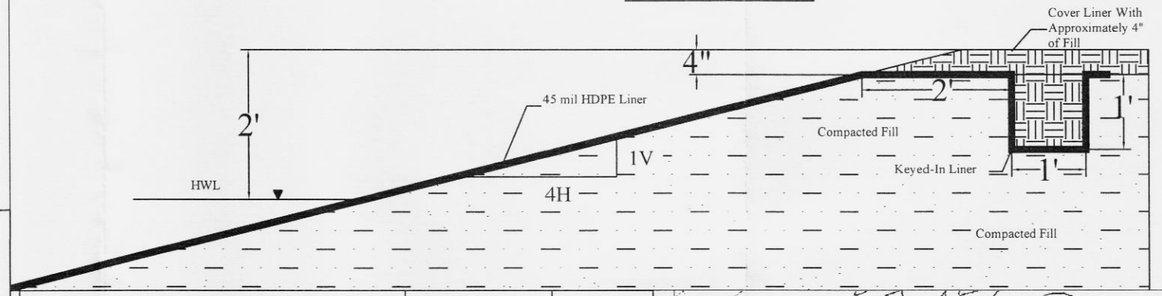
6) ESTIMATED QUANTITIES:

A) R&R TOPSOIL:	2710 BCY
B) EXCAVATION:	73,984 BCY
C) COMPACTED FILL:	64,113 BCY (1.15 SHRINK)
D) FENCING ON TOP OF PIT:	2200 LF
E) SEEDING:	9.0 ACRES
F) 45 MIL HDPE LINER	340,110 S.F. / POND
G) DISTURBANCE AREA	10.0 ACRES

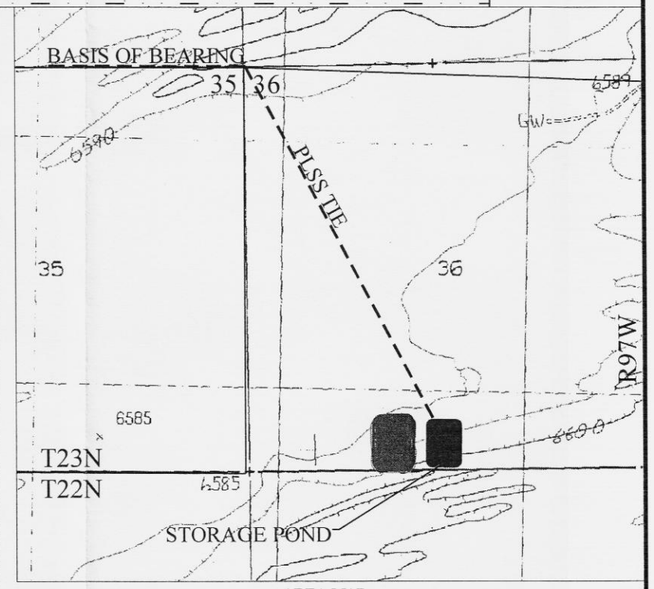
7) ALL SIX PONDS WILL BE LINED WITH A 45 MIL HDPE LINER TO PROVIDE TOTAL CONTAINMENT. LINER WILL BE INSTALLED TO RECOMMENDED MANUFACTURERS INSTALLATION PROCEDURES/GUIDELINES.

8) MANUFACTURED LINERS SHALL BE INSTALLED OVER SMOOTH FILL SUB GRADE WHICH IS FREE OF POCKETS, LOOSE ROCKS, OR OTHER MATERIAL THAT COULD DAMAGE THE LINER. INSPECTOR/ENGINEER SHALL VISUALLY INSPECT SURFACE BEFORE INSTALLING THE LINER. ALL ROCKS GREATER THAN 2" DIAMETER WILL BE REMOVED FROM THE SURFACE BEFORE INSTALLATION. SHOULD THERE BE A LARGE QUANTITY OF ROCK, THEN THE MATERIAL WILL BE SIEVED WITH A 2" SCREEN TO REMOVE THE LARGER ROCKS BEFORE THE LINER CAN BE INSTALLED.

Liner Key Detail



STORAGE POND CAPACITY TABLE				
25-Jan-07				
		INCREMENTAL	CUMULATIVE	
	AREA	CAPACITY	CAPACITY	
ELEV	(AC)	(ACRE/FT)	(ACRE/FT)	
6575.5	3.27	0.00	0.00	BOTTOM
6576	3.34	1.65	1.7	
6578	3.63	6.98	8.6	
6580	3.94	7.57	16.2	
6582	4.25	8.18	24.4	
6584	4.56	8.81	33.2	
6586	4.89	9.46	42.6	
6588	5.23	10.12	52.8	
6590	5.58	10.81	63.6	
6592	5.93	11.51	75.1	
6594	6.30	12.23	87.3	
6595.5	6.58	9.66	97.0	HWL
6596	6.67	3.31	100.3	
6597.5	6.96	10.23	110.5	TOP



AREA MAP
SCALE: 1" = 2,000'

No	REVISIONS	BY	CHKD	PM	DATE
1	ISSUE FOR APPROVAL	BGK	MRD	MRD	25 JAN 2006

DEPARTMENTS	BY	DATE
DRAWN	BGK	25 JAN 2006
SURVEYED		
CIV./STRUCT.		
ENVIR./PERMITTING		
PIPE HYDRAULICS		
ROAD CONS. MNGR.		
ELECT. CONS. MNGR.		
PIPE CONS. MNGR.		
DRILLING MNGR.		
LANDMAN		
PROJECT MANAGER		
CLIENT REP.		

PREPARED BY:

PEARL FIELD SERVICES

PEARL FIELD SERVICES

1082 East Brundage Lane
PO Box 783
Sheridan, Wyoming USA
307-672-8090
www.pearldc.com

"FROM PROJECT CONCEPTION TO OPERATING REALITY"

OWNER / OPERATOR:

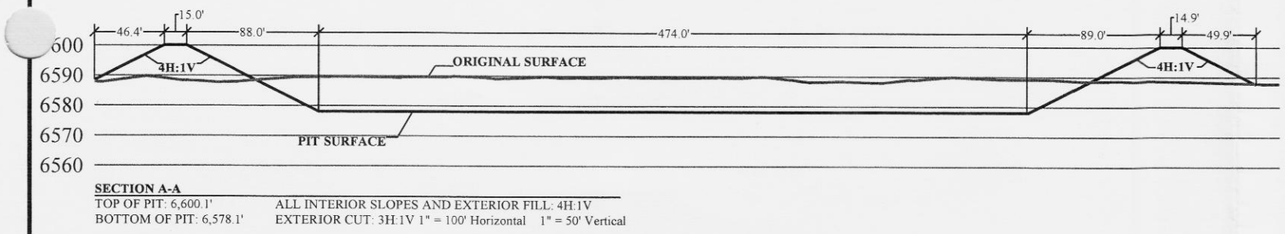
Pinnacle Gas Resources, Inc.

Pinnacle Gas Resources, Inc.

SWEETWATER SOUTH FIELD
15-36-23-97 STORAGE POND
SEC 36, T23N, R97W, 6TH P.M.
SWEETWATER COUNTY, WYOMING

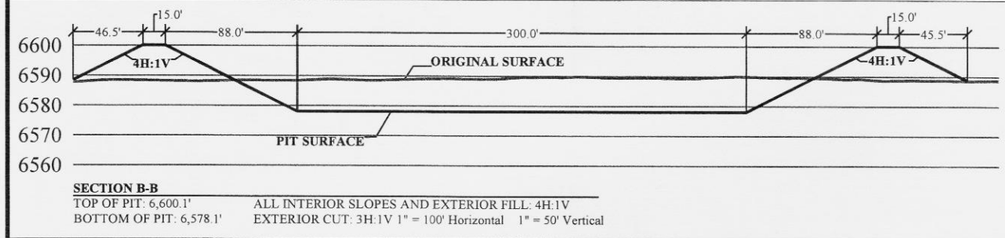
PROJ. NUMBER	DRAWING NUMBER	SCALE	REVISION
40-0034	9608	AS SHOWN	0

Z:\Site\Sweetwater\CAD\Pit & Reservoir Designs\14&15-36-23-97\dwg---



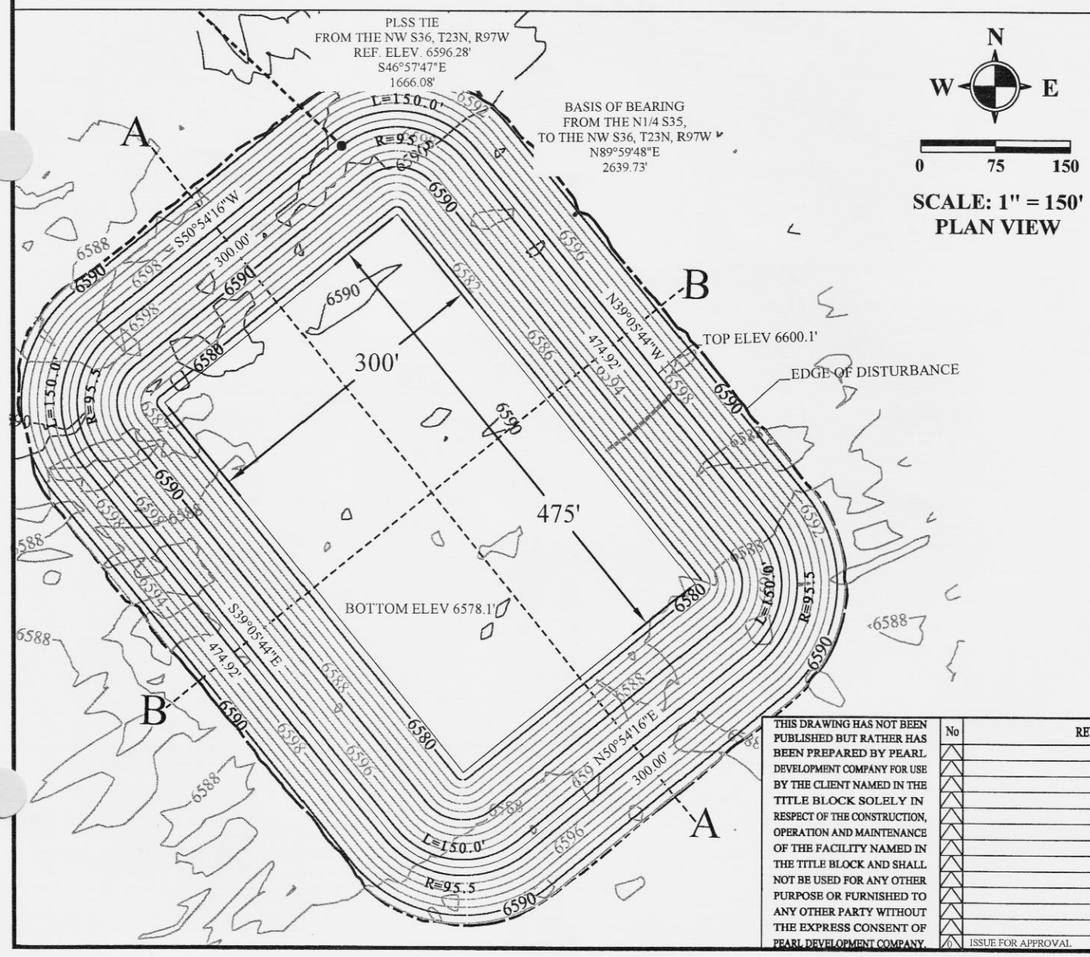
SECTION A-A

TOP OF PIT: 6,600.1' ALL INTERIOR SLOPES AND EXTERIOR FILL: 4H:1V
BOTTOM OF PIT: 6,578.1' EXTERIOR CUT: 3H:1V 1" = 100' Horizontal 1" = 50' Vertical



SECTION B-B

TOP OF PIT: 6,600.1' ALL INTERIOR SLOPES AND EXTERIOR FILL: 4H:1V
BOTTOM OF PIT: 6,578.1' EXTERIOR CUT: 3H:1V 1" = 100' Horizontal 1" = 50' Vertical



SCALE: 1" = 150'
PLAN VIEW

GENERAL NOTES:

1) REMOVE AND REPLACE TOPSOIL, 2" +/- DEPTH.

2) PRIMARY COMPACTED FILL WITHIN THE RESERVOIR EMBANKMENTS SHALL BE PLACED AT 95% OF STANDARD PROCTOR, AT +/- 2% OPTIMUM MOISTURE. NO ROCKS WITH A DIAMETER GREATER THAN EIGHT (8) INCHES SHALL BE PLACED WITHIN FIFTEEN (15) FEET HORIZONTALLY OF THE INSIDE FACE OF THE EMBANKMENT. EXCESS MATERIAL, IF ANY, SHALL BE WASTED ON THE EXTERIOR PIT SLOPES.

3) OWNER WILL CONDUCT COMPACTION TESTING. ANY AREA NOT MEETING THE COMPACTION REQUIREMENTS SHALL BE REMOVED, RECOMPACTED AND MOISTENED AS NECESSARY, AT THE CONTRACTOR'S EXPENSE.

4) THE ORIGINAL GROUND IN COMPACTED FILL AREAS SHALL BE SCARIFIED, MOISTENED AND COMPACTED PER ITEM 2 ABOVE TO 8" DEPTH. COST TO BE INCLUDED IN COMPACTED FILL.

5) THE RESERVOIR SHALL HAVE 4H:1V SLOPES ON THE INTERIOR AND EXTERIOR OF THE COMPACTED FILL. TOP WIDTH OF THE COMPACTED EMBANKMENT SHALL BE A MINIMUM OF FIFTEEN (15) FEET. THE MAXIMUM WATER DEPTH OF THE PIT SHALL BE TWENTY (20) FEET, WITH TWO (2) FEET OF FREE BOARD.

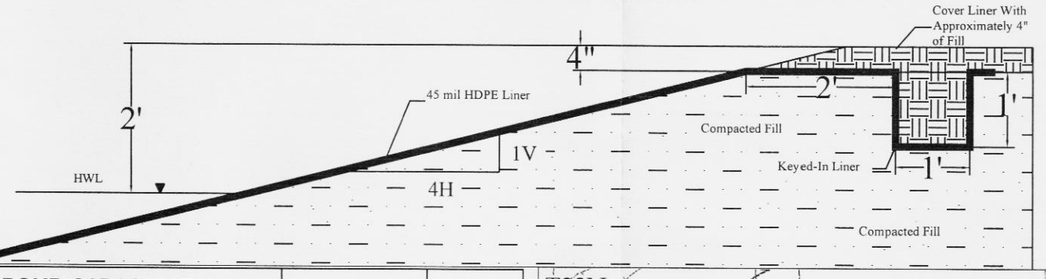
6) ESTIMATED QUANTITIES:

A) R&R TOPSOIL:	2,747 BCY
B) EXCAVATION:	78,894 BCY
C) COMPACTED FILL:	66,178 BCY (1.15 SHRINK)
D) FENCING ON TOP OF PIT:	2200 LF
E) SEEDING:	9.0 ACRES
F) 45 MIL HDPE LINER	340,110 S.F. / POND
G) DISTURBANCE AREA	10.2 ACRES

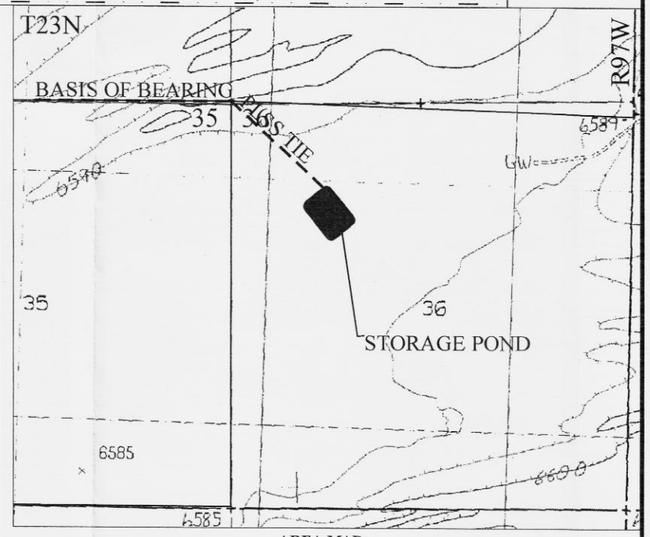
7) ALL SIX PONDS WILL BE LINED WITH A 45 MIL HDPE LINER TO PROVIDE TOTAL CONTAINMENT. LINER WILL BE INSTALLED TO RECOMMENDED MANUFACTURERS INSTALLATION PROCEDURES/GUIDELINES.

8) MANUFACTURED LINERS SHALL BE INSTALLED OVER SMOOTH FILL SUB GRADE WHICH IS FREE OF POCKETS, LOOSE ROCKS, OR OTHER MATERIAL THAT COULD DAMAGE THE LINER. INSPECTOR/ENGINEER SHALL VISUALLY INSPECT SURFACE BEFORE INSTALLING THE LINER. ALL ROCKS GREATER THAN 2" DIAMETER WILL BE REMOVED FROM THE SURFACE BEFORE INSTALLATION. SHOULD THERE BE A LARGE QUANTITY OF ROCK, THEN THE MATERIAL WILL BE SIEVED WITH A 2" SCREEN TO REMOVE THE LARGER ROCKS BEFORE THE LINER CAN BE INSTALLED.

Liner Key Detail



STORAGE POND CAPACITY TABLE				
23-Jan-07				
		INCREMENTAL	CUMULATIVE	
	AREA	CAPACITY	CAPACITY	
ELEV	(AC)	(ACRE/FT)	(ACRE/FT)	
6578.1	3.27	0.00	0.00	BOTTOM
6580	3.55	6.48	6.5	
6582	3.84	7.39	13.9	
6584	4.15	8.00	21.9	
6586	4.47	8.62	30.5	
6588	4.79	9.26	39.7	
6590	5.13	9.92	49.7	
6592	5.47	10.60	60.3	
6594	5.83	11.30	71.6	
6596	6.19	12.01	83.6	
6598.1	6.58	13.41	97.0	HWL
6600.1	6.96	13.54	110.5	TOP



AREA MAP
SCALE: 1" = 2,000'

No	REVISIONS	BY	CHKD	PM	DATE
0	ISSUE FOR APPROVAL	BGK	MRD	MRD	23 JAN 2006

DEPARTMENTS	BY	DATE
DRAWN	BGK	23 JAN 2006
SURVEYED		
CIV./STRUCT.		
ENVIR./PERMITTING		
PIPE HYDRAULICS		
ROAD CONS. MNGR.		
ELECT. CONS. MNGR.		
PIPE CONS. MNGR.		
DRILLING MNGR.		
LANDMAN		
PROJECT MANAGER		
CLIENT REP.		

PREPARED BY:
PEARL FIELD SERVICES
1082 East Brundage Lane
PO Box 783
Sheridan, Wyoming USA
307-672-8090
www.pearldc.com

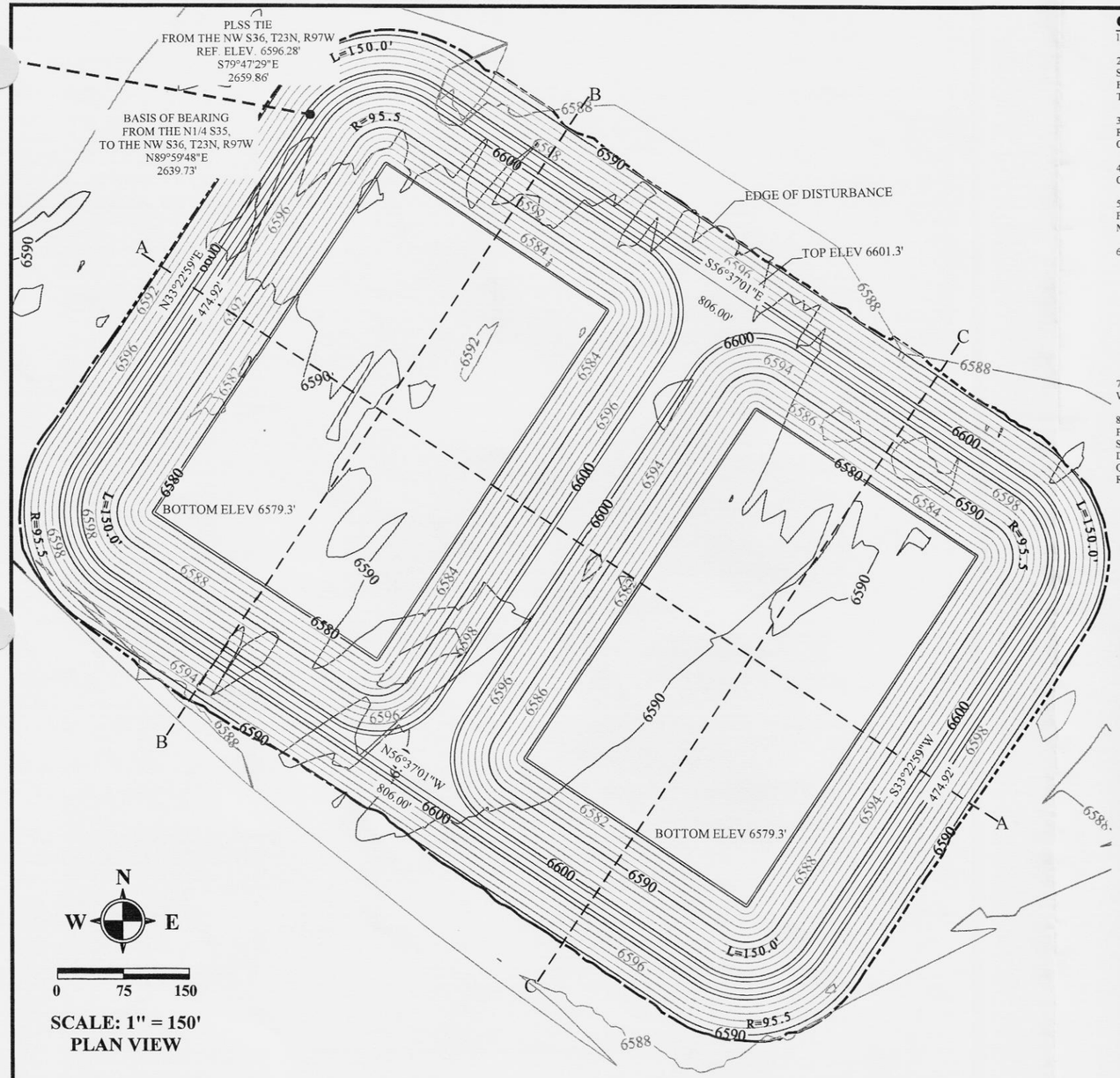
"FROM PROJECT CONCEPTION TO OPERATING REALITY"

OWNER / OPERATOR:
Pinnacle Gas Resources, Inc.

SWEETWATER SOUTH FIELD
04-36-23-97 STORAGE POND
SEC 36, T23N, R97W, 6TH P.M.
SWEETWATER COUNTY, WYOMING

PROJ. NUMBER	DRAWING NUMBER	SCALE	REVISION
40-0034	9604	AS SHOWN	0

Z:\Site\Sweetwater\CAD\Pit & Reservoir Designs\04-36-23-97\dwg---



GENERAL NOTES:

1) REMOVE AND REPLACE TOPSOIL, 2" +/- DEPTH.

2) PRIMARY COMPACTED FILL WITHIN THE RESERVOIR EMBANKMENTS SHALL BE PLACED AT 95% OF STANDARD PROCTOR, AT +/- 2% OPTIMUM MOISTURE. NO ROCKS WITH A DIAMETER GREATER THAN EIGHT (8) INCHES SHALL BE PLACED WITHIN FIFTEEN (15) FEET HORIZONTALLY OF THE INSIDE FACE OF THE EMBANKMENT. EXCESS MATERIAL, IF ANY, SHALL BE WASTED ON THE EXTERIOR PIT SLOPES.

3) OWNER WILL CONDUCT COMPACTION TESTING. ANY AREA NOT MEETING THE COMPACTION REQUIREMENTS SHALL BE REMOVED, RECOMPACTED AND MOISTENED AS NECESSARY, AT THE CONTRACTOR'S EXPENSE.

4) THE ORIGINAL GROUND IN COMPACTED FILL AREAS SHALL BE SCARIFIED, MOISTENED AND COMPACTED PER ITEM 2 ABOVE TO 8" DEPTH. COST TO BE INCLUDED IN COMPACTED FILL.

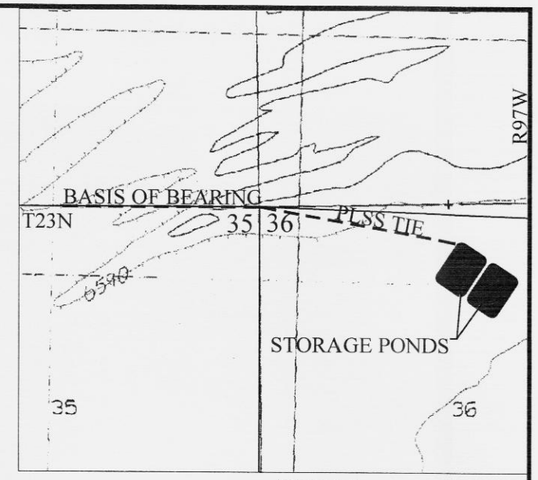
5) THE RESERVOIR SHALL HAVE 4H:1V SLOPES ON THE INTERIOR AND EXTERIOR OF THE COMPACTED FILL. TOP WIDTH OF THE COMPACTED EMBANKMENT SHALL BE A MINIMUM OF FIFTEEN (15) FEET. THE MAXIMUM WATER DEPTH OF THE PIT SHALL BE TWENTY (20) FEET, WITH TWO (2) FEET OF FREE BOARD.

