U.S. Department of the Interior
Bureau of Land Management
Wyoming State Office

Rawlins Field Office August 2004

ENVIRONMENTAL ASSESSMENT for the Scotty Lake Coalbed Natural Gas Pilot Project, Sweetwater County, Wyoming

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-04/031 + 1310

WY-030-04-EA-359

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

In Reply Refer To:
1790

August 6, 2004

Re: Environmental Assessment for the Scotty Lake Coalbed Natural Gas Pilot Project

Dear Reader:

This is to inform you of the availability of the Scotty Lake Coalbed Natural Gas Pilot Project Environmental Assessment (EA) at the Wyoming Bureau of Land Management's (BLM) website:

www.wy.blm.gov/rfo/nepa.htm

The Scotty Lake pilot project is an exploratory coalbed natural gas (CBNG) project located in Sweetwater County, Wyoming, approximately 45 miles northwest of Wamsutter, Wyoming. The project is within the existing Scotty Lake CBNG Exploratory Unit and lies primarily within the jurisdictional boundaries of the Rawlins Field Office with a small portion lying within the Lander Field Office boundaries. In order to satisfy the requirements of the National Environmental Policy Act, this EA was prepared to analyze impacts associated with the exploratory drilling of coal formations in the project area.

It is expected that this EA can be viewed at our website beginning August 6, 2004. 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 7, 2004.

Comments may be submitted via regular mail to:

John Ahlbrandt, 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 Scotty Lake Pilot 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 John Ahlbrandt, Project Manager, at the Rawlins address or phone (307) 328-4223.

Sincerely,

Field Manager

ENVIRONMENTAL ASSESSMENT FOR THE SCOTTY LAKE COALBED NATURAL GAS PILOT PROJECT, SWEETWATER COUNTY, WYOMING

Prepared for

Bureau of Land Management
Rawlins Field Office
Rawlins, Wyoming

This Environmental Assessment was prepared by Anderson Environmental Consulting, an independent environmental consulting firm, with the guidance, participation, and independent evaluation of the Bureau of Land Management (BLM). The BLM, in accordance with Federal Regulation 40 CFR 1506.5 (a) and (b), is in agreement with the findings of the analysis and approves and takes responsibility for the scope and content of this document.

August 2004

TABLE OF CONTENTS

Document Section **Page**

TABLE OF CONTENTS - Continued

Document Section **Page**

TABLE OF CONTENTS - Continued

Document Section **Page**

TABLE OF CONTENTS - Continued

Document Section **Page**

TABLE OF CONTENTS - Continued

LIST OF TABLES

LIST OF TABLES - Continued

LIST OF FIGURES

1.0 PURPOSE OF AND NEED FOR ACTION

1.1 INTRODUCTION

Hudson Group, LLC (Hudson) has notified the Rawlins Field Office (RFO), Bureau of Land Management (BLM) of their proposal for a coalbed natural gas (CBNG) pilot project within the proposed Scotty Lake CBNG Exploratory Unit located within the administrative boundaries of both the Rawlins and Lander Field Offices, BLM. The proposed pilot project would encompass approximately 2,880 acres of federal surface and mineral estate within the Scotty Lake CBNG Exploratory Unit in Sweetwater County, Wyoming (see Figure #1.1) and would involve the drilling of up to eighteen CBNG wells in three phases over a period of three years.

These wells would be drilled to test the potential of coals within the Fort Union Formation for commercial natural gas production at depths of up to 5,000 feet. Information gathered from the drilling of these pilot wells would ultimately be used to determine if additional CBNG exploration and development is warranted within the Scotty Lake CBNG Exploratory Unit. National mineral leasing policies and the regulations by which they are enforced recognize the statutory right of lease holders to explore for and develop federal mineral resources in order to meet continuing national needs and economic demands as long as undue and unnecessary environmental degradation is not incurred.

There are currently three producing CBNG wells in the project area consisting of previously abandoned well bores which were re-entered by Hudson in 2002 and successfully completed in the Fort Union Formation. Additional exploration proposed in conjunction with the Scotty Lake CBNG Pilot Project would generally consist of the following component activities:

- construction of up to 18 additional well locations within the Scotty Lake CBNG Exploratory Unit;

- construction of approximately 26,579 feet (5.03 miles) of access road necessary to provide access to the pilot well locations proposed by Hudson;

- installation of approximately 43,342 feet (8.21 miles) of buried natural gas and 22,597 feet (4.27 miles) of buried produced water pipelines for the gathering and transportation of gas and water produced from wells within the project area to sales (gas) and disposal (water) facilities;

- installation of processing and production facilities, and the routine operation/maintenance of commercially productive wells within the field;

- expansion of existing water disposal facilities to facilitate the surface discharge of water produced from the pilot wells under pre-existing National Pollutant Discharge Elimination System (NPDES) permits issued by the Wyoming Department of Environmental Quality (WDEQ); and

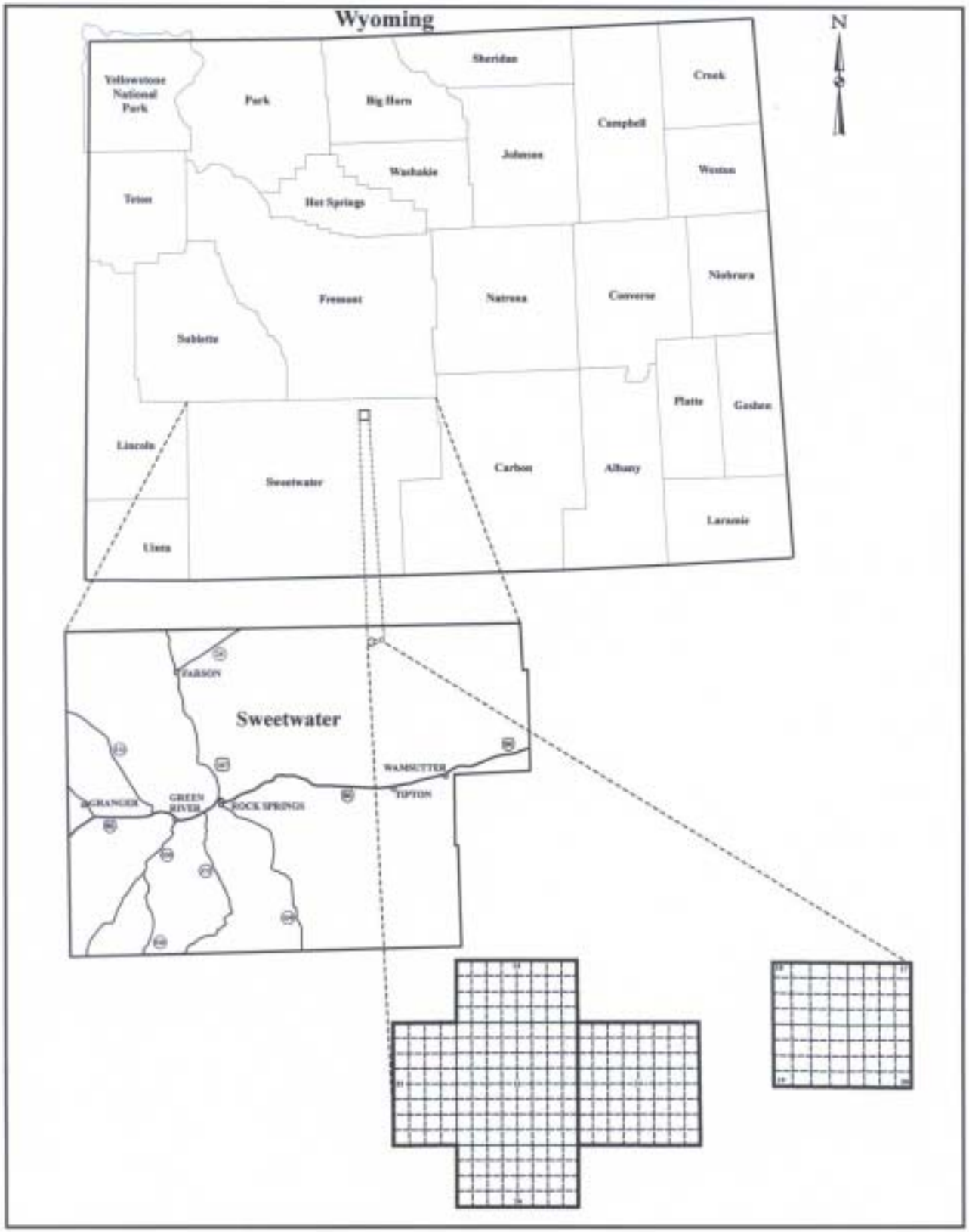


Figure 1.1: General Vicinity Map

- abandonment and reclamation of individual well locations and associated facilities as wells are determined to be commercially non-productive.

These activities are hereafter referred to as the Proposed Action. Those lands potentially affected by implementation of the proposed action are defined as the "project area" and the boundaries of this project area are shown on Figure 1.2.

Through interdisciplinary analysis and review, consideration of reasonable alternatives, and public participation, this EA will serve as a vehicle for:

- determining the significance of environmental impacts associated with the Proposed Action and alternatives;

- assisting in the decision-making process;

- deciding whether an Environmental Impact Statement (EIS) is necessary; and,

- identifying and developing appropriate mitigation measures to minimize the environmental impacts of the Proposed Action and alternatives.

1.2 PURPOSE AND NEED FOR THE PROPOSED ACTION

The development of federal oil and gas leases is an integral part of the BLM oil and gas leasing program under the authority of the *Mineral Leasing Act* (MLA) of 1920 as amended (30 U.S.C. 181, *et seq*), the *Federal Land Policy and Management Act* (FLPMA) of 1976 (P.L. 94-579), the *Federal Onshore Oil and Gas Royalty Management Act* (FOOGRMA) of 1982 (30 U.S.C. 1701, *et seq*), and the *Federal Onshore Oil and Gas Leasing Reform Act* (FOOGLRA) of 1987 (43 CFR Part 3100). The BLM's oil and gas leasing program is intended to encourage the development of domestic oil and gas reserves, thereby reducing national dependence upon foreign energy supplies. Furthermore, exploration and production of natural gas, including methane gas from coal-bearing formations, is in accordance with the President's National Energy Policy as outlined in Executive Order (EO) 13212.

1.3 CONFORMANCE WITH EXISTING LAND MANAGEMENT PLANS

The Scotty Lake Coalbed Natural Gas Pilot Project (SLPP), as proposed by Hudson, would be consistent with management direction contained in:

- the Record of Decision (ROD) for BLM's Great Divide Resource Area *Resource Management Plan* dated November 8, 1990 (BLM 1990); and

- the Record of Decision (ROD) for BLM's Lander Resource Area *Resource Management Plan* dated June 6, 1987 (BLM 1987).

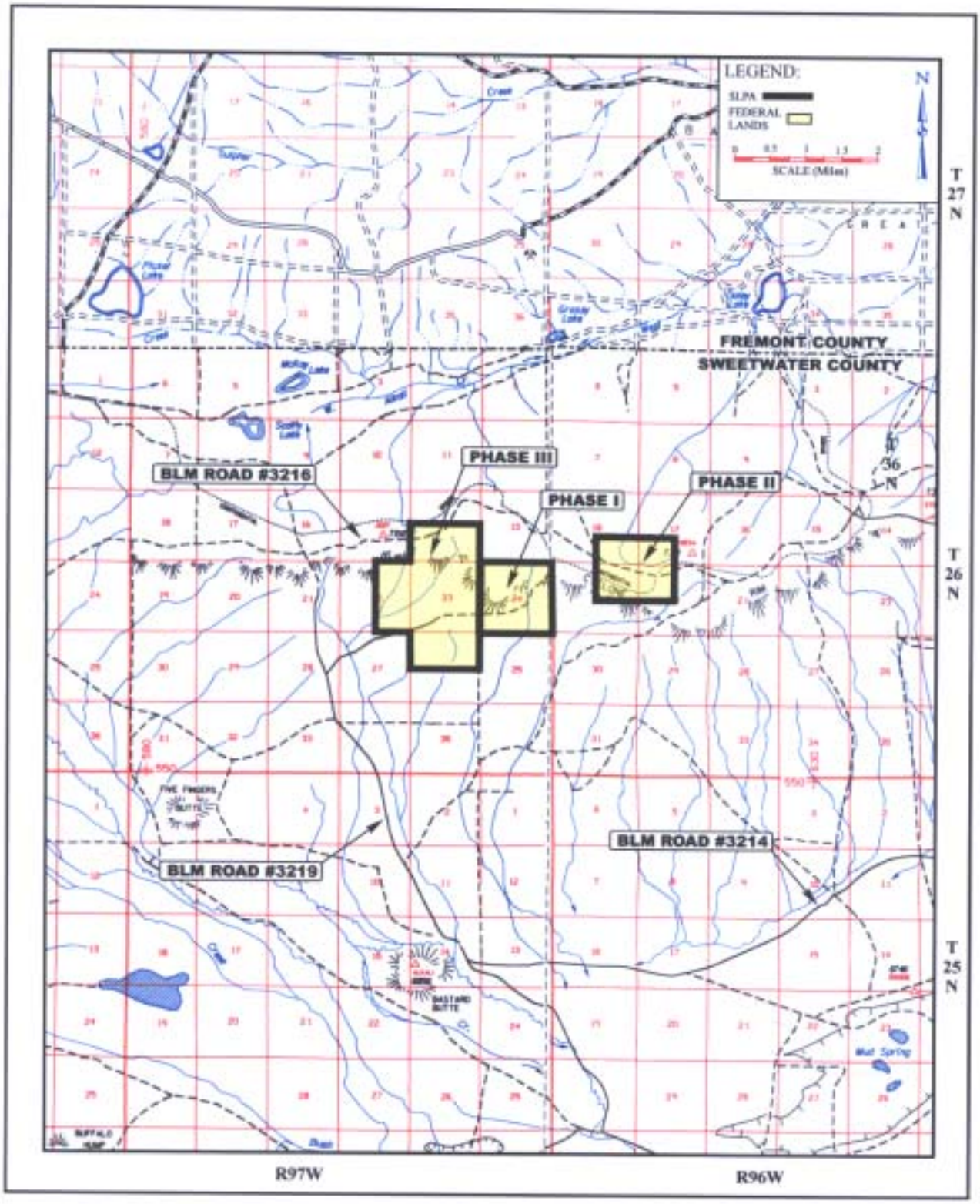


Figure 1.2: Small Scale Map Showing the Proposed Scotty Lake CBNG Pilot Project Area

Furthermore, all operations proposed by Hudson would be conducted in full compliance with the terms and conditions of the federal leases involved in the Proposed Action or project alternatives, applicable Onshore Oil and Gas Orders, 43 CFR Part 2800 regarding right-of-way grants, and also with oil and gas leasing regulations as contained in 43 CFR Part 3100, specifically with subpart 3162 concerning Requirements for Operating Rights, Owners and Operators.

1.4 AUTHORIZING ACTIONS AND RELATIONSHIP TO STATUTES AND REGULATIONS, OR OTHER PLANS

The proposed project is in conformance with the State of Wyoming Land Use Plan (Wyoming State Land Commission 1979) and would comply with all relevant federal, state, and local laws and regulations. Please refer to Appendix A for a discussion of primary federal, state, and local permitting requirements.

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

1.5 LAND AND RESOURCE MANAGEMENT ISSSUES AND CONCERNS

In accordance with NEPA and the CEQ regulations contained in 40 CFR 1501.7, an open process has been employed for the determination and scope of issues to be addressed in this environmental document. In compliance with this procedural requirement, the RFO released a scoping notice on March 17, 2004 in order to identify the significant issues related to the SLCBNGPP proposal. Ten comment letters were received in response to project scoping which led to the identification of the following land and resource management issues and concerns potentially associated with the Proposed Action:

- Acquisition of appropriate permits
- Conformance with LUP
- Control of invasive, non-native species (weeds)
- Cumulative impacts
- Effects of erosion and sedimentation
- Geologic Hazards (earthquakes)
- Habitat fragmentation
- Impacts to air quality
- Impacts to aquifer being produced including water quality and recharge of aquifer
- Impacts of fences and roads on migratory antelope herd
- Impacts to greater sage grouse
- Impacts to livestock grazing operations
- Impacts to migratory birds and compliance with the Migratory Bird Treaty Act
- Impacts of noise
- Impacts to social/economic values
- Impacts to soils from construction of roads, well pads and buried pipelines
- Impacts of surface discharge on soils and surface water quality
- Impacts on wetlands and riparian areas

- ∉ Potential for impacts to biological soil crusts
- ∉ Potential for depletion of Colorado and/or Platte River water
- ∉ Potential effects on small and big game species
- ∉ Potential for migration of methane
- ∉ Potential for underground (coal seam) fires
- ∉ Protection of special status wildlife and plant species including endangered, threatened, candidate, proposed and BLM sensitive species
- ∉ Reclamation
- ∉ Risk from earthquakes
- ∉ Risk to ground water from hydraulic fracturing
- ∉ Use of alternative technologies, including directional drilling
- ∉ Use of hazardous/toxic materials in drilling/completion operations

Certain issues identified in conjunction with project scoping were determined not to be "significant issues related to the Proposed Action" (40 CFR 1501.7) because they are not potentially affected or impacted by the proposal. Those issues brought forth during public scoping that are not considered in depth in this document and the reasons for eliminating that particular issue from consideration in this analysis are enumerated in Appendix B.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

Hudson Group, LLC (the Operator) has proposed a coalbed natural gas pilot project within the Scotty Lake CBNG Exploratory Unit consisting of the drilling, completion, and testing of up to 18 CBNG wells within the 2,880 acre pilot project area (see Figure 2.1). These wells would be drilled in three phases over a period of three years. A review of Figure 2.1 will reveal wells proposed in conjunction with the proposed pilot project as follows: Phase I - 4 potential new well locations; Phase II - 6 potential new well locations; and Phase III - 8 potential new well locations.

Although 21 well locations are depicted on Figure 2.1, only 18 total wells will be drilled in conjunction with the SLPP. The ultimate selection of those wells to be drilled during Phase III of the pilot project will be based upon the results of initial drilling and testing operations on wells previously drilled in Phases I and II with consideration given to contractual obligations for operations on leases within the Phase III project area boundary. Table 2.1 lists the wells proposed in conjunction with the SLPP.

Table 2.1

Wells Proposed in Conjunction with the SLPP

Well Name and Number	Legal Location of Well				Federal Lease Number	Project Phase	BLM Field Office
	Quarter	Section	Township	Range			
Scotty Lake Unit # 9	SE¼NW¼	24	26 North	97 West	WYW-14104A	I	Rawlins
Scotty Lake Unit #10	SE¼NE¼	24	26 North	97 West	WYW-14104A	I	Rawlins
Scotty Lake Unit #11	SE¼SE¼	24	26 North	97 West	WYW-14104A	I	Rawlins
Scotty Lake Unit #12	SE¼SW¼	24	26 North	97 West	WYW-14104A	I	Rawlins
Scotty Lake Unit # 7	NE¼NE¼	19	26 North	96 West	WYW-52013	II	Rawlins
Scotty Lake Unit #22	C SE¼	18	26 North	96 West	WYW-52012	II	Lander
Scotty Lake Unit #23	NW¼NW¼	20	26 North	96 West	WYW-131839	II	Rawlins
Scotty Lake Unit #24	C SW¼	17	26 North	96 West	WYW-152174	II	Lander
Scotty Lake Unit #25	NE¼NE¼	19	26 North	96 West	WYW-5201	II	Lander
Scotty Lake Unit # 8	NE¼NW¼	23	26 North	97 West	WYW-147468	III	Rawlins
Scotty Lake Unit #13	NW¼SW¼	14	26 North	97 West	WYW-147467	III	Rawlins
Scotty Lake Unit #14	NE¼NW¼	23	26 North	97 West	WYW-147468	III	Rawlins
Scotty Lake Unit #15	C SW¼	23	26 North	97 West	WYW-147468	III	Rawlins
Scotty Lake Unit #19	SE¼SE¼	22	26 North	97 West	WYW-147467	III	Rawlins
Scotty Lake Unit #20	C NE¼	22	26 North	97 West	WYW-147467	III	Rawlins
Scotty Lake Unit #26	C NE¼	23	26 North	97 West	WYW-147468	III	Rawlins
Scotty Lake Unit #27	C SE¼	14	26 North	97 West	WYW-147467	III	Rawlins
Scotty Lake Unit #28	SE¼SE¼	23	26 North	97 West	WYW-147468	III	Rawlins
Scotty Lake Unit #16 [1]	NE¼NW¼	26	26 North	97 West	WYW-158426	III	Rawlins
Scotty Lake Unit #17 [1]	NW¼NW¼	26	26 North	97 West	WYW-158426	III	Rawlins
Scotty Lake Unit #18 [1]	C NE¼	26	26 North	97 West	WYW-158426	III	Rawlins

[1] Optional wells

This environmental assessment (EA) addresses both the Proposed Action and the No Action alternative. Directional drilling operations were considered for wells proposed in conjunction with the SLPP but this alternative was not analyzed in detail (please refer to Section 2.5.2 for additional information in this regard).

- **Proposed Action.** This alternative would allow the Operator to construct 18 additional well locations and install related production (ancillary) facilities within the Scotty Lake Coalbed Natural Gas Pilot Project Area (SLPA). Approximately 106.05 (+/-) acres of initial (short-term) surface disturbance would occur in conjunction with the project proposal.

- **No Action Alternative.** This alternative implies that both ongoing and previously approved natural gas exploration, development, and production activities would be allowed to continue by the BLM in the overall project area, but additional activity would not be allowed. Future Applications for Permit to Drill (APD's) and Right-of-Way (ROW) applications would be evaluated by the BLM on a case-by-case basis through site specific environmental analyses in accordance with management direction contained in both the Great Divide and Lander Resource Area approved RMP's (BLM 1990, BLM 1987).

2.2 PROPOSED ACTION

The proposed action entails the initiation of a pilot project in the Scotty Lake CBNG Exploratory Unit designed to test the productive potential of coals in the Fort Union Formation for commercial CBNG production. Surface disturbing activities associated with Phase I of the proposed pilot project would commence in late summer of 2004 and would continue over a period of approximately 3 years, with Phases II and III of the proposed pilot project initiated in the summer of each successive year following 2004. Should commercial CBNG production be established in conjunction with this pilot project, the productive life of these wells is estimated to be somewhere between 15 and 25 years.

The statewide spacing pattern established by the Wyoming Oil and Gas Conservation Commission (WOGCC) for oil and natural gas wells in this area of Wyoming is 40 acres or 16 wells per 640-acre section. However, the operator is currently proposing to drill those wells proposed in conjunction with the SLPP on a 160-acre spacing pattern or 4 wells per section, with a fifth well drilled in (or close to) the center of selected sections (which equates approximately 120 acres/well).

Specific components of the proposed pilot project are contained in both the SLPP Plan of Development and Master Field Permit (see Appendix C) and the Water Management Plan (see Appendix D) and which are summarized below. Additional site-specific environmental analyses and resource information would be contained in each individual Application for Permit to Drill (APD) and/or Right-of-Way (ROW) application subsequently submitted to the BLM.

2.2.1 Well Pad Construction

As indicated in Section 1.1, the 18 wells proposed in conjunction with the SLPP are all situated on surface and mineral estate owned by the United States of America (USA) and administered by the BLM. A typical location layout for CBNG wells as proposed by the Operator is shown on Figure 2.2. Major components of each individual well pad would include:

- a leveled area suitable for placement/support of the drilling rig and related equipment; and

- an earthen reserve pit designed to contain drilling fluids, drilled cuttings, and fluids produced during the drilling operation.

The entire well pad area would be cleared of all vegetation and graded to the required specifications prior to moving in the drilling rig and subsequent commencement of actual drilling operations. Sufficient topsoil to facilitate revegetation would be segregated from subsoil material during construction operations and stockpiled for future reclamation of the disturbed area. The salvaged topsoil would be evenly distributed over those disturbed surfaces subject to reclamation upon termination of drilling and completion operations as part of the reclamation and revegetation program. Topsoil stockpiles would be stabilized with vegetation until used for reclamation purposes.

After the topsoil has been removed, the well pad would be graded to produce a level working platform around the drill hole for support of the rig substructure. The excavated soil material (subsoil) would be utilized in overall pad construction, with the finished well pad graded to allow for positive drainage of natural water (e.g., rain and/or snow melt) away from the drill site.

Generally, each individual well location would be designed so that the amount of soil material excavated (less the stockpiled topsoil) should "balance", thereby eliminating the need to store excess subsoil material(s) in large stockpiles adjacent to the well location until site reclamation. Balancing of the excavated soil material would apply to the leveled area of the pad and would not include any materials excavated from the reserve pit below the finished pad grade. Subsoil excavated from the reserve pit would be stockpiled directly adjacent to the reserve pit and would be utilized to backfill the pit once operations were completed and the pit was reclaimed.

The leveled area required for initial drilling and completion operations for each individual well would equal approximately 1.16 acres in size (including the reserve pit). Likewise, the area(s) required for cut/fill slopes and topsoil/subsoil stockpiles associated with the proposed pad design would average approximately 0.67 acres per well pad (based upon a 25-foot buffer zone surrounding the entire well pad to accommodate cut/fill slopes and topsoil/subsoil stockpiles). Overall surface disturbance associated with the construction of individual well pads would average approximately 1.83 acres per well location.

Erosion control would be maintained through prompt revegetation and by constructing surface water drainage controls such as berms and diversion ditches as necessary at each individual well location.

2.2.2 Access Roads

Exploration and development activities to date within and/or directly adjacent to the SLPA have resulted in the construction of approximately 26,579 feet (5.03 miles) of new access road therein.

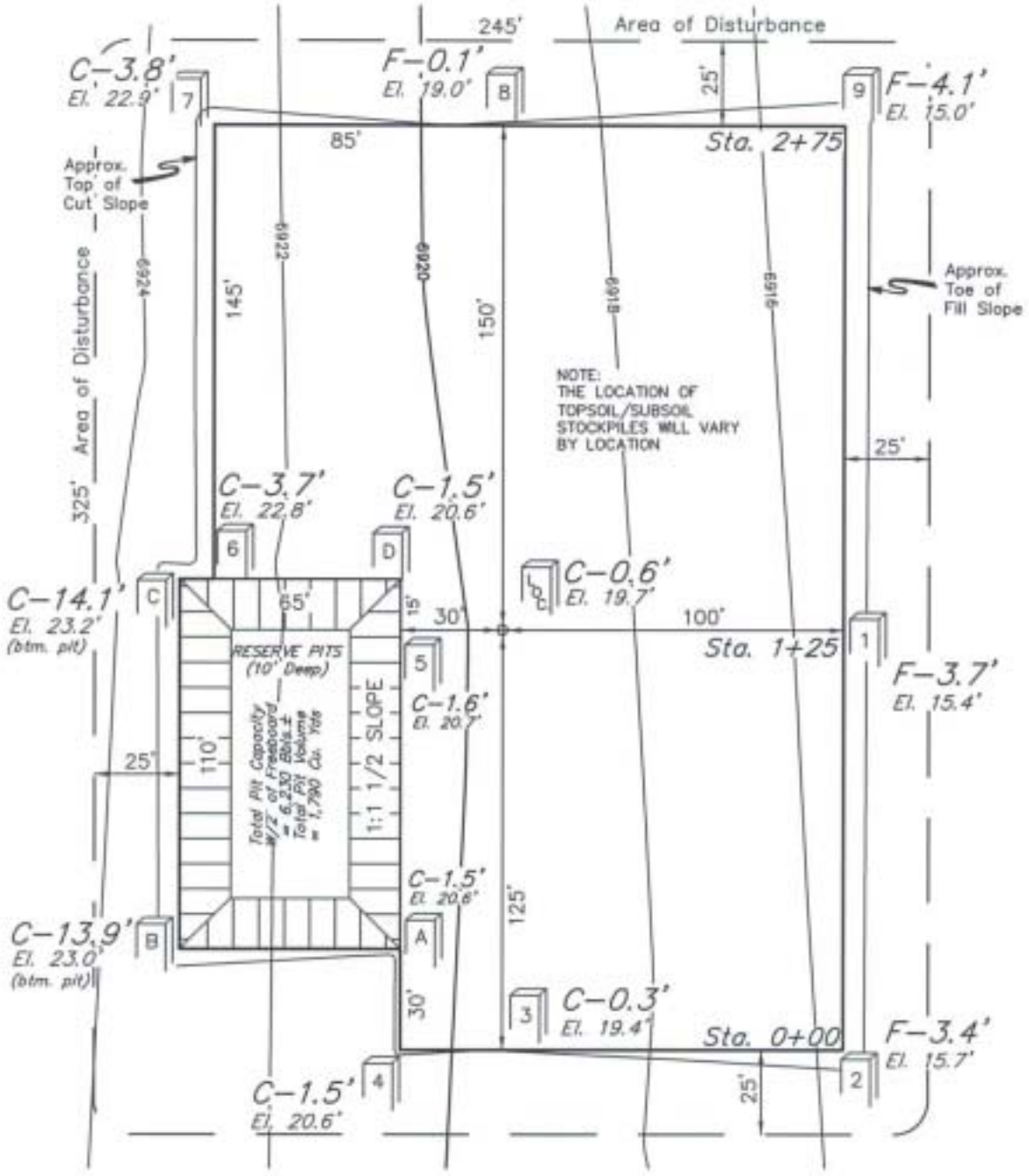


Figure 2.2: Typical Location Layout

Generally speaking, previous exploration activities within the SLPA have resulted in the construction of a road system that should be more than adequate to serve the needs of the Operator for arterial traffic into and within the overall project area.

New road construction associated with additional exploration and development in the project area would generally average approximately 1,477 feet (0.28 miles) of resource road per well location and would utilize existing two-track trails in the project area to the extent possible or feasible. Considering a total disturbed right-of-way (ROW) width which did not exceed forty (40) feet, this new road construction would result in additional surface disturbance equal to approximately 24.41 acres (or approximately 1.36 acres per well location). Whenever possible, access roads would be designed and constructed to disturb less than the 40 foot ROW width referenced above, as long as traffic and safety concerns could be satisfied. The existing access roads would be maintained as necessary to accommodate appropriate year-round traffic and prevent unnecessary erosion. These access roads would be constructed in accordance with roading guidelines established for oil & gas exploration and development activities as referenced 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 federal lands (BLM 1985, 1991). Please refer to the SLPP Plan of Development and Master Field Permit (Appendix C) for additional information in this regard.

2.2.3 Drilling Operations

To facilitate the drilling of these proposed wells, the Operator would utilize a single rotary drilling rig rated for drilling operations to depths of approximately 5,000 feet. Rig transport and on-site assembly would be completed in approximately 4 days, involve approximately 15 people per well location, and require approximately 60 round trips per well location. Generally speaking, drilling operations would be expected to occur on a seasonal basis during the summer and early fall periods when weather conditions are generally more favorable for field operations in this area of Wyoming.

Drilling operations would require approximately 7 days per well location from the time the drilling rig is moved onto the location (move in-rig up) until such time as drilling operations have been completed and the rig is moved off of the location (rig down-move out).

After completion of the drilling phase of operations and prior to rig release, the well would be logged and production casing would be set to total depth and cemented into place. Setting and cementing the production casing string would serve to maintain hole integrity while isolating those formations downhole which could potentially contain either fresh water or hydrocarbons. Proper cementing of the production casing string would reduce or eliminate the possibility for fluid communication between hydrocarbon bearing zones and/or near surface fresh water aquifers.

Human waste generated at well locations would be collected in standard portable chemical toilets or service trailers and regularly transported off-site to a state-approved wastewater treatment site. Each well location would be provided with one or more such facilities during drilling and completion operations. A septic system would not be required. Non-human waste would be collected in enclosed containers and disposed of at a state-approved solid waste disposal facility.

2.2.3.1 Drilling Fluids System

The actual drilling operation would utilize a water-based mud system with additives for lost circulation, hole stabilization, and/or conditioning prior to logging and/or running casing. Basically, this system involves drilling with water and utilizing non-hazardous additives to minimize downhole problems. On the average, the Operator would utilize approximately 1.5 barrels of water (42 gallons/barrel) per foot of hole drilled. Fresh water for use in drilling operations would be obtained either from the Pickett Lake Unit #1 producing CBNG well located in the NW¼SE¼ of Section 24, Township 26 North, Range 97 West or from an existing storage reservoir constructed by the Operator in the NW¼SE¼ of Section 24, Township 26 North, Range 97 West (see Appendix C). No water would be used from either the North Platte River or the Colorado River or their tributaries for use in construction, drilling, cementing, or completion operations within the SLPA.

Water to be utilized in drilling operations would be contained in a "reserve pit" constructed on each location (refer to Figure 2.2) and would serve as the base medium for the drilling mud system. The reserve pit would be fenced on the three non-working sides during drilling, with the fourth side of the pit fenced immediately following removal of the drilling rig in order to protect wildlife and livestock. Fencing would be installed in accordance with guidelines contained in the joint BLM/USFS publication: *Surface Operating Standards for Oil and Gas Exploration and Development*, Third Edition and would be maintained until the reserve pit has been backfilled (see Appendix C).

Fluids that accumulate in the reserve pit during drilling and completion operations would be contained therein and would be allowed to evaporate prior to the reclamation of said pit. Once free of liquids, the reserve pit would be reclaimed by backfilling the pit with the sub-soil (spoil) material removed therefrom during construction. Once the pit has been backfilled, a portion of the stockpiled topsoil would be evenly distributed (spread) over the reclaimed area and reseeded in accordance with the specifications of the BLM (see Appendix C).

2.2.3.2 Casing & Cementing Operations

Surface casing would typically be set to a minimum depth of 450 feet and cemented back to the surface on each proposed well (see Appendix C). This would serve to isolate all near surface fresh water aquifers which could occur in the project area. Upon reaching total depth, production casing would be run and cement circulated to a minimum of 200 feet above the top of the shallowest coal in the Fort Union Formation, effectively isolating all geologic formations encountered down hole in compliance with *Onshore Oil and Gas Order Number 2*. This procedure would eliminate any possibility for fluid communication between potential hydrocarbon bearing zones and any near-surface fresh water aquifers which may be encountered downhole.

2.2.4 Completion and Evaluation Operations

Once the well has been drilled and cased, a completion (work-over) unit is moved onto the well location and completion operations are commenced. These completion operations generally require an average of 3 to 5 days per well location, consist of cleaning out the well bore with fresh water, pressure testing, and perforating the potentially productive formations downhole.

After the casing has been perforated, production tubing is run and dewatering operations commence. In certain instances, it may be necessary to hydraulically fracture the coals within the Fort Union Formation using fresh (produced) water. Should the initial hydraulic "frac" prove to be unsuccessful, a second "frac" would be performed utilizing a mixture of approximately 1,500 barrels of fresh water and 100,000 to 150,000 pounds of sand which would be pumped down the casing under extreme pressure and forced through the perforations into the formation. As the formation is fractured, the resultant fissures (fractures) are filled with sand which props them open and facilitates the flow of gas/water into the well bore and subsequently to the surface. Upon completion of the frac job, the well would be flowed back to the surface in an attempt to recover as much of the frac fluid as possible and to clean excess sand out of the perforations prior to setting production equipment on location and placing the well on line. All fluids utilized in the completion procedure are captured either in the reserve pit or in test tanks on the well location and ultimately disposed of in strict accordance with Wyoming Department of Environmental Quality (WDEQ) rules and regulations.

Once each well has been completed, a submersible/progressive cavity pump would be set and the evaluation (dewatering) phase of the project would commence. The operator would obtain approval of an Application for Permit to Appropriate Ground Water (form #UW-5) from the Wyoming State Engineer's office (WSEO) prior to beginning the dewatering process. In this regard, we would expect the continuous operations of these wells for a period ranging from approximately 6 months to 2 years in order to obtain a proper evaluation of the Fort Union Formation and subsequently determine the commercial feasibility of CBNG production therefrom. During this initial evaluation phase of operations, these wells could be expected to be on pump continuously twenty-four (24) hours a day. Each "producing" well would be monitored on a daily basis by a single contract pumper to ensure that the wells were functioning properly and that no leaks had occurred in the gas/water gathering system.

Generally speaking, natural gas within the coal is held in place by pressure from water contained in fractures within the coal seam. Mechanical pumping removes this water, lowering the formation pressure, and thus allowing the gas to "desorb" from the coal facies. An evaluation of the actual volume(s) of water removed prior to commencement of desorption, coupled with the resultant desorption rates will be extrapolated to calculate the commercial feasibility of additional exploration and/or development activity within the Scotty Lake CBNG Exploratory Unit and will also be used to refine a prediction of potential well densities required to accomplish economic recovery of the CBNG resource.

As the coal is depressured, desorption will occur and CBNG will commence flowing to the surface. Typically, there is an inverse relationship between water and gas production, with water volumes tending to decrease over time as the water pressure in the coal is lowered, while gas volumes tend to increase as the water is removed from the formation. Eventually, an equilibrium will be reached at which point maximum gas desorption will occur in association with diminished water production. However, this equilibrium can only be maintained as long as the well remains on pump. Should the well be "shut-in" for any period of time, the coal(s) could recharge with water, resulting in a loss of gas production as pressures rebuild.

2.2.5 Production Operations

Production equipment required at each individual well location would typically include the following equipment:

- a small christmas tree at the well head (a series of valves designed to control pressures and regulate flows from the well) with a submersible/progressive cavity pump;
- 50 horsepower (hp) generator powered by natural gas which would power the submersible/progressive cavity pump used to dewater the coal seam;
- a 50 hp screw compressor powered by natural gas; and
- a meter run for measurement of gas volumes produced into the pipeline.

All above ground production facilities installed at each producing well location would be painted a standard environmental color that blends with the surrounding landscape (see Appendix C).

The presence of very small quantities of liquid hydrocarbons (condensate) within the Fort Union Formation may necessitate the installation of tanks at selected well locations where condensate production is encountered. These tanks would be used to contain fluids produced from the well bore, allowing separation of the liquids prior to discharge. The collected condensate would either be introduced into the gas sales pipeline for capture downstream or be trucked to sales upon collection of a sufficient quantity to justify trucking. At this point, liquid hydrocarbon production from the three existing CBNG wells is nominal.

Pipelines would be installed for the transportation of natural gas and water produced from the well bore. Gas would be transported via buried pipeline to a connection with the closest existing line within the project area while the produced water would be transported to a discharge point for surface disposal.

No hydrogen sulfide (H_2S) is known to occur within the Fort Union Formation and none is expected to be encountered during project operations.

Water produced in association with the gas stream is expected to average approximately 700 barrels of water per day (bwpd) per well.

2.2.6 Pipeline Gathering System

Two types of pipelines would be installed as part of the proposed pilot project:

1) gas-gathering pipeline systems consisting of low pressure lines that would collect gas produced at the well head and transport said gas downstream to an existing central production facility (compressor site located in the SW¼NE¼SE¼ of Section 23 in Township 26 North, Range 97 West); and

2) produced water disposal lines.

In those cases where the gas and water lines are traveling in the same direction, both lines would typically be installed (buried) in a common trench. In most cases, however, produced water will be discharged to the surface in relatively close proximity to the well location and may involve a separate pipeline ROW that is divergent from the gas gathering system pipeline ROW.

2.2.6.1 Gas Gathering System

An existing gas gathering system within the project area would be augmented as necessary to transport CBNG produced from wells drilled in association with the SLPP to a pre-existing, compressor facility located approximately in the SW¼NE¼SE¼ of Section 23, Township 26 North, Range 97 West. These pipelines would follow existing and proposed roads within the SLPA to the greatest extent possible. Pipelines installed directly adjacent to existing/proposed access roads within the SLPA would typically require a slightly smaller overall right-of-way (ROW) width of 25 feet as the Operator would be able to utilize the existing access road running surface as a staging area for pipe assembly and installation, as opposed to cross-country lines which would require a ROW width of approximately 50 feet. Industry standard pipeline equipment, materials, techniques, and procedures conforming with all applicable regulatory requirements would be employed during construction, testing, operation, and maintenance of gathering system pipelines in order to ensure the safety and efficiency of all pipelines installed in the SLPA.

As indicated above, pipeline ROWs would generally be located adjacent to existing/proposed roads to the greatest extent possible in order to minimize surface disturbance and maximize construction and gas transport efficiency. Where major excavation is required, sufficient topsoil to facilitate reclamation would be removed from the pipeline ROWs before construction, as determined by the Authorized Officer. Where individual ROWs do not require major excavation, vegetation would be removed to ground level by mechanical treatments including either "brush-beating" or scalping, both of which leave the topsoil intact minimizing disturbance to plant root systems, thereby facilitating vegetative re-establishment. Brush beating or scalping would typically be limited to an area approximately 15 feet in width along the pipeline ROW. All pipeline ROW reclamation would be initiated as soon as practical following disturbance, but would be completed within a maximum of 1 year following completion of pipe installation.

All CBNG pipelines would be tested with either natural gas or water to ensure the integrity of newly constructed lines. This testing would consist of filling pipeline segments with the testing medium and pressurizing the segments to levels exceeding expected operating pressures. If leaks or ruptures occur, they would be repaired and testing would be repeated until successful. Natural gas used for testing would either be returned to the gathering system for sales or would be vented (released) to the surface in accordance with NTL-4A and/or WOGCC Rule 340. Water used in hydrostatic testing would be discharged to the surface in accordance with Wyoming Department of Environmental Quality rules and regulations governing surface water discharges.

Approximately 23,353 feet (4.42 miles) of 2 inch gas pipeline would be required to connect the 18 wells proposed in conjunction with the SLPP to an existing/proposed gas gathering system for transportation to the compressor site located in Section 23. Approximately 4,382 feet of the 2 inch line would be

installed in "cross-country" right-of-ways with the remaining 18,971 feet of pipeline installed directly adjacent to existing/proposed access roads within the SLPA. An additional 19,989 feet (3.79 miles) of 8 inch line would be installed as a gathering system to transport gas collected from individual wells in Phases II and III of the SLPA, with approximately 7,396 feet of the 8 inch line installed in "cross-country" right-of-ways and the remaining 12,592 feet of pipeline installed directly adjacent to existing/proposed access roads within the SLPA. These pipelines would be buried to a depth of approximately 6 feet within the ROW. Reclamation of pipeline right-of-ways (ROWs) would occur as soon as practical following pipe installation. Installation of 43,342 feet of buried pipeline to transport gas produced from the individual wells within the SLPA to the compressor site in Section 23 would result in short-term surface disturbance equal to approximately 31.63 acres (which includes 31,564 feet of pipeline in a 25 foot ROW and 11,778 feet of pipeline in a 50 foot ROW).

Gas delivered to the central compressor facility referenced above would be introduced into an existing gas transmission for transportation to market via a pre-existing connection therewith.

2.2.6.2 Water Discharge Lines

Water produced from each CBNG well would be transported via buried pipeline to a surface discharge point typically located in close proximity to the producing well. These produced water pipelines would generally consist of 3 inch polyethylene pipe buried at a maximum depth of 6 feet. In most cases these pipelines would be installed "cross-country" in order to achieve the most direct route from the well to the discharge point and minimize the amount of surface disturbance associated with pipe installation, as well as minimize the potential for freeze-up during the winter months.

The 22,597 feet (4.28 miles) of water discharge line would typically be installed with a small trencher (ditch witch or backhoe) resulting in a minimum of surface disturbance within the pipeline ROW. As a result, it is anticipated that no ROW preparation (i.e., topsoil salvage or blading) would be required prior to the commencement of actual trenching activities, pipe installation, and subsequent backfilling of the trench. Consequently, surface disturbance associated with the installation of these buried water discharge lines would be primarily limited to the actual trench itself (approximately six inches in width) and the travelway along the ROW route used for trenching activities and pipe staging. Considering a travelway width of 10 feet, short-term surface disturbance associated with the installation of these water discharge lines would result in approximately 5.19 acres of short-term disturbance.

2.2.7 Ancillary Facilities

The Proposed Action would utilize the existing ancillary facility infrastructure within the SLPA to the greatest extent possible for access to proposed well locations, gas gathering, and water disposal.

2.2.8 Transportation and Workforce Requirements

Estimated transportation and workforce requirements for drilling, completion, and evaluation operations on similar CBNG projects have been analyzed for numerous, similarly-sized CBNG projects throughout southwestern Wyoming in recent years. Consequently, the reader is directed to one or more of these documents for additional information in this regard:

- Decision Record, Finding of No Significant Impact and Environmental Assessment for Lower Bush Creek Coal Bed Methane Exploratory Pilot Project. Rock Springs Field Office, Bureau of Land Management. August 2003.

- Environmental Assessment for the Atlantic Rim Interim Drilling Project, Doty Mountain POD, Carbon County, Wyoming. Rawlins Field Office, Bureau of Land Management. October 2003.

- Environmental Assessment for the Atlantic Rim Coalbed Methane Project, Brown Cow POD, Carbon County, Wyoming. Rawlins Field Office, Bureau of Land Management. December 2003.

2.2.9 Water Production and Disposal

The operator has previously obtained approval of a National Pollutant Discharge Elimination System (NPDES) permit (permit #WY0049662) from the Wyoming Department of Environmental Quality (WDEQ) which allows for the surface discharge of water produced from both pre-existing wells as well as those wells proposed in conjunction with the SLPP within the approved parameters of said permit. NPDES Permit #WY0049662 currently allows the operator to discharge 0.81 million gallons of water per day (mgwpd) into Red Creek and ephemeral tributaries thereof. No produced water will be discharged into the West Alkali Creek drainage basin. The operator estimates that water production from wells drilled in conjunction with the SLPP would average approximately 550 barrels of water per day (bwpd) per well, for total water production from all 18 wells equivalent to 9,900 bwpd or 415,800 gallons per day (gpd), which is approximately one-half of the discharge currently approved under NPDES Permit #WY0049662 as amended.

Surface disposal methods that would be utilized in conjunction with the proposed SLPP would include the following or various combinations thereof:

1) Direct discharge of produced water to the surface via a "bubbler" or gravel envelope;

2) discharge into an unlined water retention pit with an overflow outlet; or

3) discharge into an unlined retention pit without an overflow outlet.

The appropriate disposal method would be selected at the time of the on-site inspection for each individual well location and would be included in the approval of each individual Application for Permit to Drill (APD) by BLM as a condition of approval. Please refer to the SLPP Water Management Plan (WMP)(Appendix D) for a full description of these discharge methods and diagrams depicting same.

Surface disturbances associated with direct surface discharge under discharge alternative 1 (above) would typically be minimal as compared to the construction of the water retention pits referenced under discharge alternatives 2 and 3. Water retention pits designed to contain the water produced from individual CBNG wells would typically be approximately 165' X 100' X 12' in size and would result in the long-term (LOP) disturbance of approximately 0.66 acres/pit including a 20' buffer around the perimeter of the retention pit. Installation of these pits would typically be limited to those particular instances where a suitable surface discharge point (ephemeral tributary to Red Creek) was not available

in close proximity to the discharge source. A suitable surface discharge point would be a location approved by the WDEQ that has both a suitable gradient and channel characteristics to allow for discharge to occur without excessive erosion and/or channel form changes such as vertical or lateral movement.

For the purposes of this environmental analysis, calculations of surface disturbance will assume that a water retention pit will be constructed at each of the 18 proposed well locations, which will overstate the surface disturbance associated with this aspect of the SLPP, yet will allow for a simplification of the impact analysis in Chapter 4, while including potential disturbances resulting from installation of bubblers or gravel envelopes under discharge alternative 1. On-site inspections conducted on the wells proposed in conjunction with Phase I of the SLPP did not identify the need for any water retention pits; consequently, the likelihood that numerous retention pits will be required in conjunction with Phases II and III is considered to be unlikely at best.

2.2.10 Hazardous Materials

Hudson Group, LLC has reviewed the EPA's Consolidated List of Chemicals Subject to Reporting Under Title III of the *Superfund Amendments and Reauthorization Act* (SARA) of 1986 (as amended) to identify any hazardous substances proposed for production, use, storage, transport, or disposal by this project, as well as the EPA's List of Extremely Hazardous Substances as defined in 40 CFR 355 (as amended) and has determined that none of the materials listed as hazardous and/or extremely hazardous would be used or generated by this project.

2.2.11 Abandonment

In the event that wells within the SLPA become commercially non-productive, the Operator would obtain the necessary authorization(s) from the appropriate regulatory agencies to abandon the non-productive well(s). All above ground facilities would be removed, the well bore would be physically plugged with cement as directed, and both the abandoned road and well location reclaimed according to BLM recommendations.

2.2.12 Reclamation

All disturbed surfaces would be reclaimed as soon as possible following the initial disturbance. This reclamation would consist primarily of backfilling the reserve pit, leveling and recontouring of disturbed areas, redistribution of stockpiled topsoil over the disturbed areas, installation of erosion control measures as appropriate, and reseeding as recommended by the BLM.

Reclamation of the reserve pit would be accomplished when the pit is no longer required for completion and/or testing operations. Free standing water in the pit would be allowed to evaporate through natural means to the greatest extent possible prior to the commencement of backfilling; however, in some instances the pit contents may be mixed with suitable solid materials and the pit backfilled, as approved by the BLM. Prior to the mixing of reserve pit contents with approved stabilizing materials, the contents of the reserve pit would be tested for total petroleum hydrocarbons (TPH) and toxicity characteristics leaching procedure (TCLP) constituents, and appropriate closure permits would be obtained from the WOGCC and/or WDEQ. If necessary, reserve pit contents would be removed and disposed of at an

approved disposal facility in a manner commensurate with all relevant county, state, and federal regulations and stipulations pertaining thereto.

Reclamation of the well location would be accomplished within a maximum of 2 years following the termination of drilling and completion operations (in the case of productive wells) or well abandonment (in the case of newly drilled dry holes).

2.2.12.1 Producing Well Location

During the production/testing phase of operations, the unneeded (non-working) area(s) of the well pad would be reclaimed as soon as possible after conclusion of drilling and completion operations, weather permitting. Reclamation would consist of backfilling the reserve pit, reducing the cut/fill slopes by pushing the fill material back up into the cut, redistributing the stockpiled topsoil over these reclaimed areas, installing erosion control measures as appropriate, and reseeding the reclaimed areas as recommended by the BLM. Restoration of these previously disturbed areas would result in the reclamation of approximately 60% of each individual well pad, or 1.10 acres/well location. As indicated above, this reclamation would be performed within 2 years of well completion and would reduce the long-term or life of project (LOP) disturbance resulting from well pad construction under this proposal to 13.14 acres.

2.2.12.2 Access Roads

A minimum of 6 inches of topsoil would be stripped from the access road corridor (new construction portions only) prior to the commencement of construction activities and would be redistributed on the "outslope" areas of the borrow ditch after completion of road construction activities. These borrow ditch areas would then be reseeded as soon as practical thereafter. Likewise, any surface disturbances on/along the "outslope" areas of existing roads within the project area resulting from implementation of the Proposed Action would be reseeded as well.

Restoration of those areas disturbed in conjunction with right-of-way clearing, topsoil salvage, and subsequent road construction would typically result in the reclamation of approximately 30% of the disturbed road ROW (for a road having a 16-foot unsurfaced running surface), not including any provision for the revegetation of the outslope portion of the borrow ditch. As indicated above, this reclamation would be performed within 2 years of well completion and would reduce the long-term or LOP disturbance resulting from access road construction under this proposal to approximately 17.09 acres.

2.2.12.3 Pipelines

A minimum of 6 inches of topsoil would be stripped from the gas pipeline ROWs prior to the commencement of construction activities. Once trenching and pipe installation operations have been completed, the trench would be backfilled with the subsoil materials previously removed therefrom, the trench will be compacted to avoid settling, and the stockpiled topsoil redistributed over the disturbed ROW. The gas pipeline ROW would then be reseeded as soon as practical thereafter.

Considering the negligible amount of surface disturbance associated with the installation of water discharge lines, wholesale reclamation would not be required unless blading and shaping of the ROW (on steep slopes) were required resulting in surface disturbance comparable to disturbances associated with gas line installation. In these instances, these water discharge ROWs would be reclaimed and reseeded as above.

Considering that all disturbances associated with pipeline construction would be reclaimed and reseeded as soon as practical following pipe installation, these disturbance are considered as short-term and are not included in the LOP cumulative disturbance totals.

2.2.12.4 Abandoned Well Location

Upon final abandonment, all existing surface facilities would be removed from the well location as stated in Section 2.2.9. The access road and remaining "work" areas of the well location would be scarified and recontoured, erosion control measures would be installed as necessary, and all recontoured (disturbed) areas would be reseeded as recommended by the BLM.

2.3 APPLICANT-COMMITTED ENVIRONMENTAL PROTECTION MEASURES

The following applicant-committed practices, design features, and procedures would be implemented by the Operator in order to minimize impacts to the environment. Each applicant-committed practice is listed only once, under the first resource where it applies; however, many practices apply to several resources and would reduce impacts to each. These practices, design features, and/or procedures may be waived when deemed inappropriate by the BLM if a thorough analysis determines that the resource(s) for which the measure was developed would not be impacted. Additional site-specific mitigation measures would be identified during the APD and ROW application review processes.

2.3.1 Preconstruction Planning and Design Measures

1. The Operator and BLM would conduct on-site inspections of each proposed disturbance site (e.g., well sites, roads, pipelines, etc.) to develop site-specific recommendations and mitigation measures.

2. Roads required for the proposed project would be constructed in accordance with BLM Manual 9113 standards (BLM 1985, 1991).

3. The Operator would prepare and submit individual drill site design plans to the BLM for approval prior to initiation of construction. These plans would show the layout of the well location over the existing topography, dimensions of the well pad, volumes and cross-sections of proposed cuts and/or fills, location and dimensions of reserve and flare pits, and access road design.

4. Prior to construction, the Operator would submit an addendum to the Plan of Development and Master Field Permit (Appendix C) which contains site-specific information concerning each proposed well site, pipeline segment, and access road project. These site-specific addendums would enumerate the measures and techniques to be used for erosion control, revegetation, and restoration, and would provide specific detail on project administration, time frames, responsible parties, objectives, characteristics of site predisturbance conditions, topsoil removal, storage and handling, runoff and erosion control, seed bed preparation, recommended seed mixtures, seed application, fertilization, mulching, site protection, weed and livestock or other herbivore control, and monitoring and maintenance.

5. The Operator would slope-stake construction activities on steep and/or unstable slopes when required by the BLM, and would receive approval by the BLM prior to initiating construction.

6. The Operator would identify aggregate and other road material sources for use in drill site and road construction. The appropriate surface management agency would approve these sources, including timing for extraction, prior to use.

2.3.2 Air Quality

1. The Operator would adhere to all applicable Wyoming Ambient Air Quality Standards (WAAQS) and Regulations including those for fugitive dust suppression presented in Wyoming Air Quality Regulations on Fugitive Dust Suppression Section 14(F) (WDEQ 2003a). If a fugitive dust problem is identified by the BLM as a result of this project, immediate abatement measures (e.g., applications of water or chemical dust suppressants to disturbed surfaces) would be initiated in consultation with the BLM and WDEQ to avoid exceeding ambient air quality standards.

2. The Operator would not allow open burning of garbage or refuse at well locations or other facilities in the SLPA. Any other open burning would be conducted under the permitting provisions of Section 13 of the Wyoming Air Quality Standards and Regulations (WDEQ 2003a).

2.3.3 Cultural Resources

1. The Operator would follow the Section 106 compliance process prior to any surface disturbing activity.

2. The Operator would halt construction activities if previously undetected cultural resource materials are discovered during construction. The BLM would be immediately notified, and consultation with the SHPO and Advisory Council would be initiated, as appropriate, to determine proper mitigation measures pursuant to 36 CFR 800.11. Construction would not resume until a Notice to Proceed is issued by the BLM.

2.3.4 Geology and Minerals

1. BLM/WOGCC casing and cementing criteria would be followed to protect all subsurface mineral and water-bearing zones.

2.3.5 Hydrology

1. Construction at drainage crossings would be limited to periods of low or no-flow.

2. The Operator would follow all practical alternatives and designs to limit disturbance within drainage channels, including ephemeral and intermittent draws.

3. A 100 foot wide buffer area of undisturbed land would be left between construction sites and ephemeral and intermittent channels, except for those construction activities designed to reduce erosion in conjunction with surface discharge locations.

4. Channel crossings by pipelines would be constructed so that the pipe is buried at least 4 feet below the channel bottom.

5. Channel crossings by roads and pipelines would be constructed perpendicular to flow.

6. Disturbed channel beds would be reshaped to their approximate original configuration.

7. All reserve pits would be constructed with a minimum of one-half (1/2) the total depth of the pit below the original ground surface on the lowest point within the pit.

8. All reserve pits would be designed with a minimum of 2 feet of freeboard.

9. The discharge of all water (storm water, produced water, etc.) would be done in conformance with applicable WDEQ, BLM and WOGCC rules and regulations.

10. An isotopic analysis will be conducted on a water sample to be taken from one CBNG well within the Scotty Lake Unit before production begins from Phase I of the SLPP.

2.3.6 Noise

1. All motorized equipment will be muffled and maintained in accordance with the manufacturer's specifications.

2. All areas of operations (drill sites, etc.) where noise levels may exceed federal OSHA safe limits, the operator will provide and require the use of proper personal protective equipment by workers.

2.3.7 Range Management

1. Removal or disturbance of vegetation would be kept to a minimum through construction site management (e.g., by utilizing previously disturbed areas, using existing ROWs, designating limited equipment/material storage yards and staging areas, scalping, etc.).

2. The Operator would seed and stabilize disturbed areas in accordance with management direction from the Authorized Officer, BLM.

3. The Operator would monitor for noxious and invasive weed species and would apply BLM-approved weed control techniques (e.g., soil sterilants, biological controls, etc.) as necessary to control infestations with the prior approval of the Authorized Officer, BLM.

4. The Operator would fence water retention pits as deemed necessary by and in accordance with management direction received from the Authorized Officer, BLM.

2.3.8 Soils

1. Prior to commencement of construction activities, all available topsoil (up to a maximum of 12 inches) would be stripped from areas of cut, fill, and subsoil storage, and stockpiled for future reclamation operations.

2. The Operator would keep the area of disturbance to the minimum necessary for drilling and subsequent production activities, while providing for worker safety on site.

3. The Operator would restrict off-road vehicle activity by employees and contract workers.

4. The Operator would restrict project-related travel and reclamation activities during periods when soils are saturated and excessive rutting could occur.

5. Where feasible, the Operator would locate pipelines immediately adjacent to roads or other pipelines to avoid creating separate areas of disturbance.

6. The Operator would minimize construction activities in areas of steep slopes and apply special slope stabilizing structures and techniques (e.g., mulch, matting, etc.) if construction cannot be avoided in these areas.

7. The Operator would not conduct construction and/or reclamation activities using frozen or saturated soils, unless an adequate plan is submitted and approved by the BLM that demonstrates potential impacts would be mitigated.

8. Runoff and erosion control measures such as water bars, berms, and interceptor ditches would be installed as necessary.

9. All drainage crossing structures would be designed to carry at least a 10 year storm event, pursuant to guidelines contained in BLM Manual, Section 9113 (BLM 1985, 1991).

10. Upon completion of drilling operations and/or production facility installation, the Operator would restore those areas disturbed in conjunction therewith to the approximate original contours.

11. The Operator would replace topsoil or suitable growth materials over all disturbed surfaces prior to reseeding.

12. The Operator would reseed all disturbed sites as soon as practical following initial disturbance.

2.3.9 Transportation

1. Existing roads and trails would be utilized to the greatest extent possible and upgraded as necessary to comply with BLM road construction specifications.

2. All roads not required for routine operation and maintenance of producing wells or ancillary facilities would be reclaimed as directed by the BLM. These roads would be permanently blocked, recontoured, reclaimed, and revegetated by the Operator, as would disturbed areas associated with permanently plugged and abandoned wells.

3. The Operator would comply with existing federal, state, and county requirements and restrictions to protect road networks and the traveling public.

4. Special arrangements would be made with the WDOT to transport oversize loads to the project area. Otherwise, load limits would be observed at all times to prevent damage to existing road surfaces.

5. All development activities along approved ROWs would be restricted to areas authorized in the approved ROW.

6. The Operator would be responsible for maintenance of roads in the project area and for closure of roads following production activities.

7. Where proposed roads would follow existing roads, those portions of existing roads not included in the new ROW would be reclaimed and revegetated by the Operator.

2.3.10 Wildlife

1. Reserve, workover, and production pits potentially hazardous to wildlife would be adequately protected (e.g., fencing, netting) to prohibit wildlife access as directed by the BLM, to ensure protection of migratory birds and other wildlife.

2. USFWS and WGFD consultation and coordination would be conducted for all mitigation activities relating to raptors, and T&E species and their habitats and all permits required for movement, removal, and/or establishment of raptor nests would be obtained.

2.4 NO ACTION ALTERNATIVE

The *National Environmental Policy Act* of 1969 (NEPA) requires that the "No Action" alternative be considered in all environmental documents. Under the No Action Alternative, the BLM would deny further CBNG exploration activities on federal lands within the SLPA as currently proposed by the Operator, while allowing other land and resource uses to continue without the impacts which would be associated with the pilot project proposal. Denial of this specific pilot proposal is not, however, a denial of all future CBNG exploration and development in the area. Under the No Action Alternative, development of lands in the Scotty Lake CBNG Exploratory Unit and adjoining areas could occur at levels similar to those which have occurred on the area in the past and could occur as authorized by existing management directives contained in the Great Divide and Lander RMP's, which includes the requirement for site-specific NEPA analysis on all proposals.

The decision to select the No Action Alternative for additional exploration within the SLPA is available to the BLM through denial of individual APD's; however, the right to drill and develop somewhere within the leasehold cannot be denied by the Secretary of the Interior. Consequently, the BLM's authority to implement the No Action Alternative is somewhat limited. This limitation is based upon the fact that valid leases have been issued which specifically grant the lessee (or his designated operator) the *"right to drill for, ...extract, remove and dispose of all oil and gas deposits"* in the leased lands subject to the terms and conditions of the respective leases. Because the Secretary of the Interior has the authority and responsibility to protect the environment within federal oil and gas leases, restrictions can be imposed on the lease terms (see *Cooper Valley Machinery Works, Inc.* vs. *Andrus*, 474 F. Supp. 189, 191; D.D.C. 1973; 653 F. 2nd 595; D.D.C. 1981; *Natural Resources Defense Council vs. Berland*, 458 F. Supp. 925, 937; D.D.C. 1978), but the secretary can not deny development of the lease.

The Tenth Circuit Court of Appeals in *Sierra Club vs. Peterson* (717 F. 2nd 1409, 1983) found that "*on land leased without a No Surface Occupancy stipulation, the Department cannot deny the permit to drill...once the land is leased the Department no longer has the authority to preclude surface disturbing activity even if the environmental impact of such activity is significant. The Department can only impose mitigation measures upon a lessee who pursues surface disturbing exploration and/or drilling activities*". The court goes on to say "*...notwithstanding the assurance that a later site-specific environmental analysis will be made, in issuing these leases the Department has made an irrevocable commitment to allow some surface disturbing activities, including drilling and road building*".
This was clarified somewhat in Instruction Memorandum 92-67 issued by the Director, Bureau of Land Management on December 3, 1992 which states that *"...Because all oil and gas activities are subject to FLPMA, mitigation required to protect public lands from unnecessary and undue degradation is consistent with the lease rights granted. The caveat, however, is that...unnecessary and undue degradation implies that there is also necessary and due degradation"*. As a matter of policy, any mitigation measures *"...which would render a proposed operation uneconomic or technically unfeasible is not considered to be consistent with a lessee's rights and cannot be required absent a lease stipulation, unless it is determined that such mitigation is required to prevent unnecessary and undue degradation of public lands or resources..."*. To deny all activity would thus constitute a "taking" of the

Operators right to conduct exploration activities on the subject federal leases. As the court held in *Union Oil Company of California vs. Morton, "Congress itself can order leases forfeited, subject to payment of compensations. But without Congressional authorization, the Secretary of the executive branch in general has no intrinsic power of condemnation".*

Based upon the above, selection of the No Action Alternative would deny the proposal as submitted, but would allow BLM to consider additional exploration and development of the federal mineral estate on a case by case basis through individual APD's and site specific environmental analysis. Off-lease access to drill sites and/or the transportation of natural gas products would also be considered on a case by case basis by BLM.

Many leases in the SLPA contain various stipulations addressing surface disturbance, steep slopes, wildlife, and other matters of concern. These stipulations would allow the BLM to preclude development in certain areas (e.g., where slopes exceed 25%) or at certain times of the year (e.g., to protect big game crucial winter habitat) if operations cannot be acceptably mitigated. However, there is no stipulation, such as a NSO, that would allow the BLM to preclude drilling operations everywhere on a lease at all times of the year. If any one of the stipulations cannot be acceptably implemented and impacts mitigated, then an exception would not be granted. A decision, therefore, of No Action, as authorized by the leases, would only be considered, given one of the following conditions:

- If there were no acceptable means of mitigating significant adverse impacts to stipulated surface resource values, then this would trigger denial of the APD and require consideration and analysis of another alternative(s). Effectively, exception(s) to one or more of the lease stipulations would not be approved.

- If the USFWS concluded that the Proposed Action and alternatives would likely jeopardize the continued existence of threatened or protected plant and animal species, then the APD and lease development may be denied in whole or in part.

This EA will help to determine whether the proposed project meets any of these conditions.

2.5 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

The BLM requires the development of alternatives when there are unresolved conflicts involving alternative uses of available resources. Based upon scoping comments received for the Scotty Lake Coalbed Natural Gas Pilot Project, two questions were raised regarding both the disposal of water produced from wells proposed in conjunction with the SLPP, as well as the issue of directional drilling to minimize surface impacts within the overall analysis area. These two alternatives will be discussed separately below.

2.5.1 Re-Injection of Produced Water

As indicated in Section 2.2.9, the operator has previously obtained approval from the WDEQ for the surface discharge of water produced from CBNG wells in the SLPA to Red Creek and ephemeral tributaries thereof. This NPDES permit presently allows for the discharge of up to 0.81 MGWPD so long as the water quality standards as set forth in the approved permit are maintained. Furthermore, information contained in Chapter 3.0 (Affected Environment) will disclose that the Great Divide Basin is a closed basin with no outside drainage; consequently, water produced in conjunction with the SLPP and subsequently discharged to the surface will not flow outside of said basin. Considering that the water being produced from the Fort Union Formation is of relatively good quality (see Appendix D), discharge of this water to the surface or containment in water retention pits represents a beneficial use to both livestock and wildlife within the overall analysis area as surface water sources within the area are limited at best.

Furthermore, as the project name implies, this is solely a pilot project designed to determine the economic feasibility of additional exploration and development of the CBNG resource within the Scotty Lake CBNG Exploratory Unit. At the present time, it is unknown if there is a sub-surface geologic formation below the Fort Union Formation that would be suitable for the disposal of water produced in conjunction with the SLPP. In the event that the pilot project proves to be successful, additional environmental analyses would be required before any additional activities would be allowed within the Scotty Lake CBNG Exploratory Unit. Geological investigations to determine the feasibility of re-injection may be implemented at that time as appropriate.

2.5.2 Directional Drilling

The proposed action includes the drilling of up to 18 exploratory wells within the SLPA on a 160-acre spacing pattern in order to evaluate the potential productivity of coals within the Fort Union Formation for commercial natural gas production. As indicated in Sections 1.1 and 2.1, these wells would be drilled to depths of up to 5,000 feet. Comments received in conjunction with the public scoping process have suggested that directional drilling operations could be utilized in conjunction with the proposed SLPP in order to reduce the environmental impacts of the project by reducing surface disturbing activities associated with well pad, access road, and pipeline construction. Directional drilling techniques are typically utilized to gain access to portions of an oil/gas lease that are not directly below the surface well location and where surface locations are expensive or prohibitive for a variety of reasons. Directional drilling techniques have been used extensively and successively, particularly in the development of off-shore oil/gas leases where reservoirs are typically extensive and the cost of installing submersible or semi-submersible drilling platforms represents a substantial investment. However, even in offshore exploration activities, the initial well is typically drilled vertically and directional drilling activities are not employed until a discovery has been made and development of the reservoir ensues.

The purpose of any pilot project, such as the on currently proposed by Hudson Group, LLC, is to gather the data necessary to determine the economic feasibility of a potentially larger exploration and development program. At this particular juncture, the operator has not gathered a sufficient amount of data to adequately assess the commercial feasibility of CBNG production from the Scotty Lake coal member of the Fort Union Formation. The SLPP is being proposed to collect additional data on the physical characteristics of the Scotty Lake coals including reservoir characteristics, coal thicknesses, gas

content, gas chemistry, recovery efficiency, coal permeability, and water quantities. This data would then be combined with economic factors such as drilling, completion and evaluation (production) costs to determine if additional exploration and/or development is warranted. This data must be collected before a reasonable assessment of commercial feasibility may be properly evaluated. To date, directional drilling methods have not been successful in low-pressure, shallow CBNG wells (such as the Scotty Lake coals) and particularly so in wells where some form of rod-pumping is required in conjunction with the depressurization of said coals. Furthermore, topography and/or other physical resource concerns (such as steep or unstable slopes, critical habitats, or other sensitive resources), which might suggest the need for directional drilling operations in order to fully evaluate the project, are not present in the SLPA. Due to these factors, mandating the use of directional drilling operations in conjunction with the SLPP was found to be unreasonable and will not be further evaluated herein.