6) ESTIMATED QUANTITIES:

A) R&R TOPSOIL:	5,225 BCY
B) EXCAVATION:	146,025 BCY
C) COMPACTED FILL:	120,851 BCY (1.15 SHRINK)
D) FENCING ON TOP OF PIT:	4400 LF
E) SEEDING:	18.0 ACRES
F) 45 MIL HDPE LINER	680,220 S.F. / POND
G) DISTURBANCE AREA	19.4 ACRES

7) ALL SIX PONDS WILL BE LINED WITH A 45 MIL HDPE LINER TO PROVIDE TOTAL CONTAINMENT. LINER WILL BE INSTALLED TO RECOMMENDED MANUFACTURERS INSTALLATION PROCEDURES/GUIDELINES.

8) MANUFACTURED LINERS SHALL BE INSTALLED OVER SMOOTH FILL SUB GRADE WHICH IS FREE OF POCKETS, LOOSE ROCKS, OR OTHER MATERIAL THAT COULD DAMAGE THE LINER. INSPECTOR/ENGINEER SHALL VISUALLY INSPECT SURFACE BEFORE INSTALLING THE LINER. ALL ROCKS GREATER THAN 2" DIAMETER WILL BE REMOVED FROM THE SURFACE BEFORE INSTALLATION. SHOULD THERE BE A LARGE QUANTITY OF ROCK, THEN THE MATERIAL WILL BE SIEVED WITH A 2" SCREEN TO REMOVE THE LARGER ROCKS BEFORE THE LINER CAN BE INSTALLED.



AREA MAP
SCALE: 1" = 2,000'

STORAGE POND CAPACITY TABLE (PER PIT)				
25-Jan-07				
		INCREMENTAL	CUMULATIVE	
	AREA	CAPACITY	CAPACITY	
ELEV	(AC)	(ACRE/FT)	(ACRE/FT)	
6579.3	3.27	0.00	0.00	BOTTOM
6580	3.37	2.33	2.3	
6582	3.66	7.04	9.4	
6584	3.97	7.63	17.0	
6586	4.28	8.24	25.2	
6588	4.60	8.87	34.1	
6590	4.93	9.52	43.6	
6592	5.27	10.19	53.8	
6594	5.61	10.88	64.7	
6596	5.97	11.58	76.3	
6598	6.34	12.31	88.6	
6599.3	6.58	8.40	97.0	HWL
6600	6.71	4.65	101.6	
6601.3	6.96	8.89	110.5	TOP

No	REVISIONS	BY	CHKD	PM	DATE
0	ISSUE FOR APPROVAL	BGK	MRD	MRD	23 JAN 2006

DEPARTMENTS	BY	DATE
DRAWN	BGK	23 JAN 2006
SURVEYED		
CIV./STRUCT.		
ENVIR./PERMITTING		
PIPE HYDRAULICS		
ROAD CONS. MNGR.		
ELECT. CONS. MNGR.		
PIPE CONS. MNGR.		
DRILLING MNGR.		
LANDMAN		
PROJECT MANAGER		
CLIENT REP.		

PREPARED BY:
PEARL FIELD SERVICES
1082 East Brundage Lane
PO Box 783
Sheridan, Wyoming USA
307-672-8090
www.pearldc.com

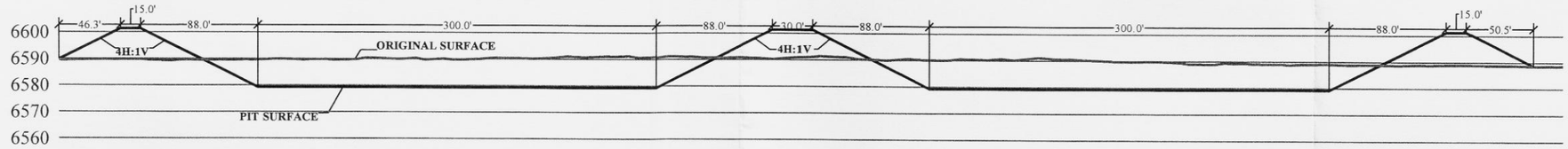
"FROM PROJECT CONCEPTION TO OPERATING REALITY"

OWNER / OPERATOR:
Pinnacle Gas Resources, Inc.

SWEETWATER SOUTH FIELD
02-36A/36B-23-97
STORAGE PONDS
SEC 36, T23N, R97W, 6TH P.M.
SWEETWATER COUNTY, WYOMING
PAGE 1 OF 2

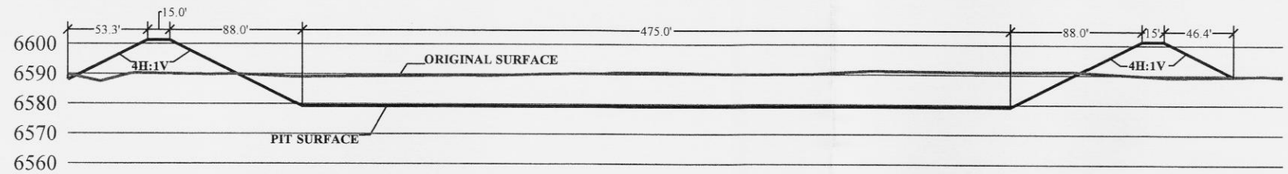
PROJ. NUMBER	DRAWING NUMBER	SCALE	REVISION
40-0034	9605	AS SHOWN	0

Z:\Site\Sweetwater\CAD\Pit & Reservoir Designs\02-36A&36B-23-97\dwg---



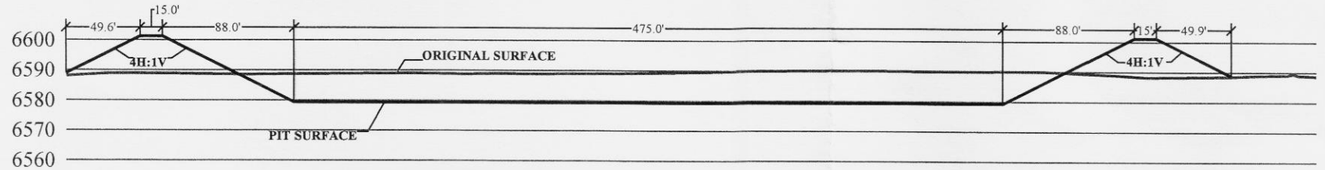
SECTION A-A

TOP OF PIT: 6,601.3' ALL INTERIOR SLOPES AND EXTERIOR FILL: 4H:1V
BOTTOM OF PIT: 6,579.3' EXTERIOR CUT: 3H:1V 1" = 100' Horizontal 1" = 50' Vertical



SECTION B-B

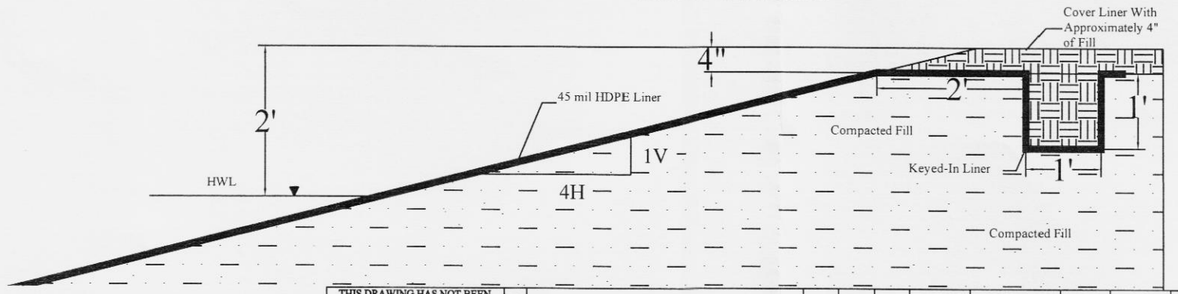
TOP OF PIT: 6,601.3' ALL INTERIOR SLOPES AND EXTERIOR FILL: 4H:1V
BOTTOM OF PIT: 6,579.3' EXTERIOR CUT: 3H:1V 1" = 100' Horizontal 1" = 50' Vertical



SECTION C-C

TOP OF PIT: 6,601.3' ALL INTERIOR SLOPES AND EXTERIOR FILL: 4H:1V
BOTTOM OF PIT: 6,579.3' EXTERIOR CUT: 3H:1V 1" = 100' Horizontal 1" = 50' Vertical

Liner Key Detail



THIS DRAWING HAS NOT BEEN PUBLISHED BUT RATHER HAS BEEN PREPARED BY PEARL DEVELOPMENT COMPANY FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION, OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK AND SHALL NOT BE USED FOR ANY OTHER PURPOSE OR FURNISHED TO ANY OTHER PARTY WITHOUT THE EXPRESS CONSENT OF PEARL DEVELOPMENT COMPANY.

No	REVISIONS	BY	CHKD	PM	DATE
0	ISSUE FOR APPROVAL	BGK	MRD	MRD	23 JAN 2006

DEPARTMENTS	BY	DATE
DRAWN	BGK	23 JAN 2006
SURVEYED		
CIV./STRUCT.		
ENVIR./PERMITTING		
PIPE HYDRAULICS		
ROAD CONS. MNGR.		
ELECT. CONS. MNGR.		
PIPE CONS. MNGR.		
DRILLING MNGR.		
LANDMAN		
PROJECT MANAGER		
CLIENT REP.		

PREPARED BY:

PEARL FIELD SERVICES

1082 East Brundage Lane
PO Box 783
Sheridan, Wyoming USA
307-672-8090
www.pearldc.com

"FROM PROJECT CONCEPTION TO OPERATING REALITY"

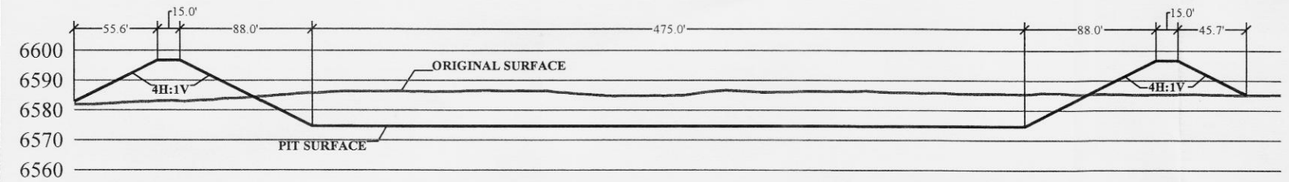
OWNER / OPERATOR:

Pinnacle Gas Resources, Inc.

SWEETWATER SOUTH FIELD
02-36A/36B-23-97
STORAGE PONDS
SEC 36, T23N, R97W, 6TH P.M.
SWEETWATER COUNTY, WYOMING
PAGE 2 OF 2

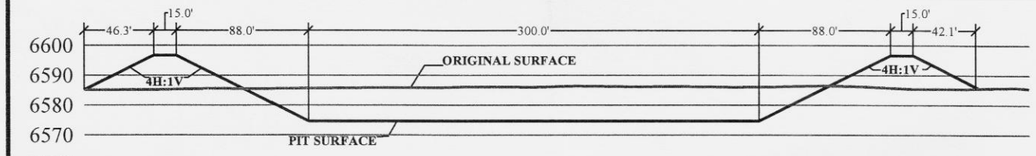
PROJ. NUMBER	DRAWING NUMBER	SCALE	REVISION
40-0034	9606	AS SHOWN	0

Z:\Site\Sweetwater\CAD\Pit & Reservoir Designs\02-36A&36B-23-97\dwg---



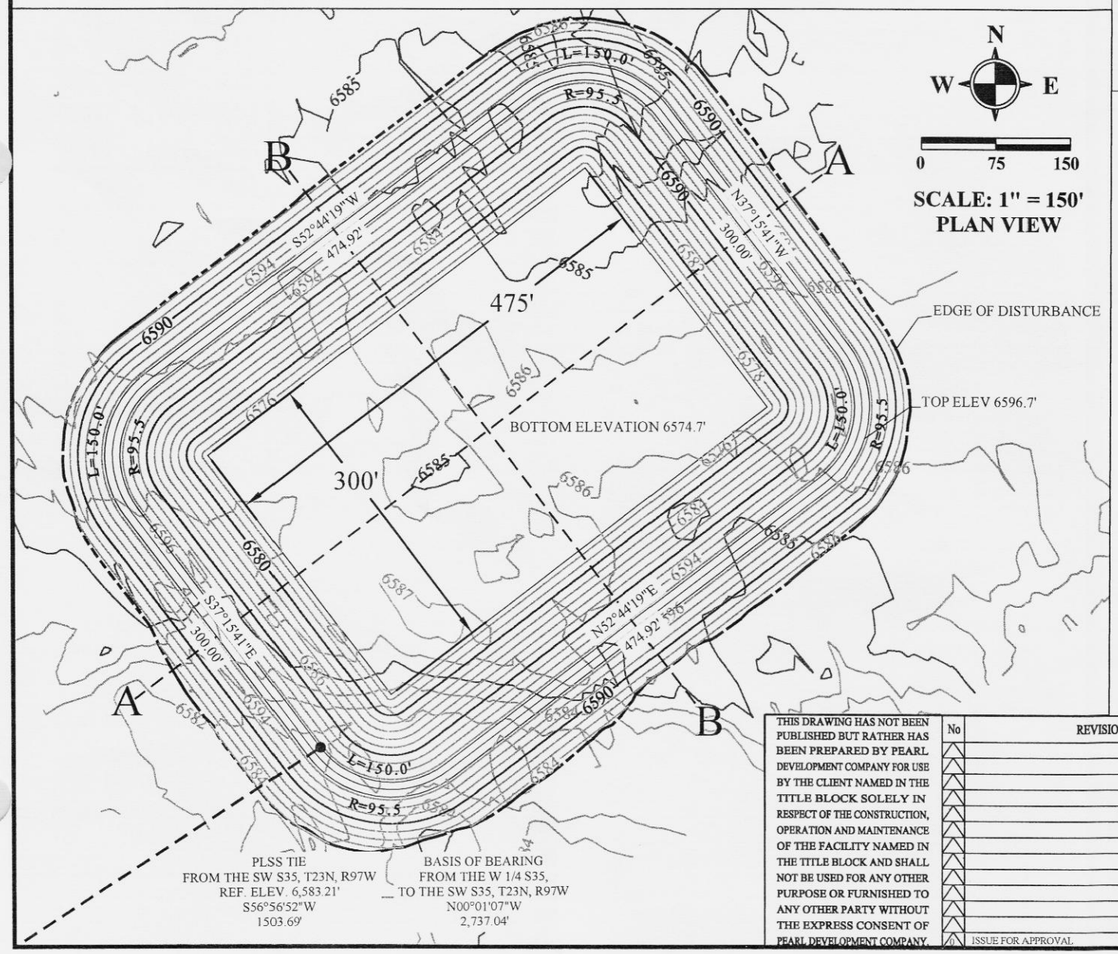
SECTION A-A

TOP OF PIT: 6,596.7' ALL INTERIOR SLOPES AND EXTERIOR FILL: 4H:1V
BOTTOM OF PIT: 6,574.7' EXTERIOR CUT: 3H:1V 1" = 100' Horizontal 1" = 50' Vertical



SECTION B-B

TOP OF PIT: 6,596.7' ALL INTERIOR SLOPES AND EXTERIOR FILL: 4H:1V
BOTTOM OF PIT: 6,574.7' EXTERIOR CUT: 3H:1V 1" = 100' Horizontal 1" = 50' Vertical



SCALE: 1" = 150'
PLAN VIEW

GENERAL NOTES:

1) REMOVE AND REPLACE TOPSOIL, 2" +/- DEPTH.

2) PRIMARY COMPACTED FILL WITHIN THE RESERVOIR EMBANKMENTS SHALL BE PLACED AT 95% OF STANDARD PROCTOR, AT +/- 2% OPTIMUM MOISTURE. NO ROCKS WITH A DIAMETER GREATER THAN EIGHT (8) INCHES SHALL BE PLACED WITHIN FIFTEEN (15) FEET HORIZONTALLY OF THE INSIDE FACE OF THE EMBANKMENT. EXCESS MATERIAL, IF ANY, SHALL BE WASTED ON THE EXTERIOR PIT SLOPES.

3) OWNER WILL CONDUCT COMPACTION TESTING. ANY AREA NOT MEETING THE COMPACTION REQUIREMENTS SHALL BE REMOVED, RECOMPACTED AND MOISTENED AS NECESSARY, AT THE CONTRACTOR'S EXPENSE.

4) THE ORIGINAL GROUND IN COMPACTED FILL AREAS SHALL BE SCARIFIED, MOISTENED AND COMPACTED PER ITEM 2 ABOVE TO 8" DEPTH. COST TO BE INCLUDED IN COMPACTED FILL.

5) THE RESERVOIR SHALL HAVE 4H:1V SLOPES ON THE INTERIOR AND EXTERIOR OF THE COMPACTED FILL. TOP WIDTH OF THE COMPACTED EMBANKMENT SHALL BE A MINIMUM OF FIFTEEN (15) FEET. THE MAXIMUM WATER DEPTH OF THE PIT SHALL BE TWENTY (20) FEET, WITH TWO (2) FEET OF FREE BOARD.

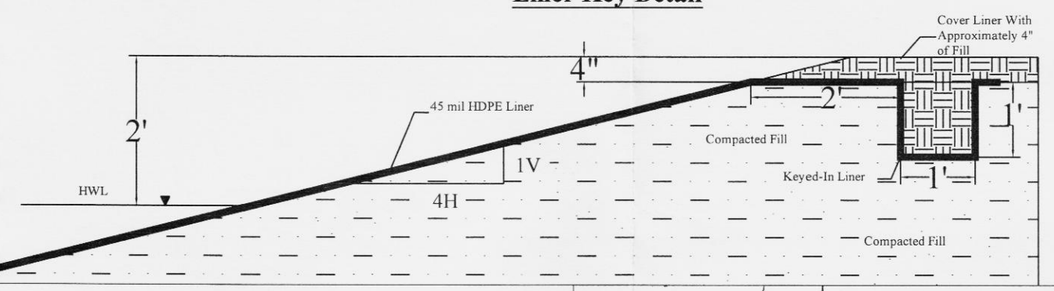
6) ESTIMATED QUANTITIES:

A) R&R TOPSOIL:	2,763 BCY
B) EXCAVATION:	81,340 BCY
C) COMPACTED FILL:	67,317 BCY (1.15 SHRINK)
D) FENCING ON TOP OF PIT:	2200 LF
E) SEEDING:	9.0 ACRES
F) 45 MIL HDPE LINER	340,110 S.F. / POND
G) DISTURBANCE AREA	10.0 ACRES

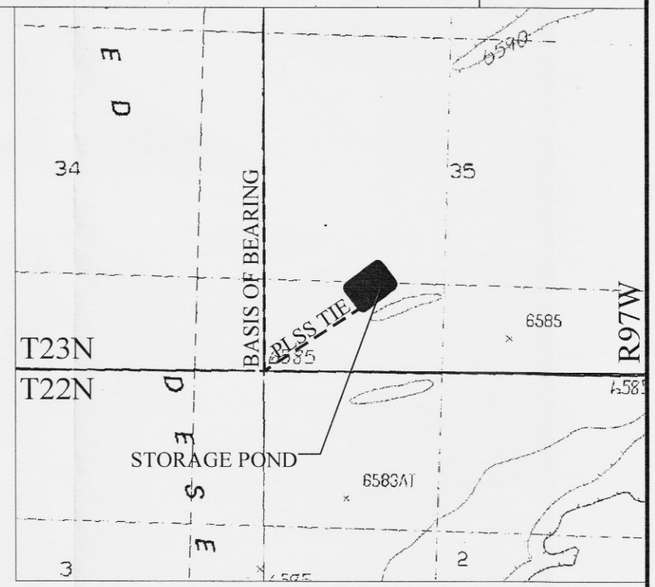
7) ALL SIX PONDS WILL BE LINED WITH A 45 MIL HDPE LINER TO PROVIDE TOTAL CONTAINMENT. LINER WILL BE INSTALLED TO RECOMMENDED MANUFACTURERS INSTALLATION PROCEDURES/GUIDELINES.

8) MANUFACTURED LINERS SHALL BE INSTALLED OVER SMOOTH FILL SUB GRADE WHICH IS FREE OF POCKETS, LOOSE ROCKS, OR OTHER MATERIAL THAT COULD DAMAGE THE LINER. INSPECTOR/ENGINEER SHALL VISUALLY INSPECT SURFACE BEFORE INSTALLING THE LINER. ALL ROCKS GREATER THAN 2" DIAMETER WILL BE REMOVED FROM THE SURFACE BEFORE INSTALLATION. SHOULD THERE BE A LARGE QUANTITY OF ROCK, THEN THE MATERIAL WILL BE SIEVED WITH A 2" SCREEN TO REMOVE THE LARGER ROCKS BEFORE THE LINER CAN BE INSTALLED.

Liner Key Detail



STORAGE POND CAPACITY TABLE				
23-Jan-07				
		INCREMENTAL	CUMULATIVE	
	AREA	CAPACITY	CAPACITY	
ELEV	(AC)	(ACRE/FT)	(ACRE/FT)	
6574.7	3.27	0.00	0.00	BOTTOM
6576	3.46	4.37	4.4	
6578	3.75	7.21	11.6	
6580	4.06	7.81	19.4	
6582	4.37	8.43	27.8	
6584	4.69	9.07	36.9	
6586	5.03	9.72	46.6	
6588	5.37	10.40	57.0	
6590	5.72	11.09	68.1	
6592	6.08	11.80	79.9	
6594	6.45	12.53	92.4	
6594.7	6.58	4.56	97.0	HWL
6596.7	6.96	13.54	110.5	TOP



AREA MAP
SCALE: 1" = 2,000'

No	REVISIONS	BY	CHKD	PM	DATE
1	ISSUE FOR APPROVAL	BGK	MRD	MRD	23 JAN 2006

DEPARTMENTS	BY	DATE
DRAWN	BGK	23 JAN 2006
SURVEYED		
CIV./STRUCT.		
ENVIR./PERMITTING		
PIPE HYDRAULICS		
ROAD CONS. MNGR.		
ELECT. CONS. MNGR.		
PIPE CONS. MNGR.		
DRILLING MNGR.		
LANDMAN		
PROJECT MANAGER		
CLIENT REP.		

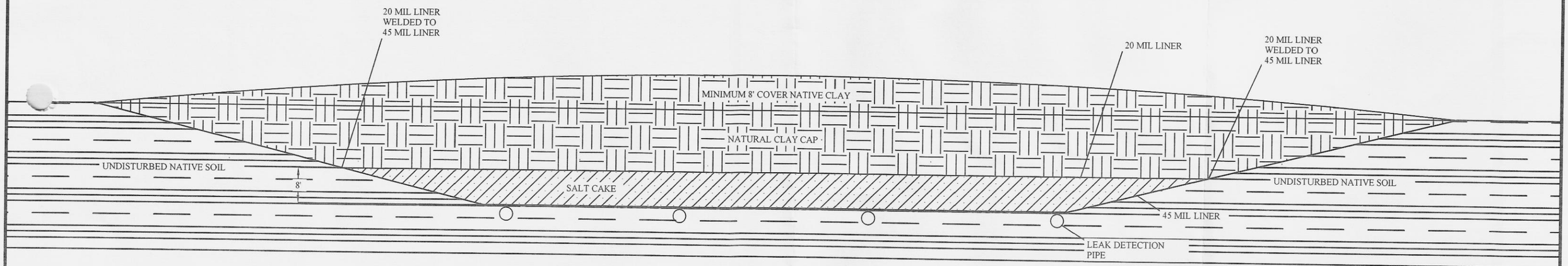
PREPARED BY:
PEARL FIELD SERVICES
PEARL FIELD SERVICES
1082 East Brundage Lane
PO Box 783
Sheridan, Wyoming USA
307-672-8090
www.pearldc.com
"FROM PROJECT CONCEPTION TO OPERATING REALITY"

OWNER / OPERATOR:
Pinnacle Gas Resources, Inc.
Pinnacle Gas Resources, Inc.
SWEETWATER SOUTH FIELD
14-35-23-97 STORAGE POND
SEC 35, T23N, R97W, 6TH P.M.
SWEETWATER COUNTY, WYOMING

PROJ. NUMBER	DRAWING NUMBER	SCALE	REVISION
40-0034	9602	AS SHOWN	0

Z:\Site\Sweetwater\CAD\Pit & Reservoir Designs\14-35-23-97\dwg---

NOT TO SCALE



THIS DRAWING HAS NOT BEEN PUBLISHED BUT RATHER HAS BEEN PREPARED BY PEARL DEVELOPMENT COMPANY FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION, OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK AND SHALL NOT BE USED FOR ANY OTHER PURPOSE OR FURNISHED TO ANY OTHER PARTY WITHOUT THE EXPRESS CONSENT OF PEARL DEVELOPMENT COMPANY.