3.0 AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter describes the affected environment in the vicinity of the Proposed Action (the project area) as it exists today. This description is organized by resource with descriptive information taken from a wide range of sources including the BLM and various other federal and state agencies and has been guided by management issues identified by BLM's RFO, public scoping, and by interdisciplinary field analyses of the project area. The critical elements of the human environment and any potential affects arising from implementation of the Proposed Action are listed in Table 3.1.

Table 3.1

Critical Elements of the Human Environment, Scotty Lake CBNG Pilot Project, Sweetwater County, Wyoming [1]

Element	Status in Project Area	Addressed In EA
Air Quality	Potentially Affected	Yes
Areas of Critical Environmental Concern	None Present	No
Cultural Resources	Potentially Affected	Yes
Environmental Justice Concerns	Not Affected	Yes
Prime or Unique Farmlands	Not Affected	No
Floodplains	Not Affected	No
Native American Religious Concerns	Not Affected	No
Threatened and Endangered Species	Not Affected	Yes
Hazardous or Solid Wastes	Not Affected	No
Water Quality	Potentially Affected	Yes
Wetlands/Riparian Habitat	Not Affected	No
Wild and Scenic Rivers	Not Affected	No
Wilderness Concerns	Not Affected	No

1 As listed in BLM's National Environmental Policy Act Handbook H-1790-1 (BLM 1988) and Subsequent Executive Orders

In addition to the critical elements listed above, this EA also discusses the potential effects of the Proposed Action on geology/minerals, range resources, soils, visual resources, wildlife (including special status species), and wild horses.

3.1.1 Environmental Elements Not Considered in Detail

The following resources would not be adversely affected by implementation of the Proposed Action. Consequently, these resources will not be addressed in this chapter or in Chapter 4.0 *(Environmental Consequences)* to follow.

- Recreation - the project area consists entirely of federal lands in the northeastern corner of Sweetwater County. Access to this relatively remote area is provided by a series of existing BLM roads which traverse the area and provide access thereto from communities such as Jeffrey City and Wamsutter. Considering that there are no special recreation management areas or developed recreational sites within the project area, combined with the generally large expanse of adjacent federal lands, implementation of the proposed SLPP would not adversely affect recreational opportunities or patterns in the area.

- Vegetation - considering that there are no T/E, candidate, or sensitive plant species known to occur within the SLPA, the long-term disturbance of 42.11 acres (1.46% of the total surface acreage) over the LOP would not represent an impact to T/E, candidate, or sensitive plant communities within the SLPA. Vegetation and the impacts thereto are considered in other elements within the document including Range Resources and Soils.

- Environmental Justice - neither the Proposed Action nor the No Action Alternative would disproportionately affect minority or low income people, and is not discussed further in this EA. The proposed project would provide some additional employment opportunities for a small number of workers in Sweetwater County, Wyoming and would add to the local economy.

3.2 GENERAL SETTING AND CLIMATE

The project area is generally situated on the extreme northeastern periphery of the Great Divide Basin, a closed intermountain basin which is located within both the Middle Rocky Mountain Division of the Northern Rocky Mountain Physiographic Province and the Great Plains Division of the Great Plains Physiographic Province (Peterson *et al* 1987, Curtis and Grimes 2004). More specifically, the SLPA is situated in an upland area of northeastern Sweetwater County locally known as Cyclone Rim that is located generally north of Red Creek, south of West Alkali Creek, west of the Stratton Lakes, east/southeast of Scotty Lake, and north/northeast of Bastard Butte. This area is classified as a High Plains Steppe (cold desert) and is characterized by gently to moderately undulated uplands dissected by numerous, ephemeral tributary drainages of Red Creek to the south and West Alkali Creek to the north. Elevations in the project area generally range from a low of 6,960 feet along an ephemeral drainage at a point located in the SW¼SW¼SE¼ of Section 26 in Township 26 North, Range 97 West (Phase III) to a high of 7,280 feet at a point located in the SE¼NE¼SW¼ of Section 17 in Township 26 North, Range 96 West (Phase II).

The local climate is characterized by a lack of moisture (where evaporation exceeds precipitation), which leads to warm summer days, cool summer nights and cold winters characteristic of a continental arid, cold-temperate-boreal climate (Trewartha 1968). Generally speaking, Wyoming has a relatively cool climate with an annual average temperature of 45.6° F, with temperatures above 6,000 feet rarely exceeding 100° F. The average number of frost-free days in northeastern Sweetwater County ranges from 81 to 100 days (Curtis and Grimes 2004). Air masses enter the region from the Pacific and mountains to the west act as effective moisture barriers. The majority of the precipitation occurs as a result of late spring and summer thunderstorms, which coincide with the growing season. The remainder of the precipitation comes in the form of snowfall, primarily from November through April, with heaviest snowfall in the spring (Martner 1986). Annual precipitation at Jeffrey City, Wyoming (closest NOAA weather station) averaged 7.50 inches in 2002 and 10.64

inches in 2003, with peak average precipitation occurring in the months of May and June (NCDC 2002, 2003). Most precipitation occurs as rain due to frontal systems and thunderstorms. Complete precipitation data for the NOAA weather station in Wamsutter, Wyoming was not available for the 2002 or 2003 reporting periods.

Monthly mean temperatures in Jeffrey City during 2003 ranged from a February low of 20°F to a monthly mean high of 71°F in July, with average daily low and high temperatures ranging from 8°F to 31°F in February, and 51°F to 90°F in July (NCDC 2003). However, as is characteristic of dry continental climates, temperature extremes are pronounced with a low temperature of -24°F recorded on February 24, 2003 and a high temperature of 97°F recorded on July 25, 2003. The average number of days per year with a maximum temperature below 32°F is 66 days and the average number of days per year with a maximum temperature above 90°F is 28 days (NCDC 2003).

Mean annual evaporation ranges from 45 inches (lake) to 70 inches (pan); therefore the potential evaporation is 21 to 23 inches, compared to the mean annual precipitation of 6 to 10 inches (Martner 1986, Curtis and Grimes 2004). This gives an average annual deficit of nearly 14 inches, creating a predominantly dry climate where evaporation exceeds precipitation.

Prevailing winds are from the west and southwest. These winds are relatively constant and have an average speed of 12 to 14 miles per hour. The uniformly high wind speeds enhance dispersion, prompting lower pollutant concentrations than would occur in the absence of steady, high wind speeds. Strong, sustained winds occur quite often, and observations indicate winds of 70 to 80 mph (with gusts to 100 mph) can occur throughout Wyoming.

3.3 AIR QUALITY

Current and complete monitoring data for ambient air quality are not available for the SLPA; however, based on data collected in similar locations and reviewed by the State of Wyoming, Department of Environmental Quality, Air Quality Division (WDEQ/AQD), air quality levels are assumed to be in attainment for all Wyoming Ambient Air Quality Standards (WAAQS) and National Ambient Air Quality Standards (NAAQS).

Estimation of background air pollutant concentrations (reported in micrograms per cubic meter, or $\mu g/m^3$) is necessary in order to compare potential total air quality impacts from the Proposed Action and Alternatives with applicable air quality standards. Thus, for comparison against an applicable standard, total impacts are the sum of the background concentration plus direct modeled impacts. It is important that individual background concentration values, model predictions, and applicable air quality standards are for the same averaging time period for each pollutant. Background air pollutant concentration data were provided by WDEQ/AQD (WDEQ 2003b). Background concentrations of carbon monoxide (CO) are taken from representative data collected by WDEQ/AQD and commercial operators at Ryckman Creek for an 8-month period and summarized in the Riley Ridge EIS (BLM 1983). Sulfur dioxide (SO_2) gaseous air pollutant data were gathered at the Lost Cabin Gas Plant site in Fremont County (1986-87). Nitrogen dioxide (NO_2) and ozone data were collected at the Thunder Basin National Grasslands (2001-2002).

Particulate matter less than 10 microns in diameter (PM_{10}) and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) were collected in an urban area at the Cheyenne State Office Building (2002). Background air pollutant concentrations and applicable air quality standards are summarized in Table 3.2, which illustrates that regional background concentrations are well below established standards (WDEQ 2003b). These regional monitoring results indicate that air quality within the SLPA exceeds all applicable state and federal air quality standards.

Table 3.2

Background Air Quality Concentrations, Ambient Standards and PSD Increments (µg/m^3)

Airborne Pollutant	Averaging Time [1]	Background Concentration	Air Quality Standards		PSD Increments	
			WAAQS	NAAQS	Class I	Class II
Carbon Monoxide (CO)	1-hour	3,336	40,000	40,000	None	None
	8-hour	1,381	10,000	10,000	None	None
Nitrogen Dioxide (NO_2)	Annual	5.0	100	100	2.5	25
Ozone (O3)	1 –hour	162	235	235	None	None
	8 –hour	150	157	157	None	None
Sulfur Dioxide (SO_2)	3-hour	93	1,300	1,300	25.0	512
	24-hour	32	260	365	5.0	91
	Annual	4	60	80	2.0	20
PM_{10}	24-hour	47	150	150	8.0	30
	Annual	16	50	50	4.0	17
$PM_{2.5}$	24-hour	15	65	65	None	None
	Annual	5	15	15	None	None

Source: WDEQ 2003b.

1 Short-term concentrations reflect the maximum measured values during the entire period of record, except for ozone, which reflect the average of available 2001 and 2002 second high data (1-hour) and fourth-high data (8-hour). Short-term (1-hour, 3-hour, etc.) ambient standards allow not more than one expected exceedance per year. Long-term (annual) standards are not to be exceeded.

3.4 CULTURAL RESOURCES

Approximately 330 acres have been inventoried for cultural resources within the SLPA (Albanese 2004), which represents 11.5% of the overall land area included within the project area. An additional 247 acres that lie directly adjacent to the proposed project area have also been inventoried for cultural resources (Albanese 2004). These inventories were conducted in compliance with Section 106 of the *National Historic Preservation Act* (NHPA).

Cultural resource inventories have identified 2 cultural sites within the project area, one of which is considered as eligible for nomination to the *National Register of Historic Places* (NRHP). Based on an overview of the known cultural resource data and geomorphological data for the SLPA, it can be said that there is a moderate potential for locating intact buried cultural deposits. Most significant cultural resources are found along major ephemeral drainages and along the lower benches of escarpments found commonly throughout the project area. Certain topographic settings have higher archaeological sensitivity such as aeolian deposits (e.g., sand dunes, sand shadows, and sand sheets), alluvial deposits along major drainages, and colluvial deposits along lower slopes of ridges.

3.5 GEOLOGY AND MINERALS

Geologic units within the SLPA include the Wasatch, Fort Union, Lance, Lewis and Mesaverde Formations. The Wasatch Formation occurs at the surface throughout the SLPA and generally extends to the top of the Fort Union Formation (Fm). The Wasatch Fm occurs at the surface throughout the SLPA and generally extends to the top of the Fort Union Fm. Both the Wasatch and Fort Union Fms were deposited (formed) in the Paleocene epoch of the Tertiary Period (Cenozoic Era), while the Lance, Lewis and Mesaverde Fms were deposited (formed) in the Late Cretaceous Period of the Mesozoic Era. The primary geologic units that are targeted for CBNG exploration within the SLPA are the Scotty Lake coals which are interbedded in the Fort Union Fm at depths generally ranging between 2,000 feet and 5,000 feet.

3.5.1 Geology

The Scotty Lake (SL) coals are unique in that they are a geologically isolated deposit that pinches out to the west, east, and south and are bounded to the north by both the Wind River Thrust Fault and the Continental Fault. Based upon subsurface mapping (see Section 3.5.2), the SL coal appears to be limited to an area 6 miles wide and 9 miles long (or approximately 54 square miles) in northeastern Sweetwater County. The northern boundary of the SL coal is approximately one-half mile south of the Fremont County line which corresponds to the Wind River Thrust Fault. Rocks on the north side of the thrust fault have been uplifted relative to the south side of the fault and the SL coal interval does not exist to the north of the fault (Babb 2004a). The SL coals occur as three mappable sequences within the Fort Union Fm (upper, middle, and lower coals), each consisting of multiple coal beds with individual beds ranging in thickness for 2 to 50 feet. The top of the SL coal in the Picket Lake Unit #2 is at a depth of 2,121 feet, with the base of the coal at a depth of 4,250 feet. Total SL coal thickness in the Picket Lake Unit #4 is 477 feet. Numerous shale sequences in the lower Wasatch Fm occur above the top of the SL coal, thereby providing an impermeable barrier between the top of the SL coal and shallower fresh water aquifers which may occur in the upper portions of the Wasatch Fm. It should be noted that the Osborne Spring Unit #31-24 recently drilled by Cabot Oil and Gas Corporation (SE¼SW¼ of Section 32 in Township 26 North, Range 97 West) reportedly did not encounter the SL coal interval (Hudson 2004).

The Big Red (BR) coal is also present within the SLPA, occurring at depths approximately 3,000 feet below the base of the SL coals. The BR coal is more regional in extent than the SL coals, underlying most of the Great Divide Basin (3,895 mi^2), outcropping on the Rock Springs uplift approximately 38 miles southwest of the SLPA and pinching out to the north as it approaches the faulting and thrusting associated with the Wind River mountain range. The BR coal is part of a

regional hydrologic system, with water contained therein subjected to higher pressures, temperatures, and residence times resulting in higher mineralization and lower water quality as compared to the SL coal. This has been demonstrated by recent exploration activity within the BR coal to the west/southwest (Kennedy Oil Lower Bush Creek Project), which recorded total dissolved solids (TDS) of 21,771 parts per million (ppm) from water produced by the Kennedy State #1-36 well located in the NE¼NE¼ of Section 36 in Township 23 North, Range 97 West (BLM 2003a). The presence of numerous shale and siltstone facies between the base of the SL coal and the top of the BR coal effectively isolates these two coal-bearing units (Hudson 2004).

3.5.2 Minerals

In 1978, Davis Oil Company (Davis) formed the Picket Lake Unit (PLU) which encompassed approximately 14,458 acres including the acreage now proposed for CBNG exploration within the SLPA. The PLU was primarily formed to test the productive potential of the Mesaverde Fm at depths of up to 14,000 feet. Subsequent to the approval of the PLU by the U.S. Geological Survey (USGS) on July 25, 1978, Davis proceeded to drilled five wells in the newly-formed exploratory unit between July 27, 1978 and October 19, 1979 (see Table 3.3). Of these five initial unit wells, four were completed in the Lewis formation as producing gas wells and one well was drilled and subsequently abandoned. Davis also drilled a sixth well directly adjacent to the PLU named the Zephyr Federal #1. Presidio Exploration, Inc. subsequently drilled a seventh unit well in 1995, which was also completed in the Lewis formation as a producing gas well. Of the five unit wells successfully completed in the Lewis Fm, two were subsequently plugged and abandoned as non-commercial wells in the mid 1980's. The two remaining wells continue to produce from the Lewis Fm and are currently owned and operated by Hudson Group, LLC. Geologic information obtained from the drilling of these wells, coupled with regional geologic data gathered from other conventional oil/gas wells drilled in the northern end of the Great Divide Basin, have been compiled by Hudson Group, LLC and were subsequently utilized to identify a general CBNG project proposal.

In this regard, it should be noted that the concept of CBNG production from the Scotty Lake coals has been tested on a very limited basis through the re-entry of the PLU #1, PLU #2 and PLU #4 abandoned well bores by the operator in 2002. These existing well bores were re-entered and completion operations undertaken in selected intervals within the Scotty Lake coals. Preliminary gas/water production information obtained from these three re-entries has resulted in the current pilot project proposal to further define the nature of the Scotty Lake coals and the potential for commercial CBNG production therefrom.

Of the eight wells that have been drilled in the overall project area since the formation of the PLU, total reclamation has been achieved on those wells which have subsequently been plugged and abandoned except as noted below. It should be noted that the WOGCC has no record for any wells drilled in the SLPA prior to the approval of the Picket Lake Unit by the USGS in 1978. Likewise, the non-working areas of the 2 producing Lewis wells have also been successfully reclaimed. Re-entry and re-completion operations on the PLU #1, PLU #2 and PLU #4 resulted in additional short-term surface disturbance on these previously abandoned and reclaimed locations.

Table 3.3

Wells Previously Drilled in and/or Adjacent to the SLPA

Well Name and Number	Legal Location of Well				Target/Producing Formation	Spud Date	Well Status
	Quarter	Section	Township	Range			
Zephyr Federal #1	NW¼SW¼	17	26 North	96 West	Mesaverde	07/28/1979	P & A
Picket Lake Unit #3 [1]	NW¼SW¼	18	26 North	96 West	Lewis	02/28/1979	Producing
Picket Lake Unit #2 [2]	SW¼NW¼	19	26 North	96 West	Lewis	05/25/1979	P & A
Picket Lake Unit #5	SW¼NE¼	13	26 North	97 West	Lewis	08/04/1979	P & A
Picket Lake Unit #40-13 [1]	C SE¼	13	26 North	97 West	Lewis	04/10/1995	Producing
Picket Lake Unit #4 [2]	NW¼SE¼	23	26 North	97 West	Lewis	05/11/1979	P & A
Picket Lake Unit #1 [2]	NW¼SE¼	24	26 North	97 West	Lewis	07/27/1978	P & A
Picket Lake Unit #6	SW¼NE¼	25	26 North	97 West	Mesaverde	10/19/1979	D & A

[1] The producing wells referenced above are owned/operated by Hudson Group, LLC
[2] Abandoned well bores re-entered by Hudson Group, LLC and completed in the Fort Union Formation

Source: Wyoming Oil and Gas Conservation Commission Well Files and Computerized Database (WOGCC 2004)

Based upon field examination, the five active wells within the project area currently represent approximately 13.15 acres of surface disturbance within the overall project area. Considering the overall age of the existing road/pipeline infrastructure within the PLU/SLPA, we will assume that short-term reclamation of non-working areas of these linear ROWs has been achieved and that any remaining long-term surface disturbance within the project area is limited to the existing access road network. Initial construction of the approximately 50,748 feet (9.61 miles) of access road within the project area resulted in total surface disturbance equal to 46.60 acres (assuming a total disturbed ROW width of 40 feet). The subsequent reclamation of approximately 30% of these existing access road ROWs (including cut/fill slopes and outslope areas of the borrow ditch) has resulted in long-term or LOP disturbance equal to approximately 27.96 acres.

3.6 HYDROLOGY

3.6.1 Surface Hydrology

The SLPA encompasses portions of two separate watersheds as follows:

1) Red Creek, containing approximately 13,184 acres (20.6 mi^2), which makes up 90% of the overall SLPA. For the purposes of this environmental analysis, the Red Creek watershed is defined as those ephemeral tributaries of Red Creek either directly or indirectly affected by surface water discharges as indicated in the Water Management Plan contained in Appendix D (Babb 2004b); and

2) West Alkali Creek, containing approximately 37,760 acres (59.0 mi^2), which makes up 10% of the overall SLPA.

The hydrologic divide between these two watersheds is Cyclone Rim, which generally represents the jurisdictional boundary between BLM's Lander and Rawlins Field Offices. The West Alkali Creek watershed lies to the north of Cyclone Rim while the Red Creek watershed lies to the south. Hudson Group, LLC is currently discharging water produced from the Picket Lake Unit #2 to an ephemeral tributary of Red Creek at the rate of approximately 550 barrels of water per day (bwpd). Water being produced from the Picket Lake Unit #1 and Picket Lake Unit #4 wells is being contained in water retention pits located directly adjacent to each respective well.

The bulk of the SLPA (2,586 acres) falls within the overall Red Creek watershed, which encompasses approximately 76,160 acres (119 square miles) within the Great Divide Basin and which ultimately flows into Hay Reservoir (Babb 2004b). The West Alkali Creek watershed encompasses approximately 37,760 acres (59 square miles) and merges with East Alkali Creek in Section 24 of Township 28 North, Range 96 West (Babb 2004a). As their names imply, these watersheds are drained by ephemeral tributaries of Red Creek and West Alkali Creek respectively. These ephemeral drainages are intermittent in nature and normally flow only during periods of spring runoff and/or localized periods of heavy rainfall. As indicated above, runoff generated in the Red Creek watershed would flow west/southwest to Hay Reservoir, which has no outlet. Runoff generated in the West Alkali Creek watershed would generally flow to north into the Sweetwater River via Alkali Creek.

Other than the two water retention pits mentioned above, there are no other surface impoundments (stock reservoirs) within the SLPA.

A fairly comprehensive look at surface hydrology within the area is presented in the Scotty Lake CBNG Pilot Project Water Management Plan (WMP) contained in Appendix D.

3.6.2 Sub-Surface Hydrology

The primary, near-surface, fresh water aquifer within the SLPA is the Eocene Wasatch Fm which overlies the Tipton shale member of the Green River Fm (Babb 2004b). In the Picket lake Unit #1, the Wasatch Fm extends from the surface to a depth of approximately 2,681 feet (Babb 2004a). A review of existing ground water rights within the SLPA issued by the Office of the Wyoming State Engineer indicates that two water supply wells have been drilled and completed within the project area as follows:

- Picket Lake #40-13 Water Well: NE¼SE¼ of Section 13, Township 26 North, Range 97 West. Permit #P145371W issued to Hudson Group, LLC and the Bureau of Land Management, Priority Date 06/03/2002. Well drilled to a total depth of 600 feet, yield 25 gpm.

- Picket Lake #1 Water Well: NW¼SE¼ of Section 24, Township 26 North, Range 97 West. Permit #P135633 issued to Hudson Group, LLC and the Bureau of Land Management, Priority Date 06/06/2001. Well drilled to a total depth of 500 feet, yield 20 gpm.

Both of the above wells were permitted and drilled by Davis Oil Company in 1978 in conjunction with initial (conventional) oil/gas exploration activities in the Picket Lake Unit and subsequently re-permitted by Hudson Group, LLC for their operations therein.
A fairly comprehensive look at sub-surface hydrology within the area is presented in the Scotty Lake CBNG Pilot Project Water Management Plan (WMP) contained in Appendix D.

3.7 RANGE MANAGEMENT

The 2,880 acres of public land included within the SLPA encompass portions of two separate grazing allotments including Cyclone Rim and Green Mountain Common, which are administered by the Rawlins and Lander Field Offices, respectively. Table 3.4 provides general information concerning each grazing allotment within the SLPA including allotment name and number, managing office, total acres of public land and total Animal Unit Months (AUMs) in each respective allotment.

Table 3.4

Grazing Allotments in the SLPA

Allotment Name	BLM Office	Allotment Number	Acres of Public Land	Total AUM'S
Cyclone Rim	Rawlins	10103	291,954	40,661
Green Mountain Common	Lander	32001	468,379	47,729

Grazing management on the Cyclone Rim Allotment (CRA) was evaluated by the RFO in 2002 and the SLPA area passed all standards for rangeland health and trend. Overall, the CRA passed all standards except Riparian/Wetland Health due primarily to excessive use by wild horses during the growing season, which has been complicated in some cases by livestock grazing. The Standards and Guides Report for the Great Divide Basin (BLM 2003b) states that these areas would likely show heavy use even with proper grazing management and proper management of the wild horse population due to the unique and rare characteristics for these areas and the relatively higher palatability of the associated plants.

Current livestock grazing management for portions of the Green Mountain Common Allotment (GMCA) has been evaluated by the LFO as unsatisfactory. The overall trend in condition is declining on the riparian areas within the GMCA based upon standards assessments which were performed by LFO in July, 1999. These standards assessments found that approximately 15,000 to 25,000 acres (3 to 5 percent) of the public lands primarily near or associated with riparian areas within the GMCA were not in compliance with Wyoming BLM standards for Rangeland Health (BLM 1998). As a result, initial changes in livestock management practices were implemented in 2000 and have been ongoing for the last 4 years. The current grazing management plan is being revised. It is projected that plan implementation will be fully completed within the next 5 years.

Generally speaking, Cyclone Rim represents the unfenced boundary between the Cyclone Rim and the Green Mountain Common Allotments, with the CRA to the south and the GMCA to the north. In the past there has been minimal north/south livestock drift over the rim due to the general lack of developed or natural surface water in the vicinity thereof.
There are no known rangeland improvements within the proposed SLPA that would be affected by surface disturbing activities associated therewith.

A survey of the proposed SLPA was conducted in July 2004 to identify infestations of noxious or invasive non-native weed species within the overall project area. No noxious weeds, as designated by Wyoming Statute (W.S.) 11-5-102(a)(xi) (WSWT 2003), were located within the project area. Two invasive non-native weed species were located on existing disturbed areas within the SLPA and included both halogeton (*Halogeton glomeratus*) and Russian thistle (*Salsola iberica*). An infestation of Russian knapweed (*Acroptilon repens*) was located approximately five miles south of the SLPA, which represents the nearest known noxious weed infestation. Likewise, an infestation of halogeton was identified approximately three road miles south of the SLPA. Both weed infestations were observed along existing BLM Road #3219.

It is possible that Canada thistle (*Cirsium arvense*), musk thistle (*Carduus nutans*), and leafy spurge may occur on or adjacent to previously disturbed areas within the overall area. These particular species have been designated as noxious weeds by the State of Wyoming [Wyoming Statute (W.S.) 11-5-102(a)(xi)] (WSWT 2003).

3.8 SOILS

Soils information for northern Sweetwater County is primarily limited to a Fourth Order Soils Inventory which describes soils within the project in very general terms only. Based upon this Fourth Order Inventory, the predominate soil encountered within the SLPA consists of Typic Torriorthents complex. This soil complex consists of ridges and steep hillsides at elevations ranging between 6,600 and 7,400 feet and on slopes of 6 to 40 percent and is composed primarily of shallow Typic Torriorthents occupying rounded ridges and steep hillsides. Included in this complex are areas of rock outcrop which consists of thin, very gravelly soils and steep drainages. The Typic Torriorthents have a loam to gravelly loam profile extending down to soft bedrock at depths of 10 to 20 inches and exhibit moderate permeability, low available water capacity, and are used primarily for range and wildlife habitat.

Soils in the S½NW¼ of Section 26 in Township 26 North, Range 97 West (Phase III) are included within the Typic Torriorthents association, rolling, which occur on gently sloping to sloping alluvial fans and on rolling upland hillsides at elevations ranging from 6,700 to 7,000 feet and on slopes of 3 to 15 percent. The areas consist of approximately 45% deep Typic Torriorthents on alluvial fans and approximately 35% moderately deep Typic Torriorthents on rolling hillsides. Included in these areas are loam or channery loam and sandy loam soils with soft bedrock at 10 to 20 inches. These Typic Torriorthent soils have a loam surface layer 2 to 3 inches thick with loam underlying layers to approximately 40 inches. These soils exhibit moderate permeability and moderate to high available water capacity.

As indicated in Section 3.7, a survey of the proposed SLPA was conducted in July 2004 to review soil types within the SLPA. Based upon this survey, soils over the area fall in the Typic Torriorthents association as described above, but range from sandy loam to clay loam soils that are very shallow to shallow on average for those sites to be disturbed.

3.9 VISUAL RESOURCES

As indicated in Section 1.1, the SLPA encompasses federal lands that are included within both the Lander (LFO) and Rawlins (RFO) Field Offices. Those portions of the project area that fall within the jurisdiction of the LFO have been designated as Visual Resource Management (VRM) Class IV (modification of the landscape character) in the Lander Resource Management Plan Final Environmental Impact Statement (BLM 1986). Under this VRM class, changes may subordinate the original composition and character of the landscape; however, they should reflect what could be a natural occurrence within the characteristic landscape.

Those portions of the project area that fall within the jurisdiction of the RFO have been designated as VRM Class III (partial retention of the landscape character) in the Great Divide Resource Area Record of Decision and Approved Resource Management Plan (BLM 1990). Under this VRM class, changes in the basic elements (form, line, color, or texture) caused by a management activity may be evident in the characteristic landscape. However, the changes should remain subordinate to the visual strength of the existing (land) character.

Cultural modifications to the existing landscape within the SLPA have resulted from construction activities primarily associated with previous oil/gas exploration activity within the area as outlined in Table 3.3. Previous road construction activities within the overall project area (BLM roads 3216 and 3219) not associated with oil/gas exploration activity has also resulted in cultural modifications to the existing landscape.

3.10 WILDLIFE AND SPECIAL STATUS SPECIES

The dramatic differences in altitude encountered in Wyoming have resulted in a varied climate which has produced differing floral and faunal communities, referred to by Cary (1917) as life zones. Of the five life zones he described for Wyoming, only the Upper Sonoran can be found in the Great Divide Basin and covers a broad expanse of the relatively low altitude country in the arid Red Desert.

Vegetation typically includes different species of saltbush, greasewood (*Sarcobatus vermiculatus*), different species of rabbitbrush, sagebrush, including spiny sagebrush (*Artemisia spinescens*), Plains yucca (*Yucca glauca*), and different species of prickly pear cactus, with skunk bush (*Schmaltzia trilobata*) and different species of juniper on the bluffs (SCS 1974). Specific vegetation observed within the project area which is characteristic of this life zone and the soils identified therein include greasewood, rabbitbrush, sagebrush, prickly-pear cactus, Indian ricegrass, western wheatgrass, and prairie junegrass.

The Upper Sonoran zone within the SLPA is somewhat weak in nature in that it exhibits a relatively small number of the characteristic life zone species of mammals and birds. Mammalian species which exemplify this zone within the Great Divide Basin, and which would be expected to occur within the specific project area include the Pronghorn antelope *(Antilocapra americana)*, Colorado chipmunk (*Eutamias quadrivittatus*), Northern grasshopper mouse (*Onchomys leucogaster articeps*), kangaroo rat (*Dipodomys ordii luteolus*), and spotted skunk (*Spilogale putoris*).

3.10.1 Big Game Species

These big game species occur within the overall project area and include Pronghorn antelope *(Antilocapra americana)*, Mule deer *(Odocoileus hemionus)*, and Rocky Mountain elk *(Cervus elaphus*) and are discussed in greater detail below.

Pronghorn Antelope

Antelope populations residing within the overall project area are classified within the Red Desert Herd Unit, which includes antelope hunt areas 60, 61, and 64. The herd objective for antelope in the Red Desert Herd Unit is 15,000 post hunt animals (WGFD 2003a). Generally speaking, antelope numbers in the Red Desert Herd Unit are near, but slightly below the desired herd objective, with the 2003 population estimated at 14,950 animals (see Table 3.5). Recruitment (fawn production) in this herd unit has been below management goals for 10 of the last 11 years, with an estimated 48 fawns per 100 does in 2002. Likewise, buck/doe ratios are also below the stated management goal of 60 bucks per 100 does, with an observed buck/doe ration of 49 bucks per 100 does in 2002. The low buck/doe ratios combined with a population that is nearing objective will result in the issuance of additional doe/fawn licenses and a concomitant decrease in buck licenses in an attempt to achieve a buck/doe ratio of 60 bucks per 100 does, while maintaining the population at or near the stated population objective (WGFD 2003a). There is no crucial antelope winter range within the SLPA.

Mule Deer

Mule deer populations residing in that portion of the project area located on the south side of BLM Road #3216 (Cyclone Ridge Road) are classified within the Steamboat Herd Unit, which comprises deer hunt area 131. Populations of mule deer on the north side of the Cyclone Ridge Road are classified within the South Wind River Herd Unit, which includes deer hunt areas 91-95 and 160. Herd objectives for mule deer in the Steamboat and South Wind River Herd Units are 4,000 and 13,000 post hunt animals, respectively (WGFD 2003a). Herd objectives for mule deer in both herd units are below objective by 22.5% and 43% respectively (WGFD 2003a) due primarily to the effects of the ongoing drought on population recruitment - particularly in those portions of both herd units within the Great Divide Basin as a direct result of water availability (see Table 3.5). The inability of these deer populations to rebound from the sustained drought has resulted in license reductions and a concomitant reduction in hunter opportunity in both herd units (WGFD 2003a). There is no crucial mule deer winter range within the SLPA.

Rocky Mountain Elk

Elk populations residing within the overall project area are classified within the Steamboat Herd Unit, which comprises elk hunt area 100. The herd objective for the Steamboat Herd Unit is currently 1,200 post hunt animals with a 2002 post-hunt population estimate of 1,530 animals (see Table 3.5). It should be noted that the herd unit objective was increased by 240% in 2002 from 500 post-hunt animals to the current herd objective of 1,200 animals (WGFD 2003a). As the numbers imply, elk populations in the Steamboat Herd Unit have expanded well beyond the initial herd unit objective of 500 post hunt animals and are thriving within hunt area 100.

Table 3.5

Population Objectives, 2002 Post-Hunt Population Estimates and and Population Trends in Antelope Elk and Mule Deer Populations in the SLPA

Herd Unit	Elk			Antelope			Mule Deer		
	Objective	Actual	Trend	Objective	Actual	Trend	Objective	Actual	Trend
Red Desert				15,000	14,950	Ź 0.33%			
Steamboat	1,200	1,530	ŷ 127.5%				4,000	3,000	Ź 25%
S. Wind River							13,000	7,385	Ź 43%

Source: WGFD Annual Big Game Herd Unit Job Completion Reports (JCRs) for the Lander and Green River Regions (WGFD 2003a)

The increased elk population has resulted in increased hunting opportunity as permits for both bull and cow elk have been increased in an effort to decrease the population below 1,600 animals and move towards the current herd objective.

3.10.2 Greater Sage Grouse

The greater sage grouse *(Centrocercus urophasianus*) is an important upland game bird in Wyoming and the project area does contain limited amounts of suitable nesting habitat; however, there are no known leks within a 2 mile radius of the proposed SLPA. The closest known leks to the project area are located as follows:

- Bastard Butte Lek: NE¼SE¼ of Section 10, T25N, R97W - lek active in 2003;
- Scotty Lake Lek: SE¼NW¼ of Section 17, T26N, R97W - lek active in 2003;
- Red Creek Lek: NE¼NE¼ of Section 10, T26N, R98W - lek active in 2003;
- Red Creek Well Lek: SW¼SW¼ of Section 30, T25N, R95W - lek active in 2003.

Sage grouse populations throughout Wyoming remain well below both historic and WGFD desired levels due to low recruitment resulting from poor nesting conditions attributable to the ongoing drought as well as other poorly understood factors such as predation and habitat loss. Declining populations of sage grouse in Grouse Management Area 9 have resulted in action designed to reduce harvest including shortening the hunting season from 30 days in 1993 to 9 days in 2002 and a concomitant reduction in bag limits from 3 birds per day with 9 in possession in 1993 to 2 birds per day with 4 birds in possession in 2002. These population declines are clearly defined in extant harvest data which recorded a harvest of 6,876 birds by 2,441 hunters in 1993 versus 1,728 birds harvested by 788 hunters in 2002 (WGFD 2003b). There are no population data estimates for sage grouse within the SLPA.

3.10.3 Raptor Species

Several birds-of-prey species may occur within the SLPA including ferruginous hawk (*Buteo regalis*), northern harrier (*Circus cyaneus*), golden eagle (*Aquila cyrysaetos*), and prairie falcon (*Falco mexicanus*). Table 3.6 provides information on the five (5) ferruginous hawk nests which have been documented in or adjacent to the SLPA.

Table 3.6

Raptor Nesting Activity In or Adjacent to the SLPA

Raptor Species	Nest Type	2003 Nest Condition	Legal Location of Nest Structure				2004 Status
			Quarter-Quarter	Section	Township	Range	
FH	Stick	Fair	SE¼SE¼	15	26 North	97 West	Inactive
FH	Stick	Poor	Center NE¼	22	26 North	97 West	Inactive
FH	Stick	Good	SE¼NE¼	23	26 North	97 West	Inactive
FH	Stick	Good	SE¼NW¼	25	26 North	97 West	Inactive
FH	Stick	Good	SE¼SE¼	26	26 North	97 West	Inactive

3.10.4 Threatened and Endangered Species

Threatened and/or endangered (T/E) species include those species which are in danger of extinction due to drastic population declines and which have subsequently been listed as threatened or endangered pursuant to the *Endangered Species Act* (ESA) of 1973 (as amended). Those T/E species identified by the U.S. Fish and Wildlife Service (USFWS) which may potentially occur within the project area include:

- **Bald eagle** *(Haliaeetus leucocephalus)* - Status: Threatened.

  Migrant through the area during the fall and spring migrational periods, seasonal resident during the winter months along major river systems throughout the state.

Historic habitat for bald eagles migrating through or wintering in west central Wyoming would include riparian area(s) along the North Platte River in Carbon and Natrona Counties; the Big and Little Wind Rivers in Fremont County; the Green River in Lincoln, Sweetwater and Sublette Counties; and the Little Snake River in Carbon County which provide roosting and perching areas for eagles foraging along the river courses and their adjacent uplands. There are no known bald eagle roosting areas in northeastern Sweetwater or southern Fremont County (south of the Shoshone National Forest boundary)(BLM 2004a).

Open rangelands throughout west-central Wyoming are probably being used opportunistically by bald eagles for foraging; however, no bald eagles have been observed in the area in conjunction with BLM or BLM-approved inventories within the project area (BLM 2004a).

- **Black-footed ferret** *(Mustela nigripes)* - Status: Endangered.

Potential resident in prairie dog *(Cynomys sp.)* colonies.

As there are no known prairie dog towns within the SLPA, impacts to black-footed ferrets are not expected to occur.

- **Ute ladies'-tresses** *(Spiranthes diluvialis)* - Status: Threatened.

Potential resident in seasonally moist soils and wet meadows below 7,000 feet. Locally found in the North Platte River drainage below Alcova Reservoir and in the drainages of the Cheyenne and Niobrara Rivers in southeastern Wyoming.

As indicated above, there are no perennial or intermittent streams with associated riparian habitats within the SLPA. Furthermore, as the SLPA does not occur in the drainages of the North Platte, Cheyenne, or Niobrara Rivers, the expected area(s) of occurrence, impacts to Ute ladies'-tresses are not expected to occur.

- **Water Depletions to the North Platte and Colorado River Systems**

In their response to project scoping, the U.S. Fish and Wildlife Service also identified four T/E fish species which could potentially be affected by water depletions to the Colorado River system (including the Colorado, Green and Yampa rivers) including the endangered bonytail chub *(Gila elegans)*, Colorado pikeminnow *(Ptychochelius lucius)*, humpback chub *(Gila cypha)*, and razorback sucker *(Xyrauchen texanus)*. In this regard, the Great Divide Basin is a hydrographically closed basin from both a surface and subsurface standpoint (BLM 2003a). The proposed SLPP has no potential to affect or impact the Colorado River System or the T/E species residing therein; consequently, these species will not be given further consideration in this document.

Although not specifically identified by the USFWS in their response to project scoping, water depletions to the North Platte River system could also potentially affect five T/E species including the endangered interior least tern *(Sterna antillarum)*, pallid sturgeon *(Scaphirhynchus albus)*, and Eskimo curlew *(Numenius borealis)* as well as the threatened piping plover

(Charadrium melodus) and western prairie fringed orchid *(Platanthera praeclara)*. Considering that no North Platte River depletions would result from the proposed action, the SLPP has no potential to affect or impact the North Platte River System or the T/E species residing therein; consequently, these species will not be given further consideration in this document.

3.10.5 Special Status Species

Special status species would include those plants/animals that do not currently warrant protection under the *Endangered Species Act* of 1973 (as amended), yet are considered by the Bureau of Land Management as sensitive species. Special status species that may be expected to occur within the SLPA include:

- **Mountain plover** (*Charadrius montanus*)

  The mountain plover is generally considered an associate of the shortgrass prairie, which is dominated by blue grama (*Bouteloua gracilis*) and buffalo grass (*Buchloe dactyloides*)(Graul 1975). The species breeds across the western Great Plains and at isolated locales in western Colorado, Wyoming and New Mexico (Leachman and Osmundson 1990). Between 1966 and 1991, continental populations of the mountain plover declined by 63% (Knopf 1994), with the Pawnee National Grassland in Weld County, Colorado being both the historic and current breeding stronghold of this aridland member of the family Charadriidae (Graul and Webster 1976). A second major breeding population of mountain plovers is currently located on the Charles M. Russell National Wildlife Refuge in Phillips, Montana (Knopf and Miller 1994).

  In April of 2004 a search was made of the Wyoming Natural Diversity Database (WYNDDB) records to determine if any sightings of mountain plover had been recorded within Township 26 North, Ranges 96 and 97 West. One mountain plover sighting was recorded in the NE¼NE¼SW¼ of Section 17 in Township 26 North, Range 97 West on May 2, 1993. No additional sightings are documented in the WYNDDB (WYNDDB 2004).

3.10.6 Migratory and Non-Migratory Birds

Habitats in the SLPA and immediate vicinity are primarily sagebrush-dominated uplands (shrub-steppe) with interspersed shortgrass prairie (WYNDDB 2004). Wyoming Partners in Flight (PIF) priority species potentially occurring in the shrub-steppe (SS) and shortgrass prairie (SGP) habitat types are listed in Table 3.8 (Nicholoff 2003).

In this regard, the SLPA lies within an area directly north of latitude 42°11’25” N and directly west of longitude 108°17’50” W. Species distribution as reported in *The Atlas of Birds, Mammals, Reptiles and Amphibians in Wyoming* (WGFD 1999) includes a compilation of observations mapped by latitude and longitude, with the State of Wyoming divided into 28 different regions, where these observations are reported within a specific region of the state. These regions are based upon a one degree separation of both latitude and longitude. As a consequence, the SLPA falls with Wyoming Distribution Area (latilongs) 17 as defined by WGFD (1999). Avian distribution data contained in *The Atlas of Birds, Mammals, Reptiles and Amphibians in Wyoming* (WGFD 1999) for the PIF priority species potentially occurring within

the SLPA is included in Table 3.7. Only those birds that have been classified by WGFD (1999) as confirmed breeders (nest and/or young observed), with circumstantial evidence of breeding (nest and/or young not located), or that have been observed at any time (season) within the general area (but without any evidence of breeding) are included in the list. Breeding Bird Survey (BBS) data for survey routes within Wyoming were included in this database (WGFD 1999). Definitions for those symbols used in Table 3.7 to report Wyoming distribution are as follows:

∉ B: Nest or young dependent upon parent birds observed.

∉ b: Circumstantial evidence of breeding.

∉ O: The species has been observed, but there was no evidence of nesting.

∉ N: The species has not been observed in the area.

Most of the birds listed in Table 3.7 typically nest either on the ground or in shrubs; thus activities associated with the Proposed Action may have the potential to destroy individual nests, eggs, and/or young of some of these species. Projected losses are indeterminate as there are no Breeding Bird Survey (BBS) routes located within the immediate vicinity of the SLPA which could provide information on breeding bird densities within the shrub-steppe and shortgrass prairie habitats encountered within the SLPA.

Concerns regarding the decline of both migratory and non-migratory bird populations both locally and on a continental scale have resulted in a nationwide bird conservation planning effort. Management goals and objectives for bird conservation are found in the following documents:

1) Land Bird Strategic Plan;

2) Presidential Executive Order (EO) 13186 dated January 17, 2001; and

3) Proposed Memorandum of Understanding associated with the above Presidential EO.

Bird Conservation Plans prepared at the state and regional levels also include objectives for bird conservation. As evidenced by EO 13186, there has been national direction to implement actions that incorporate these goals.

3.11 WILD HORSE MANAGEMENT

The proposed SLPA falls in the extreme southwest corner of the Antelope Hills Horse Management Area (HMA) which is administered by BLM's Lander Field Office (LFO). This HMA encompasses approximately 110,000 acres of both federal and non-federal lands in Fremont and Sweetwater Counties.

Table 3.7

List of Partners In Flight (PIF) Priority Bird Species Potentially Found Within the SLPA

Common Name	Scientific Name Name	Habitat Type	Distribution Area 17
Level I Species (Conservation Action)			
Ferruginous Hawk	*Buteo regalis*	SS/SGP	B
Mountain Plover	*Charadrius montanus*	SS/SGP	B
Upland Sandpiper	*Bartramia longicauda*	SGP	N
Long-billed Curlew	*Numenius Americana*	SGP/M	B
Burrowing Owl	*Athene cunnicularia*	SGP	B
Short-eared Owl	*Asio flammeus*	SGP/M	O
Brewer's Sparrow	*Spizella breweri*	SS/MFS	B
Sage Sparrow	*Amphispiza belli*	SS/MFS	b
McCown's Longspur	*Calcarius mccownii*	SS/SGP	O
Level II Species (Monitoring)			
Loggerhead Shrike	*Lanius ludovicianus*	SS	b
Sage Thrasher	*Oreoscoptes montanus*	SS	B
Vesper Sparrow	*Pooecetes gramineus*	SS	B
Lark Sparrow	*Chondestes grammacus*	SS	B
Lark Bunting	*Calamospiza melanocorys*	SGP	O
Grasshopper Sparrow	*Ammodramus savannarum*	SGP	N
Chestnut-collared Longspur	*Calcarius omatus*	SGP	N
Dickcissel	*Spiza Americana*	SGP	O
Bobolink	*Dolichonyx oryzivorus*	SGP/M	B
Level III Species (Local Interest)			
Common Poorwill	*Phalaenoptilus nuttallii*	SS/MFS	b
Say's Phoebe	*Sayornis saya*	SS	O

Source: Wyoming Bird Conservation Plan, Version 2.0 (Nicholoff 2003)

The population objective or "appropriate management level" (AML) for this particular HMA is 60 to 82 adult horses with a population currently estimated at 166 horses. Two other HMAs occur directly adjacent to the SLPA as follows:

- Lost Creek HMA which is managed by BLMs Rawlins Field Office (RFO); and

- Great Divide Basin HMA which is managed by BLMs Rock Springs Field Office.

The Lost Creek HMA encompasses approximately 250,000 acres, lies completely within the Great Divide Basin, and adjoins the Antelope Hills HMA directly to the south of the SLPA. The AML for the Lost Creek HMA is 140 to 165 adult horses, with the population currently estimated at 143 horses. Through genetic testing, the Lost Creek wild horse herd has been shown to carry a very high percentage of genetic markers identified with the Spanish Mustang breed, which means that these horses are genetically more like the Spanish Mustang and other New World Iberian breeds than other breeds such as American Quarter Horse or Morgan. The Spanish Mustang breed was introduced to the Americas by the Spanish explorers and conquistadors in the 1500s. As a consequence, this characteristic makes these horses unique among the wild horse herds tested in Wyoming to date.

The Great Divide Basin HMA encompasses approximately 778,915 acres and adjoins the Antelope Hills HMA approximately 8 miles to the west of the SLPA boundary. The AML for the Great Divide Basin HMA is 415 to 600 adult horses, with the population currently estimated at 812 horses.

Horses in the Antelope Hills and Great Divide Basin HMAs have not been genetically tested to determine if they share genetic markers with the Spanish Mustang breed; however, horses in all three herds are considered as one single meta-population that has been subdivided into separate herds for management purposes.

4.0 ENVIRONMENTAL IMPACTS

4.1 Introduction

The potential environmental consequences of construction, drilling, completion, and evaluation activities associated with both the Proposed Action and No Action Alternative are discussed for each potentially affected resource. An environmental impact is defined as a change in the quality or quantity of a given resource due to a modification in the existing environment resulting from project-related activities. Impacts can be beneficial or adverse; a primary (direct) result or a secondary (indirect) result of an action; long-term (more than five years) or short-term (less than five years); and can vary in degree from a slightly discernable change to a total change in the environment. In accordance with CEQ regulation 40 CFR 1502.16, this chapter includes a discussion of the potential impacts of the Proposed Action and the No Action Alternative. Possible conflicts between the Proposed Action and No Action Alternative and the objectives of the Great Divide and Lander RMPs as well as state and local land use plans and policies are identified if such conflicts exist.

Potential impacts are quantified when possible; however, when impacts are not quantifiable appropriate adjectives are used to best describe the level of impact. Impact assessment assumes that all applicant-committed practices will be successfully implemented. If such measures are not implemented, additional adverse impacts may occur. Additional mitigation measures are suggested if such measures are appropriate, and BLM will decide whether to include such additional measures in the Decision Record. The Decision Record will be the decision document for this proposed project.

The air quality analysis found in this document tiers to and incorporates by reference the Desolation Flats Natural Gas Field Development Project (BLM 2004b).

4.2 AIR QUALITY

4.2.1 Proposed Action

BLM has recently released the Final Environmental Impact Statement for the Desolation Flats Natural Gas Field Development Project (BLM 2004b). The northern boundary of the Desolation Flats Project (DFP) Area is located approximately 60 air miles south of the SLPA. Detailed air quality modeling was conducted for Alternative A of the Desolation Flats NEPA analysis and included the drilling of 592 gas wells, and both the successful completion and subsequent production of 385 gas wells. The results of the modeling studies for Desolation Flats indicate that no adverse impacts to sub-grid or near-field air quality would result from the proposed project and the DFP would comply with all state and national ambient air quality standards. The air quality modeling conducted for the DFP suggested the possibility of some contribution to far-field visibility reduction within the Class I airsheds when combined with all other human development in the analysis area.

The scope of the Scotty Lake project differs considerably from Desolation Flats in well numbers (18 versus 592), well-site equipment (conventional gas production versus coalbed natural gas), and

compression horsepower requirements (32,000 hp versus 50 hp/well), which will result in a dramatic reduction in overall emissions associated with the proposed SLPP as compared to the DFP.

Construction emissions associated with the Proposed Action would include PM_{10}, SO_2, NO_x, CO, and VOCs. These emissions would result primarily from construction, drilling and completion activities, would be temporary in nature and would occur in isolation at each individual well location. Considering that construction, drilling and operations within the SLPA would be conducted one well, the relatively small number of exploratory wells and facilities proposed in conjunction with the SLPP would generate a near-undetectable level of emissions that would be limited to the near-field with no impact in the far-field.

The use of Best Available Technology in the small engines to be utilized to power the generators and screw compressors at each individual well location would ensure the operator complies with applicable state and national ambient air quality standards. As indicated in Section 2.3.2, the Operator would take appropriate measures to minimize impacts to air quality. Non-particulate emissions would be minimized by ensuring that vehicles, rig engines, and generator, and screw compressors are maintained in proper operating condition. Watering of access roads (or the use of chemical dust suppressants) within the SLPA during periods of heavy vehicle traffic vehicle would also serve to reduce fugitive dust (PM_{10}) by 50% or more (BLM 2003a).

4.2.2 The No Action Alternative

Under the No Action Alternative, there would be no additional impacts to ambient air quality.

4.2.3 Mitigation and Monitoring

Please refer to Section 2.3.2 for Applicant-Committed Practices designed to reduce impacts to air quality within the overall analysis area. No additional mitigation is recommended.

4.3 CULTURAL RESOURCES

Cultural resources, including archaeological and historic sites, on lands subject to federal authority are protected by various laws and regulations commencing with the *Antiquities Act* of 1906. Specific directives concerning Cultural Resource Management can be found in *Archaeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines* (Federal Register 1983) and BLM Manual Section 8100. Prior to the initiation of any federal action, cultural resources must be inventoried and evaluated to determine their eligibility for inclusion in the NRHP. NRHP criteria (36 CFR 60.4) for determining eligibility define four (4) criteria of significance based upon "...the quality of significance in American history, architecture, archaeology, and culture present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling, and association; and that:

- are associated with events that have made a significant contribution to the broad patterns of our society; or

- are associated with the lives of persons significant in our past; or

- embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

- have yielded, or may be likely to yield, information important in prehistory or history".

Cultural properties are generally not eligible for inclusion in the NRHP if they lack diagnostic artifacts, subsurface remains, or structural features. Furthermore, sites that cannot be placed in a temporal context or shown to be related to other sites are usually not eligible and therefore are discharged from management.

4.3.1 Proposed Action

As indicated in Section 3.4, the records of the Wyoming State Historic Preservation Office (SHPO) indicate that approximately 578 acres have been inventoried for cultural resources within or directly adjacent to the SLPA. Six cultural sites were identified in conjunction with these inventories including 1 site which was considered as eligible for nomination to the NRHP (Albanese 2004). From these numbers, we may predict a site density of one cultural site per 96 acres and one potentially eligible cultural site per 578 acres. Predictions of site density within the SLPA are drawn from environmental factors within the study area including depositional environments, as well as past studies of cultural resources in the area. Certain environments are more likely to yield intact, buried cultural deposits than others. Most significant cultural resources are found along major ephemeral drainages and along the lower benches of escarpments found commonly throughout southern Wyoming. Certain topographic settings have higher archaeological sensitivity such as aeolian deposits (e.g., sand dunes, sand shadows and sand sheets), alluvial deposits along major drainages, and colluvial deposits along lower sloes of ridges.

Prior to initiation of any ground disturbing activity associated with exploration operations within the SLPA, a Class III cultural resource inventory would be completed on all areas that would be disturbed and any NRHP-eligible cultural resources identified would either be avoided or mitigated according to standard procedures. Likewise, any unanticipated discoveries of cultural resources made during construction activities would be mitigated according to standard procedures and project personnel would be prohibited from collecting any artifacts or disturbing any significant cultural resources in the area. As a consequence, impacts to cultural resources would likely be negligible to nonexistent.

4.3.2 The No Action Alternative

Under the No Action Alternative, there would be no project-related surface disturbances beyond those levels previously approved and impacts to cultural resources would remain at current levels.

4.3.3 Mitigation and Monitoring

Please refer to Section 2.3.3 for Applicant-Committed Practices designed to reduce impacts to cultural resources within the overall analysis area. No additional mitigation is recommended.

4.4 GEOLOGY AND MINERALS

4.4.1 Proposed Action

Potential oil/gas exploration activities within the SLPA would not have an adverse impact upon other mineral resources and would be consistent with management direction for the area as prescribed in the LFO and RFO RMPs. Conflicts which could interfere with the recovery of other mineral resources within the immediate project area, such as mining for gravel or uranium, would be subject to prior existing rights, thereby lessening the potential for future conflict. At this time, there are no other known mineral resources within the project area which are considered to be economically recoverable.

Minimum engineering standards established by *Onshore Oil and Gas Order Number 2* for oil/gas drilling and completion operations would ensure hole integrity and should preclude the possibility of downhole fluid migration between formations.

4.4.2 No Action Alternative

No additional impacts would result to the geology and mineral resources within the SLPP under this action alternative.

4.4.3 Mitigation and Monitoring

Please refer to Section 2.3.4 for Applicant Committed Practices and the Typical Drilling Prognosis contained in Appendix C for those measures designed to reduce impacts to geologic and mineral resources within the overall analysis area. No additional mitigation is recommended.

4.5 HYDROLOGY

A comprehensive Water Management Plan (WMP) has been prepared in conjunction with the proposed Scotty Lake Coalbed Natural Gas Pilot Project (Appendix D). The subject WMP not only discusses alternative methods for water disposal, but discloses the current hydrologic situation within the SLPA and discusses the impacts of the produced water discharge upon both the surface and subsurface hydrology of the area. Information contained in the WMP will be summarized below.

4.5.1 Proposed Action

Because there are no perennial streams, springs, or other sources of permanent surface water (stock water reservoirs) known to exist within the project area, the potential for degradation of existing

surface water quality in or adjacent to the SLPA resulting from implementation of the proposed action is considered to be remote.

4.5.1.1 Erosion and Sedimentation

The 106 acres of short-term surface disturbance within the SLPA would occur in the two watersheds defined in Section 3.6.1. Of this total, 76.49 acres (72 percent) of the surface disturbance would occur in the Red Creek watershed, with the remaining 29.55 acres (28 percent) occurring in the West Alkali Creek watershed, which would represent less than one percent (0.6 and 0.08) percent of each respective watershed.

The potential for off-site erosion and sedimentation throughout the SLPA would be reduced through the implementation of Best Management Practices (BMP) in the construction and subsequent reclamation of surface disturbances as referenced in the Master Field Permit (Appendix C). These reclamation techniques would be augmented on an as-needed basis through the incorporation of site specific reclamation requirements directly into the conditions of approval for those actions within the SLPA requiring federal authorization. Typically, these reclamation requirements would be developed during the permit review process (on-site inspection) and would be based upon site-specific concerns identified during the course thereof. Consequently, the potential for increased erosion and sedimentation within or directly adjacent to the SLPA is considered to be negligible when one considers the following:

- the total amount of surface disturbance which would result over the LOP from additional oil/gas exploration and development activity within the SLPA (106 acres of short-term disturbance) represents only 3.7 percent of the total land area within the SLPA;

- successful reclamation of disturbed areas not required for on-going production operations (57 acres) would result in an approximate 53% overall reduction in long-term or LOP surface disturbance, thereby further reducing the potential for erosion and off-site sedimentation (LOP disturbance for the SLPP = 49 acres); and

- the implementation of site specific "Best Management" reclamation practices designed to stabilize disturbed areas as quickly as possible, would result in a 94% overall reduction in erosion after the first year and a 95% reduction in erosion after five years (refer to Section 4.8.1).

4.5.1.2 Surface Water Discharge

Water produced in conjunction with the proposed SLPP is of good quality as indicated in Table 2a of the referenced WMP and will be discharged to the surface via one of three methods as discussed in Section 2.2.9 under an existing NPDES permit issued to Hudson Group, LLC by the WDEQ. Based upon analyses contained in the WMP, this water is expected to dissipate quite rapidly, irrespective of the discharge method. The WMP predicts that water discharged to one of three primary ephemeral drainages (drainage basins A, B and C) of Red Creek will dissipate within a maximum of 4.8 miles (drainage basin C) downstream of the discharge point due to conveyance loss (Babb 2004a). Flow rates for the discharged water would be less than two feet per second, with

most flows being less than one foot per second - which is below erosion thresholds (Babb 2004a). No water will be discharged into the West Alkali Creek drainage on the north side of Cyclone Rim.

4.5.3.2 Sub-Surface Hydrology

Chemical analyses contained in the WMP indicate that water produced from the Scotty Lake coals (Fort Union Fm) is geologically isolated from the fresh water aquifers in the shallower Wasatch Fm and also from the degraded Big Red aquifer within the Fort Union Fm below the Scotty Lake coals (Babb 2004a). These analyses confirm that there is no significant communication between the geologic horizons above or below the Scotty Lake coals and that said coals represent a confined aquifer within the Fort Union Fm (Babb 2004a).

In this regard, concern has been expressed regarding potential aquifer depletion and potential cross-contamination between aquifers. As indicated in Section 2.2.4, water is removed from the coal in order to depressure said coal and facilitate the desorption of gas from the coal facies. It is a popular misconception that the aquifer must be or is completely dewatered in conjunction with CBNG production - which leads to fears of subsidence and underground coal fires. Studies conducted in conjunction with CBNG production in Wyoming's Powder River Basin have shown that up to twenty percent of the entrained water must be removed from the aquifer in order to depressure the coal sufficiently to facilitate gas desorption (Babb 2004a). Once a pressure equilibrium has been reached and gas begins to flow into the well bore, water production falls off dramatically and, in many cases, ceases altogether. As a consequence, the concerns expressed regarding the potential dewatering of the aquifer are unfounded. Likewise, concerns regarding subsequent subsidence and underground coal fires are also unfounded as the Scotty Lake coals will not be dewatered, but only depressured to the extent that gas will desorb and flow to the well bore. Concerns regarding subsidence, underground coals fires and hydraulic fracturing have been addressed in Appendix B.

Drilling and completion techniques to be utilized by Hudson Group, LLC will ensure that no communication occurs between aquifers in the shallower Wasatch Fm and the Fort Union Fm which contains the Scotty Lake coals. As indicated in Section 2.2.3.2 and Appendix C, surface casing would be set to an approximate depth of 450 feet and cemented back to surface, with production casing set to total depth (TD) with cement circulated from TD back to a point located approximately 200 feet above the shallowest coal in the Fort Union Fm. Cement bond logs would be run to ensure that full cement coverage was obtained.

4.5.4 The No Action Alternative

Under the No Action Alternative, there would be no additional impacts to either the surface or sub-surface hydrology of the overall project area.

4.5.5 Mitigation and Monitoring

Please refer to Section 2.3.5 for Applicant-Committed Practices designed to reduce impacts to surface and sub-surface hydrologic resources within the overall analysis area. No additional mitigation is recommended.

4.6 RANGE MANAGEMENT

Actual construction of the individual well pads, access roads, pipelines, etc. would result in an overall reduction in livestock and wildlife forage and a subsequent reduction in the available animal unit months (AUMs) in each affected grazing allotment. For the purpose of assessing impacts to range resources, acres of disturbance were converted to a reduction in AUMs based upon an average of 7.2 acres/AUM for the overall project area (based upon the average AUMs in the Cyclone Rim allotment).

4.6.1 Proposed Action

The primary impact to range resources within the SLPA would be the initial loss of vegetation and vegetative (forage) production resulting from additional oil/gas exploration activity. As indicated in Section 2.2, routine activities associated with oil/gas exploration and development in the SLPA would result in approximate surface disturbances as follows:

- 32.94 acres associated with the construction of 18 well locations;
- 24.41 acres associated with access road construction and reconstruction;
- 36.82 acres associated with installation of the gas/water gathering system; and
- 11.88 acres associated with the installation of water retention pits at each individual well location.

Under these assumptions, the initial loss of approximately 106.05 (106) acres of vegetation would result in the short-term loss of 14.7 AUMs, which represents approximately 3.7% of the 400 average total AUMs (2,800 acres ÷ 7.2 average AUMs) available on surface lands within the SLPA. Reclamation of those areas not required for ongoing production and operations would place approximately 57.28 acres back into forage production within 1 to 2 years following the initial disturbance. Reclamation of these areas would result in a long term loss of 6.8 AUMs, which represents less than one percent of the total average AUMs available on surface lands within the SLPA. It should be noted that selection of a water discharge option other than the construction of 18 water evaporation (retention) would reduce the long-term (LOP) disturbance by approximately 11.88 acres, which would result in a concomitant decrease in the long-term AUMs lost from 6.8 to 5.1 as a result of project-related activities.

Selection of surface water disposal methods 2 or 3 (discharge into an unlined water retention pit with or without an overflow outlet) as defined in Section 2.2.9 could attract additional cattle to these discharge sites. Depending on the amount, duration, and specific location of the discharge, an estimated 100 to 200 head of cattle could drift from the GMCA south into the CRA across the unfenced boundary. This estimate is based on documented cattle observations at the two existing water retention pits (one fenced and one unfenced) within the SLPA during the 2003 and 2004 grazing seasons. Should the water retention pit option be selected for discharge, it is likely that additional cattle would be initially attracted to these sites. However, if these pits were properly fenced, the cattle would quickly learn that water at these sites was not available and would thus be

less likely to return. All three discharge options are likely to increase the number of cattle that would cross into the CRA from the GMCA; however, option #3 could exacerbate the current situation and create a long term range management problem that would require additional livestock control measures.

Additional impacts to the range resource within the SLPA would result from the invasion of newly disturbed areas by invasive non-native and/or noxious weed species. As indicated in Section 3.7, several species of invasive non-native weeds have become established on disturbed sites within the SLPA including halogeton (*Halogeton glomeratus*) and Russian thistle (*Salsola iberica*), with a possibility of invasion of disturbed areas within the SLPA by other non-native and noxious weed species. However, surface disturbances associated with the proposed SLPP would affect less than four percent of the combined surface acreage within the overall SLPA. As indicated above, selection of a water discharge option other than the installation of 18 water retention pits would reduce overall long-term (LOP) surface disturbance within the SLPA by approximately 11.2 percent, which would lessen the areas potentially subject to invasion by non-native and noxious weed species. Nonetheless, Hudson Group, Inc. intends to implement an aggressive weed management policy as indicated in Section 2.3.7 and Appendix C.

4.6.2 The No Action Alternative

Under the No Action Alternative there would be no further loss of vegetation with a concomitant reduction in available AUMs. Likewise, the invasion of disturbed areas by non-native species would be restricted to areas previously disturbed in conjunction with prior approvals.

4.6.3 Mitigation and Monitoring

Please refer to Section 2.3.7 for Applicant-Committed Practices designed to reduce impacts to the range resource within the overall analysis area. No additional mitigation is recommended.

4.7 SOILS

4.7.1 Proposed Action

Removal of native vegetation and disturbance of the underlying soil material as a result of surface disturbing activities associated with the Proposed Action would increase the potential for loss of the existing soil resource through erosion. This potential would increase proportionately as degree of slope increases. Overall, soils within the overall project area generally have an adequate amount of topsoil available to ensure satisfactory reclamation, assuming the use of proper techniques designed to control erosion and ensure revegetation of the reclaimed areas are utilized in the reclamation process and slopes throughout the project area are relatively gentle. Additional oil/gas exploration activity within the SLPA would result in the overall disturbance of approximately 106 acres of the soil resource, or less than four percent of the total surface estate included within the proposed project area.

Analyses conducted in conjunction with the Cave Gulch-Bullfrog-Waltman Natural Gas Development Project (BLM 1997) determined that implementation of BMP for reclamation and erosion control would result in a substantial reduction in erosion rates for surface disturbances associated with project activities (Grah 1997). While this was a project-specific analysis based upon information gathered in conjunction therewith, these calculations suggest that soil erosion resulting from additional CBNG exploration activity in the SLPA could be reduced to negligible levels with the application of BMP for reclamation and stabilization of disturbed soils as outlined in Section 2.3 and Appendix C. Site specific reclamation, erosion control, and revegetation recommendations would be developed on a site-specific basis in conjunction with the on-site inspections to be conducted on each individual well location (including access road and pipeline ROWs). These recommendations would be incorporated in the Conditions of Approval (COAs) appended to each APD. Subsequent construction and reclamation activities would be monitored and remedial action taken as necessary to ensure that all surface disturbances are properly reclaimed, erosion is minimized, and the disturbed areas revegetated.

4.7.2 The No Action Alternative

Under the No Action Alternative there would be no project-related disturbance of soils and soils would remain in their current state.

4.7.3 Mitigation and Monitoring

Please refer to Section 2.3.8, Applicant-Committed Practices, for measures designed to reduce impacts to soil resources within the overall analysis area. No additional mitigation is recommended.

4.8 VISUAL RESOURCES

Short-term visual impacts associated with implementation of the Proposed Action would include visual contrasts between the industrial character of the construction and drilling equipment and the somewhat natural surrounding landscape. In addition, potentially heavy volumes of sporadic truck traffic and the fugitive dust created as a result thereof, could produce negative visual impacts beyond the immediate project area. In this regard, both short-term and long-term impacts to the visual resource would be possible where patterns of line, form, color and texture in the existing characteristic landscape would be visually contrasted by drilling equipment and/or construction related disturbances to the existing topography or other readily visible site features. The severity of this impact would be dependent upon a number of factors including:

- the visual absorption capability of the surrounding landscape,
- distance from the most sensitive viewing area,
- reclamation potential of the landscape to be disturbed, and/or
- the level of disturbance to the visual resource to be created by the Proposed Action.

The duration of the impact would be a function of both the time required to complete the action and the time required for the disturbed site to return to a pre-disturbance condition. In general, the visual impact would be greatest on those sites where mitigation would be difficult and/or where the visual contrast would be highly visible to a potentially large number of viewers.

As indicated in Section 3.9, that portion of the project area north of Cyclone Rim falls under the jurisdiction of the Lander Field Office and is included in VRM Class IV. Under this VRM Class, changes may subordinate the original composition and character, but must reflect what could be a natural occurrence within the characteristic landscape. The majority of the project area south of Cyclone Rim falls within the jurisdiction of the Rawlins Field Office and is included in VRM Class III. Under this VRM class, changes in the basic environmental (topographic) elements caused by additional oil/gas exploration and development may be evident in the characteristic landscape; however, the changes should remain subordinate to the visual strength of the existing (land) character.

The following analysis of visual impacts will focus on a discussion of the visual landscape in terms of viewer proximity to intrusions related to additional oil/gas exploration and development from a foreground, middleground, and/or background perspective. For the purposes of this document, the terms *foreground*, *middleground* and *background* are defined as follows:

Foreground - Generally the area that lies within one-half mile of the viewer.

Middleground - The area between the foreground and background in a landscape. The area located from one-half mile to five miles from the viewer.

Background - The distant part of a landscape located from five miles to infinity from the viewer.

4.8.1 Proposed Action

The SLPA is located in a remote area of northeastern Sweetwater County far from established recreational areas, historic sites or other areas that would routinely attract visitors thereto. The distances from paved access to the SLPA are such that travel to/from the area would generally be restricted to periods of good weather by hardy individuals possessing vehicles suited to extended travel over dirt/gravel roads such as sport utility or other four-wheel drive (4WD) vehicles. The primary access route into the area would be via the Red Creek Road (BLM Road #3219). The westernmost boundary of the proposed pilot project is approximately one mile east of the Red Creek Road at its closest point thereto. Consequently, additional CBNG exploration activities within the SLPA would not affect the foreground perspective of viewers traveling along said road.