No	REVISIONS	BY	CHKD	PM	DATE
/0\	ISSUE FOR APPROVAL	BGK			

DEPARTMENTS	BY	DATE
DRAWN	BGK	30 APR 2007
SURVEYED		
CIV./STRUCT.		
ENVIR./PERMITTING		
PIPE HYDRAULICS		
ROAD CONS. MNGR.		
ELECT. CONS. MNGR.		
PIPE CONS. MNGR.		
DRILLING MNGR.		
LANDMAN		
PROJECT MANAGER		
CLIENT REP.		

PREPARED BY:

PEARL FIELD SERVICES

1082 East Brundage Lane
PO Box 783
Sheridan, Wyoming USA
307-672-8090
www.pearldc.com

"FROM PROJECT CONCEPTION TO OPERATING REALITY"

OWNER / OPERATOR:

PINNACLE GAS RESOURCES

SWEETWATER SOUTH
TYPICAL RECLAIMED PIT
CROSS SECTION

PROJ. NUMBER	DRAWING NUMBER	SCALE	REVISION
40-0034	4101	AS SHOWN	/0\

X:\Site\Sweetwater\CAD\Typical Designs\Reclaimed Site X-Sect\dwg---

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING, AND OPERATIONS

Project: **Pinnacle Gas Resources, Inc.**
Location: **Great Divide Basin, Sweetwater County, WY**
Prospect: **Sweetwater**
Field: **Sweetwater South**
Pumper: **PGR**

Issue: For Approval
Rev.: A
Rev. Date: 9-May-07
By: DRL
Chk:

Passive (Pan) + Mechanical Evaporation Calculations, Year 1

Site Data		31 Jan	28 Feb	31 Mar	30 Apr	31 May	30 Jun	31 Jul	31 Aug	30 Sept	31 Oct	30 Nov	31 Dec	365 Annual	Comments
Monthly Ave Precipitation	in.	0.25	0.24	0.37	0.69	1.05	0.76	0.79	0.79	0.76	0.57	0.34	0.23	6.84	Note 1
Monthly Ave Pan Evap	in.	0	0	0	0	8.22	9.71	11.08	9.80	6.82	4.62	0	0	50.25	Note 2
Monthly Ave Adjust Pan Evap	in.	0	0	0	0	4.60	5.44	6.20	5.49	3.82	2.59	0	0	28.14	Note 2
Mean Monthly Rel. Humidity (Morning)	%	68	70	73	75	77	75	68	66	68	67	69	68	70	Note 3
Mean Monthly Rel. Humidity (Afternoon)	%	60	57	48	41	39	32	26	24	30	40	56	62	43	Note 3
Average Wind Speed	mph	15.7	15.0	14.7	14.5	13.4	12.9	11.4	11.0	11.9	13.4	14.1	15.3	14	Note 4
Average Min Dry Bulb Temp	F	7.3	10.5	17.8	26	34.2	42.3	49	47.1	38.5	28.6	17.1	9.4	27	Note 5
Average Max Dry Bulb Temp	F	27.9	32.7	41.2	53.7	64.6	75.8	83.9	81.5	72.2	59.0	41.0	29.9	55	Note 5
Mean Monthly Wet Bulb Temp	F	21	23	30	36	45	52	56	54	47	35	28	22	37	Note 6
Production Rate	bwpd	3,914	3,914	3,914	3,893	3,589	3,299	3,039	2,790	2,561	2,356	2,160	1,985	1,985	Note 7
Precipitation Rate	bwpd	17	18	25	48	70	52	53	53	52	38	23	15		
Total Inflow	bwpd	3,931	3,932	3,939	3,941	3,659	3,351	3,091	2,843	2,613	2,394	2,183	2,000		
Solar Evaporation Rate	bwpd	-	-	-	-	307	375	414	366	263	173	-	-		
Difference	**bwpd**	**3,931**	**3,932**	**3,939**	**3,941**	**3,352**	**2,976**	**2,677**	**2,477**	**2,350**	**2,221**	**2,183**	**2,000**		Note 2 & 8
Accumulated in 1 pond with Spray Evaporators	**acre-ft**	**15.707**	**29.898**	**45.636**	**60.875**	**60.875**	**58.734**	**54.765**	**50.519**	**47.415**	**45.353**	**53.796**	**61.787**		
Mass of NaCl in Pond (30,000 mg/l feed)	**mg**	**5.788E+11**	**1.102E+12**	**1.680E+12**	**2.237E+12**	**2.768E+12**	**3.240E+12**	**3.689E+12**	**4.102E+12**	**4.468E+12**	**4.817E+12**	**5.126E+12**	**5.419E+12**		
Concentration of NaCl in pond	**mg/l**	**29873**	**29869**	**29849**	**29796**	**36864**	**44723**	**54614**	**65826**	**76401**	**86100**	**77245**	**71105**		
Spray Efficiency	% Evap/Pump	0.0%	0.0%	0.0%	0.0%	36.4%	38.3%	39.9%	38.5%	34.3%	29.7%	0.0%	0.0%		Note 14
Required Pump Capacity	**bwpd**	0.0	0.0	0.0	0.0	**9,205**	**7,761**	**6,714**	**6,441**	**6,861**	**7,470**	0.0	0.0		Note 15
Humidity Ratio (Morning)	lbs H2O /k-lbs Air	6.9	8.4	12.6	19.1	28.4	38.0	44.5	40.2	29.7	19.3	11.5	7.7		Note 3, 5, 9
Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	16.7	19.7	23.3	31.9	44.9	54.1	57.3	48.9	44.8	37.7	26.9	18.9		Note 4, 5, 9
Saturated Humidity Ratio (Morning)	lbs H2O /k-lbs Air	10.2	12.0	17.2	25.5	36.9	50.9	65.8	61.2	43.8	28.8	16.6	11.4		
Saturated Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	27.9	34.7	48.7	78.5	117.0	173.6	229.1	211.2	153.1	95.5	48.3	30.6		
Atmospheric Capacity (Morning)	lbs H2O /k-lbs Air	3.3	3.6	4.7	6.4	8.5	12.8	21.3	21.0	14.1	9.6	5.2	3.6		
Atmospheric Capacity (Afternoon)	lbs H2O /k-lbs Air	11.2	15.0	25.5	46.7	72.1	119.5	171.8	162.3	108.3	57.8	21.4	11.7		
Air Density (Morning)	lb/ft3	0.061	0.060	0.059	0.058	0.057	0.056	0.056	0.056	0.057	0.058	0.059	0.060		Note 5, 9, 11
Air Density (Afternoon)	lb/ft3	0.058	0.058	0.057	0.055	0.054	0.053	0.052	0.052	0.053	0.055	0.057	0.058		Note 5, 9, 11
Air Mass Flow (Morning)	lb/hr	21,039,165	19,090,005	14,795,902	10,774,475	6,874,409	4,064,466	2,204,463	2,065,546	2,916,662	4,072,247	7,393,136	9,622,353		
Air Mass Flow (Afternoon)	lb/hr	6,146,903	4,592,000	2,709,051	1,478,943	814,370	436,207	273,045	267,368	380,102	673,134	1,787,097	2,997,166		
Required Wind Velocity (Morning)	**mph**	**9.2**	**8.4**	**6.6**	**4.9**	**3.2**	**1.9**	**1.1**	**1.0**	**1.4**	**1.9**	**3.3**	**4.2**		
Required Wind Velocity (Afternoon)	**mph**	**2.8**	**2.1**	**1.3**	**0.7**	**0.4**	**0.2**	**0.1**	**0.1**	**0.2**	**0.3**	**0.8**	**1.4**		
Check Required Wind Velocity versus Average						Okay	Okay	Okay	Okay	Okay	Okay				

Notes

1. Western Regional Climatic Center (http://www.wrcc.dri.edu/summary/Climsmwy.html) for Wamsutter, WY
2. Pan evaporation data to more closely estimate the evaporation from naturally existing features like a shallow lake requires an adjustment factor of
Pan evaporation data from Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Green River, WY
3. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
4. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Rawlins, WY Airport
5. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Wamsutter, WY
6. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
7. Production Rate based on discussions with Pinnacle Gas Resources (24 wells total) with 6 months full production and 9 month half-life
8. Pit Surface Area at minimum surface area (300*475)
9. Altitude (FAMSL)
10. Assumed Height of Water Spray
11. Molecular Weight of Air
12. WaterDensity
13. Weight Average mass transfer between afternoon and morning
14. Spray Efficiency based SMI Super Polecat Evaporator Efficiency as a function of Pan Evaporation Data
15. Selected Pump Sizing based on maximum required monthly flow (This flow rate is maintained across the months of mechanical evaporation)
16. Assumed hours per day for evaporation

0.70	Correction Factor	0.80	Salinity Factor	
3.20	acres	475.0	Side Dimension (ft)	
6,500	ft	10.5	Atmospheric Pressure	
15.0	ft			
28.96	lb/lbmol			
62.4	lb/cf			
50%	Afternoon	or	5	hours/day at Afternoon Conditions
9,205	bpd	or	268	gpm
10	hrs/day			

PEARL FIELD SERVICES, LLC
LAND, PERMITTING, ENGINEERING, DRILLING, AND OPERATIONS

Project: **Pinnacle Gas Resources, Inc.**
Location: **Great Divide Basin, Sweetwater County, WY**
Prospect: **Sweetwater**
Field: **Sweetwater South**
Pumper: **PGR**

Issue: For Approval
Rev.: A
Rev. Date: 9-May-07
By: DRL
Chk:

Passive (Pan) + Mechanical Evaporation Calculations, Year 2

Site Data		31 Jan	28 Feb	31 Mar	30 Apr	31 May	30 Jun	31 Jul	31 Aug	30 Sept	31 Oct	30 Nov	31 Dec	365 Annual	Comments
Monthly Ave Precipitation	in.	0.25	0.24	0.37	0.69	1.05	0.76	0.79	0.79	0.76	0.57	0.34	0.23	6.84	Note 1
Monthly Ave Pan Evap	in.	0	0	0	0	8.22	9.71	11.08	9.80	6.82	4.62	0	0	50.25	Note 2
Monthly Ave Adjust Pan Evap	in.	0	0	0	0	4.60	5.44	6.20	5.49	3.82	2.59	0	0	28.14	Note 2
Mean Monthly Rel. Humidity (Morning)	%	68	70	73	75	77	75	68	66	68	67	69	68	70	Note 3
Mean Monthly Rel. Humidity (Afternoon)	%	60	57	48	41	39	32	26	24	30	40	56	62	43	Note 3
Average Wind Speed	mph	15.7	15.0	14.7	14.5	13.4	12.9	11.4	11.0	11.9	13.4	14.1	15.3	14	Note 4
Average Min Dry Bulb Temp	F	7.3	10.5	17.8	26	34.2	42.3	49	47.1	38.5	28.6	17.1	9.4	27	Note 5
Average Max Dry Bulb Temp	F	27.9	32.7	41.2	53.7	64.6	75.8	83.9	81.5	72.2	59.0	41.0	29.9	55	Note 5
Mean Monthly Wet Bulb Temp	F	21	23	30	36	45	52	56	54	47	35	28	22	37	Note 6
Production Rate	bwpd	1,817	1,662	1,533	1,400	1,281	1,168	1,066	969	879	799	723	654	654	Note 7
Precipitation Rate	bwpd	17	18	25	48	70	52	53	53	52	38	23	15	39	
Total Inflow	bwpd	1,834	1,680	1,558	1,448	1,351	1,220	1,119	1,022	932	837	746	669		
Solar Evaporation Rate	bwpd	-	-	-	-	307	375	414	366	263	173	-	-		Note 2 & 8
Difference	**bwpd**	**1,834**	**1,680**	**1,558**	**1,448**	**1,044**	**845**	**705**	**655**	**668**	**665**	**746**	**669**		
Accumulated in 1 pond with Spray Evaporators	**acre-ft**	**69.114**	**75.178**	**81.402**	**87.000**	**80.640**	**73.175**	**64.458**	**55.956**	**48.954**	**43.009**	**45.893**	**48.568**	**61.787**	From Year 1
Mass of NaCl in Pond (30,000 mg/l feed)	**mg**	**5.688E+12**	**5.910E+12**	**6.136E+12**	**6.337E+12**	**6.526E+12**	**6.693E+12**	**6.851E+12**	**6.994E+12**	**7.120E+12**	**7.238E+12**	**7.342E+12**	**7.438E+12**	**5.419E+12**	From Year 1
Concentration of NaCl in pond	**mg/l**	**66718**	**63731**	**61115**	**59050**	**65611**	**74155**	**86166**	**101334**	**117912**	**136438**	**129689**	**124161**		
Spray Efficiency	% Evap/Pump	0.0%	0.0%	0.0%	0.0%	36.4%	38.3%	39.9%	38.5%	34.3%	29.7%	0.0%	0.0%		Note 14
Required Pump Capacity	**bwpd**	0.0	0.0	0.0	0.0	**2,867**	**2,204**	**1,767**	**1,705**	**1,951**	**2,235**	0.0	0.0		Note 15
Humidity Ratio (Morning)	lbs H2O /k-lbs Air	6.9	8.4	12.6	19.1	28.4	38.0	44.5	40.2	29.7	19.3	11.5	7.7		Note 3, 5, 9
Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	16.7	19.7	23.3	31.9	44.9	54.1	57.3	48.9	44.8	37.7	26.9	18.9		Note 4, 5, 9
Saturated Humidity Ratio (Morning)	lbs H2O /k-lbs Air	10.2	12.0	17.2	25.5	36.9	50.9	65.8	61.2	43.8	28.8	16.6	11.4		
Saturated Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	27.9	34.7	48.7	78.5	117.0	173.6	229.1	211.2	153.1	95.5	48.3	30.6		
Atmospheric Capacity (Morning)	lbs H2O /k-lbs Air	3.3	3.6	4.7	6.4	8.5	12.8	21.3	21.0	14.1	9.6	5.2	3.6		
Atmospheric Capacity (Afternoon)	lbs H2O /k-lbs Air	11.2	15.0	25.5	46.7	72.1	119.5	171.8	162.3	108.3	57.8	21.4	11.7		
Air Density (Morning)	lb/ft3	0.061	0.060	0.059	0.058	0.057	0.056	0.056	0.056	0.057	0.058	0.059	0.060		Note 5, 9, 11
Air Density (Afternoon)	lb/ft3	0.058	0.058	0.057	0.055	0.054	0.053	0.052	0.052	0.053	0.055	0.057	0.058		Note 5, 9, 11
Air Mass Flow (Morning)	lb/hr	9,814,676	8,157,251	5,850,994	3,958,113	2,141,305	1,154,179	580,237	546,619	829,521	1,218,276	2,525,981	3,220,434		
Air Mass Flow (Afternoon)	lb/hr	2,867,503	1,962,183	1,071,286	543,305	253,667	123,869	71,868	70,755	108,104	201,378	610,590	1,003,099		
Required Wind Velocity (Morning)	**mph**	**4.3**	**3.6**	**2.6**	**1.8**	**1.0**	**0.5**	**0.3**	**0.3**	**0.4**	**0.6**	**1.1**	**1.4**		
Required Wind Velocity (Afternoon)	**mph**	**1.3**	**0.9**	**0.5**	**0.3**	**0.1**	**0.1**	**0.0**	**0.0**	**0.1**	**0.1**	**0.3**	**0.5**		
Check Required Wind Velocity versus Average						Okay	Okay	Okay	Okay	Okay	Okay				

Notes

1. Western Regional Climatic Center (http://www.wrcc.dri.edu/summary/Climsmwy.html) for Wamsutter, WY
2. Pan evaporation data to more closely estimate the evaporation from naturally existing features like a shallow lake requires an adjustment factor of
Pan evaporation data from Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Green River, WY
3. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
4. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Rawlins, WY Airport
5. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Wamsutter, WY
6. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
7. Production Rate based on discussions with Pinnacle Gas Resources (24 wells total) with 9-month half life
8. Pit Surface Area at minimum surface area (300*475)
9. Altitude (FAMSL)
10. Assumed Height of Water Spray
11. Molecular Weight of Air
12. WaterDensity
13. Weight Average mass transfer between afternoon and morning
14. Spray Efficiency based SMI Super Polecat Evaporator Efficiency as a function of Pan Evaporation Data
15. Selected Pump Sizing based on maximum required monthly flow- Pump is ran at maximum required rate from first year of evaporation (3990 bwpd)
16. Assumed hours per day for evaporation

0.70 Correction Factor
0.80 Salinity Factor

bpd
3.20 acres
475.0 Side Dimension (ft)
6,500 ft
10.5 Atmospheric Pressure
15.0 ft
28.96 lb/lbmol
62.4 lb/cf
50% Afternoon or 5 hours/day at Afternoon Conditions
2,867 bpd or 84 gpm
10 hrs/day

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING, AND OPERATIONS

Project: **Pinnacle Gas Resources, Inc.**
Location: **Great Divide Basin, Sweetwater County, WY**
Prospect: **Sweetwater**
Field: **Sweetwater South**
Pumper: **PGR**

Issue: For Approval
Rev.: A
Rev. Date: 9-May-07
By: DRL
Chk:

Passive (Pan) + Mechanical Evaporation Calculations, Year 3

Site Data		31 Jan	28 Feb	31 Mar	30 Apr	31 May	30 Jun	31 Jul	31 Aug	30 Sept	31 Oct	30 Nov	31 Dec	365 Annual	Comments
Monthly Ave Precipitation	in.	0.25	0.24	0.37	0.69	1.05	0.76	0.79	0.79	0.76	0.57	0.34	0.23	6.84	Note 1
Monthly Ave Pan Evap	in.	0	0	0	0	8.22	9.71	11.08	9.80	6.82	4.62	0	0	50.25	Note 2
Monthly Ave Adjust Pan Evap	in.	0	0	0	0	4.60	5.44	6.20	5.49	3.82	2.59	0	0	28.14	Note 2
Mean Monthly Rel. Humidity (Morning)	%	68	70	73	75	77	75	68	66	68	67	69	68	70	Note 3
Mean Monthly Rel. Humidity (Afternoon)	%	60	57	48	41	39	32	26	24	30	40	56	62	43	Note 3
Average Wind Speed	mph	15.7	15.0	14.7	14.5	13.4	12.9	11.4	11.0	11.9	13.4	14.1	15.3	14	Note 4
Average Min Dry Bulb Temp	F	7.3	10.5	17.8	26	34.2	42.3	49	47.1	38.5	28.6	17.1	9.4	27	Note 5
Average Max Dry Bulb Temp	F	27.9	32.7	41.2	53.7	64.6	75.8	83.9	81.5	72.2	59.0	41.0	29.9	55	Note 5
Mean Monthly Wet Bulb Temp	F	21	23	30	36	45	52	56	54	47	35	28	22	37	Note 6
Production Rate	bwpd	589	528	477	426	379	335	295	257	222	191	161	153	153	Note 7
Precipitation Rate	bwpd	17	18	25	48	70	52	53	53	52	38	23	15	39	
Total Inflow	bwpd	605	546	502	473	449	387	348	310	274	229	184	168		
Solar Evaporation Rate	bwpd	-	-	-	-	307	375	414	366	263	173	-	-		Note 2 & 8
Difference	**bwpd**	**605**	**546**	**502**	**473**	**142**	**12**	**(66)**	**(57)**	**11**	**56**	**184**	**168**		
Accumulated in 1 pond with Spray Evaporators	**acre-ft**	**50.986**	**52.956**	**54.962**	**56.792**	**57.359**	**57.405**	**57.671**	**57.897**	**57.939**	**58.163**	**58.875**	**59.546**	**48.568**	From Year 2
Mass of NaCl in Pond (30,000 mg/l feed)	**mg**	**7.525E+12**	**7.596E+12**	**7.666E+12**	**7.727E+12**	**7.783E+12**	**7.831E+12**	**7.875E+12**	**7.913E+12**	**7.944E+12**	**7.973E+12**	**7.996E+12**	**8.018E+12**	**7.438E+12**	From Year 2
Concentration of NaCl in pond	**mg/l**	**119656**	**116285**	**113081**	**110308**	**110009**	**110596**	**110700**	**110800**	**111163**	**111129**	**110102**	**109168**		
Spray Efficiency	% Evap/Pump	0.0%	0.0%	0.0%	0.0%	43.1%	45.1%	46.6%	45.2%	41.0%	36.5%	0.0%	0.0%		Note 14
Required Pump Capacity	**bwpd**	0.0	0.0	0.0	0.0	**329**	**27**	**(143)**	**(125)**	**27**	**154**	0.0	0.0		Note 14
Humidity Ratio (Morning)	lbs H2O /k-lbs Air	6.9	8.4	12.6	19.1	28.4	38.0	44.5	40.2	29.7	19.3	11.5	7.7		Note 3, 5, 9
Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	16.7	19.7	23.3	31.9	44.9	54.1	57.3	48.9	44.8	37.7	26.9	18.9		Note 4, 5, 9
Saturated Humidity Ratio (Morning)	lbs H2O /k-lbs Air	10.2	12.0	17.2	25.5	36.9	50.9	65.8	61.2	43.8	28.8	16.6	11.4		
Saturated Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	27.9	34.7	48.7	78.5	117.0	173.6	229.1	211.2	153.1	95.5	48.3	30.6		
Atmospheric Capacity (Morning)	lbs H2O /k-lbs Air	3.3	3.6	4.7	6.4	8.5	12.8	21.3	21.0	14.1	9.6	5.2	3.6		
Atmospheric Capacity (Afternoon)	lbs H2O /k-lbs Air	11.2	15.0	25.5	46.7	72.1	119.5	171.8	162.3	108.3	57.8	21.4	11.7		
Air Density (Morning)	lb/ft3	0.061	0.060	0.059	0.058	0.057	0.056	0.056	0.056	0.057	0.058	0.059	0.060		Note 5, 9, 11
Air Density (Afternoon)	lb/ft3	0.058	0.058	0.057	0.055	0.054	0.053	0.052	0.052	0.053	0.055	0.057	0.058		Note 5, 9, 11
Air Mass Flow (Morning)	lb/hr	3,239,139	2,649,831	1,886,173	1,293,474	291,049	16,495	(54,702)	(47,157)	13,620	102,607	623,323	808,308		
Air Mass Flow (Afternoon)	lb/hr	946,362	637,403	345,348	177,547	34,479	1,770	(6,775)	(6,104)	1,775	16,961	150,672	251,771		
Required Wind Velocity (Morning)	**mph**	**1.4**	**1.2**	**0.8**	**0.6**	**0.1**	**0.0**	**(0.0)**	**(0.0)**	**0.0**	**0.0**	**0.3**	**0.4**		
Required Wind Velocity (Afternoon)	**mph**	**0.4**	**0.3**	**0.2**	**0.1**	**0.0**	**0.0**	**(0.0)**	**(0.0)**	**0.0**	**0.0**	**0.1**	**0.1**		
Check Required Wind Velocity versus Average						Okay	Okay	Okay	Okay	Okay	Okay				

Notes

1. Western Regional Climatic Center (http://www.wrcc.dri.edu/summary/Climsmwy.html) for Wamsutter, WY
2. Pan evaporation data to more closely estimate the evaporation from naturally existing features like a shallow lake requires an adjustment factor of 0.70 Correction Factor 0.80 Salinity Factor
Pan evaporation data from Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Green River, WY
3. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
4. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Rawlins, WY Airport
5. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Wamsutter, WY
6. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
7. Production Rate based on discussions with Pinnacle Gas Resources (24 wells total) with 0.99743 decline factor
8. Pit Surface Area at minimum surface area (300*475) 3.20 acres 475.0 Side Dimension (ft)
9. Altitude (FAMSL) 6,500 ft 10.5 Atmospheric Pressure
10. Assumed Height of Water Spray 15.0 ft
11. Molecular Weight of Air 28.96 lb/lbmol
12. WaterDensity 62.4 lb/cf
13. Weight Average mass transfer between afternoon and morning 50% Afternoon or 5 hours/day at Afternoon Conditions
14. **Sprayers are turned off in this year**
15. Selected Pump Sizing based on maximum required monthly flow 329 bpd or 10 gpm
16. Assumed hours per day for evaporation 10 hrs/day

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING, AND OPERATIONS

Project: Pinnacle Gas Resources, Inc.
Location: Great Divide Basin, Sweetwater County, WY
Prospect: **Sweetwater**
Field: **Sweetwater South**
Pumper: **PGR**

Issue: For Approval
Rev.: A
Rev. Date: 9-May-07
By: DRL
Chk:

Passive (Pan) + Mechanical Evaporation Calculations, Year 4

Site Data		31 Jan	28 Feb	31 Mar	30 Apr	31 May	30 Jun	31 Jul	31 Aug	30 Sept	31 Oct	30 Nov	31 Dec	365 Annual	Comments
Monthly Ave Precipitation	in.	0.25	0.24	0.37	0.69	1.05	0.76	0.79	0.79	0.76	0.57	0.34	0.23	6.84	Note 1
Monthly Ave Pan Evap	in.	0	0	0	0	8.22	9.71	11.08	9.80	6.82	4.62	0	0	50.25	Note 2
Monthly Ave Adjust Pan Evap	in.	0	0	0	0	4.60	5.44	6.20	5.49	3.82	2.59	0	0	28.14	Note 2
Mean Monthly Rel. Humidity (Morning)	%	68	70	73	75	77	75	68	66	68	67	69	68	70	Note 3
Mean Monthly Rel. Humidity (Afternoon)	%	60	57	48	41	39	32	26	24	30	40	56	62	43	Note 3
Average Wind Speed	mph	15.7	15.0	14.7	14.5	13.4	12.9	11.4	11.0	11.9	13.4	14.1	15.3	14	Note 4
Average Min Dry Bulb Temp	F	7.3	10.5	17.8	26	34.2	42.3	49	47.1	38.5	28.6	17.1	9.4	27	Note 5
Average Max Dry Bulb Temp	F	27.9	32.7	41.2	53.7	64.6	75.8	83.9	81.5	72.2	59.0	41.0	29.9	55	Note 5
Mean Monthly Wet Bulb Temp	F	21	23	30	36	45	52	56	54	47	35	28	22	37	Note 6
Production Rate	bwpd	153	153	153	153	153	153	153	153	153	153	153	153	153	Note 7
Precipitation Rate	bwpd	17	18	25	48	70	52	53	53	52	38	23	15	39	
Total Inflow	bwpd	169	170	177	200	223	205	205	205	205	191	176	168		
Solar Evaporation Rate	bwpd	-	-	-	-	307	375	414	366	263	173	-	-		Note 2 & 8
Difference	**bwpd**	**169**	**170**	**177**	**200**	**(84)**	**(170)**	**(209)**	**(161)**	**(58)**	**18**	**176**	**168**		
Accumulated in 1 pond with Spray Evaporators	**acre-ft**	**60.222**	**60.837**	**61.546**	**62.320**	**61.983**	**61.326**	**60.492**	**59.849**	**59.624**	**59.552**	**60.232**	**60.904**	**59.546**	From Year 3
Mass of NaCl in Pond (30,000 mg/l feed)	**mg**	**8.041E+12**	**8.061E+12**	**8.084E+12**	**8.106E+12**	**8.128E+12**	**8.150E+12**	**8.173E+12**	**8.195E+12**	**8.217E+12**	**8.240E+12**	**8.261E+12**	**8.284E+12**	**8.018E+12**	From Year 3
Concentration of NaCl in pond	**mg/l**	**108245**	**107423**	**106483**	**105444**	**106314**	**107741**	**109529**	**111011**	**111728**	**112170**	**111196**	**110271**		
Spray Efficiency	% Evap/Pump	0.0%	0.0%	0.0%	0.0%	43.1%	45.1%	46.6%	45.2%	41.0%	36.5%	0.0%	0.0%		Note 14
Required Pump Capacity	**bwpd**	0.0	0.0	0.0	0.0	**(196)**	**(377)**	**(448)**	**(356)**	**(142)**	**49**	0.0	0.0		Note 15
Humidity Ratio (Morning)	lbs H2O /k-lbs Air	6.9	8.4	12.6	19.1	28.4	38.0	44.5	40.2	29.7	19.3	11.5	7.7		Note 3, 5, 9
Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	16.7	19.7	23.3	31.9	44.9	54.1	57.3	48.9	44.8	37.7	26.9	18.9		Note 4, 5, 9
Saturated Humidity Ratio (Morning)	lbs H2O /k-lbs Air	10.2	12.0	17.2	25.5	36.9	50.9	65.8	61.2	43.8	28.8	16.6	11.4		
Saturated Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	27.9	34.7	48.7	78.5	117.0	173.6	229.1	211.2	153.1	95.5	48.3	30.6		
Atmospheric Capacity (Morning)	lbs H2O /k-lbs Air	3.3	3.6	4.7	6.4	8.5	12.8	21.3	21.0	14.1	9.6	5.2	3.6		
Atmospheric Capacity (Afternoon)	lbs H2O /k-lbs Air	11.2	15.0	25.5	46.7	72.1	119.5	171.8	162.3	108.3	57.8	21.4	11.7		
Air Density (Morning)	lb/ft3	0.061	0.060	0.059	0.058	0.057	0.056	0.056	0.056	0.057	0.058	0.059	0.060		Note 5, 9, 11
Air Density (Afternoon)	lb/ft3	0.058	0.058	0.057	0.055	0.054	0.053	0.052	0.052	0.053	0.055	0.057	0.058		Note 5, 9, 11
Air Mass Flow (Morning)	lb/hr	906,316	827,223	666,156	547,464	(173,227)	(232,050)	(171,841)	(134,153)	(72,361)	33,068	596,290	808,308		
Air Mass Flow (Afternoon)	lb/hr	264,793	198,984	121,970	75,147	(20,521)	(24,904)	(21,284)	(17,365)	(9,430)	5,466	144,137	251,771		
Required Wind Velocity (Morning)	**mph**	**0.4**	**0.4**	**0.3**	**0.2**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.0)**	**0.0**	**0.3**	**0.4**		
Required Wind Velocity (Afternoon)	**mph**	**0.1**	**0.1**	**0.1**	**0.0**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**0.0**	**0.1**	**0.1**		
Check Required Wind Velocity versus Average						Okay	Okay	Okay	Okay	Okay	Okay				

Notes

1. Western Regional Climatic Center (http://www.wrcc.dri.edu/summary/Climsmwy.html) for Wamsutter, WY
2. Pan evaporation data to more closely estimate the evaporation from naturally existing features like a shallow lake requires an adjustment factor of 0.70 Correction Factor 0.80 Salinity Factor
   Pan evaporation data from Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Green River, WY
3. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
4. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Rawlins, WY Airport
5. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Wamsutter, WY
6. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
7. Production Rate based on discussions with Pinnacle Gas Resources (24 wells total) with 0.99743 decline factor
8. Pit Surface Area at minimum surface area (300*475) 3.20 acres 475.0 Side Dimension (ft)
9. Altitude (FAMSL) 6,500 ft 10.5 Atmospheric Pressure
10. Assumed Height of Water Spray 15.0 ft
11. Molecular Weight of Air 28.96 lb/lbmol
12. WaterDensity 62.4 lb/cf
13. Weight Average mass transfer between afternoon and morning 50% Afternoon or 5 hours/day at Afternoon Conditions
14. Spray Efficiency based SMI Super Polecat Evaporator Efficiency as a function of Pan Evaporation Data
15. **Sprayers are turned off in this year** 49 bpd or 1 gpm
16. Assumed hours per day for evaporation 10 hrs/day

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING, AND OPERATIONS

Project: **Pinnacle Gas Resources, Inc.**
Location: **Great Divide Basin, Sweetwater County, WY**
Prospect: **Sweetwater**
Field: **Sweetwater South**
Pumper: **PGR**

Issue: For Approval
Rev.: A
Rev. Date: 9-May-07
By: DRL
Chk:

Passive (Pan) + Mechanical Evaporation Calculations, Year 5

Site Data		31 Jan	28 Feb	31 Mar	30 Apr	31 May	30 Jun	31 Jul	31 Aug	30 Sept	31 Oct	30 Nov	31 Dec	365 Annual	Comments
Monthly Ave Precipitation	in.	0.25	0.24	0.37	0.69	1.05	0.76	0.79	0.79	0.76	0.57	0.34	0.23	6.84	Note 1
Monthly Ave Pan Evap	in.	0	0	0	0	8.22	9.71	11.08	9.80	6.82	4.62	0	0	50.25	Note 2
Monthly Ave Adjust Pan Evap	in.	0	0	0	0	4.60	5.44	6.20	5.49	3.82	2.59	0	0	28.14	Note 2
Mean Monthly Rel. Humidity (Morning)	%	68	70	73	75	77	75	68	66	68	67	69	68	70	Note 3
Mean Monthly Rel. Humidity (Afternoon)	%	60	57	48	41	39	32	26	24	30	40	56	62	43	Note 3
Average Wind Speed	mph	15.7	15.0	14.7	14.5	13.4	12.9	11.4	11.0	11.9	13.4	14.1	15.3	14	Note 4
Average Min Dry Bulb Temp	F	7.3	10.5	17.8	26	34.2	42.3	49	47.1	38.5	28.6	17.1	9.4	27	Note 5
Average Max Dry Bulb Temp	F	27.9	32.7	41.2	53.7	64.6	75.8	83.9	81.5	72.2	59.0	41.0	29.9	55	Note 5
Mean Monthly Wet Bulb Temp	F	21	23	30	36	45	52	56	54	47	35	28	22	37	Note 6
Production Rate	bwpd	153	153	153	153	153	153	153	153	153	153	153	153	153	Note 7
Precipitation Rate	bwpd	17	18	25	48	70	52	53	53	52	38	23	15	39	
Total Inflow	bwpd	169	170	177	200	223	205	205	205	205	191	176	168		
Solar Evaporation Rate	bwpd	-	-	-	-	307	375	414	366	263	173	-	-		Note 2 & 8
Difference	**bwpd**	**169**	**170**	**177**	**200**	**(84)**	**(170)**	**(209)**	**(161)**	**(58)**	**18**	**176**	**168**		
Accumulated in 1 pond with Spray Evaporators	**acre-ft**	**61.580**	**62.195**	**62.904**	**63.678**	**63.341**	**62.684**	**61.850**	**61.207**	**60.982**	**60.910**	**61.590**	**62.262**	**60.904**	From Year 4
Mass of NaCl in Pond (30,000 mg/l feed)	**mg**	**8.307E+12**	**8.327E+12**	**8.349E+12**	**8.371E+12**	**8.394E+12**	**8.416E+12**	**8.438E+12**	**8.461E+12**	**8.483E+12**	**8.505E+12**	**8.527E+12**	**8.550E+12**	**8.284E+12**	From Year 4
Concentration of NaCl in pond	**mg/l**	**109357**	**108541**	**107609**	**106579**	**107436**	**108844**	**110608**	**112068**	**112773**	**113207**	**112243**	**111326**		
Spray Efficiency	% Evap/Pump	0.0%	0.0%	0.0%	0.0%	43.1%	45.1%	46.6%	45.2%	41.0%	36.5%	0.0%	0.0%		Note 14
Required Pump Capacity	**bwpd**	0.0	0.0	0.0	0.0	**(196)**	**(377)**	**(448)**	**(356)**	**(142)**	**49**	0.0	0.0		Note 15
Humidity Ratio (Morning)	lbs H2O /k-lbs Air	6.9	8.4	12.6	19.1	28.4	38.0	44.5	40.2	29.7	19.3	11.5	7.7		Note 3, 5, 9
Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	16.7	19.7	23.3	31.9	44.9	54.1	57.3	48.9	44.8	37.7	26.9	18.9		Note 4, 5, 9
Saturated Humidity Ratio (Morning)	lbs H2O /k-lbs Air	10.2	12.0	17.2	25.5	36.9	50.9	65.8	61.2	43.8	28.8	16.6	11.4		
Saturated Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	27.9	34.7	48.7	78.5	117.0	173.6	229.1	211.2	153.1	95.5	48.3	30.6		
Atmospheric Capacity (Morning)	lbs H2O /k-lbs Air	3.3	3.6	4.7	6.4	8.5	12.8	21.3	21.0	14.1	9.6	5.2	3.6		
Atmospheric Capacity (Afternoon)	lbs H2O /k-lbs Air	11.2	15.0	25.5	46.7	72.1	119.5	171.8	162.3	108.3	57.8	21.4	11.7		
Air Density (Morning)	lb/ft3	0.061	0.060	0.059	0.058	0.057	0.056	0.056	0.056	0.057	0.058	0.059	0.060		Note 5, 9, 11
Air Density (Afternoon)	lb/ft3	0.058	0.058	0.057	0.055	0.054	0.053	0.052	0.052	0.053	0.055	0.057	0.058		Note 5, 9, 11
Air Mass Flow (Morning)	lb/hr	906,316	827,223	666,156	547,464	(173,227)	(232,050)	(171,841)	(134,153)	(72,361)	33,068	596,290	808,308		
Air Mass Flow (Afternoon)	lb/hr	264,793	198,984	121,970	75,147	(20,521)	(24,904)	(21,284)	(17,365)	(9,430)	5,466	144,137	251,771		
Required Wind Velocity (Morning)	**mph**	**0.4**	**0.4**	**0.3**	**0.2**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.0)**	**0.0**	**0.3**	**0.4**		
Required Wind Velocity (Afternoon)	**mph**	**0.1**	**0.1**	**0.1**	**0.0**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**0.0**	**0.1**	**0.1**		
Check Required Wind Velocity versus Average						Okay	Okay	Okay	Okay	Okay	Okay				

Notes

1. Western Regional Climatic Center (http://www.wrcc.dri.edu/summary/Climsmwy.html) for Wamsutter, WY
2. Pan evaporation data to more closely estimate the evaporation from naturally existing features like a shallow lake requires an adjustment factor of 0.70 Correction Factor 0.80 Salinity Factor
Pan evaporation data from Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Green River, WY
3. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
4. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Rawlins, WY Airport
5. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Wamsutter, WY
6. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
7. Production Rate based on discussions with Pinnacle Gas Resources (24 wells total) with 0.99743 decline factor
8. Pit Surface Area at minimum surface area (300*475) 3.20 acres 475.0 Side Dimension (ft)
9. Altitude (FAMSL) 6,500 ft 10.5 Atmospheric Pressure
10. Assumed Height of Water Spray 15.0 ft
11. Molecular Weight of Air 28.96 lb/lbmol
12. WaterDensity 62.4 lb/cf
13. Weight Average mass transfer between afternoon and morning 50% Afternoon or 5 hours/day at Afternoon Conditions
14. Spray Efficiency based SMI Super Polecat Evaporator Efficiency as a function of Pan Evaporation Data
15. **Sprayers are turned off (not needed)** 49 bpd or 1 gpm
16. Assumed hours per day for evaporation 10 hrs/day

Project: **Pinnacle Gas Resources, Inc.**
Location: **Great Divide Basin, Sweetwater County, WY**
Prospect: **Sweetwater**
Field: **Sweetwater South**
Pumper: **PGR**

Issue: For Approval
Rev.: A
Rev. Date: 9-May-07
By: DRL
Chk:

Passive (Pan) + Mechanical Evaporation Calculations, Year 6

Site Data		31 Jan	28 Feb	31 Mar	30 Apr	31 May	30 Jun	31 Jul	31 Aug	30 Sept	31 Oct	30 Nov	31 Dec	365 Annual	Comments
Monthly Ave Precipitation	in.	0.25	0.24	0.37	0.69	1.05	0.76	0.79	0.79	0.76	0.57	0.34	0.23	6.84	Note 1
Monthly Ave Pan Evap	in.	0	0	0	0	8.22	9.71	11.08	9.80	6.82	4.62	0	0	50.25	Note 2
Monthly Ave Adjust Pan Evap	in.	0	0	0	0	4.60	5.44	6.20	5.49	3.82	2.59	0	0	28.14	Note 2
Mean Monthly Rel. Humidity (Morning)	%	68	70	73	75	77	75	68	66	68	67	69	68	70	Note 3
Mean Monthly Rel. Humidity (Afternoon)	%	60	57	48	41	39	32	26	24	30	40	56	62	43	Note 3
Average Wind Speed	mph	15.7	15.0	14.7	14.5	13.4	12.9	11.4	11.0	11.9	13.4	14.1	15.3	14	Note 4
Average Min Dry Bulb Temp	F	7.3	10.5	17.8	26	34.2	42.3	49	47.1	38.5	28.6	17.1	9.4	27	Note 5
Average Max Dry Bulb Temp	F	27.9	32.7	41.2	53.7	64.6	75.8	83.9	81.5	72.2	59.0	41.0	29.9	55	Note 5
Mean Monthly Wet Bulb Temp	F	21	23	30	36	45	52	56	54	47	35	28	22	37	Note 6
Production Rate	bwpd	153	153	153	153	153	153	153	153	153	153	153	153	153	Note 7
Precipitation Rate	bwpd	17	18	25	48	70	52	53	53	52	38	23	15	39	
Total Inflow	bwpd	169	170	177	200	223	205	205	205	205	191	176	168		
Solar Evaporation Rate	bwpd	-	-	-	-	307	375	414	366	263	173	-	-		Note 2 & 8
Difference	**bwpd**	**169**	**170**	**177**	**200**	**(84)**	**(170)**	**(209)**	**(161)**	**(58)**	**18**	**176**	**168**		
Accumulated in 1 pond with Spray Evaporators	**acre-ft**	**62.938**	**63.553**	**64.262**	**65.036**	**64.699**	**64.042**	**63.208**	**62.565**	**62.340**	**62.268**	**62.948**	**63.620**	**62.262**	From Year 5
Mass of NaCl in Pond (30,000 mg/l feed)	**mg**	**8.572E+12**	**8.593E+12**	**8.615E+12**	**8.637E+12**	**8.660E+12**	**8.682E+12**	**8.704E+12**	**8.727E+12**	**8.748E+12**	**8.771E+12**	**8.793E+12**	**8.815E+12**	**8.550E+12**	From Year 5
Concentration of NaCl in pond	**mg/l**	**110420**	**109612**	**108688**	**107666**	**108511**	**109901**	**111640**	**113079**	**113772**	**114198**	**113244**	**112337**		
Spray Efficiency	% Evap/Pump	0.0%	0.0%	0.0%	0.0%	43.1%	45.1%	46.6%	45.2%	41.0%	36.5%	0.0%	0.0%		Note 14
Required Pump Capacity	**bwpd**	0.0	0.0	0.0	0.0	**(196)**	**(377)**	**(448)**	**(356)**	**(142)**	**49**	0.0	0.0		Note 15
Humidity Ratio (Morning)	lbs H2O /k-lbs Air	6.9	8.4	12.6	19.1	28.4	38.0	44.5	40.2	29.7	19.3	11.5	7.7		Note 3, 5, 9
Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	16.7	19.7	23.3	31.9	44.9	54.1	57.3	48.9	44.8	37.7	26.9	18.9		Note 4, 5, 9
Saturated Humidity Ratio (Morning)	lbs H2O /k-lbs Air	10.2	12.0	17.2	25.5	36.9	50.9	65.8	61.2	43.8	28.8	16.6	11.4		
Saturated Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	27.9	34.7	48.7	78.5	117.0	173.6	229.1	211.2	153.1	95.5	48.3	30.6		
Atmospheric Capacity (Morning)	lbs H2O /k-lbs Air	3.3	3.6	4.7	6.4	8.5	12.8	21.3	21.0	14.1	9.6	5.2	3.6		
Atmospheric Capacity (Afternoon)	lbs H2O /k-lbs Air	11.2	15.0	25.5	46.7	72.1	119.5	171.8	162.3	108.3	57.8	21.4	11.7		
Air Density (Morning)	lb/ft3	0.061	0.060	0.059	0.058	0.057	0.056	0.056	0.056	0.057	0.058	0.059	0.060		Note 5, 9, 11
Air Density (Afternoon)	lb/ft3	0.058	0.058	0.057	0.055	0.054	0.053	0.052	0.052	0.053	0.055	0.057	0.058		Note 5, 9, 11
Air Mass Flow (Morning)	lb/hr	906,316	827,223	666,156	547,464	(173,227)	(232,050)	(171,841)	(134,153)	(72,361)	33,068	596,290	808,308		
Air Mass Flow (Afternoon)	lb/hr	264,793	198,984	121,970	75,147	(20,521)	(24,904)	(21,284)	(17,365)	(9,430)	5,466	144,137	251,771		
Required Wind Velocity (Morning)	**mph**	**0.4**	**0.4**	**0.3**	**0.2**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.0)**	**0.0**	**0.3**	**0.4**		
Required Wind Velocity (Afternoon)	**mph**	**0.1**	**0.1**	**0.1**	**0.0**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**0.0**	**0.1**	**0.1**		
Check Required Wind Velocity versus Average						Okay	Okay	Okay	Okay	Okay	Okay				

Notes

1. Western Regional Climatic Center (http://www.wrcc.dri.edu/summary/Climsmwy.html) for Wamsutter, WY
2. Pan evaporation data to more closely estimate the evaporation from naturally existing features like a shallow lake requires an adjustment factor of 0.70 Correction Factor 0.80 Salinity Factor
   Pan evaporation data from Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Green River, WY
3. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
4. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Rawlins, WY Airport
5. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Wamsutter, WY
6. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
7. Production Rate based on discussions with Pinnacle Gas Resources (24 wells total) with 0.99743 decline factor
8. Pit Surface Area at minimum surface area (300*475) 3.20 acres 475.0 Side Dimension (ft)
9. Altitude (FAMSL) 6,500 ft 10.5 Atmospheric Pressure
10. Assumed Height of Water Spray 15.0 ft
11. Molecular Weight of Air 28.96 lb/lbmol
12. WaterDensity 62.4 lb/cf
13. Weight Average mass transfer between afternoon and morning 50% Afternoon or 5 hours/day at Afternoon Conditions
14. Spray Efficiency based SMI Super Polecat Evaporator Efficiency as a function of Pan Evaporation Data
15. **Sprayers are turned off (not needed)** 49 bpd or 1 gpm
16. Assumed hours per day for evaporation 10 hrs/day

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING, AND OPERATIONS

Project: **Pinnacle Gas Resources, Inc.**
Location: **Great Divide Basin, Sweetwater County, WY**
Prospect: **Sweetwater**
Field: **Sweetwater South**
Pumper: **PGR**

Issue: For Approval
Rev.: A
Rev. Date: 9-May-07
By: DRL
Chk:

Passive (Pan) + Mechanical Evaporation Calculations, Year 7

Site Data		31 Jan	28 Feb	31 Mar	30 Apr	31 May	30 Jun	31 Jul	31 Aug	30 Sept	31 Oct	30 Nov	31 Dec	365 Annual	Comments
Monthly Ave Precipitation	in.	0.25	0.24	0.37	0.69	1.05	0.76	0.79	0.79	0.76	0.57	0.34	0.23	6.84	Note 1
Monthly Ave Pan Evap	in.	0	0	0	0	8.22	9.71	11.08	9.80	6.82	4.62	0	0	50.25	Note 2
Monthly Ave Adjust Pan Evap	in.	0	0	0	0	4.60	5.44	6.20	5.49	3.82	2.59	0	0	28.14	Note 2
Mean Monthly Rel. Humidity (Morning)	%	68	70	73	75	77	75	68	66	68	67	69	68	70	Note 3
Mean Monthly Rel. Humidity (Afternoon)	%	60	57	48	41	39	32	26	24	30	40	56	62	43	Note 3
Average Wind Speed	mph	15.7	15.0	14.7	14.5	13.4	12.9	11.4	11.0	11.9	13.4	14.1	15.3	14	Note 4
Average Min Dry Bulb Temp	F	7.3	10.5	17.8	26	34.2	42.3	49	47.1	38.5	28.6	17.1	9.4	27	Note 5
Average Max Dry Bulb Temp	F	27.9	32.7	41.2	53.7	64.6	75.8	83.9	81.5	72.2	59.0	41.0	29.9	55	Note 5
Mean Monthly Wet Bulb Temp	F	21	23	30	36	45	52	56	54	47	35	28	22	37	Note 6
Production Rate	bwpd	153	153	153	153	153	153	153	153	153	153	153	153	153	Note 7
Precipitation Rate	bwpd	17	18	25	48	70	52	53	53	52	38	23	15	39	
Total Inflow	bwpd	169	170	177	200	223	205	205	205	205	191	176	168		
Solar Evaporation Rate	bwpd	-	-	-	-	307	375	414	366	263	173	-	-		Note 2 & 8
Difference	**bwpd**	**169**	**170**	**177**	**200**	**(84)**	**(170)**	**(209)**	**(161)**	**(58)**	**18**	**176**	**168**		
Accumulated in 1 pond with Spray Evaporators	**acre-ft**	**64.296**	**64.911**	**65.620**	**66.394**	**66.057**	**65.400**	**64.566**	**63.923**	**63.698**	**63.625**	**64.306**	**64.978**	**63.620**	From Year 6
Mass of NaCl in Pond (30,000 mg/l feed)	**mg**	**8.838E+12**	**8.858E+12**	**8.881E+12**	**8.903E+12**	**8.925E+12**	**8.947E+12**	**8.970E+12**	**8.992E+12**	**9.014E+12**	**9.037E+12**	**9.059E+12**	**9.081E+12**	**8.815E+12**	From Year 6
Concentration of NaCl in pond	**mg/l**	**111439**	**110638**	**109722**	**108709**	**109542**	**110913**	**112629**	**114048**	**114729**	**115147**	**114203**	**113305**		
Spray Efficiency	% Evap/Pump	0.0%	0.0%	0.0%	0.0%	43.1%	45.1%	46.6%	45.2%	41.0%	36.5%	0.0%	0.0%		Note 14
Required Pump Capacity	**bwpd**	0.0	0.0	0.0	0.0	**(196)**	**(377)**	**(448)**	**(356)**	**(142)**	**49**	0.0	0.0		Note 15
Humidity Ratio (Morning)	lbs H2O /k-lbs Air	6.9	8.4	12.6	19.1	28.4	38.0	44.5	40.2	29.7	19.3	11.5	7.7		Note 3, 5, 9
Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	16.7	19.7	23.3	31.9	44.9	54.1	57.3	48.9	44.8	37.7	26.9	18.9		Note 4, 5, 9
Saturated Humidity Ratio (Morning)	lbs H2O /k-lbs Air	10.2	12.0	17.2	25.5	36.9	50.9	65.8	61.2	43.8	28.8	16.6	11.4		
Saturated Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	27.9	34.7	48.7	78.5	117.0	173.6	229.1	211.2	153.1	95.5	48.3	30.6		
Atmospheric Capacity (Morning)	lbs H2O /k-lbs Air	3.3	3.6	4.7	6.4	8.5	12.8	21.3	21.0	14.1	9.6	5.2	3.6		
Atmospheric Capacity (Afternoon)	lbs H2O /k-lbs Air	11.2	15.0	25.5	46.7	72.1	119.5	171.8	162.3	108.3	57.8	21.4	11.7		
Air Density (Morning)	lb/ft3	0.061	0.060	0.059	0.058	0.057	0.056	0.056	0.056	0.057	0.058	0.059	0.060		
Air Density (Afternoon)	lb/ft3	0.058	0.058	0.057	0.055	0.054	0.053	0.052	0.052	0.053	0.055	0.057	0.058		
Air Mass Flow (Morning)	lb/hr	906,316	827,223	666,156	547,464	(173,227)	(232,050)	(171,841)	(134,153)	(72,361)	33,068	596,290	808,308		Note 5, 9, 11
Air Mass Flow (Afternoon)	lb/hr	264,793	198,984	121,970	75,147	(20,521)	(24,904)	(21,284)	(17,365)	(9,430)	5,466	144,137	251,771		Note 5, 9, 11
Required Wind Velocity (Morning)	**mph**	**0.4**	**0.4**	**0.3**	**0.2**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.0)**	**0.0**	**0.3**	**0.4**		
Required Wind Velocity (Afternoon)	**mph**	**0.1**	**0.1**	**0.1**	**0.0**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**0.0**	**0.1**	**0.1**		
Check Required Wind Velocity versus Average						Okay	Okay	Okay	Okay	Okay	Okay				