Depending upon the direction of travel on the Red Creek Road, surface disturbance and project-related facilities within the SLPA would primarily be visible from both a middleground and background perspective. Viewers traveling south on the Red Creek Road would view the SLPA primarily from a middleground perspective for a short time as they come over Cyclone Rim and were directly west of the project area. However, the viewer perspective traveling south from Cyclone Rim would be dominated in the background by a panoramic vista of the Great Divide Basin

including Bastard Butte. Viewers traveling north on the Red Creek Road would view the SLPA from both a background and middleground perspective depending upon their position on the road - with the perspective transitioning from background to middleground as the viewer moves closer to the SLPA area along the Red Creek Road. Again, the viewer perspective traveling north from Bastard Butte would be dominated by Cyclone Rim and the panoramic vistas associated therewith.

Short-term disturbances (construction, drilling and completion activities) associated with the proposed pilot project may well dominate the viewshed in the short-term. Removal of drilling/completion rigs and successful reclamation of the disturbed areas within the SLPA would reduce the long-term visual impact(s) of existing wells and would reduce the visual contrast (form and texture of the landscape) to a level that is subordinate to the visual strength of the existing, natural landscape. Moreover, mitigation measures recommended below would further minimize the visual impacts of oil/gas exploration activity to viewers from both the middleground and background perspective. As a consequence, the proposed Scotty Lake CBNG Pilot Project would not violate existing visual resource management direction for the area or produce contrasts beyond the degree allowed for in the stated VRM guidelines from either a foreground, middleground, or background perspective.

4.8.2 The No Action Alternative

Under the No Action Alternative there would be no project-related degradation of the viewshed resulting from the proposed action and visual contrasts in the area would remain as they are today.

4.8.3 Mitigation and Monitoring

While visual intrusions which would result from project activities are not inconsistent with the stated VRM management goals, the following mitigation measures are suggested in order to minimize the overall visual impact associated with additional CBNG exploration activity within the SLPA.

1. All permanent (on-site for six months or longer) above-ground structures constructed or installed on the individual well locations (including pumping units, tank batteries, etc.) should be painted a flat, non-reflective, earthtone color to match one of the standard environmental colors as determined by the Five State Rocky Mountain Interagency Committee.

   Those facilities required to comply with *Occupational Health and Safety Act* (OSHA) rules and regulations would be excluded from this painting requirement.

4.9 WILDLIFE AND SPECIAL STATUS SPECIES

The overall project area provides habitat for many species of both game and non-game vertebrates, including antelope, elk mule deer, raptors, upland game birds, predators and furbearers. The principal impacts likely to be associated with additional CBNG exploration activity within the SLPA would include potential displacement of some wildlife species from preferred habitat and the potential loss of wildlife habitat as a result of project activities

Crucial habitat(s) for either big game or game bird species are not known to exist with the SLPA.

4.9.1 Proposed Action

Impacts on local wildlife populations would result from direct removal or alteration of habitat, increased human presence associated with additional CBNG exploration activity, and direct wildlife/human interaction. Activities associated with additional exploration and/or development activity within the SLPA would temporarily eliminate approximately 106 acres of wildlife habitat, consisting mostly of shrubs, grasses and forbs, until project reclamation occurs. This would result in a proportionate reduction in the amount of herbaceous and browse forage available to herbivorous species such as antelope and mule deer, as well as a reduction in nesting, feeding and security habitat for game birds (e.g., sage grouse) and those smaller vertebrate species that may inhabit the affected areas. These habitat losses can generally be classified as being either short-term or long-term in duration, with these terms defined below.

1. Short-term loss refers to disturbances that would be reclaimed immediately after exploration activities are completed.

   Loss or alteration of habitats in grass-shrub meadows and/or on grassy slopes would be considered short-term and are expected to occur in conjunction with lease development.

2. Long-term loss would occur in areas that could not be returned to their original vegetative state within a reasonable period of time (3 to 5 years), such as producing well sites and access roads.

4.9.1.1 Habitat Loss and Displacement

Disturbances resulting from well pad, access road, and pipeline construction activity within the SLPA would result in the loss of smaller, less mobile species of wildlife, such as small mammals and reptiles until such time as reclamation has been accomplished. However, considering the relatively small geographic area of disturbance, the actual magnitude of this loss and any potential displacement of these species would be considered as minimal.

Rather than direct habitat loss, the greatest impact on wildlife populations would be from displacement of economically important wildlife species such as antelope, elk and mule deer from preferred habitats as a result of increased level(s) of human activity (including vehicular traffic) and associated noise. The extent of this displacement is difficult to predict when one considers that response to noise and human presence varies from species to species as well as among individuals of the same species. In some cases, wildlife species may habituate to noise and human presence after initial exposure, and begin to re-invade areas that were formerly avoided. It is commonly assumed that these effects are detrimental to individual species and numerous studies have examined the effects of human presence on big game species (Klein 1974; Irwin and Peek 1979; Ward and Cupal 1979; MacArthur *et al* 1982; Brekke 1985).

In addition to the avoidance response, an increased human presence intensifies the potential for wildlife-human interactions ranging from the harassment of wildlife to poaching and increased legal harvest. Likewise, increased traffic levels on existing access roads could increase the potential for wildlife-vehicle collisions. These collisions are most frequent where roads traverse areas commonly frequented by game species. Considering the relatively minimal road network to be constructed in association with additional CBNG exploration activity within the SLPA, the generally short duration of intensive field activities (i.e., construction, drilling, and completion operations), combined with the inconsequential amount of daily/weekly production traffic expected within the field, the potential for adverse wildlife-human interaction is considered to be minimal.

4.9.1.2 Big Game Species

The project area includes year-round habitat for several economically important game species including pronghorn antelope (*Antilocapra americana*), elk (*Cervus elaphus*), and mule deer (*Odocoileus hemionus*). While the project area includes year-round habitat for the above species, crucial habitat(s) for these species are not known to occur within the SLPA. Considering that no crucial wildlife habitat(s) will be affected by implementation of the Proposed Action, the potential for long-term displacement and/or individual losses (mortality) attributable to human activities within the SLPA are considered to be minimal. Since population numbers for both antelope and mule deer in their respective herd units (Red Desert, Steamboat and S. Wind River) are currently below objective levels as indicated in Table 3.6, implementation of the proposed SLPP should not cause a substantial increase in the current downward trend of these specific herds.

4.9.1.3 Greater Sage Grouse

As indicated in Section 3.10.2 there are no known leks within a two mile radius of the SLPA. The closest known leks to the project area would be the Bastard Butte lek located in Section 10, T25N, R97W (3.25 miles southwest of the southern project are boundary) and the Scotty Lake lek located in Section 17 (3.25 miles west/northwest of the western project area boundary). Both leks were active in 2003 (WGFD 2003b). Considering the distance of these leks from the exterior boundaries of the project area, it is questionable whether nesting is occurring within the SLPA, particularly considering that suitable patches of sagebrush with the appropriate height and density to support sage grouse nesting are rather discontinuous in nature throughout the overall project area. The relatively small percentage of total surface disturbance proposed within the 2,880 acre SLPA would suggest that the potential effects of the proposed pilot project upon sage grouse nesting will be minimal at best.

4.9.1.4 Raptor Species

As indicated in Section 3.10.3, five historic raptor nests are known to exist within or directly adjacent to the SLPA, with two of these five historic nests located within the 2,880 acre project area. These historic raptor nests were not active in either 2003 or 2004 (AEC 2004). It should be noted that the ferruginous hawk nest located in the NE¼ of Section 22 (FH26972201) is in close proximity to (within several hundred feet of) the proposed Scotty Lake #20 CBNG well. The subject nest was observed to be in very poor condition on June 23, 2004 (AEC 2004).

Raptors may utilize presently unoccupied nesting territories within the SLPA in future years. The implementation of seasonal timing restrictions (within a "buffer zone" around active nests) to avoid surface disturbing activities (including construction, drilling and completion operations) within a "buffer zone" around active nests should reduce impacts the nesting raptors within the overall project area (see Section 4.9.5). Currently, the BLM also attempts to relocate well pad facilities if they fall within a 1200' distance of a ferruginous hawk nest and 825' of any other raptor. The installation of additional infrastructure in conjunction with the proposed SLPP and the concomitant human activity associated therewith may prevent some raptors from utilizing potential nesting habitat during the life of the project.

4.9.1.5 Threatened and Endangered Species

∉ **Bald eagle** *(Haliaeetus leucocephalus)* - Status: Threatened.

The SLPA does not contain suitable roosting/perching habitat, concentrated feeding areas (perennial streams), or other special (nesting) habitats which might result in increased eagle activity therein. While the general area may be opportunistically used by bald eagles in conjunction with wide-ranging foraging activities, these foraging activities would likely occur during times of the year when human activity within the project area is at seasonally low levels, which would minimize the potential impacts to eagles foraging in the area. Consequently, we would not expect any potentially significant impacts to occur to bald eagle populations as a result of activities associated with the proposed pilot project.

Determination: May affect, but not likely to adversely affect.

∉ **Black-footed ferret** *(Mustela nigripes)* - Status: Endangered.

It is well documented that black-footed ferrets depend primarily upon prairie dogs *(Cynomys ssp.)* for food and upon prairie dog burrows for shelter (Hillman and Clark 1980, Fagerstone 1987). Inventories within the SLPA conducted by AEC during the spring/summer of 2004 failed to identify any prairie dog colonies within the analysis area (AEC 2004). Considering the lack of both an available food source and suitable habitat for black-footed ferrets within the SLPA, impacts to this species are not anticipated.

Determination: No effect.

∉ **Preble's meadow jumping mouse** *(Zapus hudsonius preblei)* - Status: Threatened.

The SLPA is well outside of the limits of known habitat for the Preble's Meadow jumping mouse. Considering that there are there are no perennial or intermittent streams with associated riparian habitats within the SLPA and the project area is not within the area of expected occurrence thereof, we do not expect any impacts to this species.

Determination: No effect.

∉ **Ute ladies'-tresses** *(Spiranthes diluvialis)* - Status: Threatened.

As indicated in Section 3.10.3.1, the SLPA is outside of the expected area of occurrence for Ute ladies'-tresses. Considering the general lack of suitable habitat within the overall project area (seasonally moist soils and wet meadows associated with riparian habitats), we do not expect any impacts to this species.

Determination: No effect.

∉ **Colorado River Species**

As indicated in Section 2.2.3.1, fresh water to be used in drilling operations would be obtained from existing water wells/produced water facilities within the SLPA which produce water from aquifers not connected to the Colorado, Green or Yampa River systems. As there will be no depletions to the Colorado River or it's tributaries, impacts to the above-named species will not occur (see Section 3.10.4).

Determination: No effect.

∉ **Black-tailed prairie dog** *(Cynomys ludovicianus*) - Status: Proposed for Listing.

As indicated above, there are no known prairie dog towns within the SLPA and the proposed project area is outside of the known range of the black-tailed prairie dog. Consequently, we do not anticipate any impacts to black-tailed prairie dogs as a result of project-related activities.

Determination: No effect.

4.9.1.6 Special Status Species

Mountain plover (*Charadrius montanus*) are considered to be a sensitive species and management decisions should consider impacts thereto. A review of the records maintained by the Wyoming Natural Diversity Database in April 2004 identified one recorded mountain plover sighting in Township 26 North, Ranges 97 and 98 West. Please refer to Section 3.10.4 for additional information in this regard.

There are areas within the SLPA which meet the habitat requirements for mountain plover breeding/nesting from a slope, aspect, vegetative height and density standpoint; however, patch size within the area is generally less than optimum and generally does not meet the 26-54 hectare polygon size believed to be the minimum requirement for brood rearing (Knopf 2004). Small patches of habitat may support nesting plovers if larger patches of suitable habitat are nearby; but, in general, the large contiguous habitats (open grasslands) preferred by mountain plover are lacking in the project area. Considering the relatively small amount of long-term surface disturbance within the SLPA, and the fact that existing plover habitat within the overall project area is relatively marginal, the potential impact to breeding/nesting mountain plovers would be slight.

4.9.1.7 Migratory and Non-Migratory Birds

Three of the species identified in Table 3.9 including ferruginous hawk, greater sage grouse, and mountain plover have been discussed elsewhere in Section 4.10 and will not be discussed further herein.

Surface disturbing activities associated with the Proposed Action would result in the initial disturbance of approximately 106 acres of shrub-steppe and shortgrass prairie habitat which would provide a source of food, security cover and nesting habitat for many of the species listed in Table 3.9. Approximately 54% of this disturbance would be reclaimed within five years of initial disturbance resulting in a long-term (LOP) loss of approximately 49 acres of habitat.

Considering the relatively small percentage of total surface disturbance proposed within the 2,880 acre project area, the actual magnitude of direct habitat loss and subsequent displacement would be minimal. The displacement of bird species to adjacent, undisturbed habitats, while difficult to predict, would be relatively short-term in nature given the overall duration of additional development activities associated with the Proposed Action.

4.9.2 The No Action Alternative

Under the No Action Alternative impacts to wildlife, raptor, and special status species populations in the area would continue at existing levels.

4.9.3 Mitigation and Monitoring

Please refer to Section 2.3.10 for a listing of Applicant-Committed Practices designed to minimize impacts to wildlife, raptor, and special status species populations within the SLPA. Additional mitigation is recommended as follows to minimize impacts to wildlife within the SLPA.

1. To protect important raptor nesting habitat, drilling and/or surface use will not be allowed within one-half (0.50) mile of occupied raptor nests during the period from February 1 to July 31.

2. If unusual maintenance is proposed within one-half (0.50) mile of an occupied nest between March 1 and June 15, the operator must contact the BLM Authorized Officer for prior approval of operations or maintenance which would be "unusual". "Unusual" means extensive or significant operations, such as workover operations or other operations, which include loud noise or night-time activity. Emergency (safety) situations would not be restricted.

3. Casual use activities away from existing roads and facilities that are scheduled to occur between March 1 and mid-June should be coordinated with the BLM in order to minimize or avoid potential impacts to nesting raptors in the area. Casual uses include, but are not limited to, ground activities such as: (1) preliminary scouting of routes or sites, (2) land surveying and staking, and (3) cultural and wildlife surveys. Because casual use is generally not treated as a managed or permitted activity, there is a potential for causing impacts to nesting raptors.

4. The Operator would implement policies designed to control poaching and littering and would notify all employees (contract and company) that conviction of a major game violation could result in disciplinary action. Contractors would be informed that any intentional poaching or littering within the SLPA could result in dismissal.

Implementation of the following Best Management Practices (BMP) developed by Wyoming PIF (Nicholoff 2003) would reduce the impacts of surface disturbing activities within the SLPA on migratory and non-migratory bird species.

1. Relocate surface disturbing activities to avoid large sagebrush stands to the greatest extent possible in order to prevent habitat fragmentation within the shrub-steppe habitat type.

2. Where possible, restore or rehabilitate degraded and disturbed sites to native plant communities.

3. Maintain remaining biological soil crust communities by minimizing sources of soil disturbance such as off-road vehicle use.

4. In large disturbed areas, sagebrush and perennial grasses may need to be reseeded to shorten the recovery time and prevent dominance by non-native grasses and forbs.

4.10 WILD HORSE MANAGEMENT

As indicated in Section 3.11, the proposed SLPA falls within the Antelope Hills Horse Management Area (HMA) and is directly adjacent to both the Lost Creek and Great Divide Basin HMAs, which constitute a wild horse meta-population in this area of Wyoming. Horse populations in both the Antelope Hills and Great Divide Basin HMAs exceed the appropriate management level (AML) established for these areas, while populations within the Lost Creek HMA are within the established AML. The Lost Creek herd has been determined to carry a high percentage of genetic markers identified with the Spanish Mustang breed, while those horses in the Antelope Hills and Great Divide Basin HMAs have not been genetically tested as of this date.

4.10.1 Proposed Action

As discussed in Section 4.6.1, implementation of the Proposed Action would result in the loss of approximately 106 acres of short-term and 49 acres of long-term forage production which would affect grazing opportunities within the SLPA. However, considering the fact that the Antelope Hills HMA encompasses approximately 110,000 acres, the loss of 49 acres of long-term forage production is negligible by comparison. As indicated above, the wild horse population within the Antelope Hills HMA exceeds the upper end of the AML by a factor of two.

There has been some concern expressed about the possible commingling of horses from the three different HMAs, particularly considering that the Lost Creek horses are apparently descended from the horses (mustangs) originally brought to the new world by the Spanish Conquistadores. In this regard, fresh water discharged to the surface may represent an attractant to these horses which could, in turn, result in interbreeding between individual horses in these three herds. While horses in the Antelope Hills and Great Divide Basin herds have not been genetically tested, there is no reason to

believe that these horses are genetically different from the Lost Creek herd and that interbreeding has already occurred between these herds at some point or points in the past - particularly considering that there are no absolute physical barriers separating the horses in these three herds. These horses are considered by BLM to be a single meta-population, but have been divided into three sub-populations or HMAs solely for management purposes. So, while the discharged water may represent an attractant to horses in an otherwise dry landscape, this does not mean that interbreeding would occur where none has taken place in the past or that said interbreeding, if it did occur, would dilute the genetics of the Lost Creek herd. In this regard, it is worth noting that Osborne Spring is approximately four miles southwest of the SLPA and represents an unfenced natural source of perennial water that may already act as an attractant for horses in all three herds - particularly in drought years and in cases where an expanding population forces individuals to occupy new or non-traditional areas within the management area. Likewise, Picket Lake is approximately six miles northwest of the SLPA and also represents an unfenced perennial source of water in the area. There is seven miles of separation between Osborne Spring and Picket Lake and it is unreasonable to assume that horses would use one source of water to the exclusion of the other. Finally, it should be noted that the HMA boundaries are somewhat artificial and the horses may or may not respect these artificial boundaries. These populations are dynamic and it is likely that genetic testing of the Antelope Hills and Great Divide Basin herds will ultimately determine that all of these horse herds are inter-related as no physical obstacles occur within the overall area to preclude interbreeding. As a consequence, we do not anticipate any adverse impacts to wild horse populations in the area in general or a dilution of the unique genetic characteristics of the Lost Creek herd as a result of the Proposed Action..

4.10.2 The No Action Alternative

Under the No Action Alternative impacts to wild horse populations in the area would continue at existing levels.

4.10.3 Mitigation and Monitoring

No mitigation or monitoring is recommended.

4.11 CUMULATIVE IMPACTS

Pursuant to NEPA, the BLM must consider the cumulative impacts of the Proposed Action in conjunction with other ongoing oil/gas exploration and development activities within the general area. In addition, unrelated activities within the overall project area which might have an adverse impact upon existing natural resources in the area and, consequently, which would further contribute to the overall degradation of the human environment must be considered in the analysis of cumulative impacts as well. In this regard, the primary activity within the general area consists of past and present oil/gas exploration activity within the Picket Lake Unit as discussed in Section 3.5.2. Additional oil/gas exploration activity within the general area includes the following:

- Cabot Oil & Gas Corporation Osborne Spring Unit #32-14: SE¼SW¼ of Section 32, Township 26 North, Range 97 West. Drilled to 13,745 feet and completed in the Ericson Formation. Well is currently being placed on production.

- Davis Petroleum Corporation Picket Lake Federal #1-14: NW¼SW¼ of Section 14, Township 26 North, Range 87 West. Well proposed to 14,700 feet to test the productive potential of the Lewis Formation. The well was originally permitted in early 2001, was not drilled, and has been subsequently been renewed on an annual basis since initial permit approval.

There are no other oil/gas exploration and/or development activities existing or proposed within a six mile radius of the SLPA.

Considering that the approving agencies (the WOGCC and BLM's Lander and Rawlins Field Offices) have not received any proposals for additional resource development or major surface disturbing activity (e.g., mines, highways, and/or industrial sites) in or adjacent to the SLPA other than those referenced above, the Proposed Action represents the only reasonably foreseeable resource development in the overall project area.

For the purposes of this Environmental Assessment, an Area of Influence (AOI) has been defined for those resource components potentially affected by additional oil/gas exploration and development within the SLPA with the AOI adjusted for each specific resource. Table 4.1 provides a listing of each specific resource component discussed herein and the AOI as defined for each. Generally speaking, the AOI defined for most resource components consists of the project area as cumulative impacts to those resources would typically be confined to the area of impact. Certain notable exceptions exist for those resource components where impacts resulting from the proposed SLPP may migrate off-site or affect population dynamics in the case of wildlife.

Table 4.1

Area of Influence for Each Specific Resource Component

Resource Component	Area of influence
Air Quality	Great Divide Basin
Cultural Resources	Project Area
Geology and Minerals	Project Area + Buffer Including Above Wells
Hydrology - Surface	Watersheds
Hydrology - Subsurface	Scotty Lake Aquifer
Range Management	Grazing Allotments
Soils	Watersheds
Wildlife	Varies by Species - See Section 4.11.8
Wild Horses	Horse Management Area(s)

As indicated in Table 4.1, the AOI for Surface Hydrology and Soils has been defined by watersheds as discussed in Section 3.6.1 and in the Scotty Lake CBNG Pilot Project Water Management Plan (WMP). However, it should be noted that the WMP does not consider impacts to the West Alkali Creek watershed as no produced water will be discharged north of Cyclone Rim. Primary surface disturbance within the Red Creek watershed AOI includes the existing wells within the SLPA as discussed in Section 3.5.2, both the existing Cabot and proposed Davis wells discussed above, and the existing BLM roads in the area (including BLM Road numbers 3214, 3216, and 3219).

Disturbances associated with these three BLM roads will vary somewhat throughout the overall AOI. However, for the purposes of this document, we will assume that the long-term disturbance associated with each BLM road right-of-way is equal to forty feet. While this is an overstatement of currently existing disturbance for BLM roads 3214 and 3216, it is fairly accurate for BLM Road 3219. Routine maintenance of these roads and the frequency thereof will dictate long-term surface disturbance associated therewith as will use of BLM Road #3216 for access to the well proposed by Davis Petroleum Corporation. Consequently, we must assume that the road ROWs either have recently been bladed or will be bladed in the near future, which will result in a continuing level of disturbance to soils and subsequent plant growth thereon. Existing two-track trails within the CIAA are not being considered in this analysis as field inspections conducted on April 14 and again on June 23, 2004 indicated that area two-track trails are both stable and well vegetated. As these trails are not contributing to potential erosion and/or sedimentation and represent only a minor reduction in forage production within the CIAA they will not be considered herein.

Existing/proposed surface disturbance within the watershed AOI is quantified in Table 4.2 by disturbance type in each respective watershed. It should be noted that BLM Road #3216 follows Cyclone Rim, which generally represents the hydrologic boundary between Red Creek and West Alkali Creek and also represents the administrative boundary between the Lander and Rawlins Field Offices as mentioned previously. In this regard, both map and field inspections of existing surface disturbance within the SLPA suggests that most of the existing surface disturbance is situated on the south side of the hydrologic divide. For the purposes of this document, existing disturbance associated with BLM Road #3216 east/southeast of the Picket Lake Unit #3 will be allocated to the West Alkali Creek Drainage as well as surface disturbance associated with the existing Picket Lake Unit #3 well location and access road route.

Table 4.3 provides a summary of total surface disturbance by watershed including existing/proposed disturbance quantified in Table 4.2 and including additional surface disturbance associated with the Proposed Action.

4.11.2 Air Quality

The cumulative impact of emissions resulting from the implementation of the proposed 18 well Scotty Lake pilot project would be much the same as those discussed for similar oil and gas projects such as the Seminoe Road Coalbed Methane Pilot Project (BLM 2001), Lower Bush Creek Coal Bed Methane Exploratory Pilot Project (BLM 2003a), and Wind Dancer Natural Gas Development Project (BLM 2004c).

Table 4.2

Summary of Existing Surface Disturbance in the Area of Influence by Watershed

Name of Watershed	Facilities [1] (acres)	BLM Roads [2] (acres)	Collector Roads [3] (acres)	Resource Roads [4] (acres)	TOTAL (acres)
Red Creek	21.55	60.63	21.82	12.75	116.75
West Alkali Creek	1.00	6.89	00.00	0.45	8.34
Totals	**22.55**	**67.52**	**21.82**	**13.20**	**125.09**

1 Includes well pads (19.83 acres), existing compressor site (0.62 acres), and water retention pits (2.10 acres).
2 73,525' of road with a 40' total disturbed ROW width (66,025' in Red Creek and 7,500' in West Alkali Creek).
3 23,760' of road with a 40' total disturbed ROW width.
4 9,530' of road with a 40' total disturbed ROW width and 6,924' of road with a total disturbed ROW width of 28'.

Table 4.3

Summary of Total Surface Disturbance Anticipated in the SLPP Area of Influence by Watershed

Name of Watershed	Facilities (acres)	BLM Roads (acres)	Access Roads [1] (acres)	Pipelines [2] (acres)	TOTAL (acres)
Red Creek	53.92	60.63	54.02	24.67	193.24
West Alkali Creek	13.45	6.89	5.41	12.15	37.90
Totals	**67.37**	**67.52**	**59.43**	**36.82**	**231.14**

1 Includes existing collector and resource roads shown in Table 4.2 and proposed resource roads to be constructed in conjunction with the Proposed Action.
2 Includes both gas and water pipelines to be constructed in conjunction with the Proposed Action.

In depth air quality analyses have been conducted on three large-scale oil and gas exploration and development projects in southwest Wyoming including the Continental Divide/Wamsutter II Natural Gas Project EIS (BLM 1999a), Desolation Flats Natural Gas Field Development Project Final EIS (BLM 2004b), and the Pinedale Anticline Oil and Gas Exploration and Development Project EIS (BLM 1999b). Analyses contained in the Continental Divide/Wamsutter II air quality study found that both short and long term predicted pollutant concentrations would comply with applicable air quality standards (i.e., WAAQS and NAAQS) resulting from direct, indirect, and cumulative project emissions (including construction and operation). Likewise, analyses presented in the Pinedale Anticline air quality study found no significant impacts to near-field air quality standards at a predicted 40 acre well density (16 wells per section). Air quality analyses conducted in conjunction with the Desolation Flats EIS found no significant adverse impacts to air quality resulting from

either the Proposed Action (385 wells drilled with a 65% success rate) or from Alternative A (592 wells drilled with a 65% success rate). Clearly, the emissions from the 18 well pilot project would be inconsequential when compared to the level of development proposed in the Continental Divide, Desolation Flats and Pinedale Anticline projects and consequently would not violate applicable WAAQS and NAAQS air quality standards.

4.11.2 Cultural Resources

Both the surface and sub-surface mineral estate included within the AOI is in federal ownership. In this regard, the Class III cultural resource inventories that have been/would be conducted in conjunction with proposed surface disturbing activities therein would not only add to our knowledge of the distribution of such resources within the area but would serve to minimize if not prevent impacts to potentially eligible cultural sites. Because all known cultural resources would either be avoided or potential impacts thereto mitigated in accordance with BLM/SHPO recommendations, no adverse cumulative impacts would occur to cultural resources within the AOI.

4.11.3 Geology and Minerals

Existing, proposed and reasonably foreseeable future actions within the AIO would not add appreciably to the level of impact to geological and mineral resources therein. Development of oil and gas resources within the AIO would result in minor alterations to the existing topography with the bulk of these alterations occurring on surface/mineral estate owned by the United States of America and subject to BLM approval. Application of site-specific Conditions of Approval (COAs) at the time of permit approval would effectively mitigate these minor levels of topographic disturbance. Likewise, use of industry standard drilling procedures and application of BMPs would minimize potential impacts to the sub-surface mineral resources penetrated in conjunction with oil/gas exploration activity within the AOI.

4.11.4 Hydrology

4.11.4.1 Surface Hydrology

Additional oil/gas exploration and development activity within the SLPA would result in negligible impacts to surface waters and their applicable watersheds within the AOI. In this regard, Table 4.3 presents a summary of the cumulative surface disturbance which would be expected within each individual watershed and would include the surface disturbance associated with the construction and subsequent drilling of the 18 wells proposed in conjunction with the SLPP. Implementation of the Proposed Action would increase the cumulative surface disturbance in the Red Creek watershed by approximately 61 percent from 119.75 acres to 193.24 acres, with the cumulative surface disturbance equal to approximately 1.47 percent of the Red Creek watershed. Likewise, implementation of the Proposed Action would also increase the surface disturbance in the West Alkali Creek watershed by approximately 354 percent from 8.34 acres to 37.9 acres, with the cumulative surface disturbance equal to less than 1 percent (0.10%) of the West Alkali Creek watershed.

Surface disturbing activities associated with the Proposed Action would increase total surface disturbance in the 50,944 acre AOI by approximately 0.20 percent from 0.25 percent to 0.45 percent. An increase of less than 1 percent in overall surface disturbance within the AOI would be considered as a negligible impact upon the affected watersheds.

As there are no permanent sources of surface water within the SLPA or the AOI, we do not anticipate any cumulative impacts to surface waters or the surface hydrology of the AOI resulting from surface disturbing activities associated with the Proposed Action.

4.11.4.2 Sub-Surface Hydrology

Implementation of the Proposed Action would result in the removal of fresh water from the Fort Union Fm (Scotty Lake coals) at the rate of approximately 9,900 barrels of water per day (bwpd). As there are no known water wells within the AOI which are permitted to the Fort Union Fm (Scotty Lake coals) other than the existing CBNG wells referenced in Section 3.5.2, cumulative impacts to the sub-surface hydrology of the AOI will not occur. There are no other activities (either currently ongoing or proposed) within the AOI which would result in a cumulative impact to the ground water resources thereof.

4.11.5 Range Management

As indicated in Table 4.1, the Area of Influence (AOI) for the Range Management resource would consist of both the Cyclone Rim and Green Mountain Common grazing allotments. An analysis of cumulative impacts was conducted in conjunction with the Wind Dancer Natural Gas Development Project (BLM 2004c) which analyzed the cumulative impacts of oil/gas exploration and development activity within the Cyclone Rim grazing allotment. This analysis included the proposed Scotty Lake CBNG Pilot Project in the cumulative impact analysis and estimated that approximately 103 AUMs would be lost due to existing and reasonably foreseeable development therein, which amounted to 0.3 percent of the 40,661 total AUMs therein. This estimate is slightly inflated as approximately 30 acres of surface disturbance included within the proposed SLPP actually occurs within the Green Mountain Common allotment; however, this small error would only serve to reduce the impacts within the Cyclone Rim allotment proportionately and would be minor in comparison with the overall size of the Cyclone Rim allotment.

The Green Mountain Common allotment contains approximately 468,379 acres of public lands with a total of 47,729 AUMs. The cumulative disturbance of 37.90 acres in the reasonably foreseeable future would amount to a short-term loss of approximately 5.26 AUMs within the Green Mountain Common grazing allotment, or substantially less than one percent (0.01%) of the total AUMs available in said allotment.

Because non-native invasive and noxious plant species would be controlled by the Operator, it is unlikely that the Proposed Action would have any adverse cumulative impacts. However, any area(s) within the SLPA subjected to new surface disturbance would represent an opportunity for the establishment of these invasive non-native species.

4.11.6 Soils

As indicated in Section 4.6.1, surface disturbances associated with the Proposed Action would result in the short-term disturbance of approximately 106 acres of the soil resource within the SLPA, or approximately 3.7% of the overall project area. The addition of 125.09 acres of existing/proposed surface disturbance within the AOI would result in cumulative, short-term disturbance of 231.14 acres or less than one percent (0.45%) of the AOI as defined in Table 4.1.

Considering that oil/gas exploration activities within the SLPA, and directly under the control of Hudson Group, LLC, represents the primary surface disturbing activity within the overall AOI, quantification of these existing and proposed impacts will present a fairly accurate view of impacts to the soil resource within the Area of Influence. Addition of the 106.05 acres of surface disturbance attributable to the Proposed Action would increase the overall, short-term surface disturbance within the AOI by approximately 85 percent. However, implementation of BMP for reclamation and erosion control within the AOI would result in a commensurate reduction in overall erosion rates as discussed in Section 4.7.1. The successful reclamation of surface disturbance within the AOI combined with routine monitoring of reclamation success and implementation of remedial measures as necessary to correct any identified deficiencies would reduce the cumulative impacts to the soil resource to negligible levels.

4.11.7 Visual Resources

While implementation of the Proposed Action would increase the overall number of facilities within the viewshed, the cumulative impact of these facilities upon the landscape would remain consistent with the stated VRM designations for the overall project area.

4.11.8 Wildlife and Special Status Species

As indicated in Table 4.1, the Area of Influence (AOI) for wildlife will vary by species. Table 4.4 defines the AOI for those species to be discussed below, with these definitions based on previous analyses including the Wind Dancer Natural Gas Development Project EA (BLM 2004c).

Table 4.4

Areas of Influence for Analysis of Cumulative Impacts to Wildlife and Special Status Species

Species	Area of Influence	Rationale
Big Game (antelope, elk, and mule deer)	WGFD Herd Unit	Potential range of herd
Raptors	Project Area + 1 Mile Buffer	Current Nesting Stipulations
Sage Grouse	Project Area + 2 Mile Buffer	Current Lek Stipulations
Other Migratory Birds	Project Area + 1 Mile Buffer	Based on Raptor Stipulation

Surface disturbing activities within the AOI for the SLPP have already accounted for approximately 125.09 acres of short-term habitat loss (see Table 4.2). Implementation of the SLPP proposal and subsequent drilling of all 18 wells proposed in conjunction therewith would add an additional 106.05 acres of short-term habitat loss, resulting in a cumulative habitat loss of 231.14 acres of habitat as shown in Table 4.3. This total includes short-term disturbance associated with oil/gas exploration activity which has previously occurred within the overall project area (or is proposed to occur as in the case of the Davis well). These disturbed areas will be subjected to an indeterminate amount of reclamation in the near term resulting in an overall reduction in the amount of surface disturbance remaining over the long term (post reclamation disturbance) for the LOP. However, for the purposes of this analysis we will assume that this 231.14 acres of surface disturbance represents post reclamation (or long-term) disturbance.

4.11.8.1 Big Game Species

An analysis of cumulative impacts to big game species in the Great Divide Basin was conducted in conjunction with the Wind Dancer Natural Gas Development Project (BLM 2004c) which analyzed the cumulative impacts of oil/gas exploration and development activity within the Red Desert (antelope) and Steamboat (elk and mule deer) Herd Units. This analysis included the proposed Scotty Lake CBNG Pilot Project in the cumulative impact analysis and estimated that approximately 13,150 acres of wildlife habitat would be/have been lost to both existing and reasonably foreseeable oil/gas exploration and development activity within the Red Desert antelope herd unit (2.16 million acres). Likewise, approximately 11,150 acres of wildlife habitat would be/have been lost to both existing and reasonably foreseeable oil/gas exploration and development activity within the Steamboat elk and mule deer herd units (2.5 million acres) (BLM 2004c). Surface disturbances resulting from approval of the Proposed Action would affect less than one-tenth of one percent of the total acreage included in both herd units and would represent slightly less than one percent of the total surface disturbance predicted in the respective herd units.