Notes

1. Western Regional Climatic Center (http://www.wrcc.dri.edu/summary/Climsmwy.html) for Wamsutter, WY
2. Pan evaporation data to more closely estimate the evaporation from naturally existing features like a shallow lake requires an adjustment factor of
Pan evaporation data from Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Green River, WY
3. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
4. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Rawlins, WY Airport
5. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Wamsutter, WY
6. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
7. Production Rate based on discussions with Pinnacle Gas Resources (24 wells total) with 0.99743 decline factor
8. Pit Surface Area at minimum surface area (300*475)
9. Altitude (FAMSL)
10. Assumed Height of Water Spray
11. Molecular Weight of Air
12. WaterDensity
13. Weight Average mass transfer between afternoon and morning
14. Spray Efficiency based SMI Super Polecat Evaporator Efficiency as a function of Pan Evaporation Data
15. Sprayers are turned off (not needed)
16. Assumed hours per day for evaporation

0.70 Correction Factor
0.80 Salinity Factor

3.20 acres
6,500 ft
15.0 ft
28.96 lb/lbmol
62.4 lb/cf
50% Afternoon
475.0 Side Dimension (ft)
10.5 Atmospheric Pressure
or
5 hours/day at Afternoon Conditions

49 bpd
or
1 gpm

10 hrs/day

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING, AND OPERATIONS

Project: **Pinnacle Gas Resources, Inc.**
Location: **Great Divide Basin, Sweetwater County, WY**
Prospect: **Sweetwater**
Field: **Sweetwater South**
Pumper: **PGR**

Issue: For Approval
Rev.: A
Rev. Date: 9-May-07
By: DRL
Chk:

Passive (Pan) + Mechanical Evaporation Calculations, Year 8

Site Data		31 Jan	28 Feb	31 Mar	30 Apr	31 May	30 Jun	31 Jul	31 Aug	30 Sept	31 Oct	30 Nov	31 Dec	365 Annual	Comments
Monthly Ave Precipitation	in.	0.25	0.24	0.37	0.69	1.05	0.76	0.79	0.79	0.76	0.57	0.34	0.23	6.84	Note 1
Monthly Ave Pan Evap	in.	0	0	0	0	8.22	9.71	11.08	9.80	6.82	4.62	0	0	50.25	Note 2
Monthly Ave Adjust Pan Evap	in.	0	0	0	0	4.60	5.44	6.20	5.49	3.82	2.59	0	0	28.14	Note 2
Mean Monthly Rel. Humidity (Morning)	%	68	70	73	75	77	75	68	66	68	67	69	68	70	Note 3
Mean Monthly Rel. Humidity (Afternoon)	%	60	57	48	41	39	32	26	24	30	40	56	62	43	Note 3
Average Wind Speed	mph	15.7	15.0	14.7	14.5	13.4	12.9	11.4	11.0	11.9	13.4	14.1	15.3	14	Note 4
Average Min Dry Bulb Temp	F	7.3	10.5	17.8	26	34.2	42.3	49	47.1	38.5	28.6	17.1	9.4	27	Note 5
Average Max Dry Bulb Temp	F	27.9	32.7	41.2	53.7	64.6	75.8	83.9	81.5	72.2	59.0	41.0	29.9	55	Note 5
Mean Monthly Wet Bulb Temp	F	21	23	30	36	45	52	56	54	47	35	28	22	37	Note 6
Production Rate	bwpd	153	153	153	153	153	153	153	153	153	153	153	153	153	Note 7
Precipitation Rate	bwpd	17	18	25	48	70	52	53	53	52	38	23	15	39	
Total Inflow	bwpd	169	170	177	200	223	205	205	205	205	191	176	168		
Solar Evaporation Rate	bwpd	-	-	-	-	307	375	414	366	263	173	-	-		Note 2 & 8
Difference	**bwpd**	**169**	**170**	**177**	**200**	**(84)**	**(170)**	**(209)**	**(161)**	**(58)**	**18**	**176**	**168**		
Accumulated in 1 pond with Spray Evaporators	**acre-ft**	**65.654**	**66.269**	**66.978**	**67.752**	**67.415**	**66.758**	**65.924**	**65.281**	**65.056**	**64.983**	**65.664**	**66.336**	**64.978**	From Year 7
Mass of NaCl in Pond (30,000 mg/l feed)	**mg**	**9.104E+12**	**9.124E+12**	**9.147E+12**	**9.169E+12**	**9.191E+12**	**9.213E+12**	**9.236E+12**	**9.258E+12**	**9.280E+12**	**9.303E+12**	**9.324E+12**	**9.347E+12**	**9.081E+12**	From Year 7
Concentration of NaCl in pond	**mg/l**	**112416**	**111622**	**110714**	**109710**	**110531**	**111884**	**113577**	**114976**	**115646**	**116056**	**115122**	**114233**		
Spray Efficiency	% Evap/Pump	0.0%	0.0%	0.0%	0.0%	43.1%	45.1%	46.6%	45.2%	41.0%	36.5%	0.0%	0.0%		Note 14
Required Pump Capacity	**bwpd**	0.0	0.0	0.0	0.0	**(196)**	**(377)**	**(448)**	**(356)**	**(142)**	**49**	0.0	0.0		Note 15
Humidity Ratio (Morning)	lbs H2O /k-lbs Air	6.9	8.4	12.6	19.1	28.4	38.0	44.5	40.2	29.7	19.3	11.5	7.7		Note 3, 5, 9
Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	16.7	19.7	23.3	31.9	44.9	54.1	57.3	48.9	44.8	37.7	26.9	18.9		Note 4, 5, 9
Saturated Humidity Ratio (Morning)	lbs H2O /k-lbs Air	10.2	12.0	17.2	25.5	36.9	50.9	65.8	61.2	43.8	28.8	16.6	11.4		
Saturated Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	27.9	34.7	48.7	78.5	117.0	173.6	229.1	211.2	153.1	95.5	48.3	30.6		
Atmospheric Capacity (Morning)	lbs H2O /k-lbs Air	3.3	3.6	4.7	6.4	8.5	12.8	21.3	21.0	14.1	9.6	5.2	3.6		
Atmospheric Capacity (Afternoon)	lbs H2O /k-lbs Air	11.2	15.0	25.5	46.7	72.1	119.5	171.8	162.3	108.3	57.8	21.4	11.7		
Air Density (Morning)	lb/ft3	0.061	0.060	0.059	0.058	0.057	0.056	0.056	0.056	0.057	0.058	0.059	0.060		Note 5, 9, 11
Air Density (Afternoon)	lb/ft3	0.058	0.058	0.057	0.055	0.054	0.053	0.052	0.052	0.053	0.055	0.057	0.058		Note 5, 9, 11
Air Mass Flow (Morning)	lb/hr	906,316	827,223	666,156	547,464	(173,227)	(232,050)	(171,841)	(134,153)	(72,361)	33,068	596,290	808,308		
Air Mass Flow (Afternoon)	lb/hr	264,793	198,984	121,970	75,147	(20,521)	(24,904)	(21,284)	(17,365)	(9,430)	5,466	144,137	251,771		
Required Wind Velocity (Morning)	**mph**	**0.4**	**0.4**	**0.3**	**0.2**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.0)**	**0.0**	**0.3**	**0.4**		
Required Wind Velocity (Afternoon)	**mph**	**0.1**	**0.1**	**0.1**	**0.0**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**0.0**	**0.1**	**0.1**		
Check Required Wind Velocity versus Average						Okay	Okay	Okay	Okay	Okay	Okay				

Notes

1. Western Regional Climatic Center (http://www.wrcc.dri.edu/summary/Climsmwy.html) for Wamsutter, WY
2. Pan evaporation data to more closely estimate the evaporation from naturally existing features like a shallow lake requires an adjustment factor of 0.70 Correction Factor 0.80 Salinity Factor
Pan evaporation data from Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Green River, WY
3. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
4. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Rawlins, WY Airport
5. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Wamsutter, WY
6. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
7. Production Rate based on discussions with Pinnacle Gas Resources (24 wells total) with 0.99743 decline factor 1,800.0 bpd
8. Minimum Pond surface area (300*475) 3.20 acres 475.0 Side Dimension (ft)
9. Altitude (FAMSL) 6,500 ft 10.5 Atmospheric Pressure
10. Assumed Height of Water Spray 15.0 ft
11. Molecular Weight of Air 28.96 lb/lbmol
12. WaterDensity 62.4 lb/cf
13. Weight Average mass transfer between afternoon and morning 50% Afternoon or 5 hours/day at Afternoon Conditions
14. Spray Efficiency based SMI Super Polecat Evaporator Efficiency as a function of Pan Evaporation Data
15. **Sprayers are turned off (not needed)** 49 bpd or 1 gpm
16. Assumed hours per day for evaporation 10 hrs/day

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING, AND OPERATIONS

Project: **Pinnacle Gas Resources, Inc.**
Location: **Great Divide Basin, Sweetwater County, WY**
Prospect: **Sweetwater**
Field: **Sweetwater South**
Pumper: **PGR**

Issue: For Approval
Rev.: A
Rev. Date: 9-May-07
By: DRL
Chk:

Passive (Pan) + Mechanical Evaporation Calculations, Year 9

Site Data		31 Jan	28 Feb	31 Mar	30 Apr	31 May	30 Jun	31 Jul	31 Aug	30 Sept	31 Oct	30 Nov	31 Dec	365 Annual	Comments
Monthly Ave Precipitation	in.	0.25	0.24	0.37	0.69	1.05	0.76	0.79	0.79	0.76	0.57	0.34	0.23	6.84	Note 1
Monthly Ave Pan Evap	in.	0	0	0	0	8.22	9.71	11.08	9.80	6.82	4.62	0	0	50.25	Note 2
Monthly Ave Adjust Pan Evap	in.	0	0	0	0	4.60	5.44	6.20	5.49	3.82	2.59	0	0	28.14	Note 2
Mean Monthly Rel. Humidity (Morning)	%	68	70	73	75	77	75	68	66	68	67	69	68	70	Note 3
Mean Monthly Rel. Humidity (Afternoon)	%	60	57	48	41	39	32	26	24	30	40	56	62	43	Note 3
Average Wind Speed	mph	15.7	15.0	14.7	14.5	13.4	12.9	11.4	11.0	11.9	13.4	14.1	15.3	14	Note 4
Average Min Dry Bulb Temp	F	7.3	10.5	17.8	26	34.2	42.3	49	47.1	38.5	28.6	17.1	9.4	27	Note 5
Average Max Dry Bulb Temp	F	27.9	32.7	41.2	53.7	64.6	75.8	83.9	81.5	72.2	59.0	41.0	29.9	55	Note 5
Mean Monthly Wet Bulb Temp	F	21	23	30	36	45	52	56	54	47	35	28	22	37	Note 6
Production Rate	bwpd	153	153	153	153	153	153	153	153	153	153	153	153	153	Note 7
Precipitation Rate	bwpd	17	18	25	48	70	52	53	53	52	38	23	15	39	
Total Inflow	bwpd	169	170	177	200	223	205	205	205	205	191	176	168		
Solar Evaporation Rate	bwpd	-	-	-	-	307	375	414	366	263	173	-	-		Note 2 & 8
Difference	**bwpd**	**169**	**170**	**177**	**200**	**(84)**	**(170)**	**(209)**	**(161)**	**(58)**	**18**	**176**	**168**		
Accumulated in 1 pond with Spray Evaporators	**acre-ft**	**67.012**	**67.627**	**68.336**	**69.110**	**68.773**	**68.116**	**67.282**	**66.639**	**66.414**	**66.341**	**67.022**	**67.694**	**66.336**	From Year 8
Mass of NaCl in Pond (30,000 mg/l feed)	**mg**	**9.370E+12**	**9.390E+12**	**9.413E+12**	**9.434E+12**	**9.457E+12**	**9.479E+12**	**9.501E+12**	**9.524E+12**	**9.546E+12**	**9.568E+12**	**9.590E+12**	**9.613E+12**	**9.347E+12**	From Year 8
Concentration of NaCl in pond	**mg/l**	**113353**	**112567**	**111667**	**110672**	**111481**	**112817**	**114487**	**115866**	**116526**	**116928**	**116004**	**115124**		
Spray Efficiency	% Evap/Pump	0.0%	0.0%	0.0%	0.0%	43.1%	45.1%	46.6%	45.2%	41.0%	36.5%	0.0%	0.0%		Note 14
Required Pump Capacity	**bwpd**	0.0	0.0	0.0	0.0	**(196)**	**(377)**	**(448)**	**(356)**	**(142)**	**49**	0.0	0.0		Note 15
Humidity Ratio (Morning)	lbs H2O /k-lbs Air	6.9	8.4	12.6	19.1	28.4	38.0	44.5	40.2	29.7	19.3	11.5	7.7		Note 3, 5, 9
Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	16.7	19.7	23.3	31.9	44.9	54.1	57.3	48.9	44.8	37.7	26.9	18.9		Note 4, 5, 9
Saturated Humidity Ratio (Morning)	lbs H2O /k-lbs Air	10.2	12.0	17.2	25.5	36.9	50.9	65.8	61.2	43.8	28.8	16.6	11.4		
Saturated Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	27.9	34.7	48.7	78.5	117.0	173.6	229.1	211.2	153.1	95.5	48.3	30.6		
Atmospheric Capacity (Morning)	lbs H2O /k-lbs Air	3.3	3.6	4.7	6.4	8.5	12.8	21.3	21.0	14.1	9.6	5.2	3.6		
Atmospheric Capacity (Afternoon)	lbs H2O /k-lbs Air	11.2	15.0	25.5	46.7	72.1	119.5	171.8	162.3	108.3	57.8	21.4	11.7		
Air Density (Morning)	lb/ft3	0.061	0.060	0.059	0.058	0.057	0.056	0.056	0.056	0.057	0.058	0.059	0.060		Note 5, 9, 11
Air Density (Afternoon)	lb/ft3	0.058	0.058	0.057	0.055	0.054	0.053	0.052	0.052	0.053	0.055	0.057	0.058		Note 5, 9, 11
Air Mass Flow (Morning)	lb/hr	906,316	827,223	666,156	547,464	(173,227)	(232,050)	(171,841)	(134,153)	(72,361)	33,068	596,290	808,308		
Air Mass Flow (Afternoon)	lb/hr	264,793	198,984	121,970	75,147	(20,521)	(24,904)	(21,284)	(17,365)	(9,430)	5,466	144,137	251,771		
Required Wind Velocity (Morning)	**mph**	**0.4**	**0.4**	**0.3**	**0.2**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.0)**	**0.0**	**0.3**	**0.4**		
Required Wind Velocity (Afternoon)	**mph**	**0.1**	**0.1**	**0.1**	**0.0**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**0.0**	**0.1**	**0.1**		
Check Required Wind Velocity versus Average						Okay	Okay	Okay	Okay	Okay	Okay				

Notes

1. Western Regional Climatic Center (http://www.wrcc.dri.edu/summary/Climsmwy.html) for Wamsutter, WY
2. Pan evaporation data to more closely estimate the evaporation from naturally existing features like a shallow lake requires an adjustment factor of 0.70 Correction Factor and 0.80 Salinity Factor
Pan evaporation data from Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Green River, WY
3. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
4. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Rawlins, WY Airport
5. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Wamsutter, WY
6. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
7. Production Rate based on discussions with Pinnacle Gas Resources (24 wells total) with 0.99743 decline factor
8. Minimum pond surface area (300*475) — 3.20 acres; 475.0 Side Dimension (ft)
9. Altitude (FAMSL) — 6,500 ft; 10.5 Atmospheric Pressure
10. Assumed Height of Water Spray — 15.0 ft
11. Molecular Weight of Air — 28.96 lb/lbmol
12. WaterDensity — 62.4 lb/cf
13. Weight Average mass transfer between afternoon and morning — 50% Afternoon or 5 hours/day at Afternoon Conditions
14. Spray Efficiency based SMI Super Polecat Evaporator Efficiency as a function of Pan Evaporation Data
15. **Sprayers are turned off (not needed)** — 49 bpd or 1 gpm
16. Assumed hours per day for evaporation — 10 hrs/day

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING, AND OPERATIONS

Project: **Pinnacle Gas Resources, Inc.**
Location: **Great Divide Basin, Sweetwater County, WY**
Prospect: **Sweetwater**
Field: **Sweetwater South**
Pumper: **PGR**

Issue: For Approval
Rev.: A
Rev. Date: 9-May-07
By: DRL
Chk:

Passive (Pan) + Mechanical Evaporation Calculations, Year 10

Site Data		31 Jan	28 Feb	31 Mar	30 Apr	31 May	30 Jun	31 Jul	31 Aug	30 Sept	31 Oct	30 Nov	31 Dec	365 Annual	Comments
Monthly Ave Precipitation	in.	0.25	0.24	0.37	0.69	1.05	0.76	0.79	0.79	0.76	0.57	0.34	0.23	6.84	Note 1
Monthly Ave Pan Evap	in.	0	0	0	0	8.22	9.71	11.08	9.80	6.82	4.62	0	0	50.25	Note 2
Monthly Ave Adjust Pan Evap	in.	0	0	0	0	4.60	5.44	6.20	5.49	3.82	2.59	0	0	28.14	Note 2
Mean Monthly Rel. Humidity (Morning)	%	68	70	73	75	77	75	68	66	68	67	69	68	70	Note 3
Mean Monthly Rel. Humidity (Afternoon)	%	60	57	48	41	39	32	26	24	30	40	56	62	43	Note 3
Average Wind Speed	mph	15.7	15.0	14.7	14.5	13.4	12.9	11.4	11.0	11.9	13.4	14.1	15.3	14	Note 4
Average Min Dry Bulb Temp	F	7.3	10.5	17.8	26	34.2	42.3	49	47.1	38.5	28.6	17.1	9.4	27	Note 5
Average Max Dry Bulb Temp	F	27.9	32.7	41.2	53.7	64.6	75.8	83.9	81.5	72.2	59.0	41.0	29.9	55	Note 5
Mean Monthly Wet Bulb Temp	F	21	23	30	36	45	52	56	54	47	35	28	22	37	Note 6
Production Rate	bwpd	153	153	153	153	153	153	153	153	153	153	153	153	153	Note 7
Precipitation Rate	bwpd	17	18	25	48	70	52	53	53	52	38	23	15	39	
Total Inflow	bwpd	169	170	177	200	223	205	205	205	205	191	176	168		
Solar Evaporation Rate	bwpd	-	-	-	-	307	375	414	366	263	173	-	-		
Difference	**bwpd**	**169**	**170**	**177**	**200**	**(84)**	**(170)**	**(209)**	**(161)**	**(58)**	**18**	**176**	**168**		Note 2 & 8
Accumulated in 1 pond with Spray Evaporators	**acre-ft**	**68.370**	**68.985**	**69.694**	**70.468**	**70.131**	**69.474**	**68.640**	**67.997**	**67.772**	**67.699**	**68.380**	**69.052**	**67.694**	From Year 9
Mass of NaCl in Pond (30,000 mg/l feed)	**mg**	**9.635E+12**	**9.656E+12**	**9.678E+12**	**9.700E+12**	**9.723E+12**	**9.745E+12**	**9.767E+12**	**9.790E+12**	**9.812E+12**	**9.834E+12**	**9.856E+12**	**9.878E+12**	**9.613E+12**	From Year 9
Concentration of NaCl in pond	**mg/l**	**114253**	**113474**	**112583**	**111597**	**112395**	**113713**	**115361**	**116720**	**117370**	**117765**	**116851**	**115980**		
Volume of Precipitate	**liters**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**		
Spray Efficiency	% Evap/Pump	0.0%	0.0%	0.0%	0.0%	43.1%	45.1%	46.6%	45.2%	41.0%	36.5%	0.0%	0.0%		
Required Pump Capacity	**bwpd**	0.0	0.0	0.0	0.0	**(196)**	**(377)**	**(448)**	**(356)**	**(142)**	**49**	0.0	0.0		Note 14
Humidity Ratio (Morning)	lbs H2O /k-lbs Air	6.9	8.4	12.6	19.1	28.4	38.0	44.5	40.2	29.7	19.3	11.5	7.7		Note 15
Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	16.7	19.7	23.3	31.9	44.9	54.1	57.3	48.9	44.8	37.7	26.9	18.9		Note 3, 5, 9
Saturated Humidity Ratio (Morning)	lbs H2O /k-lbs Air	10.2	12.0	17.2	25.5	36.9	50.9	65.8	61.2	43.8	28.8	16.6	11.4		Note 4, 5, 9
Saturated Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	27.9	34.7	48.7	78.5	117.0	173.6	229.1	211.2	153.1	95.5	48.3	30.6		
Atmospheric Capacity (Morning)	lbs H2O /k-lbs Air	3.3	3.6	4.7	6.4	8.5	12.8	21.3	21.0	14.1	9.6	5.2	3.6		
Atmospheric Capacity (Afternoon)	lbs H2O /k-lbs Air	11.2	15.0	25.5	46.7	72.1	119.5	171.8	162.3	108.3	57.8	21.4	11.7		
Air Density (Morning)	lb/ft3	0.061	0.060	0.059	0.058	0.057	0.056	0.056	0.056	0.057	0.058	0.059	0.060		Note 5, 9, 11
Air Density (Afternoon)	lb/ft3	0.058	0.058	0.057	0.055	0.054	0.053	0.052	0.052	0.053	0.055	0.057	0.058		Note 5, 9, 11
Air Mass Flow (Morning)	lb/hr	906,316	827,223	666,156	547,464	(173,227)	(232,050)	(171,841)	(134,153)	(72,361)	33,068	596,290	808,308		
Air Mass Flow (Afternoon)	lb/hr	264,793	198,984	121,970	75,147	(20,521)	(24,904)	(21,284)	(17,365)	(9,430)	5,466	144,137	251,771		
Required Wind Velocity (Morning)	**mph**	**0.4**	**0.4**	**0.3**	**0.2**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.0)**	**0.0**	**0.3**	**0.4**		
Required Wind Velocity (Afternoon)	**mph**	**0.1**	**0.1**	**0.1**	**0.0**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**0.0**	**0.1**	**0.1**		
Check Required Wind Velocity versus Average						Okay	Okay	Okay	Okay	Okay	Okay				

Notes

1. Western Regional Climatic Center (http://www.wrcc.dri.edu/summary/Climsmwy.html) for Wamsutter, WY
2. Pan evaporation data to more closely estimate the evaporation from naturally existing features like a shallow lake requires an adjustment factor of
Pan evaporation data from Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Green River, WY
3. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
4. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Rawlins, WY Airport
5. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Wamsutter, WY
6. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
7. Production Rate based on discussions with Pinnacle Gas Resources (24 wells total) with 0.99743 decline factor
8. Minimum pond surface area (300*475)
9. Altitude (FAMSL)
10. Assumed Height of Water Spray
11. Molecular Weight of Air
12. WaterDensity
13. Weight Average mass transfer between afternoon and morning
14. Spray Efficiency based SMI Super Polecat Evaporator Efficiency as a function of Pan Evaporation Data
15. **Sprayers are turned off (not needed)**
16. Assumed hours per day for evaporation