While direct impacts resulting from the implementation of the SLPP would affect less than one percent of the total area included within the Red Desert and Steamboat Herd Units, the increase in human activity associated with both existing and proposed oil/gas exploration activity within the AOI has the potential to add a larger human "footprint" to an otherwise remote area, thereby increasing the indirect impact of human intrusion and associated disturbance to wildlife populations. Animals within the affected areas will be displaced into surrounding habitats, with this displacement occurring over an indeterminate area and for an indeterminate period of time. However, considering that there are no crucial habitats within the proposed SLPA, the cumulative impact of this additional human presence within these herd units is considered to be minimal.

As stated in Section 3.10.1, that portion of the SLPA lying north of BLM road #3216 is included in the South Wind River Herd Unit for mule deer. An additional 29.56 acres of habitat on the extreme southern edge of the South Wind River Mule Deer Herd Unit would be affected by activities associated with the Proposed Action, which represents substantially less than one percent (0.002%) of the total acreage included within the subject herd unit (1,229,793 acres). As indicated in Section 3.10.1, there are no crucial mule deer habitats known to exist within the overall SLPA. Large portions of the Wind River Herd Unit including hunt areas 91, 93, 94 and 95 have no existing or ongoing oil/gas activity therein, with limited activity occurring in hunt areas 92 and 160 consisting

mainly of old, existing fields. Considering the extremely small amount of additional disturbance proposed within the South Wind River Herd Unit to result from project related activities, no additional analyses will be undertaken as the cumulative impact of the Proposed Action on mule deer within said herd unit will inconsequential, both from a direct (surface disturbance) and indirect (displacement) standpoint.

4.11.8.2 Greater Sage Grouse

There are no known leks within a two mile radius of the proposed SLPA. The closest leks to the actual SLPA boundary include both the Bastard Butte and Scotty Lake leks (see Section 3.10.2), which are approximately 3.25 miles southwest and 3.25 miles west/northwest respectively of the project area boundary. The AOI for sage grouse would encompass a two mile buffer zone surrounding the SLPA. Surface disturbance within the buffer zone surrounding the project area would be limited to pre-existing disturbance including the existing road network and reasonably foreseeable activity including the proposed Davis well - activities associated with the Proposed Action would not contribute to cumulative impacts to sage grouse nesting habitat within the AOI as defined in Table 4.4.

4.11.8.3 Raptors

Although historic raptor nests are known to occur within the AOI for the SLPP, inventories conducted in both 2003 and 2004 failed to identify any active raptor nesting within the project area. Mitigation measures suggested in Section 4.9.5, would serve to eliminate the cumulative impacts of additional CBNG exploration activity within the SLPA to these nesting territories by restricting surface disturbing activities within 0.5 miles of active nests during the period between February 1 and July 31 in any given year should an active nest be discovered. As stated in Section 4.9.1.4, BLM also attempts to relocate well pad facilities if they should fall within 1200 feet of a ferruginous hawk nest and 825 feet of any other raptor nest.

4.11.8.4 Migratory and Non-Migratory Birds

Direct impacts to migratory and non-migratory birds within the SLPA would include the cumulative loss of approximately 231.14 acres of habitat. Indirect losses would primarily involve the fragmentation of existing habitat within the 2,880 acre SLPA. As there are no reliable population data for migratory and/or non-migratory birds within the area, and considering that both direct and indirect impacts upon these bird populations are poorly understood, it would be difficult to accurately predict the cumulative impacts of the project thereon. The 106.05 acres of additional surface disturbance which would result from project implementation would increase cumulative surface disturbance within the SLPA by approximately 3.68 percent from 4.34 percent to 8.03 percent of the 2,880 acre project area. The impact of this 3.68 percent increase in cumulative surface disturbance to the migratory and non-migratory bird species identified in Table 3.9 would be negligible.

4.11.9 Wild Horse Management

The AOI for wild horses would be the Antelope Hills HMA, which encompasses approximately 110,000 acres in Fremont and Sweetwater counties. Cumulative impacts resulting from the loss of an additional 231.14 acres of forage production within the 110,000 acre HMA would account for less than one percent (0.21%) of available forage within the overall HMA, which is negligible in comparison to the total amount of forage available elsewhere within the HMA.

4.12 SHORT-TERM USE OF THE ENVIRONMENT VERSUS LONG-TERM PRODUCTIVITY

Short-term use of the environment during the life of the project would not detract from long-term productivity of the area. Even during the life of the project, only the small areas from which vegetation is removed would be unavailable for grazing and wildlife habitat. Once the project is completed and disturbed areas are reclaimed the same resources that were available prior to the project would be available once again, with the exception of the hydrocarbons that were extracted from the subsurface. While it may ultimately take up to 25 years to regenerate a mature, climax stand of shrubs (e.g., sagebrush) comparable to shrub populations present prior to project initiation, successful and ongoing reclamation of surface disturbance within the overall project area would introduce vegetative communities which would support wildlife and livestock grazing.

4.13 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The term "Irreversible Commitment of Resources" refers to the loss of future options which would result from additional exploration and development of those lands included within the SLPA and primarily applies to the resultant impacts upon:

- non-renewable resources such as minerals or cultural resources; or to

- processes or factors that are renewable only over long periods of time (e.g., soil productivity).

Likewise, the term "Irretrievable Commitment of Resources" refers to the loss of production, harvest, or use of natural resources. For example, some or all of the forage production from an area is irretrievably lost while the area serves as an oil/gas well pad. Although this forage production loss is irretrievable, the action is not irreversible and, if the land use changes though subsequent abandonment and reclamation of these facilities, forage production would resume.

4.13.1 Air Quality

No irreversible or irretrievable commitment of resources would occur to air quality. Short-term impacts to air quality resulting from additional CBNG exploration activity within the SLPA would be reversible. Similarly, these impacts would not be irretrievable since air quality is a transient characteristic subject to improvement through natural meteorological movements within the atmosphere.

4.13.2 Cultural Resources

Should cultural resource inventories fail to identify or inventory all sites and/or artifacts within the proposed area(s) of disturbance, there is a possibility that the cultural resource could be damaged or destroyed during subsequent construction activities. Such an impact would be both an irreversible and irretrievable commitment of the affected cultural resource. Likewise, the loss of contextual information that could have been retrieved from the undamaged cultural site would also be an irretrievable commitment of the cultural resource.

The loss of cultural properties as a result of vandalism or artifact collection would be both an irreversible and irretrievable commitment of the cultural resource as well.

4.13.3 Geology and Minerals

The removal natural gas from the Fort Union Fm would be both an irreversible and irretrievable commitment of resources. Once the hydrocarbons have been removed from the formation and put to other uses, the natural gas resource has been irreversibly and irretrievably lost.

4.13.4 Hydrology

No irreversible and only a minimal irretrievable commitment of resources would occur to the hydrologic environment of the project area. Water withdrawn from the Fort Union Fm in conjunction with CBNG operations in the SLPA would discharged to the surface and would be irretrievably lost to the parent aquifer; however, the aquifer would be expected to naturally recharge over time so the loss to the aquifer would not be irreversible. Likewise, the water withdrawn from the Fort Union Fm would be potentially withheld from other uses (such as agricultural uses) and would be irretrievably lost to those uses that are not able to take advantage of the discharged water.

4.13.5 Range Management

The only potentially irreversible commitment of range resources would result from the direct mortality of individual plants resulting from surface disturbances associated with additional CBNG exploration activities, which would translate into a direct reduction of available forage for livestock, wild horse, and wildlife use. However, plants (both as populations and as communities) have the reproductive potential to renew themselves. Consequently, this loss of individual plants would be reversible in the long term as disturbed areas were reclaimed. Likewise, the interim loss of vegetative cover types and associated resources (AUMs) would represent a minor irretrievable commitment of resources. As above, this irretrievable commitment of resources (loss of forage) would persist until such time as the disturbed area(s) had been reclaimed and their original productivity restored.

4.13.6 Soils

Any loss of topsoil associated with surface disturbance resulting from additional CBNG exploration activities within the SLPA and the subsequent loss or reduction in soil productivity resulting there from would be considered as an irreversible commitment of the soil resource. However, this

commitment is expected to be quite small when one considers the relatively small amount of soil disturbance that would result from the Proposed Action. A minimal irretrievable commitment of the soil resource would result from the disturbance of previously productive soils in conjunction with surface disturbing activities such as road and well pad construction. This commitment of resources would last until final project abandonment and reclamation.

Soil disturbances associated with additional CBNG exploration activity within the SLPA could result in erosion and the subsequent discharge of sediments into ephemeral tributaries of both Red Creek and West Alkali Creek which would both an irreversible and irretrievable commitment of resources.

4.13.7 Visual Resources

Visual intrusions resulting from alterations to the natural landscape would represent an irretrievable commitment of resources. However, these visual intrusions on the landscape are not irreversible and would be eliminated upon final abandonment of project related facilities within the SLPA and subsequent reclamation of disturbed areas associated therewith.

4.13.8 Wildlife and Special Status Species

The only irreversible commitment of resources that could occur to wildlife populations within the SLPA would be the direct mortality of individual animals. Wildlife species have the reproductive capacity to renew themselves and thereby maintain their populations, given the overall availability of quality habitat within the general vicinity of the potential impact. Considering both the availability and diversity of wildlife habitat existing throughout the overall project area, no irreversible commitment of resources would be expected to wildlife populations in the affected area.

The loss of habitat use associated with project related activities resulting from displacement (alteration of behavioral patterns) due to human intrusion would be an irretrievable commitment of wildlife resources. However, with proper timing constraints in critical habitats, the magnitude of such a commitment would be small and the commitment would be reversible upon final project termination and reclamation.

4.13.9 Wild Horses

The irreversible and irretrievable commitment of resources that are defined above for Wildlife and Special Status Species (Section 4.13.8) would apply to wild horses as well.

4.14 RESIDUAL IMPACTS

The term “residual impacts” refers to those impacts remaining after all reasonable mitigation has been applied. The disturbance of approximately 106 acres of soil and related wildlife habitat resulting from construction associated with additional CBNG exploration activity within the SLPA would constitute a short-term impact, considering that approximately 54% of this initial disturbance (49 acres) would be reclaimed within two years following initial disturbance. The remaining 57 acres of initial surface disturbance would not be reclaimed until termination of the project and

would, therefore, represent a long-term (or residual) impact to the affected resources. This long-term impact to both the soil and related resources would also represent a residual loss of both domestic livestock, wild horse and wildlife forage, as well as associated wildlife habitat for a comparable period of time.

Construction of roads and drill pads, in conjunction with the installation of permanent production facilities on each individual well location would result in a long-term (or residual) impact to the visual resource of the area. Final abandonment of the project, plugging of each individual well, reclamation and revegetation of the remaining 57 acres of disturbed surface area and cessation of project related human intrusions into the area would effectively eliminate all of the above-referenced residual impacts associated with this project.

5.0 CONSULTATION AND COORDINATION

5.1 BACKGROUND

The Scotty Lake Coalbed Natural Gas Pilot Project (SLPP) Environmental Assessment was prepared by an independent environmental consulting firm, with the guidance, participation, and independent evaluation of the Bureau of Land Management. A list of the personnel responsible for document preparation, and their individual responsibilities are provided in Section 5.3.

5.2 PUBLIC PARTICIPATION

As indicated in Section 1.5, an open process has been employed for the determination and scope of the issues addressed in this environmental document. In compliance with the procedural requirements of the Council on Environmental Quality for the implementation of NEPA (40 CFR 15001.7, the RFO released a scoping notice on March 17, 2004 in order to identify the significant issues related to the SLPP proposal. The scoping notice was sent to all individuals, agencies, companies, and organizations listed on the BLM's NEPA mailing list. The thirty day public comment period ended on April 19, 2004, Comments were received from the following individuals, agencies, or organizations:

- Natural Resources Conservation Service
- Petroleum Association of Wyoming
- Southern Ute Indian Tribe
- U.S. Fish and Wildlife Service
- Wyoming Department of Agriculture
- Wyoming Department of Environmental Quality
- Wyoming Game and Fish Department
- Wyoming Office of State Lands and Investments
- Wyoming Outdoor Council - Biodiversity Conservation Alliance
- Wyoming State Engineer's Office

5.3 LIST OF PREPARERS

The following tables identify those BLM and consulting individuals that played a key role in the preparation of this Environmental Assessment.

Table 5.1

Interdisciplinary Reviewers from the Bureau of Land Management

Name	Title
Rawlins Field Office	
John Ahlbrandt	Project Lead, Natural Resource Specialist
Mike Calton	Rangeland Management Specialist
Bob Hartman	Petroleum Engineer
Krystal Clair	Recreation/Visual
Bill Falvey	Wildlife Biologist
Susan Foley	Soils/Invasive Weeds
Pam Huter	Archaeologist
Bob Lange	Hydrologist, Water Quality
Sandy Meyers	Assistant Field Manager, Resources
Clare Miller	Assistant Field Manager, Minerals and Lands
Mark Newman	Geology
Chuck Reed	Wild Horses
Mike Robinson	Realty Specialist
David Simons	Environmental Planner
Lander Field Office	
Greg Bautz	Soil Scientist
Chris Carusona	Natural Resource Specialist
Stuart Cerovski	Petroleum Engineer
John Likins	Range Management
Griff Morgan	Wildlife Biologist
Roy Packer	Wild Horses
Ruble Vigil	Assistant Field Manager, Resources
Ed Womack	Assistant Field Manager, Minerals and Lands

Table 5.2

Principal Interdisciplinary Team

Name	Affiliation	Responsibility
Robert M. Anderson	Anderson Environmental Consulting	Project Manager, Principal Author
John Albanese	Independent Archaeologist	Cultural Resources
Carleton S. Babb	Independent Hydrogeologist	Water Management Plan
Susan J. Connell	TRC Environmental Corporation	Air Quality
Chris Gardiner	Uintah Engineering & Land Surveying, Inc.	Cartography - Environmental Assessment
Jeff Garrard	Uintah Engineering & Land Surveying, Inc.	Cartography - Environmental Assessment
Arch Swank	WyoCAD, LLC	Cartography - Water Management Plan

6.0 REFERENCES

Albanese, John P. 2004. Class I Cultural Resources Survey of Two Acreage Blocks; Hudson Group, LLC Scotty Lake Pilot Project Located in Township 26 North, Ranges 96 and 97 West, Sweetwater County, Wyoming. March 2004. Casper, Wyoming. Unpublished report. 4 pp + maps.

Anderson Environmental Consulting (AEC). 2004. Raptor nesting inventory of the Scotty Lake Coalbed Natural Gas Pilot Project Area - Sweetwater County, Wyoming. August 2004. Unpublished report prepared for Hudson Group, LLC and the Rawlins Field Office, Bureau of Land Management. Anderson Environmental Consulting. Casper, Wyoming. 6 pp + maps and appendices.

Advanced Resources International, Inc. 2002. Powder River Basin Coalbed Methane Development and Produced Water Management Study. Advanced Resources International, Inc., U.S Department of Energy, Office of Fossil Energy and National Energy Technology Laboratory.

Babb, Carleton, S. 2004a. Personal communications: July 2004.

_____. 2004b. Water Management Plan. Hudson Group, LLC Scotty Lake CBNG Pilot Project. Sections 17, 18, 19, and 20, T26N-R96W. Sections 14, 22, 23, 24 and 26, T26N-R97W. Sweetwater County, Wyoming. July 2004. Casper, Wyoming. Unpublished report. 11 pp + appendices.

Bureau of Land Management (BLM). 1983. Riley Ridge Natural Gas Project Environmental Impact Statement. Prepared by the USDI - Bureau of Land Management, USDA - Forest Service, and Environmental Research & Technology, Inc. May 1983.

_____. 1985. Manual 9113 - Roads. Engineering Release 9-247. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

_____. 1986. Lander Resource Area Resource Management Plan Final Environmental Impact Statement. Bureau of Land Management, Wyoming State Office. Cheyenne, Wyoming. July 1986. BLM-WY-ES-86-017-4410. 605 pp.

_____. 1987. Lander Resource Area Record of Decision and Approved Resource Management Plan. Bureau of Land Management, Rawlins District Office. Rawlins, Wyoming. June 1987. BLM-WY-ES-87-015-4410. 124 pp.

_____. 1988. National Environmental Policy Act Handbook H-1790-1. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C. 67 pp + appendices.

_____. 1990. Great Divide Resource Area Record of Decision and Approved Resource Management Plan. Bureau of Land Management, Rawlins District Office. Rawlins, Wyoming. BLM-WY-PT-91-010-4410. November 1990. 74 pp.

_____. 1991. Wyoming Supplement to BLM Manual 9113. U.S. Department of the Interior, Bureau of Land Management, Wyoming State Office. Cheyenne, Wyoming. 16 pp.

_____. 1997. Cave Gulch-Bullfrog-Waltman Natural Gas Development Project, Natrona County, Wyoming. Draft Environmental Impact Statement. Casper District Office, Platte River Resource Area, Bureau of Land Management. Mills, Wyoming. DEIS 97-4. 353 pp + appendices.

_____. 1998. Implementation Plan. Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management for Public Lands Administered by the Bureau of Land Management in the State of Wyoming. Updated January 15, 2004. http://www.wy.blm.gov/range/sandgimp.htm.

_____. 1999a. Continental Divide/Wamsutter II Natural Gas Project, Sweetwater and Carbon Counties, Wyoming. Draft Environmental Impact Statement. Rawlins and Rock Springs Field Offices, Bureau of Land Management. Cheyenne, Wyoming. BLM-WY-PL-00-003-1310. 276 pp + appendices.

_____. 1999b. Pinedale Anticline Oil and Gas Exploration and Development Project, Sublette County, Wyoming. Draft Environmental Impact Statement. Pinedale Field Office, Bureau of Land Management. Cheyenne, Wyoming. BLM-WY-PL-98-024-1320. 363 pp + appendices.

_____. 2001. Seminoe Road Coalbed Methane Pilot Project, Carbon County, Wyoming. Environmental Assessment. Rawlins Field Office, Bureau of Land Management. Rawlins, Wyoming. BLM-WY-030-EA00-288. 147 pp + appendices.

_____. 2003a. Lower Bush Creek Coal Bed Methane Pilot Project Environmental Assessment. Rock Springs Field Office, Bureau of Land Management. Rock Springs, Wyoming. BLM-WY-040-EA03-211. 144 pp.

_____. 2003b. Great Divide Basin/Ferris and Seminoe Mountain Watersheds Standards and Guidelines Assessment. Rawlins Field Office, Bureau of Land Management. 122 pp. http://www.wy.blm.gov/rfo/range.htm.

_____. 2003c. Final Environmental Impact Statement and Proposed Plan Amendment for the Powder River Basin Oil and Gas Project,. Buffalo Field Office, Bureau of Land Management. Cheyenne, Wyoming. BLM-WY-PL-03/004+1310 (WY-070-02-065).

_____. 2004a. Personal communications with Bill Falvey (Wildlife Biologist/RFO) and Griff Morgan (Wildlife Biologist/LFO) on July 9, 2004.

_____. 2004b. Desolation Flats Natural Gas Field Development Project, Sweetwater and Carbon Counties, Wyoming. Final Environmental Impact Statement. Rawlins and Rock Springs Field Offices, Bureau of Land Management. Cheyenne, Wyoming. BLM-WY-PL-040-026-1310. 365 pp + appendices.

_____. 2004c. Wind Dancer Natural Gas Development Project Environmental Assessment. Rawlins Field Office, Bureau of Land Management. Cheyenne, Wyoming. BLM-WY-PL-04/027-1310 (WYW-030-04-EA-204). 84 pp + appendices.

Brekke, E.B. 1985. Effects of CO_2 development on elk calving in south-central Colorado. Unpublished report. Bureau of Land Management. Canon City, Colorado.

Cary, M. 1917. North American Fauna Number 42. Life zone investigations in Wyoming. U.S. Department of Agriculture, Bureau of Biological Survey. Government Printing Office. Washington, D.C. 95 pp.

Case, J.C. 1997. Earthquakes and Active Faults in Wyoming. Preliminary Hazards Report 97-2, Wyoming State Geological Survey. Laramie, Wyoming.

Case, J.C. and J.A. Green. 2000. Earthquakes in Wyoming. Information Pamphlet 6, Wyoming State Geological Survey. Laramie, Wyoming.

Case, J.C., L.L. Larsen, C.S. Boyd, and J.C. Cannia (compilers). 1995. Earthquake Epicenters and Suspected Active Faults with Surficial Expression in Wyoming (1:1,000,000 scale map). Wyoming State Geological Survey. Laramie, Wyoming.

Curtis, Jan and K. Grimes. 2004. Wyoming Climate Atlas. Prepared in cooperation with the Wyoming Water Research Program, University of Wyoming; the U.S. Geological Survey; and the Wyoming Water Development Commission. 328 pp.

Fagerstone, K.A. 1987. Black-footed ferret, long-tailed weasel, and least weasel. Pages 548-573. In: Wild Furbearer Management and Conservation in North America edited by M. Novak, J.A. Baker, M.E. Obbard, and B. Malloch. Ministry of Natural Resources. Ontario, Canada.

Federal Register. 1983. 48 FR 44716.

Grah, Oliver J. 1997. Soils, water, and vegetation resources technical report. Report prepared for the Cave Gulch-Bullfrog-Waltman Natural Gas Development Project Environmental Impact Statement. Prepared for the USDI-BLM, Casper District Office, Casper, Wyoming and Gary Holsan Environmental Planning, Thayne, Wyoming by ECOTONE Environmental Consulting, Inc., Logan, Utah. 101 pp.

Graul, W.D. 1975. Breeding biology of the mountain plover. Wilson Bulletin 87:6-31.

Graul, W.D. and L.E. Webster. 1976. Breeding status of the mountain plover. Condor 78:265-267.

Hillman, C.N. and T.W. Clark. 1980. *Mustela nigripes*. Mammalian Species, Number 126. 3 pp.

Hudson, Gene. 2004. Geologic report, proposed coalbed methane unit area, Sweetwater County, Wyoming. May 2004. Casper, Wyoming. Unpublished report. 2 pp.

Irwin, L.L. and J.M. Peek. 1979. Relationship between road closures and elk behavior in northern Idaho. Pages 199-204. In: North American Elk: Ecology, Behavior and Management edited by M.S. Boyce and L.D. Hayden-Wing. University of Wyoming. Laramie, Wyoming.

Klein, D.R. 1974. The reaction of some northern mammals to aircraft disturbance. Pages 377-383. In: Eleventh International Congress of Game Biologists; September 3-7, 1973. Stockholm, Sweden. Swedish Environmental Protection Board. Stockholm, Sweden.

Knopf, F.L. 1994. Avian assemblages on altered grasslands. Studies in Avian Biology 15:247-257.

_____. 2004. Personal communication. April 7, 2004.

Knopf, F.L. and B.J. Miller. 1994. *Charadrius montanus* - montane, grassland, or bare-ground plover? The Auk 111(2):504-506.

Leachman, B. and B. Osmundson. 1990. Status of the mountain plover: a literature review. U.S. Fish and Wildlife Service. Golden, Colorado. 83 pp.

MacArthur, R.A., V. Geist and R.H. Johnson. 1982. Cardiac and behavioral responses of mountain sheep to human disturbance. Journal of Wildlife Management 46:351-358.

Martner, B. 1986. Wyoming Climate Atlas. Prepared in cooperation with the Wyoming Water Research Center, University of Wyoming. University of Nebraska Press. Lincoln, Nebraska.

National Climatic Data Center (NCDC). 2002. Annual Climatological Summaries for Jeffrey City and Wamsutter, Wyoming. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. Ashville, North Carolina. Online data retrieved from: http://www1.ncdc.noaa.gov.

_____. 2003. Annual Climatological Summaries for Jeffrey City and Wamsutter, Wyoming. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. Ashville, North Carolina. Online data retrieved from: http://www1.ncdc.noaa.gov.

Nicholoff, S.H., compiler. 2003. Wyoming Bird Conservation Plan, Version 2.0. Wyoming Partners in Flight. Wyoming Game and Fish Department. Lander, Wyoming. 668 pp.

Peterson, D.A., K.L. Mora, M.E. Lowry, J.G. Rankl, J.F. Wilson, Jr., H.W. Lowham, and B.H. Ringen. 1987. Hydrology of Area 51, northern Great Plains and Rocky Mountain coal provinces, Wyoming and Montana. Water Resources Investigations, Open File Report 84-734. U.S. Geological Survey. Cheyenne, Wyoming. 73 pp.

Soil Conservation Service (SCS). 1974. Wyoming supplement for the Wind-Bighorn-Clarks Fork River Basin, Type IV Survey. USDA Water and Related Land Resources Report. Portland, Oregon.

Trewartha, G.T. 1968. An Introduction to Climate. McGraw-Hill Book Company. New York, New York.

Ward, A.L. and J.J. Cupal. 1979. Telemetered heart rate of three elk as affected by activity and human disturbance. Pages 47-56. In: Proceedings of the Dispersed Recreation and Natural Resource Management Symposium. Utah State University. Logan, Utah.

Water Resources Data System. 2004. Wyoming Earthquake Database cooperatively produced by the Wyoming State Geological Survey and Water Resources Data System. Electronic information available over the Internet at website: http://www.wrds.uwyo.edu/data.html.

Wyoming Department of Environmental Quality (WDEQ). 1990. Wyoming water quality rules and regulations. Wyoming Department of Environmental Quality. Cheyenne, Wyoming.

_____. 2003. Wyoming air quality standards and regulations, including revisions through 2003. Wyoming Department of Environmental Quality. Cheyenne, Wyoming.

Wyoming Department of Environmental Quality (WDEQ). 2003. Personal communications between Susan Connell (TRC Environmental) and both Darla Potter and Cara Casten (WDEQ-AQD) regarding regional air pollutant background concentrations for central Wyoming. Wyoming Department of Environmental Quality, Air Quality Division. Cheyenne, Wyoming. December 2003.

Wyoming Game and Fish Department (WGFD). 1999. Atlas of Birds, Mammals, Reptiles, and Amphibians in Wyoming. Wyoming Game and Fish Department, Wildlife Division. Cheyenne, Wyoming. November 1999. 190 pp. + appendices.

_____. 2003a. 2002 Annual Big Game Herd Unit JCRs. Lander and Green River Region Annual Big Game Herd Unit Reports 2002. Cheyenne, Wyoming. 288 pp and 349 pp, respectively.

_____. 2003b. 2002 Sage Grouse JCR. 2002 Sage Grouse and Pheasant Job Completion Report Lander Region. Cheyenne, Wyoming. 115 pp.

Wyoming Natural Diversity Database (WYNDDB). 2004. Data Compilation for Robert M. Anderson/Anderson Environmental Consulting. Completed on May 2, 2003. Unpublished Report. Wyoming Natural Diversity Database, University of Wyoming. Laramie, Wyoming.

Wyoming Oil and Gas Conservation Commission (WOGCC). 2004. Electronic well records compiled and maintained by the Wyoming Oil and Gas Conservation Commission. Casper, Wyoming. Information acquired via the Internet at website: http://wogcc.state.wy.us.

Wyoming State Land Use Commission. 1979. State of Wyoming Land Use Plan.

Wyoming State Weed Team (WSWT). 2003. Wyoming Weed Management Strategic Plan prepared by the Wyoming State Weed Team. June 2003. 12pp. Information acquired via the Internet at website: http://www.wyoweed.org.

7.0 ABBREVIATIONS AND ACRONYMS

4WD	Four Wheel Drive
AEC	Anderson Environmental Consulting
AML	Appropriate Management Level
AOI	Area of Influence
APD	Application for Permit to Drill
AUM	Animal Unit Month
BBS	Breeding Bird Survey
BLM	Bureau of Land Management
BMP	Best Management Practices
BR	Big Red (coal)
bwpd	Barrels of water per day
CBNG	Coalbed Natural Gas
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	Carbon monoxide
COA	Condition of Approval
CRA	Cyclone Rim Allotment
D & A	Drilled and Abandoned
DFP	Desolation Flats Project
DR	Decision Record
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FLPMA	Federal Land Policy and Management Act
Fm	Formation
FOOGLRA	Federal Onshore Oil and Gas Leasing Reform Act
FOOGRMA	Federal Onshore Oil and Gas Royalty Management Act
gpd	Gallons per day
GMCA	Green Mountain Common Allotment
H_2S	Hydrogen sulfide (gas)
HMA	Horse Management Area
LFO	Lander Field Office
LOP	Life of Project
mi^2	Square Mile
MLA	Mineral Leasing Act of 1920
mgwpd	Million gallons of water per day
MSLE	Modified Soil Loss Equation
NAAQS	National Ambient Air Quality Standards
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act

NHPA	National Historic Preservation Act
NO_2	Nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
O_3	Ozone
OSHA	Occupational Health and Safety Act
P & A	Plugged and Abandoned
PIF	Partners in Flight
PL	Public Law
PLU	Picket Lake Unit
PM_{10}	Particulate matter with an effective diameter less than 10 microns
$PM_{2.5}$	Particulate matter with an effective diameter less than 2.5 microns
ppm	Parts per Million
PSD	Prevention of Significant Deterioration
RFO	Rawlins Field Office
RMP	Resource Management Plan
ROD	Record of Decision
ROW	Right-of-Way
SARA	Superfund Amendments and Reauthorization Act
SCS	Soil Conservation Service
SGP	Shortgrass Prairie
SHPO	State Historic Preservation Officer
SL	Scotty Lake
SLPA	Scotty Lake Project Area
SLPP	Scotty Lake Pilot Project
SO_2	Sulfur dioxide
SS	Shrub Steppe
TCLP	Toxicity Constituent Leaching Process
TD	Total Depth
TDS	Total Dissolved Solids
T/E	Threatened and Endangered Species
TPH	Total Petroleum Hydrocarbons
t/ac/yr	Tons per Acre per Year
t/yr	Tons per Year
TRC	TRC Environmental Corporation/TRC Mariah Associates Inc.
USA	United States of America
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UW	University of Wyoming
VOC	Volatile Organic Compound
VRM	Visual Resource Management
WAAQS	Wyoming Ambient Air Quality Standards

WDEQ	Wyoming Department of Environmental Quality
- AQD	Air Quality Division
WGFD	Wyoming Game and Fish Department
WMP	Water Management Plan
WOGCC	Wyoming Oil and Gas Conservation Commission
WSEO	Wyoming State Engineer's Office
WSWT	Wyoming State Weed Team
WYNDDB	Wyoming Natural Diversity Database

APPENDIX A

FEDERAL PERMITS, APPROVALS AND AUTHORIZING ACTIONS APPLICABLE TO ADDITIONAL EXPLORATION IN THE SCOTTY LAKE CBNG PILOT PROJECT AREA

A. DEPARTMENT OF THE INTERIOR

Agency	Nature of Action
1. Bureau of Land Management	
a. Rawlins and Lander Field Offices	Approval of APD and Sundry Notices for actions on federal surface and/or mineral estate.
	Approval to vent or flare gas during testing.
	Approval to dispose of produced water.
	Right-of-Way Grants for off-lease/unit facilities.
	Right-of-Way Grants to third party applicants for facilities both in and out of the lease/unit.
	Review cultural resource inventories, consult with SHPO and ACHP.
b. Wyoming Reservoir Management Group	Approval of Unit Agreement and annual Unit Plan of Development.
2. U.S. Fish & Wildlife Service	Review impacts to federally listed, or proposed for listing, threatened or endangered species of fish, wildlife and plants.
	Administers the *Migratory Bird Treaty Act*.

B. DEPARTMENT OF THE ARMY

Agency	Nature of Action
1. U.S. Army Corps of Engineers	Issue permits for the placement of dredged or fill material in or excavation of waters of the U.S. and their adjacent wetlands pursuant to Section 404 of the Clean Water Act.

STATE OF WYOMING PERMITS, APPROVALS AND AUTHORIZING ACTIONS APPLICABLE TO ADDITIONAL EXPLORATION IN THE SCOTTY LAKE CBNG PILOT PROJECT AREA

Agency	Nature of Action
1. Department of Environmental Quality	
a. Air Quality Division	Approval to burn commercial garbage and/or any other open air burning.
	Permitting/approval for compression sites, flaring, and other natural gas production and processing facilities.
	Fugitive dust suppression.
b. Land Quality Division	Approval of off-site solid waste disposal.
	Approval of permits for aggregate material (e.g., sand and gravel) mining activity.
c. Water Quality Division	Approval of Storm Water Pollution Prevention Plan (SWPPP).
	Approval of surface discharge of produced water.
	Approval of waste water and sewage disposal.
2. Department of Transportation	The transport of oversize, overweight or overlength loads (particularly construction and drilling equipment) would require transport permits from the State of Wyoming (for the use of both state and federal highway systems within the State).
3. Oil & Gas Conservation Commission	Primary authority for drilling operations on state and privately owned mineral resources, and secondary authority for drilling operations on federal lands.
	Authority to allow or prohibit flaring or venting of gas on private or state owned minerals.
	Aquifer exemption permit.
	Approval of directional drilling operations.
	Rules and regulations governing drilling units.
	Underground Injection Control (UIC) permits.
	Approval of exceptions to well spacing patterns established under WOGCC Rule 302 or special orders approved by the commission. Underground Injection Control (UIC) permits.
4. State Engineer's Office	Issue permits for the appropriation of surface and ground water.
	Issue permits for the construction of water retention (evaporation) ponds.
5. State Historic Preservation Office	Section 106 consultation concerning inventory of, and impacts to, cultural and historical resources.

SWEETWATER COUNTY APPROVALS AND AUTHORIZING ACTIONS APPLICABLE TO ADDITIONAL EXPLORATION IN THE SCOTTY LAKE CBNG PILOT PROJECT AREA

Agency	Nature of Action
1. Health Department	Small wastewater (septic) system permits, where applicable.
2. Planning Department	Administers zoning changes, where applicable.
	Construction and conditional use permits for all new structures and non-mineral mining activity (aggregate material) where appropriate.
3. Road and Bridge Department	Driveway access permits where new roads intersect with existing county roads.
	Road use agreements and/or oversize trip permits when traffic on county roads exceeds established size/weight limitations or where the potential for excessive road damage exists.

NON-SIGNIFICANT ISSUES RAISED DURING THE PUBLIC SCOPING PROCESS

As discussed in Section 1.5, certain issues identified in conjunction with project scoping were determined not to be "significant issues related to the Proposed Action" (40 CFR 1501.7) because they are not potentially affected or impacted by the proposal. Those issues brought forth during public scoping and reasons for eliminating that particular issue from consideration in this analysis are stated below.

Conformance with LUP

On April 15, 2003 the Interior Board of Land Appeals issued a decision (158 IBLA 384), Wyoming Outdoor Council, et al, in which they determined that the Great Divide Resource Management Plan (RMP) and subsequent documentation failed to identify any of the relevant areas of environmental concern associated with coalbed natural gas development, failed to discuss reasonable alternatives to the proposed action and did not satisfy BLM's NEPA obligation. In the IBLA ruling they reversed the Acting Director's decision and remanded the matter to BLM for further appropriate action. The Rawlins Field Office responded to the IBLA remand by preparing a new Documentation of Land Use Plan Conformance and NEPA Adequacy (DNA) to determine if exploration and development of methane gas from coal reservoirs is within the broad impacts predicted for oil and gas development described in the current land use plan. The DNA was transmitted to the BLM Wyoming State Office on July 29, 2003, and confirms that the exploration and development of methane gas from coal reservoirs is in conformance with the Great Divide RMP.

Geologic Hazards (earthquakes)

The Wyoming Earthquake Database lists four earthquakes having occurred in Sweetwater County since 1986 with a magnitude greater than 2.5. Two of these quakes occurred in northeastern Sweetwater County in May of 2000 just south of Bairoil, while the remaining two quakes occurred in the southwestern portion of the county in an area generally south of Little America in November of 1998 and January of 2000 respectively (WRDS 2004).

According to Case (1999), 31 earthquakes have occurred in Sweetwater County between 1888 and 1995, with these various quakes ranging in magnitude from 2.2 to 5.3 on the Richter scale. One of the most recent earthquakes occurred on February 3, 1995, with an epicenter located near Little America, Wyoming. The quake had a magnitude of 5.3, was felt throughout the state and as far away as Salt Lake City, Utah and was associated with the collapse of a shaft in an active trona mine. Fault zones in the geographic region have been recurrently active for the past 20 million years; however, their activity is poorly defined or nonexistent in recent times (Case *et al* 1995). Known or suspected active faults are located on the northern and southern boundaries of Sweetwater County (Case and Green 2000).

Considering the relatively stable nature of the Great Divide/Green River Basin(s) and the fact that no devastating earthquakes have been recorded in Sweetwater County in over 115 years, the likelihood of a major earthquake occurring within the general area is unlikely, as is the probability of a quake that could/would cause extensive damage to any infrastructure constructed in conjunction with the Proposed Action.

Impacts of Noise

The project area is located in a very-sparsely populated area which is subject to modest sound disturbances associated primarily with jet aircraft overflights, localized vehicular traffic on existing road networks within the area and, most notably, the wind. Local increases in noise may be expected as a result of exploration activities associated with the pilot project, but these impacts will typically be very short-term in nature and would occur primarily during active construction, drilling and completion operations. The EPA has established 55 decibels (dBA) as the maximum noise level that does not adversely affect public health and welfare. The State of Wyoming has not adopted any regulations concerning quantitative noise levels.

Considering that the project area is located in a very sparsely populated area of Sweetwater County, any noise generated by activities associated with the Proposed Action during peak activity periods would be dispersed and short-term in nature and would likely be unnoticed by the relatively few visitors to the area. In this regard, noise impacts have been analyzed for numerous CBNG projects throughout southwestern Wyoming in recent years. Consequently, the reader is directed to one or more of these documents for additional information in this regard:

- Decision Record, Finding of No Significant Impact and Environmental Assessment for Lower Bush Creek Coal Bed Methane Exploratory Pilot Project. Rock Springs Field Office, Bureau of Land Management. August 2003.

- Environmental Assessment for the Atlantic Rim Interim Drilling Project, Doty Mountain POD, Carbon County, Wyoming. Rawlins Field Office, Bureau of Land Management. October 2003.

- Environmental Assessment for the Atlantic Rim Coalbed Methane Project, Brown Cow POD, Carbon County, Wyoming. Rawlins Field Office, Bureau of Land Management. December 2003.

- Decision Record, Finding of No Significant Impact and Environmental Assessment for the Cooper Ridge Shallow Gas Exploration and Development Project. Rock Springs Field Office, Bureau of Land Management. December 2003.

Impacts to Social/Economic Values

Neither the economy of Sweetwater County nor the quality of life for the residents thereof will be adversely affected by the Proposed Action. As described in Chapter 2.0, additional oil/gas exploration and development activity in the SLPA would not result in an increase in the local workforce, with a concomitant burden on the resources of Sweetwater County and the infrastructure thereof. In point of fact, implementation of the Proposed Action would ultimately have a positive impact on the economy of Sweetwater County through increased revenues generated by additional hydrocarbon production from leases within the project area should commercial CBNG production be established from any/all of the proposed wells proposed in conjunction with this pilot project.

As this is a pilot project, it would be difficult at best to predict the financial revenue to Sweetwater County, should commercial production result from any/all of the wells proposed in conjunction with

said pilot project. Considering that no commercial production has been reported to date from the three initial wells completed by Hudson Group, LLC in the Scotty Lake coals, the task of predicting potential revenue (positive economic benefit) becomes highly speculative at best.

Migration of Methane

Coalbed natural gas production as proposed in the SLPP would occur from coal-bearing seams within the Fort Union Fm at depths ranging between 2,000 feet and 5,000 feet below the natural ground surface with an overburden consisting of sandstones, siltstones and shales. Considering that the Scotty Lake coal sequence represents a confined reservoir having a minimum of 2,000 feet of overburden, it is extremely unlikely that there would be any significant migration of methane to the surface resulting from the depressurization of the targeted coal-bearing seam in conjunction with this pilot project (see Appendix D). Furthermore, completion techniques to be utilized in conjunction with this pilot project would be designed and implemented in order to minimize the potential for communication with the surface (BLM 2003a).

Potential for Depletion of Colorado River System Waters

The sub-surface and surface water resources in the Great Divide Basin are hydrographically closed (see Section 3.5.1 and Appendix D). Consequently, the project proposal has no potential to impact these resources (BLM 2003a).

Potential for Impacts to Biological Soil Crusts

Biological soil crusts are common, but not widespread, in semiarid and arid environments. Crusts in southwest Wyoming appear to be confined to protected or inaccessible areas that probably have not been disturbed by heavy, sustained livestock use (both historic and contemporary), unlike the Colorado plateau where crusts are a prominent feature. While no crusts have been observed in the project area during past field reviews, this does not preclude their presence. However, the fact that these crusts may exist in the project area does not limit development or other surface disturbing activities, as they would be salvaged in conjunction with topsoil stripping associated with well pad, access road, and pipeline right-of-way construction. The salvaged topsoil would ultimately be placed back on the reclaimed portions of the disturbed area and re-seeded with native species as directed by the RFO, with these reclamation activities occurring as soon as practical following the initial surface disturbance in an attempt to maintain soil microbe viability and enhance reclamation success (BLM 2003a).

While it is highly unlikely that construction activities associated with the Proposed Action would be located on contiguous or conterminous areas of biological soil crusts, efforts would be made to avoid the crusts should such an area be identified.

Risk to Ground Water from Hydraulic Fracturing

Fresh water aquifers utilized for water supplies within the overall project area are much nearer the surface than the Scotty lake coals and are separated by hundreds, if not thousands, of feet of sedimentary rock including layers of sandstone, siltstone, and shale. The hydraulic fracturing of the

targeted coal-bearing seams will be conducted with the best technological methods designed to protect against risks to other aquifers. As indicated in Section 2.2.4, hydraulic fracturing conducted in conjunction with the SLPP would be conducted with fresh water and/or freshwater/sand and would not involve any chemical agents that could be considered as a contaminant.

In this regard, the Environmental Protection Agency (EPA) has recently released a draft report addressing the potential for impacts to underground sources of drinking water by the hydraulic fracturing of coal bed natural gas reservoirs (EPA 816-D-02-006). Based upon information collected during the Phase I investigation, the EPA has preliminarily found that "the potential threats to public health posed by hydraulic fracturing of CBNG wells appear to be small and do not justify additional study" (BLM 2003a). Please refer to Section 2.2.4 of this document for additional information concerning hydraulic fracturing techniques.

Subsidence

Subsidence typically occurs when solid material is extracted (e.g., coal or trona). While it may be possible for subsidence to occur, the probability of subsidence occurring is extremely remote considering the depth of the targeted coals, the fact that no solid material is being removed from the coal-bearing seam, combined with the structural integrity of the overlying formations (sandstones and shales). Finally, the pilot project only affects a very small portion of the Scotty Lake coal, further reducing the potential for subsidence to occur.

Underground Coal Fires

Spontaneous combustion of the coal seam following depressurization (dewatering) is not likely considering the depth of the coal and the fact that the coal-bearing seam does not outcrop. As a consequence, sufficient oxygen is unavailable for spontaneous combustion. Furthermore, it should be noted that depressurization of the coal does not result in the removal of all entrained water therefrom. A sufficient quantity of water will be removed from the targeted coal-bearing seam to lower the hydrostatic pressure to the point where gas will desorb from the coal and flow to the surface via the well bore (see Section 2.2.4). Once this equilibrium has been reached, water production would decrease dramatically. Based upon studies conducted in conjunction with the Powder River Basin Oil and Gas EIS (ARI 2002, BLM 2003c), approximately 20% of the water in the coal aquifer is removed in order to facilitate desorption, leaving 80% of the entrained water in place.

Use of hazardous/toxic materials in drilling/completion operations

As indicated in Section 2.2.10, no hazardous or toxic materials will be utilized in drilling or completion operations.

HUDSON GROUP, LLC
Scotty Lake Coalbed Natural Gas Pilot Project
Plan of Development and Master Field Permit
Sweetwater County, Wyoming

TYPICAL DRILLING PROGNOSIS

1. ESTIMATED TOPS OF IMPORTANT GEOLOGIC MARKERS

The proposed Scotty Lake Coal Bed Natural Gas (CBNG) Pilot Project will test the productive potential of coals in the Fort Union Fm at varying depths across the project area. Please refer to each individual Application for Permit to Drill (APD) for site specific geologic information.

2. ESTIMATED DEPTHS OF ANTICIPATED WATER, OIL, GAS OR MINERAL FORMATIONS

As indicated above, the Scotty Lake CBNG Pilot Project will test the productive potential of the Fort Union Fm at varying depths across the project area. No other potentially productive formations are anticipated between surface and total depth. Please refer to each individual Application for Permit to Drill (APD) for site specific geologic information.

Any shallow water zones encountered will be adequately protected and reported. All potentially productive hydrocarbon zones will be cemented off.

3. PRESSURE CONTROL EQUIPMENT - Schematic Attached

A. Type: Double Gate Hydraulic Blow-Out Preventer (BOP) equipped as follows:

1. One (1) blind ram (above).
2. One (1) pipe ram (below).
3. Kill line (2-inch minimum).
4. One (1) kill line valve (2-inch minimum).
5. One (1) choke line valve.
6. Two (2) adjustable chokes (2-inch minimum).
7. Upper kelly cock valve with handle available.
8. Full opening internal blowout preventer or drill pipe safety valve able to fit all connections.
9. 2-inch (minimum) choke line.
10. Fill-up line above the uppermost preventer.

B. Pressure Rating: 2,000 psi

C. Testing Procedure:

At a minimum, the BOP, choke manifold, and related equipment will be pressure tested to the approved working pressure of the BOP stack (if isolated from the surface casing by a test plug) or to 70% of the internal yield strength of the surface casing (if the BOP is not isolated from the casing by a test plug). Pressure will be maintained for a period of at least 10 minutes or until the requirements of the test are met, whichever is longer.

3. PRESSURE CONTROL EQUIPMENT

C. Testing Procedure: Continued

At a minimum, the above pressure test will be performed:

1. When the BOP is initially installed;
2. Whenever any seal subject to test pressure is broken;
3. Following related repairs; and
4. At thirty (30) day intervals.

In addition to the above, the pipe and blind rams will be activated each trip, but not more than once each day. All BOP drills and tests will be recorded in the IADC driller's log.

D. Choke Manifold Equipment:

All choke lines will be straight lines unless turns use tee blocks or are targeted with running tees, and will be anchored to prevent whip and vibration.

E. Accumulator:

The accumulator will have sufficient capacity to close all BOP's and retain 200 psi above precharge. Nitrogen bottles that meet the manufacturer's specifications will be used as the backup to the required independent power source. The accumulator precharge pressure test will be conducted prior to connecting the closing unit to the BOP stack and at least once every six (6) months thereafter. The accumulator pressure will be corrected if the measured precharge pressure is found to be above or below the maximum or minimum limits specified in *Onshore Oil and Gas Order Number 2*.

A manual locking device (i.e., hand wheels) or automatic locking device will be installed on all systems of 2M or greater. A valve will be installed in the closing line as close as possible to the annular preventer to act as a locking device. This valve will be maintained in the open position and will be closed only when the power source for the accumulator system is inoperative.

F. Miscellaneous Information:

The Blow-Out Preventer and related pressure control equipment will be installed, tested and maintained in compliance with the specifications in and requirements of *Onshore Oil & Gas Order Number 2*.

4. THE PROPOSED CASING AND CEMENTING PROGRAM

Hudson Group, LLC proposes to test the potential of interbedded coals in the Fort Union Fm for natural gas production. Actual total depths will vary from well to well and will be reported in each individual Application for Permit to Drill.

Hudson Group, LLC
Scotty Lake CBNG Pilot Project
Plan of Development and Master Field Permit
Typical Drilling Prognosis
Page 3

4. THE PROPOSED CASING AND CEMENTING PROGRAM - Continued

A. Casing Program: All New

Hole Size	Casing Size	Wt./Ft.	Grade	Joint	Depth Set
12.000"	8.625"	20.0#	J-55	ST&C	0 - 450'
7.875"	5.500"	15.5#	J-55	LT&C	0 - Total Depth

The surface casing will have centralizers on the bottom three (3) joints joint of casing, with a minimum of one (1) centralizer per joint starting with the shoe joint.

Casing string(s) will be pressure tested to 0.22 psi/foot of casing string length or 1500 psi, whichever is greater (not to exceed 70% of the internal yield strength of the casing), after cementing and prior to drilling out from under the casing shoe.

B. Cementing Program:

The surface casing will be cemented back to surface with approximately 160 sx of Halliburton "Lite" cement mixed at 12.4 ppg (yield = 1.97 ft^3/sx). The 5.500" production casing string will be cemented with Class "G" cement mixed at 14.5 ppg (yield = 1.15 ft^3/sx). Actual cement volumes may vary due to variations in the actual hole gauge and will be determined by running a caliper log on the drilled hole prior to cementing. Approximate cement volumes will be provided in each individual Application for Permit to Drill with cement circulated to a minimum of 200' above the top of the shallowest coal in the Fort Union Fm.

All waiting on cement (WOC) times will be adequate to achieve a minimum of 500 psi compressive strength at the casing shoe prior to drilling out.

5. MUD PROGRAM - Visual Monitoring

Interval	Mud Type	Weight	Viscosity	Fluid Loss
Surface to 3000'	Fresh Water/Gel	8.2 - 8.6	26 - 30	No Control
3000' to Total Depth	LSND w/Polymer Sweeps	8.6 - 9.2	28 - 40	No Control

Sufficient mud material(s) to maintain mud properties, control lost circulation and contain a blowout will be available at the well site during drilling operations.

Hudson Group, LLC
Scotty Lake CBNG Pilot Project
Plan of Development and Master Field Permit
Typical Drilling Prognosis
Page 4

6. EVALUATION PROGRAM - Continued

Logs : DIL : from Total Depth to Surface.
FDC/GR/CAL-GR : from Total Depth to 2000' *.

DST's : Formation test(s) are possible in the Fort Union Fm. Additional tests will be run as warranted by logs and/or shows.

Cores : Cores are possible in the Fort Union Fm. Please refer to each individual Application for Permit to Drill for more specific information in this regard.

* Pull Gamma Ray Log Back to Surface

The evaluation program may change at the discretion of the well site geologist, with prior approval from the Authorized Officer, Rawlins Field Office, Bureau of Land Management.

Stimulation : No stimulation or frac treatment has been formulated for this test at this time. The drill site, as approved, will be of sufficient size to accommodate all completion activities.

Whether each well is completed as a dry hole or as a producer, *Well Completion and Recompletion Report and Log* (form #3160-4) will be submitted to the Rawlins Field Office not later than thirty (30) days after the completion of each individual well or after completion of operations being performed, in accordance with 43 CFR 3164.

Two (2) copies of all logs, core descriptions, core analyses, well test data, geologic summaries, sample description, and all other surveys or data obtained and compiled during the drilling, workover, and/or completion operations, will be filed with form #3160-4. Samples (cuttings, fluids, and/or gases) will be submitted when requested by the Authorized Officer, Rawlins Field Office, Bureau of Land Management, P.O. Box 2407, Rawlins, Wyoming 82301-2407, Telephone: 307-328-4200.

7. ABNORMAL CONDITIONS

No abnormal temperatures or pressures are anticipated. No H_2S has been encountered in or known to exist from previous wells drilled to similar depths in the general area.

Maximum anticipated bottom hole pressure in the Scotty Lake CBNG Pilot Project area equals approximately 2,300 psi (calculated at 0.50 psi/foot for the deepest well currently drilled or proposed) and maximum anticipated surface pressure equals approximately 1,288 psi (bottom hole pressure minus the pressure of a partially evacuated hole calculated at 0.22 psi/foot) for the deepest well currently drilled/proposed in the Scotty Lake CBNG Pilot Project area.

Hudson Group, LLC
Scotty Lake CBNG Pilot Project
Plan of Development and Master Field Permit
Typical Drilling Prognosis
Page 5

8. ANTICIPATED STARTING DATES AND NOTIFICATION OF OPERATIONS

A. Anticipated Starting Dates:

Anticipated Commencement Date : September 15, 2004
Drilling Days : Approximately 14 Days per Well
Completion Days : Approximately 14 Days per Well

B. Notification of Operations:

Bureau of Land Management
Rawlins Field Office
P.O. Box 2407
Rawlins, Wyoming 82301-2407
Telephone: 307-328-4200

Contacts for the Rawlins Field Office are:

Contact Title	Contact Name	Work Phone	Home Phone
Petroleum Engineer	Bob Hartman	307-328-4254	307-321-3439
Assistant Field Manager	Clare Miller	307-328-4245	307-324-2372
Petroleum Technician	Cole Thomas	307-328-4249	307-328-1901
Petroleum Technician	Chuck Ross	307-328-4230	307-324-9123
Petroleum Technician	Bill Ashline	307-328-4263	307-324-6355
Petroleum Technician	Bryan Hurst	307-328-4277	307-324-5066
Natural Resource Specialist	John Ahlbrandt	307-328-4223	307-328-1808

Alternate Petroleum Engineer Contact if unable to reach Bob Hartman:

Office	Contact Name	Work Phone	Home Phone
Lander Field Office	Stuart Cerovski	307-332-7822	307-332-2408

C. General Conditions of Approval for Each Individual Well:

1. All lease and/or unit operations are to be conducted in such a manner to ensure full compliance with the applicable laws, regulations (43 CFR, Part 3160), Onshore Orders, Notices to Lessees, and the approved plan of operations.

Hudson Group, LLC
Scotty Lake CBNG Pilot Project
Plan of Development and Master Field Permit
Typical Drilling Prognosis
Page 6

8. ANTICIPATED STARTING DATES AND NOTIFICATION OF OPERATIONS

C. General Conditions of Approval for Each Individual Well: Continued

2. The spud date will be reported orally to the Rawlins Field Office ***24 HOURS PRIOR TO SPUDDING***, unless otherwise required in the site specific conditions of approval.

3. All wells, whether drilling, producing, suspended or abandoned shall be identified in accordance with 43 CFR 3162.6. There shall be a sign or marker with the name of the operator, the lease serial number, the well number and the surveyed description of the well.

4. In accordance with *Onshore Oil & Gas Order Number 1*, this well will be reported on MMS form #3160-6, *Monthly Report of Operations and Production*, starting with the month in which operations commence and continuing each month until the well is physically plugged and abandoned. This report will be filed directly with the Royalty Management Program, Minerals Management Service, P.O. Box 17110, Denver, Colorado 80217.

5. 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)

6. No well abandonment operations will be commenced without the prior approval of the Authorized Officer. In the case of newly-drilled dry holes or failures, and in emergency situations, oral approval will be obtained from the Field Office Petroleum Engineer. A *Notice of Intention to Abandon* (form #3160-5) will be filed with the Authorized Officer within fifteen (15) days following the granting of oral approval to plug and abandon.

7. Upon completion of approved 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, cap, or beaded-on with a welding torch: Company Name, Well Name and Number, Location by Quarter/Quarter, Section, Township, Range, and the Federal Lease Number.

8. 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. If the location is on private surface, a *Landowner Acceptance of Reclamation* letter will be attached to this "Sundry Notice".

Hudson Group, LLC
Scotty Lake CBNG Pilot Project
Plan of Development and Master Field Permit
Typical Drilling Prognosis
Page 7

8. ANTICIPATED STARTING DATES AND NOTIFICATION OF OPERATIONS

C. General Conditions of Approval for Each Individual Well: Continued

9. 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 Authorized Officer, and approval received, for any venting/flaring of gas beyond the initial thirty (30) day or otherwise authorized test period.

10. Not later than the 5*th* 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 Authorized Officer by letter or sundry notice, of the date on which such production has begun or resumed. The notification shall provide at a minimum, the following informational items:

    a. Operator name, address, and telephone number
    b. Well name and number
    c. Well location "¼, ¼, Section, Township, Range, P.M."
    d. Date well was placed in a producing status
    e. The nature of the wells production (i.e., crude oil, casing gas, or natural gas and entrained liquid hydrocarbons).
    f. 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).
    g. As appropriate, the communitization agreement number, the unit agreement name, number and participating area name.

11. 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 Authorized Officer. Facility diagrams shall be filed within sixty (60) days after existing facilities are modified. For complete information as to what is required on these diagrams, please refer to 43 CFR 3162.7-4(d).

12. Pursuant *to Onshore Oil & Gas Order Number 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 are applicable to operations on federal and Indian lands.

HUDSON GROUP, LLC
Scotty Lake Coalbed Natural Gas Pilot Project
Plan of Development and Master Field Permit
Sweetwater County, Wyoming

TYPICAL MULTI-POINT SURFACE USE & OPERATIONS PLAN

1. EXISTING ROADS - Refer to Maps "A" and "B"

A. Each proposed well site is staked and two (2) 200-foot reference stakes are present.
B. Specific information describing the proposed access to each individual well location from the community of Wamsutter, Wyoming will be contained in the Application for Permit to Drill (APD) submitted for each individual CBNG well included within the Scotty Lake CBNG Pilot Project Plan of Development.
C. Access roads - refer to Maps "A" and "B" in each individual APD.
D. Access roads within a one (1) mile radius - refer to Map "B".
E. Existing roads will be maintained in the same or better condition as existed prior to the commencement of operations and said maintenance will continue until final abandonment and reclamation of wells drilled and completed in conjunction with the Scotty Lake CBNG Pilot Project Plan of Development.

2. PLANNED ACCESS ROADS

Each individual APD will contain site-specific information concerning the construction standard(s) proposed for implementation on each segment of the access road route required for access to the well location. Access roads constructed in the Scotty Lake CBNG Pilot Project area will be constructed in accordance with the road construction guidelines outlined below.

A. Width - fourteen (14) foot running surface with a sixteen (16) foot subgrade, crowned and ditched for both drilling and completion operations.
B. Construction standard - access roads will be constructed (or reconstructed as appropriate) in accordance with roading guidelines established for oil & gas exploration and development activities as referenced 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.

   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. A typical road design is presented in Attachment "A" which provides information concerning minimum standards for road construction associated with federally administered projects.

   Approximately six (6) inches of topsoil will be stripped from the new construction portion of each primary access road route prior to performing any further construction activities thereon.

2. PLANNED ACCESS ROADS - Continued

B. Construction standard - if soils along primary access road routes are dry during reconstruction, water will be applied to the road surface to facilitate soil compaction and minimize soil loss as a result of wind erosion.

C. Maximum grade - please refer to the individual APD's for specific information concerning maximum grade(s) anticipated on/along each proposed access road route.

D. Turnouts - turnouts will be constructed along proposed access road routes as necessary or required to allow for the safe passage of traffic. These turnouts will be constructed in accordance with roading guidelines established for oil and gas exploration and development activities as referenced 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.

E. Drainage design - primary access roads will be upgraded and maintained as necessary to prevent soil erosion and accommodate all-weather traffic. These roads will be crowned and ditched with water turnouts installed as necessary to provide for proper drainage along the access road route.

F. Culverts, cuts and fills - culverts will be installed on/along all access roads as necessary or required by the Authorized Officer. Please refer to each individual APD for specific information regarding the need for culverts on/along the proposed access road route.

   Any required culverts will be installed in accordance with roading 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. Attachment "B" presents a typical design for culvert installation on those road construction projects subject to federal jurisdiction

   Please refer to each individual APD for specific information regarding cuts and/or fills anticipated on/along the proposed access road route.

G. Surfacing material - access roads will be surfaced to an average minimum depth (after compaction) of four (4) inches with two (2) inch minus pit run gravel or crushed rock purchased from a local contractor having a permitted source of materials within the general area. These surfacing materials will be installed at the discretion/requirement of the Authorized Officer, Bureau of Land Management.

H. Gates, cattleguards or fence cuts - gates, cattleguards, and/or fence cuts will be installed on/along each proposed access road route as necessary to provide reasonable access to each individual well location. Where required, these cattleguards will be installed in accordance with roading 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.

   Please refer to each individual APD for specific information regarding the need for gates, cattleguards or fence cuts on/along the proposed access road routes.

Hudson Group, LLC
Scotty Lake CBNG Pilot Project
Plan of Development and Master Field Permit
Surface Use and Operations Plan
Page 3

2. PLANNED ACCESS ROADS - Continued

I. Road maintenance - 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.

Access road rights-of-way will be kept free of trash during all operations.

J. The proposed access road route to each individual well location will be centerline staked prior to conducting the individual on-site inspections.

3. LOCATION OF EXISTING WELLS WITHIN A ONE-MILE RADIUS OF THE SCOTTY LAKE CBNG PILOT PROJECT AREA

A.	Water wells	-	SW¼SE¼, Section 13, T26N, R97W. NW¼SE¼, Section 24, T26N, R97W
			see Item #3F (below) for existing CBNG wells.
B.	Abandoned wells	-	NW¼SW¼, Section 17, T26N, R96W. SW¼SE¼, Section 21, T26N, R96W. SE¼NW¼, Section 28, T26N, R96W. SW¼NE¼, Section 13, T26N, R97W. SW¼NE¼, Section 25, T26N, R97W.
C.	Temporarily abandoned wells	-	none known.
D.	Disposal wells	-	none known.
E.	Drilling wells	-	none known.
F.	Producing wells	-	NW¼SW¼, Section 18, T26N, R96W. [1] SW¼NW¼, Section 19, T26N, R96W. [1] C SE¼, Section 13, T26N, R97W. [1] NW¼SE¼, Section 23, T26N, R97W. [1] NW¼SE¼, Section 24, T26N, R97W. [1]
G.	Shut-in wells	-	none known.
H.	Injection wells	-	none known.
I.	Monitoring wells	-	none known.

[1] - Coal bed natural gas wells previously drilled by Hudson Group, LLC.

SOURCE: WOGCC computerized well files accessible via the Internet.

4. LOCATION OF EXISTING AND/OR PROPOSED FACILITIES OWNED BY HUDSON GROUP, LLC WITHIN A ONE (1) MILE RADIUS

A. Existing Facilities

1. Tank batteries - none known.

Hudson Group, LLC
Scotty Lake CBNG Pilot Project
Plan of Development and Master Field Permit
Surface Use and Operations Plan
Page 4

4. LOCATION OF EXISTING AND/OR PROPOSED FACILITIES OWNED BY HUDSON GROUP, LLC WITHIN A ONE (1) MILE RADIUS

A. Existing Facilities - Continued

2. Production facilities - NW¼SW¼, Section 18, T26N, R96W.
   SW¼NW¼, Section 19, T26N, R96W.
   C SE¼, Section 13, T26N, R97W.
   NW¼SE¼, Section 23, T26N, R97W.
   NW¼SE¼, Section 24, T26N, R97W.
3. Oil gathering lines - none known.
4. Gas gathering lines - same as Item #4A2, above.

B. New Facilities Contemplated

1. All production facilities will be located on the disturbed portion of the well pad and at a minimum of fifteen (15) feet from the toe of the back slope.
2. Production facilities will require a working area approximately 150' X 10' in size. A diagram showing the proposed production facility layout will be submitted to the Authorized Officer via *Sundry Notice* (form #3160-5) for approval ***prior*** to commencement of installation operations.
3. Production facilities will be accommodated on the disturbed portion of the well pad. 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 materials in the area.

   A dike will be constructed completely around those production facilities designed to hold fluids (i.e., production tanks, produced water tanks and/or separator). These dikes will be constructed of compacted subsoil, be impervious, hold 110% of the capacity of the largest tank, and be independent of the back cut.

4. Water Gathering and Discharge

   Free water produced from each well will be transported from the well head via flowline to a surface discharge point for disposal. A *Permanent Water Management Plan* has been prepared by Hudson Group, LLC and has submitted to the Rawlins Field Office under separate cover (see Appendix D). The outfall of each discharge will be lined with rock (rip-rap) or some other suitable material in order to prevent erosion.

   Water produced from wells in close proximity to each other will be routed to a common discharge point to the greatest extent possible in order to minimize the overall number of discharge points required for water disposal within the Scotty Lake CBNG Pilot Project area. Entrained water which is separated from the gas stream will generally be routed to the closest discharge point for disposal. The actual discharge point and method of disposal for each individual well will be determined by the BLM at the time of the on-site inspection.

Hudson Group, LLC
Scotty Lake CBNG Pilot Project
Plan of Development and Master Field Permit
Surface Use and Operations Plan
Page 5

4. LOCATION OF EXISTING AND/OR PROPOSED FACILITIES OWNED BY HUDSON GROUP, LLC WITHIN A ONE (1) MILE RADIUS

B. New Facilities Contemplated - Continued

5. Gas Gathering and Sales

   Gas produced from each well will be transported from the well head via buried flowline to an existing, processing/metering facility where any remaining (entrained) water will be separated from the gas stream via a gas/water separator. The gas will then be metered and introduced into a gas sales line for transportation to market. The gas and water gathering lines will be buried in a common trench directly adjacent to existing access roads to the greatest extent possible to minimize surface disturbances within the field.

6. Pipeline and Flowline Right-of-Ways

   Graders will be used whenever possible to construct or clear individual pipeline rights-of-way. Each right-of-way will not be more than twenty-five 12) feet wide [preferably ten (10) feet wide on the soil stockpile side and fifteen (15) feet wide on the working side of the trench] without prior approval from the Authorized Officer, Bureau of Land Management. Right-of-ways constructed for the installation of water discharge lines will be no more than ten (10) feet in total width. Bladed materials will be placed back into the cleared route once construction has been completed. Pipeline construction will not block or change the natural course of any drainage.

7. 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*** (Munsell standard color #5Y 4/2) or another of the standard environmental colors recommended by the Rocky Mountain Five-State Interagency Committee to be selected at the discretion of the Authorized Officer, BLM. The exception being that *Occupational Safety and Health Act* Rules and Regulations will be complied with where special safety colors are required.

C. We do not anticipate the need to construct a production (emergency) pit on any of the individual well locations.
D. 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.
E. Reclamation of disturbed areas no longer needed for operations will be accomplished by grading, leveling and seeding as recommended by the Authorized Officer, Bureau of Land Management as appropriate.

5. LOCATION AND TYPE OF WATER SUPPLY

A. Fresh water for use in drilling operations will be obtained from the Picket Lake Unit #1 producing CBNG well and water retention (evaporation) pond located in the NW¼SE¼ of Section 24, Township 26 North, Range 97 West.

Hudson Group, LLC
Scotty Lake CBNG Pilot Project
Plan of Development and Master Field Permit
Surface Use and Operations Plan
Page 6

5. LOCATION AND TYPE OF WATER SUPPLY - Continued

A. Should this source prove to be inadequate, additional water for use in drilling and completion operations would be obtained from existing commercial water wells within the Scotty Lake Unit as follows:

1) Picket Lake #40-13 water supply well located in the NE¼SE¼ of Section 13, Township 26 North, Range 97 West, Permit #P145371W; or

2) Picket Lake #1 water supply well located in the NW¼SE¼ of Section 24, Township 26 North, Range 97 West, Permit #P135633.

Hudson Group, LLC will obtain all necessary permits for appropriation of surface and/or ground water from the office o the Wyoming State Engineer prior to diversion.

B. Water would be hauled over existing roads via tank truck from the Picket Lake Unit #1 water retention (evaporation) pond to each proposed point of use. No new road construction would be required on/along the proposed water haul route(s).

Should Hudson Group, LLC utilize either of the two existing water supply wells, water would then be transported via temporary surface pipeline from the source to each proposed point of use. These surface water lines will be laid in the borrow ditch directly adjacent to existing/proposed access road routes to the greatest extent possible. In the event that it is not practical to follow the existing road network, installation of "cross country" pipelines would be accomplished in such a manner as to minimize surface disturbances associated with the installation of said surface line(s).

Access across any off-lease or off-unit federal lands on/along the proposed water haul or surface pipeline route(s) would be secured under a separate right-of-way (ROW) authorization to be issued by the Rawlins Field Office, Bureau of Land Management. Said ROW authorization would typically be issued concurrent with the approval of the individual Application for Permit to Drill for each individual well location proposed hereunder.

C. Hudson Group, LLC currently has no plans to drill any additional water supply wells in conjunction with the proposed Scotty Lake CBNG Pilot Project.

6. SOURCE OF CONSTRUCTION MATERIALS

A. Any construction materials (gravel) which may be required for surfacing of the individual drill pads and/or central processing/metering facility sites will be obtained from a private contractor having a previously approved source of materials within the general area. Please refer to Item #2G (page #3) for information regarding those construction materials which may be required for surfacing of the main access roads.
B. No construction materials will be taken from federal or Indian lands without prior approval from the appropriate Surface Management Agency.

Hudson Group, LLC
Scotty Lake CBNG Pilot Project
Plan of Development and Master Field Permit
Surface Use and Operations Plan
Page 7

6. SOURCE OF CONSTRUCTION MATERIALS - Continued

C. Any construction materials which may be required for surfacing of primary access roads and/or the installation of central processing/metering facilities will be purchased from a local supplier having a permitted source of materials within the general area.
D. No new access roads for transportation of these construction materials will be required.