0.70 Correction Factor
0.80 Salinity Factor

3.20 acres
6,500 ft
15.0 ft
28.96 lb/lbmol
62.4 lb/cf
475.0 Side Dimension (ft)
10.5 Atmospheric Pressure
50% Afternoon or 5 hours/day at Afternoon Conditions
49 bpd or 1 gpm
10 hrs/day

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING, AND OPERATIONS

Project: **Pinnacle Gas Resources, Inc.**
Location: **Great Divide Basin, Sweetwater County, WY**
Prospect: **Sweetwater**
Field: **Sweetwater South**
Pumper: **PGR**

Issue: For Approval
Rev.: A
Rev. Date: 9-May-07
By: DRL
Chk:

Passive (Pan) + Mechanical Evaporation Calculations, Year 11

Site Data		31 Jan	28 Feb	31 Mar	30 Apr	31 May	30 Jun	31 Jul	31 Aug	30 Sept	31 Oct	30 Nov	31 Dec	365 Annual	Comments
Monthly Ave Precipitation	in.	0.25	0.24	0.37	0.69	1.05	0.76	0.79	0.79	0.76	0.57	0.34	0.23	6.84	Note 1
Monthly Ave Pan Evap	in.	0	0	0	0	8.22	9.71	11.08	9.80	6.82	4.62	0	0	50.25	Note 2
Monthly Ave Adjust Pan Evap	in.	0	0	0	0	4.60	5.44	6.20	5.49	3.82	2.59	0	0	28.14	Note 2
Mean Monthly Rel. Humidity (Morning)	%	68	70	73	75	77	75	68	66	68	67	69	68	70	Note 3
Mean Monthly Rel. Humidity (Afternoon)	%	60	57	48	41	39	32	26	24	30	40	56	62	43	Note 3
Average Wind Speed	mph	15.7	15.0	14.7	14.5	13.4	12.9	11.4	11.0	11.9	13.4	14.1	15.3	14	Note 4
Average Min Dry Bulb Temp	F	7.3	10.5	17.8	26	34.2	42.3	49	47.1	38.5	28.6	17.1	9.4	27	Note 5
Average Max Dry Bulb Temp	F	27.9	32.7	41.2	53.7	64.6	75.8	83.9	81.5	72.2	59.0	41.0	29.9	55	Note 5
Mean Monthly Wet Bulb Temp	F	21	23	30	36	45	52	56	54	47	35	28	22	37	Note 6
Production Rate	bwpd	153	153	153	153	153	153	153	153	153	153	153	153	153	Note 7
Precipitation Rate	bwpd	17	18	25	48	70	52	53	53	52	38	23	15	39	
Total Inflow	bwpd	169	170	177	200	223	205	205	205	205	191	176	168		
Solar Evaporation Rate	bwpd	-	-	-	-	307	375	414	366	263	173	-	-		
Difference	**bwpd**	**169**	**170**	**177**	**200**	**(84)**	**(170)**	**(209)**	**(161)**	**(58)**	**18**	**176**	**168**		Note 2 & 8
Accumulated in 1 pond with Spray Evaporators	**acre-ft**	**69.728**	**70.343**	**71.052**	**71.826**	**71.489**	**70.832**	**69.998**	**69.355**	**69.129**	**69.057**	**69.738**	**70.410**	**69.052**	From Year 10
Mass of NaCl in Pond (30,000 mg/l feed)	**mg**	**9.635E+12**	**9.656E+12**	**9.678E+12**	**9.700E+12**	**9.723E+12**	**9.745E+12**	**9.767E+12**	**9.790E+12**	**9.812E+12**	**9.834E+12**	**9.856E+12**	**9.878E+12**	**9.613E+12**	From Year 10
Concentration of NaCl in pond	**mg/l**	**112028**	**111283**	**110431**	**109487**	**110260**	**111533**	**113123**	**114435**	**115064**	**115449**	**114576**	**113743**		
Volume of Precipitate	**liters**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	From Year 10
Spray Efficiency	% Evap/Pump	0.0%	0.0%	0.0%	0.0%	43.1%	45.1%	46.6%	45.2%	41.0%	36.5%	0.0%	0.0%		Note 14
Required Pump Capacity	**bwpd**	0.0	0.0	0.0	0.0	**(196)**	**(377)**	**(448)**	**(356)**	**(142)**	**49**	0.0	0.0		Note 15
Humidity Ratio (Morning)	lbs H2O /k-lbs Air	6.9	8.4	12.6	19.1	28.4	38.0	44.5	40.2	29.7	19.3	11.5	7.7		Note 3, 5, 9
Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	16.7	19.7	23.3	31.9	44.9	54.1	57.3	48.9	44.8	37.7	26.9	18.9		Note 4, 5, 9
Saturated Humidity Ratio (Morning)	lbs H2O /k-lbs Air	10.2	12.0	17.2	25.5	36.9	50.9	65.8	61.2	43.8	28.8	16.6	11.4		
Saturated Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	27.9	34.7	48.7	78.5	117.0	173.6	229.1	211.2	153.1	95.5	48.3	30.6		
Atmospheric Capacity (Morning)	lbs H2O /k-lbs Air	3.3	3.6	4.7	6.4	8.5	12.8	21.3	21.0	14.1	9.6	5.2	3.6		
Atmospheric Capacity (Afternoon)	lbs H2O /k-lbs Air	11.2	15.0	25.5	46.7	72.1	119.5	171.8	162.3	108.3	57.8	21.4	11.7		
Air Density (Morning)	lb/ft3	0.061	0.060	0.059	0.058	0.057	0.056	0.056	0.056	0.057	0.058	0.059	0.060		Note 5, 9, 11
Air Density (Afternoon)	lb/ft3	0.058	0.058	0.057	0.055	0.054	0.053	0.052	0.052	0.053	0.055	0.057	0.058		Note 5, 9, 11
Air Mass Flow (Morning)	lb/hr	906,316	827,223	666,156	547,464	(173,227)	(232,050)	(171,841)	(134,153)	(72,361)	33,068	596,290	808,308		
Air Mass Flow (Afternoon)	lb/hr	264,793	198,984	121,970	75,147	(20,521)	(24,904)	(21,284)	(17,365)	(9,430)	5,466	144,137	251,771		
Required Wind Velocity (Morning)	**mph**	**0.4**	**0.4**	**0.3**	**0.2**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.0)**	**0.0**	**0.3**	**0.4**		
Required Wind Velocity (Afternoon)	**mph**	**0.1**	**0.1**	**0.1**	**0.0**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**0.0**	**0.1**	**0.1**		
Check Required Wind Velocity versus Average						Okay	Okay	Okay	Okay	Okay	Okay				

Notes

1. Western Regional Climatic Center (http://www.wrcc.dri.edu/summary/Climsmwy.html) for Wamsutter, WY
2. Pan evaporation data to more closely estimate the evaporation from naturally existing features like a shallow lake requires an adjustment factor of
Pan evaporation data from Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Green River, WY
3. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
4. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Rawlins, WY Airport
5. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Wamsutter, WY
6. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
7. Production Rate based on discussions with Pinnacle Gas Resources (24 wells total) with 0.99743 decline factor
8. Minimum pond surface area (300*475)
9. Altitude (FAMSL)
10. Assumed Height of Water Spray
11. Molecular Weight of Air
12. WaterDensity
13. Weight Average mass transfer between afternoon and morning
14. Spray Efficiency based SMI Super Polecat Evaporator Efficiency as a function of Pan Evaporation Data
15. **Sprayers are turned off (not needed)**
16. Assumed hours per day for evaporation

0.70 Correction Factor

0.80 Salinity Factor

3.20 acres
6,500 ft
15.0 ft
28.96 lb/lbmol
62.4 lb/cf
50% Afternoon

475.0 Side Dimension (ft)
10.5 Atmospheric Pressure

or 5 hours/day at Afternoon Conditions

49 bpd or 1 gpm

10 hrs/day

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING, AND OPERATIONS

Project: **Pinnacle Gas Resources, Inc.**
Location: **Great Divide Basin, Sweetwater County, WY**
Prospect: **Sweetwater**
Field: **Sweetwater South**
Pumper: **PGR**

Issue: For Approval
Rev.: A
Rev. Date: 9-May-07
By: DRL
Chk:

Passive (Pan) + Mechanical Evaporation Calculations, Year 12

Site Data		31 Jan	28 Feb	31 Mar	30 Apr	31 May	30 Jun	31 Jul	31 Aug	30 Sept	31 Oct	30 Nov	31 Dec	365 Annual	Comments
Monthly Ave Precipitation	in.	0.25	0.24	0.37	0.69	1.05	0.76	0.79	0.79	0.76	0.57	0.34	0.23	6.84	Note 1
Monthly Ave Pan Evap	in.	0	0	0	0	8.22	9.71	11.08	9.80	6.82	4.62	0	0	50.25	Note 2
Monthly Ave Adjust Pan Evap	in.	0	0	0	0	4.60	5.44	6.20	5.49	3.82	2.59	0	0	28.14	Note 2
Mean Monthly Rel. Humidity (Morning)	%	68	70	73	75	77	75	68	66	68	67	69	68	70	Note 3
Mean Monthly Rel. Humidity (Afternoon)	%	60	57	48	41	39	32	26	24	30	40	56	62	43	Note 3
Average Wind Speed	mph	15.7	15.0	14.7	14.5	13.4	12.9	11.4	11.0	11.9	13.4	14.1	15.3	14	Note 4
Average Min Dry Bulb Temp	F	7.3	10.5	17.8	26	34.2	42.3	49	47.1	38.5	28.6	17.1	9.4	27	Note 5
Average Max Dry Bulb Temp	F	27.9	32.7	41.2	53.7	64.6	75.8	83.9	81.5	72.2	59.0	41.0	29.9	55	Note 5
Mean Monthly Wet Bulb Temp	F	21	23	30	36	45	52	56	54	47	35	28	22	37	Note 6
Production Rate	bwpd	153	153	153	153	153	153	153	153	153	153	153	153	153	Note 7
Precipitation Rate	bwpd	17	18	25	48	70	52	53	53	52	38	23	15	39	
Total Inflow	bwpd	169	170	177	200	223	205	205	205	205	191	176	168		
Solar Evaporation Rate	bwpd	-	-	-	-	307	375	414	366	263	173	-	-		Note 2 & 8
Difference	**bwpd**	**169**	**170**	**177**	**200**	**(84)**	**(170)**	**(209)**	**(161)**	**(58)**	**18**	**176**	**168**		
Accumulated in 1 pond with Spray Evaporators	**acre-ft**	**71.086**	**71.701**	**72.410**	**73.184**	**72.847**	**72.190**	**71.356**	**70.713**	**70.487**	**70.415**	**71.096**	**71.768**	**70.410**	From Year 11
Mass of NaCl in Pond (30,000 mg/l feed)	**mg**	**9.901E+12**	**9.921E+12**	**9.944E+12**	**9.966E+12**	**9.988E+12**	**1.001E+13**	**1.003E+13**	**1.006E+13**	**1.008E+13**	**1.010E+13**	**1.012E+13**	**1.014E+13**	**9.878E+12**	From Year 11
Concentration of NaCl in pond	**mg/l**	**112918**	**112180**	**111335**	**110399**	**111162**	**112419**	**113989**	**115284**	**115904**	**116283**	**115418**	**114593**		
Volume of Precipitate	**liters**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	From Year 11
Spray Efficiency	% Evap/Pump	0.0%	0.0%	0.0%	0.0%	43.1%	45.1%	46.6%	45.2%	41.0%	36.5%	0.0%	0.0%		Note 14
Required Pump Capacity	**bwpd**	0.0	0.0	0.0	0.0	**(196)**	**(377)**	**(448)**	**(356)**	**(142)**	**49**	0.0	0.0		Note 15
Humidity Ratio (Morning)	lbs H2O /k-lbs Air	6.9	8.4	12.6	19.1	28.4	38.0	44.5	40.2	29.7	19.3	11.5	7.7		Note 3, 5, 9
Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	16.7	19.7	23.3	31.9	44.9	54.1	57.3	48.9	44.8	37.7	26.9	18.9		Note 4, 5, 9
Saturated Humidity Ratio (Morning)	lbs H2O /k-lbs Air	10.2	12.0	17.2	25.5	36.9	50.9	65.8	61.2	43.8	28.8	16.6	11.4		
Saturated Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	27.9	34.7	48.7	78.5	117.0	173.6	229.1	211.2	153.1	95.5	48.3	30.6		
Atmospheric Capacity (Morning)	lbs H2O /k-lbs Air	3.3	3.6	4.7	6.4	8.5	12.8	21.3	21.0	14.1	9.6	5.2	3.6		
Atmospheric Capacity (Afternoon)	lbs H2O /k-lbs Air	11.2	15.0	25.5	46.7	72.1	119.5	171.8	162.3	108.3	57.8	21.4	11.7		
Air Density (Morning)	lb/ft3	0.061	0.060	0.059	0.058	0.057	0.056	0.056	0.056	0.057	0.058	0.059	0.060		Note 5, 9, 11
Air Density (Afternoon)	lb/ft3	0.058	0.058	0.057	0.055	0.054	0.053	0.052	0.052	0.053	0.055	0.057	0.058		Note 5, 9, 11
Air Mass Flow (Morning)	lb/hr	906,316	827,223	666,156	547,464	(173,227)	(232,050)	(171,841)	(134,153)	(72,361)	33,068	596,290	808,308		
Air Mass Flow (Afternoon)	lb/hr	264,793	198,984	121,970	75,147	(20,521)	(24,904)	(21,284)	(17,365)	(9,430)	5,466	144,137	251,771		
Required Wind Velocity (Morning)	**mph**	**0.4**	**0.4**	**0.3**	**0.2**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.0)**	**0.0**	**0.3**	**0.4**		
Required Wind Velocity (Afternoon)	**mph**	**0.1**	**0.1**	**0.1**	**0.0**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**0.0**	**0.1**	**0.1**		
Check Required Wind Velocity versus Average						Okay	Okay	Okay	Okay	Okay	Okay				

Notes

1. Western Regional Climatic Center (http://www.wrcc.dri.edu/summary/Climsmwy.html) for Wamsutter, WY
2. Pan evaporation data to more closely estimate the evaporation from naturally existing features like a shallow lake requires an adjustment factor of
Pan evaporation data from Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Green River, WY
3. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
4. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Rawlins, WY Airport
5. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Wamsutter, WY
6. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
7. Production Rate based on discussions with Pinnacle Gas Resources (24 wells total) with 0.99743 decline factor
8. Minimum pond surface area (300*475)
9. Altitude (FAMSL)
10. Assumed Height of Water Spray
11. Molecular Weight of Air
12. WaterDensity
13. Weight Average mass transfer between afternoon and morning
14. Spray Efficiency based SMI Super Polecat Evaporator Efficiency as a function of Pan Evaporation Data
15. **Sprayers are turned off (not needed)**
16. Assumed hours per day for evaporation

0.70 Correction Factor

0.80 Salinity Factor

3.20 acres
6,500 ft
15.0 ft
28.96 lb/lbmol
62.4 lb/cf
50% Afternoon

475.0 Side Dimension (ft)
10.5 Atmospheric Pressure

or 5 hours/day at Afternoon Conditions

49 bpd

or 1 gpm

10 hrs/day

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING, AND OPERATIONS

Project: **Pinnacle Gas Resources, Inc.**
Location: **Great Divide Basin, Sweetwater County, WY**
Prospect: **Sweetwater**
Field: **Sweetwater South**
Pumper: **PGR**

Issue: For Approval
Rev.: A
Rev. Date: 9-May-07
By: DRL
Chk:

Passive (Pan) + Mechanical Evaporation Calculations, Year 13

Site Data		31 Jan	28 Feb	31 Mar	30 Apr	31 May	30 Jun	31 Jul	31 Aug	30 Sept	31 Oct	30 Nov	31 Dec	365 Annual	Comments
Monthly Ave Precipitation	in.	0.25	0.24	0.37	0.69	1.05	0.76	0.79	0.79	0.76	0.57	0.34	0.23	6.84	Note 1
Monthly Ave Pan Evap	in.	0	0	0	0	8.22	9.71	11.08	9.80	6.82	4.62	0	0	50.25	Note 2
Monthly Ave Adjust Pan Evap	in.	0	0	0	0	4.60	5.44	6.20	5.49	3.82	2.59	0	0	28.14	Note 2
Mean Monthly Rel. Humidity (Morning)	%	68	70	73	75	77	75	68	66	68	67	69	68	70	Note 3
Mean Monthly Rel. Humidity (Afternoon)	%	60	57	48	41	39	32	26	24	30	40	56	62	43	Note 3
Average Wind Speed	mph	15.7	15.0	14.7	14.5	13.4	12.9	11.4	11.0	11.9	13.4	14.1	15.3	14	Note 4
Average Min Dry Bulb Temp	F	7.3	10.5	17.8	26	34.2	42.3	49	47.1	38.5	28.6	17.1	9.4	27	Note 5
Average Max Dry Bulb Temp	F	27.9	32.7	41.2	53.7	64.6	75.8	83.9	81.5	72.2	59.0	41.0	29.9	55	Note 5
Mean Monthly Wet Bulb Temp	F	21	23	30	36	45	52	56	54	47	35	28	22	37	Note 6
Production Rate	bwpd	153	153	153	153	153	153	153	153	153	153	153	153	153	Note 7
Precipitation Rate	bwpd	17	18	25	48	70	52	53	53	52	38	23	15	39	
Total Inflow	bwpd	169	170	177	200	223	205	205	205	205	191	176	168		
Solar Evaporation Rate	bwpd	-	-	-	-	307	375	414	366	263	173	-	-		Note 2 & 8
Difference	**bwpd**	**169**	**170**	**177**	**200**	**(84)**	**(170)**	**(209)**	**(161)**	**(58)**	**18**	**176**	**168**		
Accumulated in 1 pond with Spray Evaporators	**acre-ft**	**72.444**	**73.059**	**73.768**	**74.542**	**74.205**	**73.548**	**72.714**	**72.071**	**71.845**	**71.773**	**72.454**	**73.126**	**71.768**	From Year 12
Mass of NaCl in Pond (30,000 mg/l feed)	**mg**	**1.017E+13**	**1.019E+13**	**1.021E+13**	**1.023E+13**	**1.025E+13**	**1.028E+13**	**1.030E+13**	**1.032E+13**	**1.034E+13**	**1.037E+13**	**1.039E+13**	**1.041E+13**	**1.014E+13**	From Year 12
Concentration of NaCl in pond	**mg/l**	**113776**	**113044**	**112206**	**111278**	**112031**	**113273**	**114823**	**116101**	**116712**	**117084**	**116228**	**115412**		
Volume of Precipitate	**liters**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	From Year 12
Spray Efficiency	% Evap/Pump	0.0%	0.0%	0.0%	0.0%	43.1%	45.1%	46.6%	45.2%	41.0%	36.5%	0.0%	0.0%		Note 14
Required Pump Capacity	**bwpd**	0.0	0.0	0.0	0.0	**(196)**	**(377)**	**(448)**	**(356)**	**(142)**	**49**	0.0	0.0		Note 15
Humidity Ratio (Morning)	lbs H2O /k-lbs Air	6.9	8.4	12.6	19.1	28.4	38.0	44.5	40.2	29.7	19.3	11.5	7.7		Note 3, 5, 9
Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	16.7	19.7	23.3	31.9	44.9	54.1	57.3	48.9	44.8	37.7	26.9	18.9		Note 4, 5, 9
Saturated Humidity Ratio (Morning)	lbs H2O /k-lbs Air	10.2	12.0	17.2	25.5	36.9	50.9	65.8	61.2	43.8	28.8	16.6	11.4		
Saturated Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	27.9	34.7	48.7	78.5	117.0	173.6	229.1	211.2	153.1	95.5	48.3	30.6		
Atmospheric Capacity (Morning)	lbs H2O /k-lbs Air	3.3	3.6	4.7	6.4	8.5	12.8	21.3	21.0	14.1	9.6	5.2	3.6		
Atmospheric Capacity (Afternoon)	lbs H2O /k-lbs Air	11.2	15.0	25.5	46.7	72.1	119.5	171.8	162.3	108.3	57.8	21.4	11.7		
Air Density (Morning)	lb/ft3	0.061	0.060	0.059	0.058	0.057	0.056	0.056	0.056	0.057	0.058	0.059	0.060		Note 5, 9, 11
Air Density (Afternoon)	lb/ft3	0.058	0.058	0.057	0.055	0.054	0.053	0.052	0.052	0.053	0.055	0.057	0.058		Note 5, 9, 11
Air Mass Flow (Morning)	lb/hr	906,316	827,223	666,156	547,464	(173,227)	(232,050)	(171,841)	(134,153)	(72,361)	33,068	596,290	808,308		
Air Mass Flow (Afternoon)	lb/hr	264,793	198,984	121,970	75,147	(20,521)	(24,904)	(21,284)	(17,365)	(9,430)	5,466	144,137	251,771		
Required Wind Velocity (Morning)	**mph**	**0.4**	**0.4**	**0.3**	**0.2**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.0)**	**0.0**	**0.3**	**0.4**		
Required Wind Velocity (Afternoon)	**mph**	**0.1**	**0.1**	**0.1**	**0.0**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**0.0**	**0.1**	**0.1**		
Check Required Wind Velocity versus Average						Okay	Okay	Okay	Okay	Okay	Okay				

Notes

1. Western Regional Climatic Center (http://www.wrcc.dri.edu/summary/Climsmwy.html) for Wamsutter, WY
2. Pan evaporation data to more closely estimate the evaporation from naturally existing features like a shallow lake requires an adjustment factor of
Pan evaporation data from Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Green River, WY
3. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
4. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Rawlins, WY Airport
5. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Wamsutter, WY
6. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
7. Production Rate based on discussions with Pinnacle Gas Resources 24 wells total) with 0.99743 decline factor
8. Minimum Pond surface area (300*475)
9. Altitude (FAMSL)
10. Assumed Height of Water Spray
11. Molecular Weight of Air
12. WaterDensity
13. Weight Average mass transfer between afternoon and morning
14. Spray Efficiency based SMI Super Polecat Evaporator Efficiency as a function of Pan Evaporation Data
15. **Sprayers are turned off (not needed)**
16. Assumed hours per day for evaporation

0.70 Correction Factor

0.80 Salinity Factor

3.20 acres
6,500 ft
15.0 ft
28.96 lb/lbmol
62.4 lb/cf
50% Afternoon

475.0 Side Dimension (ft)
10.5 Atmospheric Pressure

or 5 hours/day at Afternoon Conditions

49 bpd or 1 gpm

10 hrs/day

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING, AND OPERATIONS

Project: **Pinnacle Gas Resources, Inc.**
Location: **Great Divide Basin, Sweetwater County, WY**
Prospect: **Sweetwater**
Field: **Sweetwater South**
Pumper: **PGR**

Issue: For Approval
Rev.: A
Rev. Date: 9-May-07
By: DRL
Chk:

Passive (Pan) + Mechanical Evaporation Calculations, Year 14

Site Data		31 Jan	28 Feb	31 Mar	30 Apr	31 May	30 Jun	31 Jul	31 Aug	30 Sept	31 Oct	30 Nov	31 Dec	365 Annual	Comments
Monthly Ave Precipitation	in.	0.25	0.24	0.37	0.69	1.05	0.76	0.79	0.79	0.76	0.57	0.34	0.23	6.84	Note 1
Monthly Ave Pan Evap	in.	0	0	0	0	8.22	9.71	11.08	9.80	6.82	4.62	0	0	50.25	Note 2
Monthly Ave Adjust Pan Evap	in.	0	0	0	0	4.60	5.44	6.20	5.49	3.82	2.59	0	0	28.14	Note 2
Mean Monthly Rel. Humidity (Morning)	%	68	70	73	75	77	75	68	66	68	67	69	68	70	Note 3
Mean Monthly Rel. Humidity (Afternoon)	%	60	57	48	41	39	32	26	24	30	40	56	62	43	Note 3
Average Wind Speed	mph	15.7	15.0	14.7	14.5	13.4	12.9	11.4	11.0	11.9	13.4	14.1	15.3	14	Note 4
Average Min Dry Bulb Temp	F	7.3	10.5	17.8	26	34.2	42.3	49	47.1	38.5	28.6	17.1	9.4	27	Note 5
Average Max Dry Bulb Temp	F	27.9	32.7	41.2	53.7	64.6	75.8	83.9	81.5	72.2	59.0	41.0	29.9	55	Note 5
Mean Monthly Wet Bulb Temp	F	21	23	30	36	45	52	56	54	47	35	28	22	37	Note 6
Production Rate	bwpd	153	153	153	153	153	153	153	153	153	153	153	153	153	Note 7
Precipitation Rate	bwpd	17	18	25	48	70	52	53	53	52	38	23	15	39	
Total Inflow	bwpd	169	170	177	200	223	205	205	205	205	191	176	168		
Solar Evaporation Rate	bwpd	-	-	-	-	307	375	414	366	263	173	-	-		Note 2 & 8
Difference	**bwpd**	**169**	**170**	**177**	**200**	**(84)**	**(170)**	**(209)**	**(161)**	**(58)**	**18**	**176**	**168**		
Accumulated in 1 pond with Spray Evaporators	**acre-ft**	**73.802**	**74.417**	**75.126**	**75.900**	**75.563**	**74.906**	**74.072**	**73.429**	**73.203**	**73.131**	**73.812**	**74.484**	**73.126**	From Year 13
Mass of NaCl in Pond (30,000 mg/l feed)	**mg**	**1.043E+13**	**1.045E+13**	**1.048E+13**	**1.050E+13**	**1.052E+13**	**1.054E+13**	**1.056E+13**	**1.059E+13**	**1.061E+13**	**1.063E+13**	**1.065E+13**	**1.068E+13**	**1.041E+13**	From Year 13
Concentration of NaCl in pond	**mg/l**	**114601**	**113877**	**113046**	**112126**	**112869**	**114095**	**115627**	**116888**	**117490**	**117856**	**117009**	**116200**		
Volume of Precipitate	**liters**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	From Year 13
Spray Efficiency	% Evap/Pump	0.0%	0.0%	0.0%	0.0%	43.1%	45.1%	46.6%	45.2%	41.0%	36.5%	0.0%	0.0%		Note 14
Required Pump Capacity	**bwpd**	0.0	0.0	0.0	0.0	**(196)**	**(377)**	**(448)**	**(356)**	**(142)**	**49**	0.0	0.0		Note 15
Humidity Ratio (Morning)	lbs H2O /k-lbs Air	6.9	8.4	12.6	19.1	28.4	38.0	44.5	40.2	29.7	19.3	11.5	7.7		Note 3, 5, 9
Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	16.7	19.7	23.3	31.9	44.9	54.1	57.3	48.9	44.8	37.7	26.9	18.9		Note 4, 5, 9
Saturated Humidity Ratio (Morning)	lbs H2O /k-lbs Air	10.2	12.0	17.2	25.5	36.9	50.9	65.8	61.2	43.8	28.8	16.6	11.4		
Saturated Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	27.9	34.7	48.7	78.5	117.0	173.6	229.1	211.2	153.1	95.5	48.3	30.6		
Atmospheric Capacity (Morning)	lbs H2O /k-lbs Air	3.3	3.6	4.7	6.4	8.5	12.8	21.3	21.0	14.1	9.6	5.2	3.6		
Atmospheric Capacity (Afternoon)	lbs H2O /k-lbs Air	11.2	15.0	25.5	46.7	72.1	119.5	171.8	162.3	108.3	57.8	21.4	11.7		
Air Density (Morning)	lb/ft3	0.061	0.060	0.059	0.058	0.057	0.056	0.056	0.056	0.057	0.058	0.059	0.060		Note 5, 9, 11
Air Density (Afternoon)	lb/ft3	0.058	0.058	0.057	0.055	0.054	0.053	0.052	0.052	0.053	0.055	0.057	0.058		Note 5, 9, 11
Air Mass Flow (Morning)	lb/hr	906,316	827,223	666,156	547,464	(173,227)	(232,050)	(171,841)	(134,153)	(72,361)	33,068	596,290	808,308		
Air Mass Flow (Afternoon)	lb/hr	264,793	198,984	121,970	75,147	(20,521)	(24,904)	(21,284)	(17,365)	(9,430)	5,466	144,137	251,771		
Required Wind Velocity (Morning)	**mph**	**0.4**	**0.4**	**0.3**	**0.2**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.0)**	**0.0**	**0.3**	**0.4**		
Required Wind Velocity (Afternoon)	**mph**	**0.1**	**0.1**	**0.1**	**0.0**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**0.0**	**0.1**	**0.1**		
Check Required Wind Velocity versus Average						Okay	Okay	Okay	Okay	Okay	Okay				

Notes

1. Western Regional Climatic Center (http://www.wrcc.dri.edu/summary/Climsmwy.html) for Wamsutter, WY
2. Pan evaporation data to more closely estimate the evaporation from naturally existing features like a shallow lake requires an adjustment factor of 0.70 Correction Factor and 0.80 Salinity Factor
Pan evaporation data from Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Green River, WY
3. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
4. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Rawlins, WY Airport
5. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Wamsutter, WY
6. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
7. Production Rate based on discussions with Pinnacle Gas Resources (24 wells total) with 0.99743 decline factor
8. Pit Surface Area at High Water Line (HWL) — 3.20 acres; 475.0 Side Dimension (ft)
9. Altitude (FAMSL) — 6,500 ft; 10.5 Atmospheric Pressure
10. Assumed Height of Water Spray — 15.0 ft
11. Molecular Weight of Air — 28.96 lb/lbmol
12. WaterDensity — 62.4 lb/cf
13. Weight Average mass transfer between afternoon and morning — 50% Afternoon or 5 hours/day at Afternoon Conditions
14. Spray Efficiency based SMI Super Polecat Evaporator Efficiency as a function of Pan Evaporation Data
15. **Sprayers are turned off (not needed)** — 49 bpd or 1 gpm
16. Assumed hours per day for evaporation — 10 hrs/day

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING, AND OPERATIONS

Project: **Pinnacle Gas Resources, Inc.**
Location: **Great Divide Basin, Sweetwater County, WY**
Prospect: **Sweetwater**
Field: **Sweetwater South**
Pumper: **PGR**

Issue: For Approval
Rev.: A
Rev. Date: 9-May-07
By: DRL
Chk:

Passive (Pan) + Mechanical Evaporation Calculations, Year 15

Site Data		31 Jan	28 Feb	31 Mar	30 Apr	31 May	30 Jun	31 Jul	31 Aug	30 Sept	31 Oct	30 Nov	31 Dec	365 Annual	Comments
Monthly Ave Precipitation	in.	0.25	0.24	0.37	0.69	1.05	0.76	0.79	0.79	0.76	0.57	0.34	0.23	6.84	Note 1
Monthly Ave Pan Evap	in.	0	0	0	0	8.22	9.71	11.08	9.80	6.82	4.62	0	0	50.25	Note 2
Monthly Ave Adjust Pan Evap	in.	0	0	0	0	4.60	5.44	6.20	5.49	3.82	2.59	0	0	28.14	Note 2
Mean Monthly Rel. Humidity (Morning)	%	68	70	73	75	77	75	68	66	68	67	69	68	70	Note 3
Mean Monthly Rel. Humidity (Afternoon)	%	60	57	48	41	39	32	26	24	30	40	56	62	43	Note 3
Average Wind Speed	mph	15.7	15.0	14.7	14.5	13.4	12.9	11.4	11.0	11.9	13.4	14.1	15.3	14	Note 4
Average Min Dry Bulb Temp	F	7.3	10.5	17.8	26	34.2	42.3	49	47.1	38.5	28.6	17.1	9.4	27	Note 5
Average Max Dry Bulb Temp	F	27.9	32.7	41.2	53.7	64.6	75.8	83.9	81.5	72.2	59.0	41.0	29.9	55	Note 5
Mean Monthly Wet Bulb Temp	F	21	23	30	36	45	52	56	54	47	35	28	22	37	Note 6
Production Rate	bwpd	153	153	153	153	153	153	153	153	153	153	153	153	153	Note 7
Precipitation Rate	bwpd	17	18	25	48	70	52	53	53	52	38	23	15	39	
Total Inflow	bwpd	169	170	177	200	223	205	205	205	205	191	176	168		
Solar Evaporation Rate	bwpd	-	-	-	-	307	375	414	366	263	173	-	-		Note 2 & 8
Difference	**bwpd**	**169**	**170**	**177**	**200**	**(84)**	**(170)**	**(209)**	**(161)**	**(58)**	**18**	**176**	**168**		
Accumulated in 1 pond with Spray Evaporators	**acre-ft**	**75.160**	**75.775**	**76.484**	**77.258**	**76.921**	**76.264**	**75.430**	**74.787**	**74.561**	**74.489**	**75.170**	**75.842**	**74.484**	From Year 14
Mass of NaCl in Pond (30,000 mg/l feed)	**mg**	**1.070E+13**	**1.072E+13**	**1.074E+13**	**1.076E+13**	**1.079E+13**	**1.081E+13**	**1.083E+13**	**1.085E+13**	**1.087E+13**	**1.090E+13**	**1.092E+13**	**1.094E+13**	**1.068E+13**	From Year 14
Concentration of NaCl in pond	**mg/l**	**115397**	**114679**	**113856**	**112944**	**113677**	**114889**	**116402**	**117647**	**118240**	**118600**	**117761**	**116960**		
Volume of Precipitate	**liters**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	From Year 14
Spray Efficiency	% Evap/Pump	0.0%	0.0%	0.0%	0.0%	43.1%	45.1%	46.6%	45.2%	41.0%	36.5%	0.0%	0.0%		Note 14
Required Pump Capacity	**bwpd**	0.0	0.0	0.0	0.0	**(196)**	**(377)**	**(448)**	**(356)**	**(142)**	**49**	0.0	0.0		Note 15
Humidity Ratio (Morning)	lbs H2O /k-lbs Air	6.9	8.4	12.6	19.1	28.4	38.0	44.5	40.2	29.7	19.3	11.5	7.7		Note 3, 5, 9
Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	16.7	19.7	23.3	31.9	44.9	54.1	57.3	48.9	44.8	37.7	26.9	18.9		Note 4, 5, 9
Saturated Humidity Ratio (Morning)	lbs H2O /k-lbs Air	10.2	12.0	17.2	25.5	36.9	50.9	65.8	61.2	43.8	28.8	16.6	11.4		
Saturated Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	27.9	34.7	48.7	78.5	117.0	173.6	229.1	211.2	153.1	95.5	48.3	30.6		
Atmospheric Capacity (Morning)	lbs H2O /k-lbs Air	3.3	3.6	4.7	6.4	8.5	12.8	21.3	21.0	14.1	9.6	5.2	3.6		
Atmospheric Capacity (Afternoon)	lbs H2O /k-lbs Air	11.2	15.0	25.5	46.7	72.1	119.5	171.8	162.3	108.3	57.8	21.4	11.7		
Air Density (Morning)	lb/ft3	0.061	0.060	0.059	0.058	0.057	0.056	0.056	0.056	0.057	0.058	0.059	0.060		Note 5, 9, 11
Air Density (Afternoon)	lb/ft3	0.058	0.058	0.057	0.055	0.054	0.053	0.052	0.052	0.053	0.055	0.057	0.058		Note 5, 9, 11
Air Mass Flow (Morning)	lb/hr	906,316	827,223	666,156	547,464	(173,227)	(232,050)	(171,841)	(134,153)	(72,361)	33,068	596,290	808,308		
Air Mass Flow (Afternoon)	lb/hr	264,793	198,984	121,970	75,147	(20,521)	(24,904)	(21,284)	(17,365)	(9,430)	5,466	144,137	251,771		
Required Wind Velocity (Morning)	**mph**	**0.4**	**0.4**	**0.3**	**0.2**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.0)**	**0.0**	**0.3**	**0.4**		
Required Wind Velocity (Afternoon)	**mph**	**0.1**	**0.1**	**0.1**	**0.0**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**0.0**	**0.1**	**0.1**		
Check Required Wind Velocity versus Average						Okay	Okay	Okay	Okay	Okay	Okay				

Notes

1. Western Regional Climatic Center (http://www.wrcc.dri.edu/summary/Climsmwy.html) for Wamsutter, WY
2. Pan evaporation data to more closely estimate the evaporation from naturally existing features like a shallow lake requires an adjustment factor of 0.70 Correction Factor 0.80 Salinity Factor
Pan evaporation data from Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Green River, WY
3. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
4. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Rawlins, WY Airport
5. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Wamsutter, WY
6. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
7. Production Rate based on discussions with Pinnacle Gas Resources (24 wells total) with 0.99743 decline factor
8. 300'*475'
9. Altitude (FAMSL) 6,500 ft
10. Assumed Height of Water Spray 15.0 ft
11. Molecular Weight of Air 28.96 lb/lbmol
12. WaterDensity 62.4 lb/cf
13. Weight Average mass transfer between afternoon and morning
14. Spray Efficiency based SMI Super Polecat Evaporator Efficiency as a function of Pan Evaporation Data 50% Afternoon or 5 hours/day at Afternoon Conditions
15. Sprayers are turned off (not needed)
16. Assumed hours per day for evaporation 49 bpd or 1 gpm
10 hrs/day

3.20 acres
475.0 Side Dimension (ft)
10.5 Atmospheric Pressure

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING, AND OPERATIONS

Project: **Pinnacle Gas Resources, Inc.**
Location: **Great Divide Basin, Sweetwater County, WY**
Prospect: **Sweetwater**
Field: **Sweetwater South**
Pumper: **PGR**

Issue: For Approval
Rev.: A
Rev. Date: 9-May-07
By: DRL
Chk:

Passive (Pan) + Mechanical Evaporation Calculations, Year 16

Site Data		31 Jan	28 Feb	31 Mar	30 Apr	31 May	30 Jun	31 Jul	31 Aug	30 Sept	31 Oct	30 Nov	31 Dec	365 Annual	Comments
Monthly Ave Precipitation	in.	0.25	0.24	0.37	0.69	1.05	0.76	0.79	0.79	0.76	0.57	0.34	0.23	6.84	Note 1
Monthly Ave Pan Evap	in.	0	0	0	0	8.22	9.71	11.08	9.80	6.82	4.62	0	0	50.25	Note 2
Monthly Ave Adjust Pan Evap	in.	0	0	0	0	4.60	5.44	6.20	5.49	3.82	2.59	0	0	28.14	Note 2
Mean Monthly Rel. Humidity (Morning)	%	68	70	73	75	77	75	68	66	68	67	69	68	70	Note 3
Mean Monthly Rel. Humidity (Afternoon)	%	60	57	48	41	39	32	26	24	30	40	56	62	43	Note 3
Average Wind Speed	mph	15.7	15.0	14.7	14.5	13.4	12.9	11.4	11.0	11.9	13.4	14.1	15.3	14	Note 4
Average Min Dry Bulb Temp	F	7.3	10.5	17.8	26	34.2	42.3	49	47.1	38.5	28.6	17.1	9.4	27	Note 5
Average Max Dry Bulb Temp	F	27.9	32.7	41.2	53.7	64.6	75.8	83.9	81.5	72.2	59.0	41.0	29.9	55	Note 5
Mean Monthly Wet Bulb Temp	F	21	23	30	36	45	52	56	54	47	35	28	22	37	Note 6
Production Rate	bwpd	153	153	153	153	153	153	153	153	153	153	153	153	153	Note 7
Precipitation Rate	bwpd	17	18	25	48	70	52	53	53	52	38	23	15	39	
Total Inflow	bwpd	169	170	177	200	223	205	205	205	205	191	176	168		
Solar Evaporation Rate	bwpd	-	-	-	-	307	375	414	366	263	173	-	-		
Difference	**bwpd**	**169**	**170**	**177**	**200**	**(84)**	**(170)**	**(209)**	**(161)**	**(58)**	**18**	**176**	**168**		Note 2 & 8
Accumulated in 1 pond with Spray Evaporators	**acre-ft**	**76.518**	**77.133**	**77.842**	**78.616**	**78.278**	**77.621**	**76.788**	**76.145**	**75.919**	**75.847**	**76.528**	**77.200**	**75.842**	From Year 15
Mass of NaCl in Pond (30,000 mg/l feed)	**mg**	**1.096E+13**	**1.098E+13**	**1.101E+13**	**1.103E+13**	**1.105E+13**	**1.107E+13**	**1.110E+13**	**1.112E+13**	**1.114E+13**	**1.116E+13**	**1.118E+13**	**1.121E+13**	**1.094E+13**	From Year 15
Concentration of NaCl in pond	**mg/l**	**116165**	**115453**	**114637**	**113734**	**114458**	**115655**	**117149**	**118378**	**118963**	**119317**	**118487**	**117694**		
Volume of Precipitate	**liters**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	From Year 15
Spray Efficiency	% Evap/Pump	0.0%	0.0%	0.0%	0.0%	43.1%	45.1%	46.6%	45.2%	41.0%	36.5%	0.0%	0.0%		Note 14
Required Pump Capacity	**bwpd**	0.0	0.0	0.0	0.0	**(196)**	**(377)**	**(448)**	**(356)**	**(142)**	**49**	0.0	0.0		Note 15
Humidity Ratio (Morning)	lbs H2O /k-lbs Air	6.9	8.4	12.6	19.1	28.4	38.0	44.5	40.2	29.7	19.3	11.5	7.7		Note 3, 5, 9
Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	16.7	19.7	23.3	31.9	44.9	54.1	57.3	48.9	44.8	37.7	26.9	18.9		Note 4, 5, 9
Saturated Humidity Ratio (Morning)	lbs H2O /k-lbs Air	10.2	12.0	17.2	25.5	36.9	50.9	65.8	61.2	43.8	28.8	16.6	11.4		
Saturated Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	27.9	34.7	48.7	78.5	117.0	173.6	229.1	211.2	153.1	95.5	48.3	30.6		
Atmospheric Capacity (Morning)	lbs H2O /k-lbs Air	3.3	3.6	4.7	6.4	8.5	12.8	21.3	21.0	14.1	9.6	5.2	3.6		
Atmospheric Capacity (Afternoon)	lbs H2O /k-lbs Air	11.2	15.0	25.5	46.7	72.1	119.5	171.8	162.3	108.3	57.8	21.4	11.7		
Air Density (Morning)	lb/ft3	0.061	0.060	0.059	0.058	0.057	0.056	0.056	0.056	0.057	0.058	0.059	0.060		
Air Density (Afternoon)	lb/ft3	0.058	0.058	0.057	0.055	0.054	0.053	0.052	0.052	0.053	0.055	0.057	0.058		Note 5, 9, 11
Air Mass Flow (Morning)	lb/hr	906,316	827,223	666,156	547,464	(173,227)	(232,050)	(171,841)	(134,153)	(72,361)	33,068	596,290	808,308		Note 5, 9, 11
Air Mass Flow (Afternoon)	lb/hr	264,793	198,984	121,970	75,147	(20,521)	(24,904)	(21,284)	(17,365)	(9,430)	5,466	144,137	251,771		
Required Wind Velocity (Morning)	**mph**	**0.4**	**0.4**	**0.3**	**0.2**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.0)**	**0.0**	**0.3**	**0.4**		
Required Wind Velocity (Afternoon)	**mph**	**0.1**	**0.1**	**0.1**	**0.0**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**0.0**	**0.1**	**0.1**		
Check Required Wind Velocity versus Average						Okay	Okay	Okay	Okay	Okay	Okay				

Notes

1. Western Regional Climatic Center (http://www.wrcc.dri.edu/summary/Climsmwy.html) for Wamsutter, WY
2. Pan evaporation data to more closely estimate the evaporation from naturally existing features like a shallow lake requires an adjustment factor of
Pan evaporation data from Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Green River, WY
3. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
4. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Rawlins, WY Airport
5. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Wamsutter, WY
6. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
7. Production Rate based on discussions with Pinnacle Gas Resources (24 wells total) with 0.99743 decline factor
8. 300*475
9. Altitude (FAMSL)
10. Assumed Height of Water Spray
11. Molecular Weight of Air
12. WaterDensity
13. Weight Average mass transfer between afternoon and morning
14. Spray Efficiency based SMI Super Polecat Evaporator Efficiency as a function of Pan Evaporation Data
15. **Sprayers are turned off (not needed)**
16. Assumed hours per day for evaporation

0.70 Correction Factor
0.80 Salinity Factor

3.20 acres
6,500 ft
15.0 ft
28.96 lb/lbmol
62.4 lb/cf
475.0 Side Dimension (ft)
10.5 Atmospheric Pressure
50% Afternoon or 5 hours/day at Afternoon Conditions
49 bpd or 1 gpm
10 hrs/day

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING, AND OPERATIONS

Project: **Pinnacle Gas Resources, Inc.**
Location: **Great Divide Basin, Sweetwater County, WY**
Prospect: **Sweetwater**
Field: **Sweetwater South**
Pumper: **PGR**

Issue: For Approval
Rev.: A
Rev. Date: 9-May-07
By: DRL
Chk:

Passive (Pan) + Mechanical Evaporation Calculations, Year 17

Site Data		31 Jan	28 Feb	31 Mar	30 Apr	31 May	30 Jun	31 Jul	31 Aug	30 Sept	31 Oct	30 Nov	31 Dec	365 Annual	Comments
Monthly Ave Precipitation	in.	0.25	0.24	0.37	0.69	1.05	0.76	0.79	0.79	0.76	0.57	0.34	0.23	6.84	Note 1
Monthly Ave Pan Evap	in.	0	0	0	0	8.22	9.71	11.08	9.80	6.82	4.62	0	0	50.25	Note 2
Monthly Ave Adjust Pan Evap	in.	0	0	0	0	4.60	5.44	6.20	5.49	3.82	2.59	0	0	28.14	Note 2
Mean Monthly Rel. Humidity (Morning)	%	68	70	73	75	77	75	68	66	68	67	69	68	70	Note 3
Mean Monthly Rel. Humidity (Afternoon)	%	60	57	48	41	39	32	26	24	30	40	56	62	43	Note 3
Average Wind Speed	mph	15.7	15.0	14.7	14.5	13.4	12.9	11.4	11.0	11.9	13.4	14.1	15.3	14	Note 4
Average Min Dry Bulb Temp	F	7.3	10.5	17.8	26	34.2	42.3	49	47.1	38.5	28.6	17.1	9.4	27	Note 5
Average Max Dry Bulb Temp	F	27.9	32.7	41.2	53.7	64.6	75.8	83.9	81.5	72.2	59.0	41.0	29.9	55	Note 5
Mean Monthly Wet Bulb Temp	F	21	23	30	36	45	52	56	54	47	35	28	22	37	Note 6
Production Rate	bwpd	153	153	153	153	153	153	153	153	153	153	153	153	153	Note 7
Precipitation Rate	bwpd	17	18	25	48	70	52	53	53	52	38	23	15	39	
Total Inflow	bwpd	169	170	177	200	223	205	205	205	205	191	176	168		
Solar Evaporation Rate	bwpd	-	-	-	-	307	375	414	366	263	173	-	-		Note 2 & 8
Difference	**bwpd**	**169**	**170**	**177**	**200**	**(84)**	**(170)**	**(209)**	**(161)**	**(58)**	**18**	**176**	**168**		
Accumulated in 1 pond with Spray Evaporators	**acre-ft**	**76.518**	**77.133**	**77.842**	**78.616**	**78.278**	**77.621**	**76.788**	**76.145**	**75.919**	**75.847**	**76.528**	**77.200**	**75.842**	From Year 16
Mass of NaCl in Pond (30,000 mg/l feed)	**mg**	**1.123E+13**	**1.125E+13**	**1.127E+13**	**1.129E+13**	**1.132E+13**	**1.134E+13**	**1.136E+13**	**1.138E+13**	**1.141E+13**	**1.143E+13**	**1.145E+13**	**1.147E+13**	**1.121E+13**	From Year 16
Concentration of NaCl in pond	**mg/l**	**118980.786**	**118246.523**	**117405.170**	**116474.135**	**117210.074**	**118430.281**	**119954.694**	**121207.570**	**121800.757**	**122157.753**	**121302.207**	**120484.464**		
Volume of Precipitate	**liters**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	From Year 16
Spray Efficiency	% Evap/Pump	0.0%	0.0%	0.0%	0.0%	43.1%	45.1%	46.6%	45.2%	41.0%	36.5%	0.0%	0.0%		Note 14
Required Pump Capacity	**bwpd**	0.0	0.0	0.0	0.0	**(196)**	**(377)**	**(448)**	**(356)**	**(142)**	**49**	0.0	0.0		Note 15
Humidity Ratio (Morning)	lbs H2O /k-lbs Air	6.9	8.4	12.6	19.1	28.4	38.0	44.5	40.2	29.7	19.3	11.5	7.7		Note 3, 5, 9
Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	16.7	19.7	23.3	31.9	44.9	54.1	57.3	48.9	44.8	37.7	26.9	18.9		Note 4, 5, 9
Saturated Humidity Ratio (Morning)	lbs H2O /k-lbs Air	10.2	12.0	17.2	25.5	36.9	50.9	65.8	61.2	43.8	28.8	16.6	11.4		
Saturated Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	27.9	34.7	48.7	78.5	117.0	173.6	229.1	211.2	153.1	95.5	48.3	30.6		
Atmospheric Capacity (Morning)	lbs H2O /k-lbs Air	3.3	3.6	4.7	6.4	8.5	12.8	21.3	21.0	14.1	9.6	5.2	3.6		
Atmospheric Capacity (Afternoon)	lbs H2O /k-lbs Air	11.2	15.0	25.5	46.7	72.1	119.5	171.8	162.3	108.3	57.8	21.4	11.7		
Air Density (Morning)	lb/ft3	0.061	0.060	0.059	0.058	0.057	0.056	0.056	0.056	0.057	0.058	0.059	0.060		Note 5, 9, 11
Air Density (Afternoon)	lb/ft3	0.058	0.058	0.057	0.055	0.054	0.053	0.052	0.052	0.053	0.055	0.057	0.058		Note 5, 9, 11
Air Mass Flow (Morning)	lb/hr	906,316	827,223	666,156	547,464	(173,227)	(232,050)	(171,841)	(134,153)	(72,361)	33,068	596,290	808,308		
Air Mass Flow (Afternoon)	lb/hr	264,793	198,984	121,970	75,147	(20,521)	(24,904)	(21,284)	(17,365)	(9,430)	5,466	144,137	251,771		
Required Wind Velocity (Morning)	**mph**	**0.4**	**0.4**	**0.3**	**0.2**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.0)**	**0.0**	**0.3**	**0.4**		
Required Wind Velocity (Afternoon)	**mph**	**0.1**	**0.1**	**0.1**	**0.0**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**0.0**	**0.1**	**0.1**		
Check Required Wind Velocity versus Average						Okay	Okay	Okay	Okay	Okay	Okay				

Notes

1. Western Regional Climatic Center (http://www.wrcc.dri.edu/summary/Climsmwy.html) for Wamsutter, WY
2. Pan evaporation data to more closely estimate the evaporation from naturally existing features like a shallow lake requires an adjustment factor of
Pan evaporation data from Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Green River, WY
3. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
4. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Rawlins, WY Airport
5. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Wamsutter, WY
6. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
7. Production Rate based on discussions with Pinnacle Gas Resources (24 wells total) with 0.99743 decline factor
8. Pit Surface Area at High Water Line (HWL)
9. Altitude (FAMSL)
10. Assumed Height of Water Spray
11. Molecular Weight of Air
12. WaterDensity
13. Weight Average mass transfer between afternoon and morning
14. Spray Efficiency based SMI Super Polecat Evaporator Efficiency as a function of Pan Evaporation Data
15. **Sprayers are turned off (not needed)**
16. Assumed hours per day for evaporation

0.70 Correction Factor
0.80 Salinity Factor

3.20 acres
6,500 ft
15.0 ft
28.96 lb/lbmol
62.4 lb/cf
50% Afternoon or 5 hours/day at Afternoon Conditions
49 bpd or 1 gpm
10 hrs/day

475.0 Side Dimension (ft)
10.5 Atmospheric Pressure

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING, AND OPERATIONS

Project: **Pinnacle Gas Resources, Inc.**
Location: **Great Divide Basin, Sweetwater County, WY**
Prospect: **Sweetwater**
Field: **Sweetwater South**
Pumper: **PGR**

Issue: For Approval
Rev.: A
Rev. Date: 9-May-07
By: DRL
Chk:

Passive (Pan) + Mechanical Evaporation Calculations, Year 18

Site Data		31 Jan	28 Feb	31 Mar	30 Apr	31 May	30 Jun	31 Jul	31 Aug	30 Sept	31 Oct	30 Nov	31 Dec	365 Annual	Comments
Monthly Ave Precipitation	in.	0.25	0.24	0.37	0.69	1.05	0.76	0.79	0.79	0.76	0.57	0.34	0.23	6.84	Note 1
Monthly Ave Pan Evap	in.	0	0	0	0	8.22	9.71	11.08	9.80	6.82	4.62	0	0	50.25	Note 2
Monthly Ave Adjust Pan Evap	in.	0	0	0	0	4.60	5.44	6.20	5.49	3.82	2.59	0	0	28.14	Note 2
Mean Monthly Rel. Humidity (Morning)	%	68	70	73	75	77	75	68	66	68	67	69	68	70	Note 3
Mean Monthly Rel. Humidity (Afternoon)	%	60	57	48	41	39	32	26	24	30	40	56	62	43	Note 3
Average Wind Speed	mph	15.7	15.0	14.7	14.5	13.4	12.9	11.4	11.0	11.9	13.4	14.1	15.3	14	Note 4
Average Min Dry Bulb Temp	F	7.3	10.5	17.8	26	34.2	42.3	49	47.1	38.5	28.6	17.1	9.4	27	Note 5
Average Max Dry Bulb Temp	F	27.9	32.7	41.2	53.7	64.6	75.8	83.9	81.5	72.2	59.0	41.0	29.9	55	Note 5
Mean Monthly Wet Bulb Temp	F	21	23	30	36	45	52	56	54	47	35	28	22	37	Note 6
Production Rate	bwpd	153	153	153	153	153	153	153	153	153	153	153	153	153	Note 7
Precipitation Rate	bwpd	17	18	25	48	70	52	53	53	52	38	23	15	39	
Total Inflow	bwpd	169	170	177	200	223	205	205	205	205	191	176	168		
Solar Evaporation Rate	bwpd	-	-	-	-	307	375	414	366	263	173	-	-		
Difference	**bwpd**	**169**	**170**	**177**	**200**	**(84)**	**(170)**	**(209)**	**(161)**	**(58)**	**18**	**176**	**168**		Note 2 & 8
Accumulated in 1 pond with Spray Evaporators	**acre-ft**	**77.876**	**78.491**	**79.200**	**79.974**	**66.580**	**50.540**	**0.000**	**0.000**	**0.000**	**0.000**	**0.681**	**1.352**	**77.200**	From Year 17
Mass of NaCl in Pond (30,000 mg/l feed)	**mg**	**1.150E+13**	**1.152E+13**	**1.154E+13**	**1.156E+13**	**1.158E+13**	**1.160E+13**	**1.163E+13**	**1.165E+13**	**1.167E+13**	**1.169E+13**	**1.172E+13**	**1.174E+13**	**1.147E+13**	From Year 17
Concentration of NaCl in pond	**mg/l**	**119672.624**	**118945.644**	**118112.462**	**117190.388**	**141039.661**	**186154.213**	**solids**	**solids**	**solids**	**solis**	**13949151.773**	**7037908.743**		
Volume of Precipitate	**liters**	**0.000**	**0.000**	**0.000**	**0.000**	**-7969693.179**	**-4747570.413**	**5383046.023**	**5393495.542**	**5403607.981**	**5414057.500**	**5414063.796**	**0.000**	**0.000**	From Year 17
Spray Efficiency	% Evap/Pump	0.0%	0.0%	0.0%	0.0%	36.4%	45.1%	46.6%	45.2%	41.0%	36.5%	0.0%	0.0%		Note 14
Required Pump Capacity	**bwpd**	0.0	0.0	0.0	0.0	**(232)**	**(377)**	**(448)**	**(356)**	**(142)**	**49**	0.0	0.0		Note 15
Humidity Ratio (Morning)	lbs H2O /k-lbs Air	6.9	8.4	12.6	19.1	28.4	38.0	44.5	40.2	29.7	19.3	11.5	7.7		Note 3, 5, 9
Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	16.7	19.7	23.3	31.9	44.9	54.1	57.3	48.9	44.8	37.7	26.9	18.9		Note 4, 5, 9
Saturated Humidity Ratio (Morning)	lbs H2O /k-lbs Air	10.2	12.0	17.2	25.5	36.9	50.9	65.8	61.2	43.8	28.8	16.6	11.4		
Saturated Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	27.9	34.7	48.7	78.5	117.0	173.6	229.1	211.2	153.1	95.5	48.3	30.6		
Atmospheric Capacity (Morning)	lbs H2O /k-lbs Air	3.3	3.6	4.7	6.4	8.5	12.8	21.3	21.0	14.1	9.6	5.2	3.6		
Atmospheric Capacity (Afternoon)	lbs H2O /k-lbs Air	11.2	15.0	25.5	46.7	72.1	119.5	171.8	162.3	108.3	57.8	21.4	11.7		
Air Density (Morning)	lb/ft3	0.061	0.060	0.059	0.058	0.057	0.056	0.056	0.056	0.057	0.058	0.059	0.060		Note 5, 9, 11
Air Density (Afternoon)	lb/ft3	0.058	0.058	0.057	0.055	0.054	0.053	0.052	0.052	0.053	0.055	0.057	0.058		Note 5, 9, 11
Air Mass Flow (Morning)	lb/hr	906,316	827,223	666,156	547,464	(173,227)	(232,050)	(171,841)	(134,153)	(72,361)	33,068	596,290	808,308		
Air Mass Flow (Afternoon)	lb/hr	264,793	198,984	121,970	75,147	(20,521)	(24,904)	(21,284)	(17,365)	(9,430)	5,466	144,137	251,771		
Required Wind Velocity (Morning)	**mph**	**0.4**	**0.4**	**0.3**	**0.2**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.0)**	**0.0**	**0.3**	**0.4**		
Required Wind Velocity (Afternoon)	**mph**	**0.1**	**0.1**	**0.1**	**0.0**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**0.0**	**0.1**	**0.1**		
Check Required Wind Velocity versus Average						Okay	Okay	Okay	Okay	Okay	Okay				

Notes

1. Western Regional Climatic Center (http://www.wrcc.dri.edu/summary/Climsmwy.html) for Wamsutter, WY
2. Pan evaporation data to more closely estimate the evaporation from naturally existing features like a shallow lake requires an adjustment factor of 0.70 Correction Factor 0.80 Salinity Factor
Pan evaporation data from Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Green River, WY
3. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
4. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Rawlins, WY Airport
5. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Wamsutter, WY
6. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
7. Production Rate based on discussions with Pinnacle Gas Resources (24 wells total) with 0.99743 decline factor
8. 300*475
9. Altitude (FAMSL) 6,500 ft
10. Assumed Height of Water Spray 15.0 ft
11. Molecular Weight of Air 28.96 lb/lbmol
12. WaterDensity 62.4 lb/cf
13. Weight Average mass transfer between afternoon and morning 50% Afternoon
14. Spray Efficiency based SMI Super Polecat Evaporator Efficiency as a function of Pan Evaporation Data
15. **Sprayers are turned on** 49 bpd or 1 gpm
16. Assumed hours per day for evaporation 10 hrs/day

3.20 acres 475.0 Side Dimension (ft)
10.5 Atmospheric Pressure
or 5 hours/day at Afternoon Conditions

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING, AND OPERATIONS

Project: **Pinnacle Gas Resources, Inc.**
Location: **Great Divide Basin, Sweetwater County, WY**
Prospect: **Sweetwater**
Field: **Sweetwater South**
Pumper: **PGR**

Issue:	For Approval
Rev.:	A
Rev. Date:	9-May-07
By:	DRL
Chk:	

Passive (Pan) + Mechanical Evaporation Calculations, Year 19

Site Data		31 Jan	28 Feb	31 Mar	30 Apr	31 May	30 Jun	31 Jul	31 Aug	30 Sept	31 Oct	30 Nov	31 Dec	365 Annual	Comments
Monthly Ave Precipitation	in.	0.25	0.24	0.37	0.69	1.05	0.76	0.79	0.79	0.76	0.57	0.34	0.23	6.84	Note 1
Monthly Ave Pan Evap	in.	0	0	0	0	8.22	9.71	11.08	9.80	6.82	4.62	0	0	50.25	Note 2
Monthly Ave Adjust Pan Evap	in.	0	0	0	0	4.60	5.44	6.20	5.49	3.82	2.59	0	0	28.14	Note 2
Mean Monthly Rel. Humidity (Morning)	%	68	70	73	75	77	75	68	66	68	67	69	68	70	Note 3
Mean Monthly Rel. Humidity (Afternoon)	%	60	57	48	41	39	32	26	24	30	40	56	62	43	Note 3
Average Wind Speed	mph	15.7	15.0	14.7	14.5	13.4	12.9	11.4	11.0	11.9	13.4	14.1	15.3	14	Note 4
Average Min Dry Bulb Temp	F	7.3	10.5	17.8	26	34.2	42.3	49	47.1	38.5	28.6	17.1	9.4	27	Note 5
Average Max Dry Bulb Temp	F	27.9	32.7	41.2	53.7	64.6	75.8	83.9	81.5	72.2	59.0	41.0	29.9	55	Note 5
Mean Monthly Wet Bulb Temp	F	21	23	30	36	45	52	56	54	47	35	28	22	37	Note 6
Production Rate	bwpd	153	153	153	153	153	153	153	153	153	153	153	153	153	Note 7
Precipitation Rate	bwpd	17	18	25	48	70	52	53	53	52	38	23	15	39	
Total Inflow	bwpd	169	170	177	200	223	205	205	205	205	191	176	168		
Solar Evaporation Rate	bwpd	-	-	-	-	307	375	414	366	263	173	-	-		Note 2 & 8
Difference	**bwpd**	**169**	**170**	**177**	**200**	**(84)**	**(170)**	**(209)**	**(161)**	**(58)**	**18**	**176**	**168**		
Accumulated in 1 pond with Spray Evaporators	**acre-ft**	**1.358**	**1.972**	**2.681**	**3.455**	**3.118**	**2.461**	**1.627**	**0.984**	**0.759**	**0.687**	**1.368**	**2.039**	**0.681**	From Year 18
Mass of NaCl in Pond (30,000 mg/l feed)	**mg**	**1.176E+13**	**1.178E+13**	**1.180E+13**	**1.183E+13**	**1.185E+13**	**1.187E+13**	**1.189E+13**	**1.192E+13**	**1.194E+13**	**1.196E+13**	**1.198E+13**	**1.200E+13**	**1.174E+13**	From Year 18
Concentration of NaCl in pond	**mg/l**	**7023740.496**	**4842460.408**	**3569420.172**	**2774720.725**	**3080943.609**	**3910676.811**	**5926294.323**	**9815104.144**	**12754740.668**	**14120070.470**	**7102727.398**	**4773240.112**		
Volume of Precipitate	**liters**	**5414066.885**	**5414068.965**	**5414070.455**	**5414071.577**	**5414072.841**	**5414074.490**	**5424524.009**	**5434973.529**	**5445085.967**	**5455535.487**	**5455538.613**	**5455540.661**	**5414063.796**	From Year 18
Spray Efficiency	% Evap/Pump	0.0%	0.0%	0.0%	0.0%	43.1%	45.1%	46.6%	45.2%	41.0%	36.5%	0.0%	0.0%		
Required Pump Capacity	**bwpd**	0.0	0.0	0.0	0.0	**(196)**	**(377)**	**(448)**	**(356)**	**(142)**	**49**	0.0	0.0		Note 14
Humidity Ratio (Morning)	lbs H2O /k-lbs Air	6.9	8.4	12.6	19.1	28.4	38.0	44.5	40.2	29.7	19.3	11.5	7.7		Note 15
Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	16.7	19.7	23.3	31.9	44.9	54.1	57.3	48.9	44.8	37.7	26.9	18.9		Note 3, 5, 9
Saturated Humidity Ratio (Morning)	lbs H2O /k-lbs Air	10.2	12.0	17.2	25.5	36.9	50.9	65.8	61.2	43.8	28.8	16.6	11.4		Note 4, 5, 9
Saturated Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	27.9	34.7	48.7	78.5	117.0	173.6	229.1	211.2	153.1	95.5	48.3	30.6		
Atmospheric Capacity (Morning)	lbs H2O /k-lbs Air	3.3	3.6	4.7	6.4	8.5	12.8	21.3	21.0	14.1	9.6	5.2	3.6		
Atmospheric Capacity (Afternoon)	lbs H2O /k-lbs Air	11.2	15.0	25.5	46.7	72.1	119.5	171.8	162.3	108.3	57.8	21.4	11.7		
Air Density (Morning)	lb/ft3	0.061	0.060	0.059	0.058	0.057	0.056	0.056	0.056	0.057	0.058	0.059	0.060		Note 5, 9, 11
Air Density (Afternoon)	lb/ft3	0.058	0.058	0.057	0.055	0.054	0.053	0.052	0.052	0.053	0.055	0.057	0.058		Note 5, 9, 11
Air Mass Flow (Morning)	lb/hr	906,316	827,223	666,156	547,464	(173,227)	(232,050)	(171,841)	(134,153)	(72,361)	33,068	596,290	808,308		
Air Mass Flow (Afternoon)	lb/hr	264,793	198,984	121,970	75,147	(20,521)	(24,904)	(21,284)	(17,365)	(9,430)	5,466	144,137	251,771		
Required Wind Velocity (Morning)	**mph**	**0.4**	**0.4**	**0.3**	**0.2**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.0)**	**0.0**	**0.3**	**0.4**		
Required Wind Velocity (Afternoon)	**mph**	**0.1**	**0.1**	**0.1**	**0.0**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**0.0**	**0.1**	**0.1**		
Check Required Wind Velocity versus Average						Okay	Okay	Okay	Okay	Okay	Okay				

Notes

1. Western Regional Climatic Center (http://www.wrcc.dri.edu/summary/Climsmwy.html) for Wamsutter, WY
2. Pan evaporation data to more closely estimate the evaporation from naturally existing features like a shallow lake requires an adjustment factor of
Pan evaporation data from Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Green River, WY
3. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
4. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Rawlins, WY Airport
5. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Wamsutter, WY
6. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
7. Production Rate based on discussions with Pinnacle Gas Resources (24 wells total) with 0.99743 decline factor
8. 300*475
9. Altitude (FAMSL)
10. Assumed Height of Water Spray
11. Molecular Weight of Air
12. WaterDensity
13. Weight Average mass transfer between afternoon and morning
14. Spray Efficiency based SMI Super Polecat Evaporator Efficiency as a function of Pan Evaporation Data
15. **Sprayers are turned off (not needed)**
16. Assumed hours per day for evaporation

0.70 Correction Factor

0.80 Salinity Factor

3.20 acres
6,500 ft
15.0 ft
28.96 lb/lbmol
62.4 lb/cf
50% Afternoon

475.0 Side Dimension (ft)
10.5 Atmospheric Pressure

or 5 hours/day at Afternoon Conditions

49 bpd

or 1 gpm

10 hrs/day

PEARL FIELD SERVICES, LLC

LAND, PERMITTING, ENGINEERING, CONSTRUCTION, DRILLING, AND OPERATIONS

Project: **Pinnacle Gas Resources, Inc.**
Location: **Great Divide Basin, Sweetwater County, WY**
Prospect: **Sweetwater**
Field: **Sweetwater South**
Pumper: **PGR**

Issue: For Approval
Rev.: A
Rev. Date: 9-May-07
By: DRL
Chk:

Passive (Pan) + Mechanical Evaporation Calculations, Year 20

Site Data		31 Jan	28 Feb	31 Mar	30 Apr	31 May	30 Jun	31 Jul	31 Aug	30 Sept	31 Oct	30 Nov	31 Dec	365 Annual	Comments
Monthly Ave Precipitation	in.	0.25	0.24	0.37	0.69	1.05	0.76	0.79	0.79	0.76	0.57	0.34	0.23	6.84	Note 1
Monthly Ave Pan Evap	in.	0	0	0	0	8.22	9.71	11.08	9.80	6.82	4.62	0	0	50.25	Note 2
Monthly Ave Adjust Pan Evap	in.	0	0	0	0	4.60	5.44	6.20	5.49	3.82	2.59	0	0	28.14	Note 2
Mean Monthly Rel. Humidity (Morning)	%	68	70	73	75	77	75	68	66	68	67	69	68	70	Note 3
Mean Monthly Rel. Humidity (Afternoon)	%	60	57	48	41	39	32	26	24	30	40	56	62	43	Note 3
Average Wind Speed	mph	15.7	15.0	14.7	14.5	13.4	12.9	11.4	11.0	11.9	13.4	14.1	15.3	14	Note 4
Average Min Dry Bulb Temp	F	7.3	10.5	17.8	26	34.2	42.3	49	47.1	38.5	28.6	17.1	9.4	27	Note 5
Average Max Dry Bulb Temp	F	27.9	32.7	41.2	53.7	64.6	75.8	83.9	81.5	72.2	59.0	41.0	29.9	55	Note 5
Mean Monthly Wet Bulb Temp	F	21	23	30	36	45	52	56	54	47	35	28	22	37	Note 6
Production Rate	bwpd	153	153	153	153	153	153	153	153	153	153	153	153	153	Note 7
Precipitation Rate	bwpd	17	18	25	48	70	52	53	53	52	38	23	15	39	
Total Inflow	bwpd	169	170	177	200	223	205	205	205	205	191	176	168		
Solar Evaporation Rate	bwpd	-	-	-	-	307	375	414	366	263	173	-	-		Note 2 & 8
Difference	**bwpd**	**169**	**170**	**177**	**200**	**(84)**	**(170)**	**(209)**	**(161)**	**(58)**	**18**	**176**	**168**		
Accumulated in 1 pond with Spray Evaporators	**acre-ft**	**2.716**	**3.330**	**4.039**	**4.813**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.072**	**0.753**	**1.424**	**2.039**	From Year 19
Mass of NaCl in Pond (30,000 mg/l feed)	**mg**	**1.203E+13**	**1.205E+13**	**1.207E+13**	**1.209E+13**	**1.211E+13**	**1.214E+13**	**1.216E+13**	**1.218E+13**	**1.220E+13**	**1.223E+13**	**1.225E+13**	**1.227E+13**	**1.200E+13**	From Year 19
Concentration of NaCl in pond	**mg/l**	**3590655.852**	**2932655.188**	**2422681.493**	**2036652.309**	**solids**	**solids**	**solids**	**solids**	**solids**	**137522983.486**	**13186274.544**	**6984309.859**		
Volume of Precipitate	**liters**	**5455542.161**	**5455543.356**	**5455544.315**	**5455545.096**	**5608553.400**	**5618665.838**	**5629115.358**	**5639564.878**	**5649677.316**	**5660126.836**	**5670239.274**	**5680688.794**	**5455540.661**	From Year 19
Spray Efficiency	% Evap/Pump	0.0%	0.0%	0.0%	0.0%	36.4%	38.3%	39.9%	38.5%	34.3%	36.5%	0.0%	0.0%		Note 14
Required Pump Capacity	**bwpd**	0.0	0.0	0.0	0.0	**(232)**	**(443)**	**(523)**	**(418)**	**(170)**	**49**	0.0	0.0		Note 15
Humidity Ratio (Morning)	lbs H2O /k-lbs Air	6.9	8.4	12.6	19.1	28.4	38.0	44.5	40.2	29.7	19.3	11.5	7.7		Note 3, 5, 9
Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	16.7	19.7	23.3	31.9	44.9	54.1	57.3	48.9	44.8	37.7	26.9	18.9		Note 4, 5, 9
Saturated Humidity Ratio (Morning)	lbs H2O /k-lbs Air	10.2	12.0	17.2	25.5	36.9	50.9	65.8	61.2	43.8	28.8	16.6	11.4		
Saturated Humidity Ratio (Afternoon)	lbs H2O /k-lbs Air	27.9	34.7	48.7	78.5	117.0	173.6	229.1	211.2	153.1	95.5	48.3	30.6		
Atmospheric Capacity (Morning)	lbs H2O /k-lbs Air	3.3	3.6	4.7	6.4	8.5	12.8	21.3	21.0	14.1	9.6	5.2	3.6		
Atmospheric Capacity (Afternoon)	lbs H2O /k-lbs Air	11.2	15.0	25.5	46.7	72.1	119.5	171.8	162.3	108.3	57.8	21.4	11.7		
Air Density (Morning)	lb/ft3	0.061	0.060	0.059	0.058	0.057	0.056	0.056	0.056	0.057	0.058	0.059	0.060		Note 5, 9, 11
Air Density (Afternoon)	lb/ft3	0.058	0.058	0.057	0.055	0.054	0.053	0.052	0.052	0.053	0.055	0.057	0.058		Note 5, 9, 11
Air Mass Flow (Morning)	lb/hr	906,316	827,223	666,156	547,464	(173,227)	(232,050)	(171,841)	(134,153)	(72,361)	33,068	596,290	808,308		
Air Mass Flow (Afternoon)	lb/hr	264,793	198,984	121,970	75,147	(20,521)	(24,904)	(21,284)	(17,365)	(9,430)	5,466	144,137	251,771		
Required Wind Velocity (Morning)	**mph**	**0.4**	**0.4**	**0.3**	**0.2**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.1)**	**(0.0)**	**0.0**	**0.3**	**0.4**		
Required Wind Velocity (Afternoon)	**mph**	**0.1**	**0.1**	**0.1**	**0.0**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**(0.0)**	**0.0**	**0.1**	**0.1**		
Check Required Wind Velocity versus Average						Okay	Okay	Okay	Okay	Okay	Okay				

Notes

1. Western Regional Climatic Center (http://www.wrcc.dri.edu/summary/Climsmwy.html) for Wamsutter, WY
2. Pan evaporation data to more closely estimate the evaporation from naturally existing features like a shallow lake requires an adjustment factor of
Pan evaporation data from Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Green River, WY
3. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
4. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Rawlins, WY Airport
5. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Wamsutter, WY
6. Western Regional Climatic Center (http://www.wrcc.dri.edu/CLIMATEDATA.html) for Casper, WY
7. Production Rate based on discussions with Pinnacle Gas Resources (24 wells total) with 0.99743 decline factor
8. 300*475
9. Altitude (FAMSL)
10. Assumed Height of Water Spray
11. Molecular Weight of Air
12. WaterDensity
13. Weight Average mass transfer between afternoon and morning
14. Spray Efficiency based SMI Super Polecat Evaporator Efficiency as a function of Pan Evaporation Data
15. **Sprayers are turned on for 1 month**
16. Assumed hours per day for evaporation

0.70 Correction Factor

0.80 Salinity Factor

4.6 acre-ft of solids accumulated in pond after 20 years
approximately 2.5 feet deep in typical pond design

3.20 acres
6,500 ft
15.0 ft
28.96 lb/lbmol
62.4 lb/cf
50% Afternoon

475.0 Side Dimension (ft)
10.5 Atmospheric Pressure

or 5 hours/day at Afternoon Conditions

49 bpd

or 1 gpm

10 hrs/day