7. METHODS OF HANDLING WASTE MATERIALS

A. Cuttings - the drilled cuttings will be deposited in the reserve pit.
B. Drilling fluids - including any salts and/or chemicals utilized in the mud system will be contained in the reserve pit. The reserve pit will be designed to prevent the collection of surface runoff and will be constructed entirely in cut on the uphill side of the well location.
C. Produced fluids - water produced from wells within the Scotty Lake CBNG Pilot Project area will be discharged to the surface as indicated in Item #4B3 (page #7) under existing National Pollutant Discharge Elimination System (NPDES) permits issued by the Wyoming Department of Environmental Quality (WDEQ).

   Any spills of oil, gas, salt water or any other potentially hazardous substance will be cleaned up and immediately removed to an approved disposal site.

D. Sewage - portable, self-contained chemical toilets will be provided on each individual well 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.
E. 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 on each individual well location. Upon completion of operations (or as needed) the accumulated trash will be hauled off-site to a WDEQ approved sanitary landfill.

   No trash will be placed in the reserve pit.

F. 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.

   Any open pits remaining upon conclusion of drilling operations will immediately be fenced with said fencing maintained until such time as the pits have been backfilled.

G. Hazardous Materials - Hudson Group, LLC 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.

Hudson Group, LLC
Scotty Lake CBNG Pilot Project
Plan of Development and Master Field Permit
Surface Use and Operations Plan
Page 8

7. METHODS OF HANDLING WASTE MATERIALS - Continued

G. Hazardous Materials - 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

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 and Extremely Hazardous Substances and commercial preparation will be handled in an appropriate manner to minimize the potential for leaks or spills to the environment.

8. ANCILLARY FACILITIES

None anticipated.

9. WELLSITE LAYOUT

A. Diagrams specific to each individual well location will be included in each respective Application for Permit to Drill and will include cross-sectional diagrams of the proposed well location as required under *Onshore Oil and Gas Order Number 1*.
B. No permanent living facilities are planned on those individual well locations to be included in the Scotty Lake CBNG Pilot Project; however, there will be a maximum of three (3) trailers on location during drilling operations which will serve as offices and housing for the mud logger, geologist and toolpusher.
C. All equipment and vehicles will be confined to those areas subsequently approved (designated) in conjunction with each individual Application for Permit to Drill (e.g., access road, well pad, spoil and topsoil storage areas).
D. Diagrams showing the proposed production facility layout on each individual well location will be submitted to the Authorized Officer via *Sundry Notice* (form #3160-5) for approval ***prior*** to the commencement of installation operations. Please refer to Item #4B2 (page #3) for additional information in this regard.
E. The reserve pit(s) will be lined with a plastic/vinyl liner in order to prevent drilling water loss through seepage. The liner will have a permeability less than or equal to 1×10^{-7} cm/sec, will be chemically compatible with all substances which may be put into the pit and will be installed so that it will not leak. Liners made of any man-made synthetic material will be of sufficient strength and thickness to withstand normal installation and pit use. The liner will be installed with sufficient bedding (either straw or dirt) to cover any rocks, will overlap the pit walls, extend under the mud tanks, and be covered with dirt and/or rocks to hold it in place.

No trash, scrap pipe, etc. that could puncture the liner will be disposed of in the reserve pit.

Hudson Group, LLC
Scotty Lake CBNG Pilot Project
Plan of Development and Master Field Permit
Surface Use and Operations Plan
Page 9

9. WELLSITE LAYOUT - Continued

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

1. 32-inch net wire shall be used with two (2) strands of barbed wire on top of (above) the net wire.
2. The net wire shall be no more than four (4) inches above the ground. The first strand of barbed wire shall be ≈ three (3) inches above the net wire. Total height of the fence shall be at least forty-two (42) inches.
3. Corner posts shall be cemented and/or braced in such a manner to keep the fence tight at all times.
4. Standard steel, wood, or pipe posts shall be used between the corner braces. The maximum distance between any two (2) posts shall be no greater than sixteen (16) feet.
5. All wire shall be stretched, by using a stretching device, before it is attached to the corner posts.

The fourth (4^{th}) side of the reserve pit(s) will be fenced immediately upon removal of the drilling rig and the fencing will be maintained until the pit has been backfilled.

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

10. PLANS FOR RECLAMATION OF THE SURFACE

A. Rat and mouse holes (as appropriate) will be backfilled and compacted from bottom to top immediately upon release of the completion rig from the location.
B. If any oil is on the reserve pit and is not immediately removed after operations cease, the pit containing the oil or other adverse substance(s) will be flagged overhead or covered with wire mesh to protect migrating waterfowl.

C. Producing Operations:

1. Backfilling, leveling and re-contouring of each individual well location will be undertaken as soon as possible after cessation of drilling and completion operations. Waste and spoil materials will be disposed of immediately upon cessation of drilling and completion activities.
2. For production, the fill slopes will be reduced from a 1.5:1 slope to a minimum 3:1 slope and the cut slopes will be reduced from a 2:1 slope to a minimum 4:1 slope by pushing the fill material back up into the cut. Please refer to each individual Application for Permit to Drill for more specific information regarding slope reduction and timing of the reclamation activities.
3. Upon completion of backfilling, leveling and recontouring, all disturbed surfaces (access road and well pad areas) will be scarified to a depth of one (1) foot and the stockpiled topsoil will be evenly redistributed to a depth of six (6) inches over the reclaimed area(s).

Hudson Group, LLC
Scotty Lake CBNG Pilot Project
Plan of Development and Master Field Permit
Surface Use and Operations Plan
Page 10

10. PLANS FOR RECLAMATION OF THE SURFACE

C. Producing Operations: Continued

4. Prior to commencement of seeding operations, the seedbed will be prepared by disking on the contour to a depth of four (4) to six (6) inches, leaving no depressions that would trap water or form ponds. All disturbed surfaces (including the access road and well pad areas) will be reseeded using the seed mixture identified below (or a different mixture to be recommended by BLM's Authorized Officer as appropriate).

Species	Pounds PLS/Acre [1]
Western wheatgrass	5.0
Needleandthread grass	3.0
Indian ricegrass	3.0
Bottlebrush squirreltail	3.0
Gardner's saltbush	2.0

[1] Pounds of Pure Live Seed per Acre.

5. 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), hand broadcast the seed at double the rate indicated above and rake or chain the area to cover the broadcast seed.
6. Fall seeding will be completed after September 1*st* and prior to ground frost. If applicable, spring seeding will be completed after the frost has left the ground and prior to June 15*th*. 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.

D. Pipeline and Flowline Right-of-Ways:

1. Pipeline/flowline trenches will be compacted during backfilling and said trenches will be maintained in order to correct settlement and erosion.
2. Prior to commencement of reseeding activities on/along the reclaimed pipeline/flowline right-of-ways, waterbars will be constructed at least one (1) foot deep, on the contour with approximately two (2) feet of drop per 100 feet of waterbar to ensure drainage, and extended into established vegetation. All waterbars will be constructed with the berm on the downhill side to prevent the soft material from silting in the trench. The initial waterbar should be constructed at the top of the backslope. Subsequent waterbars should follow the following general spacing guidelines provided below:

Hudson Group, LLC
Scotty Lake CBNG Pilot Project
Plan of Development and Master Field Permit
Surface Use and Operations Plan
Page 11

10. PLANS FOR RECLAMATION OF THE SURFACE

D. Pipeline and Flowline Right-of-Ways: Continued

2. Subsequent waterbars should follow the following general spacing guidelines provided below:

% Slope	Spacing Interval (feet)
2% or <	200’
2% - 4%	100’
4% - 5%	75’
5% or >	50’

3. All disturbed surfaces along pipeline/flowline right-of-ways will be reseeded as recommended in Item #10C3-6, above.

E. Abandoned Well Location:

1. Upon final abandonment of each well location and/or associated facilities, gravel will be removed from the access road surface and well location (as appropriate), water diversion installed as needed, and both the access road and well location will be restored to approximately the original ground contour(s) by pushing the fill material back into the cut and up over the backslope (as applicable).
2. No depressions will be left that would trap water or form ponds. All disturbed surfaces will be reseeded as recommended in Item #10C2-5, above.

11. SURFACE OWNERSHIP

All of the facilities included within the proposed Scotty Lake CBNG Pilot Project area are situated on surface estate which is owned by the United States of America. These public lands are administered in trust by:

Field Manager
Rawlins Field Office
Bureau of Land Management
P.O. Box 2407
Rawlins, Wyoming 82301-2407
Telephone: 307-328-4200

Hudson Group, LLC
Scotty Lake CBNG Pilot Project
Plan of Development and Master Field Permit
Surface Use and Operations Plan
Page 12

12. OTHER INFORMATION

A. General Description of the Project Area:

The Scotty Lake CBNG Pilot Project area is situated in an upland area of northeastern Sweetwater County locally known as Cyclone Rim. The overall area is located in the northern portion of the Great Divide Basin, a closed intermountain basin bounded by the Leucite Hills to the west, Delaney Rim to the south, the Wind River Mountains (and Beaver Rim) to the north, and the Sierra Madre Mountain range to the south. More specifically, the project area is located generally north of Red Creek, south of West Alkali Creek, west of the Stratton Lakes, east/southeast of Scotty Lake, and north/northeast of Bastard Butte. This area is classified as a *High Plains Steppe* (cold desert) and is characterized by gently to moderately undulated uplands dissected by numerous ephemeral drainages of Red Creek to the south and West Alkali Creek to the north.

Local flora consists primarily of needleandthread grass, western wheatgrass, prairie junegrass, Indian ricegrass, threadleaf sedge, prickly pear cactus, sagebrush, and yucca. Local fauna consists primarily of mule deer, antelope, coyotes, badgers, skunks, rabbits, raptors, and various smaller vertebrate and invertebrate species.

There are no known threatened or endangered species that would be affected by implementation of operations on any of the wells included within the proposed Scotty Lake CBNG Pilot Project.

B. Surface Use Activities:

Livestock grazing is the primary surface use within the area encompassed by the Scotty Lake CBNG Pilot Project.

C. Proximity of Water, Occupied Dwellings, Archaeological, Historical or Cultural Sites:

1. The closest source of semi-permanent water in the project area is Red Creek, which is located approximately five (5) miles to the southwest of the Scotty Lake CBNG Pilot Project area.

2. There are no occupied dwellings with a twenty (20) mile radius of the proposed project area.

3. Hudson Group, LLC 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, Hudson Group, LLC 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.

Hudson Group, LLC
Scotty Lake CBNG Pilot Project
Plan of Development and Master Field Permit
Surface Use and Operations Plan
Page 13

12. OTHER INFORMATION - Continued

C. Proximity of Water, Occupied Dwellings, Archaeological, Historical or Cultural Sites:

3. Within five (5) working days the Authorized Officer will evaluate the discovery and inform Hudson Group, LLC of actions that will be necessary to prevent loss of significant cultural or scientific values.

   Hudson Group, LLC will be responsible for the cost of any 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, Hudson Group, LLC will be allowed to resume operations.

D. Additional Requirements for Operations on Lands Administered by the Bureau of Land Management:

1. Hudson Group, LLC will be responsible for weed control on disturbed areas within the exterior limits of this permit and will consult with the Authorized Officer and/or local authorities for acceptable weed control measures.

   A *"Pesticide Use Proposal"* (form #WY-04-9222-1) and pesticide label will be submitted by Hudson Group, LLC to the Authorized Officer no later than December 1st for use during the following spring/summer period.

2. As indicated in Item #4B3, a comprehensive *Permanent Water Management Plan* is being prepared for the proposed Scotty Lake CBNG Pilot Project and will be submitted under separate cover for review and subsequent approval (see Appendix D).

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

Representative

Kirk W. Hudson, Petroleum Engineer
Hudson Group, LLC
330 South Center, Suite 307
Casper, Wyoming 82601
Telephone: 307-237-3083

Certification

All lease and/or unit operations will be conducted in such a manner that full compliance is made with all applicable laws, regulations, *Onshore Oil & Gas Orders*, the approved plan of operations, and any applicable *Notice to Lessees*.

Hudson Group, LLC
Scotty Lake CBNG Pilot Project
Plan of Development and Master Field Permit
Surface Use and Operations Plan
Page 14

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

Certification - Continued

Hudson Group, LLC will be fully responsible for the actions of their subcontractors. A copy of these conditions will be furnished to the field representative(s) to ensure compliance. The dirt contractor will be provided with a copy of the Surface Use Plan from each approved Application for Permit to Drill.

Each individual drilling permit will be valid for a period of one (1) year from the date of approval. After permit termination, a new application will be filed for approval for any future operations.

I hereby certify that I, or persons under my direct supervision, have inspected each proposed drill site and access route; that I am familiar with the conditions which currently exist; that the statements made in this plan are, to the best of my knowledge, true and correct; and that the work associated with the operations proposed herein will be performed by Hudson Group, LLC, their contractors and subcontractors in conformity with this plan and the terms and conditions under which it is approved. This statement is subject to the provisions of 18 U.S.C. 1001 for the filing of a false statement.

_____ _____

Date Kirk W. Hudson, Petroleum Engineer

APPENDIX D

Scotty Lake CBNG Pilot Project Water Management Plan

HUDSON GROUP, LLC

SCOTTY LAKE CBNG PILOT PROJECT

Sections 17, 18, 19 & 20, T26N-R96W
Sections 14, 22, 23, 24 & 26, T26N-R97W
Sweetwater County, Wyoming

WATER MANAGEMENT PLAN

Prepared for Hudson Group, LLC & U.S. Bureau of Land Management, Rawlins Field Office

Prepared by Carleton S. Babb, PG
Hydrogeologist
P.O. Box 4146
Casper, Wyoming 82604
307:234-7376
cnlbabb@wyoming.com
June 25, 2004

HUDSON GROUP, LLC
SCOTTY LAKE CBNG PILOT PROJECT

TABLE OF CONTENTS

Page

APPENDIX A: TABLES

APPENDIX B: FIGURES

1. #40-13 Water Well Schematic Diagram
2. Typical Riser-type Outfall

APPENDIX C: PHOTOGRAPHS

Observation Point	Description
13	View down tributary to reach 4 near DP #7/25 in DB C; channel slope 3°, width 1 to 2', depth < 1'
38	View down tributary to reach 2b near well #15 in DB A; slope 2.4°, width 1 to 2', depth < 1'
31	View up tributary to reach 3 in DB B south of well #28;slope 0.5°, width 3 to 4', depth 0.5'
16	View up reach 4 in DB C; water is snowmelt; slope 1.5°, width 3 to 4', depth 1'
27	View up reach 4 in DB C; water is snowmelt; slope 0.5°, width 6', depth 1.5 to 2'
42	View up reach 2c in DB A near DP #15; slope 1.2°, width 2 to 3', depth 0.5'
29	View down reach 5 in DB A @ site of PT 2; slope < 1°, width 5 to 6', depth 1.5 to 2'
34	1 to 3' head cut on tributary 3 in DB B, above DP #16
18	5 to 6' head cut on tributary 1a in DB C, above DP #3
8	DP #6 near well #2; perforated pipe in rip-rap blanket in channel
10	Rip-rap inlet to recharge pond at well #4
19	Stock pond at well #1
USDI/BLM flowing well in Section 25, T23N, R96W:	
	a. Outlet from pond receiving well water
	b. Channel below pond outlet; width 1 to 2', depth < 0.5'

APPENDIX D: MAPS AND CHARTS

Water Management Map
Drainage Basin & Channel Reach Index Map
Type Log - Picket Lake #1

HUDSON GROUP, LLC
SCOTTY LAKE CBNG PILOT PROJECT

WATER MANAGEMENT PLAN

Project Location - Geographic & Geologic Settings

Hudson Group, LLC has proposed the development of their Scotty Lake CBNG Pilot Project. The purpose of this project is to determine the feasibility of establishing commercial natural gas production from the Scotty Lake Coals contained within the Tertiary (Eocene) Fort Union Formation. The development of this pilot project will also provide the opportunity to collect site-specific hydrologic and geologic data for possible use in future analyses.

The project consists of 18 wells, including three alternate wells, and 15 discharge points. There are also three existing CBNG wells and three existing discharge points within the project area, which were included in this analysis. Produced water will be pumped to direct surface discharge points, stock ponds or recharge pits with outlets. This project is located within the Picket Lake Field, which has produced natural gas from the Cretaceous Lewis Formation since the field's discovery in 1978. The project will be developed in three phases, commencing with the drilling of four wells in phase I this year. NPDES discharge points have already been permitted with the Wyoming Department of Environmental Quality (WDEQ). The Water Management Map shows the project outline by phases, proposed CBNG well locations, discharge point locations, stock ponds, pits and existing wells.

The pilot project covers an area of 4.5 square miles (mi^2) and lies in the northern portion of the Great Divide Basin (GDB) at an elevation of approximately 7000 to 7100 ft. The GDB covers an area of 3500 mi^2, lying NE of Rock Springs and NW of Rawlins. The GDB is both a topographic and structural basin with internal drainage, meaning surface water drains towards the center of the basin. Water loss is by evaporation, transpiration by plants and infiltration or seepage into the subsurface. The climate is arid, with average annual rainfall of 9.8 inches (Lowham 1988). Evaporation is approximately 10 times the annual precipitation rate (Welder *et al* 1966). Photographs OP 13, 16, 27, 29, 31, 34, 38 & 42 document the nature of the terrain within the project area. Drainages are established and ephemeral, flowing only in response to precipitation events and snowmelt. Sandstone lenses outcrop in the project area. Sediments in the drainages are silty and sandy.

The structural geology of the GDB is an asymmetric syncline trending NW-SE with the synclinal axis located towards the northern flank of the basin. Geologic dips are approximately 3° northeasterly off the Rock Springs uplift. The syncline is bounded on the north by the Wind River Thrust fault and associated normal faults. Surface outcrops in the project area are the Eocene-age Cathedral Bluffs tongue of the Wasatch Formation, consisting of shale and siltstone with interbedded sandstones. These rocks overlie the Tipton Shale tongue of the Green River Formation (Welder *et al* 1966). The Scotty Lake coals are a localized deposit in the northern portion of the GDB, covering an area of approximately 55 mi^2; this is different than the deeper Big Red coals, which have been deposited basin-wide. The Scotty Lake coals occur at a depth of between 2000 and 5000 ft in the project area. These are multiple coal beds ranging in thickness from 2 to 50 ft each. The Big Red coals are almost 3000 ft deeper. These relationships can be seen on the Type Log.

Watershed Delineation

Water discharged by the Scotty Lake project will enter one of three local drainage basins (DB), designated A, B and C in this report. These sub-basins are defined relative to their respective confluence with Red Creek. The areas and basin slopes of these sub basins are:

Drainage Basin (DB)	Area, mi^2	Slope, ft/mi
A	6.51	246
B	3.97	155
C	10.07	204

The Red Creek watershed, defined from the confluence of DB C with Red Creek covers an area of 119 mi^2. The total area of DB's A, B and C is 20.55 mi^2, or 17.3 % of the Red Creek watershed, as defined here. The project drainage area is 0.59% of the area of the Great Divide Basin. Red Creek terminates in Hay Reservoir, approximately 8.7 miles south of the confluence with DB C. The Wyoming Department of Environmental Quality (WDEQ) conducted a use attainability analysis (UAA) on Red Creek and its tributaries in September 2002 (WDEQ 2002). The UAA found no significant wetlands present and resulted in the reclassification of Red Creek and its tributaries from 3B to 4B.

The tributaries contained within DB's A, B and C have been subdivided and given numbered designations for this study. The DB's and reaches are presented on the enclosed Index Map. All of the designated tributaries are ephemeral (dry most of the time) and are losing streams. That is, the water table is below the base of the channels, so water in the channels will infiltrate or seep downward into the alluvial sediments in the drainages and the underlying weathered bedrock. The total length of the tributaries within DB's A, B and C that will receive CBNG water is 35.58 miles.

Produced Water - Project

The 18 project wells are expected to initially produce CBNG water at the rate of 550 bpd (16 gpm) per well. Wells will be drilled on an average spacing of 128 acres, one well per location. The maximum, total initial production from 21 wells (18 new, 3 existing) will be approximately 11,550 bpd (336 gpm or 0.755 cfs). Hudson Group has received approved NPDES permits for up to 19,286 bpd (0.81 mgpd). Because the Scotty Lake coals are normally pressured, the rate of water production is expected to decline at an annual rate of 10 to 30% per year. CBNG water decline rates have been documented for the Powder River Basin by Advanced Resources International (2002) (BLM 2003a) and numerous press releases and talks by the Wyoming Oil & Gas Conservation Commission. It should be noted that only enough water will be removed from the coals to lower the reservoir pressure to allow the adsorbed gas to break free from the coal and flow to the wells. For example, this volume of water has been estimated at 20% of the recoverable water volume contained in the Wasatch and Fort Union Formations in the Powder River Basin (BLM 2003a). When production ceases, water levels will mostly recover - rapidly at first - then more slowly as the water levels approach original static conditions. Proposed well locations are shown on the enclosed water management map and listed in Table 1.

Table 2a presents the water quality analysis dated 3/9/03 for the PL #1 well completed in the Scotty Lake Main coals. A summary of the produced water quality and the standards imposed by the approved project NPDES permit are as follows:

Parameter Analyzed	Well	Permit
Total dissolved solids @ 180° C, mg/l	1060	---
Specific conductance @ 25° C, µmhos/cm	1750	7500
pH, su	8.24	6.5 - 8.5
Sulfate, mg/l	ND	3000
Chloride, mg/l	74.1	2000
Sodium adsorption ration	42.9	---
Total radium 226, pCi/l	1.6	60
Total petroleum hydrocarbons, mg/l	1.5	10
Dissolved iron, µg/l	212	---
Total barium, µg/l	8440	---
Dissolved manganese, µg/l	ND	---
Total arsenic	1	---

ND = not detected

This water is Class III groundwater, suitable for livestock & wildlife consumption. The alluvial sediments and soils in the project area contain sulfate, which is expected to react with the barium in the produced water, precipitating as barite, a stable, inert mineral. Soil samples from the project area contained sulfate concentrations between 710 and 1490 mg/kg-dry.

Produced Water - Non-Project Related

Existing Wells

There are two existing, permitted water wells within a one-mile radius of the project: PL #1 WW (NW¼SE¼, Section 24, T26N, R97W) and PL #40-13 WW (SW¼SE¼, Section 13, T26N, R97W). Both wells are operated by Hudson Group. The PL #1WW is the only water well within ½ mile of a CBNG well.

Potential Development

It is anticipated that additional leases within the Red Creek watershed may be developed in the future. The occurrence of the Scotty Lake coals is limited to an area of 55 mi^2. However this area is the zero-line for the coal. The area for potential development is more like 40 mi^2. A maximum development scenario for the Red Creek drainage basin is 200 wells on 120-acre spacing with one well per location. This includes the 18 project wells and 3 existing wells. It is premature to evaluate this scenario at this time. The pilot project will provide site-specific data for further analysis if additional exploration and/or development is warranted in the future.

Surface Water

Surface water rights permitted with the Wyoming State Engineer's Office (WSEO) are listed in Table 3 (WSEO 2004). There are no surface water rights within a one-mile radius of the project area. Osborne Springs, which is discussed in this report, is located three miles southwest of the project area. All tributaries within and downstream of the Scotty Lake project are ephemeral, losing streams classified 4B by WDEQ.

Ground Water

Ground water rights near the Scotty Lake Project that are permitted with the WSEO are listed in Table 4 (WSEO 2004). There are no springs within a one-mile radius of the Scotty Lake project. Welder *et al* (1966) indicated that most of the water wells in the Great Divide Basin are completed in confined aquifers. By definition, the static water level in a well completed in a confined aquifer will rise above the top of the aquifer. This indicates the aquifer is under pressure, which means it is confined by low-permeability rocks effectively sealing it from the local surface. A review of available data on water wells in the northern Great Divide Basin supports Welder's conclusion. Data from water wells in T26N, R96 & 97W have average reported yields of 36.5 gpm from depths of 350 to 810 ft. Most well depths are between 400 and 600 ft. Static water levels in these wells are all above the tops of the water-bearing zones. The mean static water level is 141 ft and the mean top of the aquifers is 382 ft. These are confined aquifers.

Figure 1 is a schematic diagram of the PL #40-13 water well, operated by Hudson and located ¼ mi north of Phase I of the Scotty Lake CBNG Pilot Project. It is completed in two water-bearing sandstones at depths of 410 to 445 ft and 460 to 530 ft. The static water level in this well is at a depth of 210 ft, therefore the aquifers are confined. There is 150 ft of shale in two zones overlying the aquifers, providing good seals from shallow groundwater. Shale has very low permeability and therefore does not transmit water very well; it is a good seal. In areas of intense structural geology, most shales deform plastically rather than fracturing; a characteristic also making them good seals.

Ground water is contained in aquifers that are a part of a hydrologic system. These systems can be local, intermediate or regional in scale. Local systems cover the smallest area and are generally located near the source or recharge area for the water in the aquifer. The recharge areas can be the outcrop of the aquifer at the surface or water contained in streams, lakes or reservoirs that infiltrates downward. The water from local hydrologic systems has the best water quality of the three types of systems because the water spends the least time in the aquifer and travels the least distance, so it has less time to dissolve minerals from the rocks and sediments. Regional hydrologic systems have the poorest water quality because the water in these systems travels greater distances at greater depths, which gives the water in the aquifer a much longer residence time at higher temperatures and pressures; this results in a high mineral content in the water.
It is important to note the fact that ground water travels very slowly in the aquifer, at a rate of a few ft to 10's of ft per year. Seasonal or temporary changes in recharge or discharge rates may not even be detectable in water level data from aquifers in intermediate or regional systems.

Welder *et al* (1966) reports water quality data from one well in Section 34, T27N, R97W and one spring in Section 32, T27N, R97W north of the continental divide from the project area. The well

had a conductivity of 580 µmhos/cm and the spring had a conductivity of 980 µmhos/cm. Water from the Scotty Lake coals has a conductivity of 1750 µmhos/cm. This supports the interpretation that the Scotty Lake coals are part of an intermediate hydrologic system separate from the more local hydrologic system feeding lakes, springs and shallow aquifers along the continental divide. Thus, temporary changes in the water pressures within the Scotty Lake coals should not affect the local hydrologic system.

A water sample was collected from Osborne Spring, located three miles southwest of the project area. The lab analysis is found in Table 2b. There are significant differences between the water from Osborne Spring and the water produced from the Scotty Lake coals. The following is a comparison of the differences in the two waters:

Parameter Analyzed	**Osborne Spring**	**Scotty Lake coal**
Total dissolved solids @ 180° C, mg/l	2300	1060
Sulfate, mg/l	652	3000
Sodium adsorption ration	28.5	42.9
Dissolved iron, µg/l	5620	212
Total barium, µg/l	146	8440
Nickel, µg/l	48	ND
Zinc, µg/l	85	ND
Aluminum	8460	188

ND = not detected

These two waters have sufficiently different chemistries to conclude they are from different hydrologic systems. Temporary water pressure changes in the Scotty Lake coals should have no impact on Osborne Spring.

The enclosed type log is from the PL #1 well, an existing well within Phase I of the Scotty Lake CBNG Pilot Project. The well was originally drilled to 13,652 ft and produced gas from the Lewis Formation. It has been plugged back to 4800 ft and recompleted in the main Scotty Lake coals between depths of 3604 and 3706 ft on the type log. Shales > 10 ft thick above and below the Scotty Lake coal interval have been shaded gray. Coals > 10 ft thick are indicated by black in the well column. There is 748 ft of shale between the base of surface casing and the top of the Scotty Lake coal. There is also 786 ft of shale between the base of the Scotty Lake coal and the top of the Big Red coal. The Scotty Lake coal is effectively sealed from overlying shallow hydrologic systems and the underlying regional hydrologic system containing the Big Red coal.

Before full water production begins from CBNG wells in Phase I, an isotopic analysis will be performed on a water sample from the producing formation to verify that there is not a connection between the CBNG water and the North Platte River system.

Discharge Point Siting & Design

Four field days were spent on-site examining drainages and discharge point locations. Observation points where data were collected are shown on the Water Management Map and their locations are listed in Table 5. There are 43 observation points; most were photographed. Selected photos are included in this report. The tributaries were subdivided into reaches within their respective local drainage basins. These are presented on the Drainage Basin & Reach Index Map.

Channel reach gradients were determined from USGS 7½ minute topographic maps and field checked at the observation points. The map gradients and field gradients are in agreement. Drainages near the divides begin as gentle swales, but quickly become small, active channels as they progress downslope. Overall, channels are entrenched with defined, vegetated banks. One major headcut 5 to 6 ft high was observed at observation point (OP) 18 (photo). No project water will be discharged above this point. Smaller headcuts, generally of one ft or less were observed on some of the steeper slopes in the upper reaches within the project area (photo OP 34). Channels in the upper reaches are typically 1 to 3 ft wide and 1 ft or less deep with gradients between 0.02 & 0.03 (1° & 2°). Channels at the lowest point receiving discharges are typically 2 to 4 ft wide and 1 ft +/- deep with gradients between 0.010 & 0.018 (0.5° & 1°). The main tributaries leaving the project boundaries are typically 3 to 6 ft wide, 1 ft deep sub-channels within a larger 6 to 8 ft wide 3 to 6 ft deep draw. Gradients are between 0.010 & 0.016 (0.5° & 1°). All channels are ephemeral with silty and sandy bottoms.

Discharge points are shown as triangles on the Water Management Map and are listed in Table 6. Some discharge points will be designed to receive water from multiple wells and some wells will be able to discharge water at multiple points to allow flexibility and control of water flow. Water will be moved off higher elevations and steeper slopes through pipelines to discharge points located in stable channels with acceptable gradients. The discharge points are distributed across the unnamed tributaries within the three drainage basins in the project area; this will keep the volume and velocity of the discharged water within acceptable limits.

Three methods of handling the surface discharge of CBNG produced water will be utilized for this project: 1) direct discharge to drainages, either through perforated pipe encased in rip-rap lying in the bottom of a channel or an energy dissipating riser (bubbler) located adjacent to a channel with a rip-rap riffle trench into the channel (Figure 2); 2) an off-channel recharge pit with an outlet to a drainage; or 3) a stock pond without an outlet with the water source also connected to a surface discharge point (photos OP 8, 10 & 19). Conveyance losses are expected to be high in the project area. This project is located within a closed basin and the produced water meets WDEQ standards for direct discharge. Other issues regarding the use of pits and ponds include surface disturbance, wildlife, and the distribution of the wild horse populations. Ponds/pits can be designed or fenced to manage wildlife, wild horse or livestock access and to address concerns with providing additional water sources in this area, These concerns will be routinely evaluated during the APD process before each phase of the project.

There is an existing stock pond and a flow-through pit that will be utilized in water management for this project. The pond and pit specifications are shown in Table 7. These were described in the EA prepared for the recompletion of three existing wells in the Picket Lake Field in February 2003

(BLM 2003b). Recompletion work on the three wells is still in progress, so sustained production has not yet been achieved. The monitoring, data collection, and analysis described in that document will continue.

All of the discharge points referenced in this report have approved NPDES permits issued by WDEQ. The permits allow the actual location of each discharge point to be administratively moved within a 1/2-mile radius of the permitted location. All discharge points described in this water management plan are within the 1/2-mile radius of the permitted location.

Subject to additional field work in Phases II & III and monitoring of the effectiveness of present discharge points, individual discharge point designs and locations may be modified, if deemed necessary, by BLM. This could include the use of additional pits or ponds at locations with higher channel gradients or where erosion downstream is of concern. When discharge ceases, all pits, ponds and discharge points will be rehabilitated to the original topography using the same standards as well pads (reference for well pad rehabilitation). Upon completion of the CBNG project, BLM may decide to evaluate some pits or ponds for potential beneficial use, which will require a dedicated water source (well). If a water source is available and it is determined to be feasible in the NEPA analysis, the project will be managed as a range or wildlife improvement project. The operator will not be responsible for maintenance or rehabilitation of pits or ponds converted to range or wildlife improvement projects, but will still be responsible for the rehabilitation of all sites not converted to BLM projects.

The USDI/BLM #25-23-96 flowing well located in Section 25, T23N, R96W is a good analog for surface discharge. This well has recently been reconfigured by the BLM to flow into a small pond, then through an outlet to a small channel. A water sample was collected from this well in 1963 and published by Welder *et al* (1966). The water analysis is as follows:

Conductivity, µmhos/cm	1750
pH, su	7.6
TDS, ppm	1110
Sodium, ppm	462
Calcium, ppm	3.4
Magnesium, ppm	0.1
Potassium, ppm	3.4
Bicarbonate, ppm	1120
Carbonate, ppm	918
Chloride, ppm	53
Sulfate, ppm	0.2
Nitrate, ppm	0.1
Iron, ppm	0.05
Silicon, ppm	13
Fluoride, ppm	5.5
Boron, ppm	0.09
SAR	67

Welder reported the flow from this well as 50 gpm and total depth of the well as 2250 ft. The WSEO database currently shows this well with a reported yield of 25 gpm, total depth of 1160 ft, top of main water zone 810 ft and static water level 7 ft above ground level (WSEO 2004). The well has been flowing for decades with no adverse impacts. The channel receiving the flow from the well is small (1 to 2 ft wide; 4 inches deep) and stable with riparian vegetation developed adjacent to the channel (Photos a & b). The area receiving the discharged water is approximately 30 acres in size, containing some wetland habitat. It is providing beneficial use to wildlife.

Peak Flows

Peak flows were computed for drainage basins (DB) A, B and C using the methods published by Miller (2003) and Lowham (1988). The input and results are presented in Table 8. The Q 1.5 through Q 500 nomenclature are recurrence intervals for the type storm events. A Q 1.5 event can be expected to occur statistically once every 1.5 years; a Q 100 event once every 100 years, etc. However these are statistics. In reality, a 100-year event could occur in consecutive years or even months. Active channels are generally formed by one or two-year events. The Q 2 events calculated using Miller's method range from 20.0 to 35.6 cfs; comparable statistics from Lowham range from 37.2 to 60.7 cfs.

Table 8 also contains Q 10 & Q 25 peak flow data in units of cfs/mi for use in culvert sizing. Lowham's method also estimates mean annual flow. These range from a low of 0.11 cfs for DB B to a high of 0.24 cfs for DB C.

Project Flows - Channel Capacity

Estimated discharge rates and velocities are found in Table 9. This table assumes a per well rate of 550 bpd (0.037 cfs) and no conveyance loss. Estimates were made for the tributary reaches in DB's A, B and C that will receive CBNG water. Discharges range from 0.036 cfs (1 well) to 0.236 cfs (6.5 wells). Respective velocities are 0.5 to 1.2 ft/sec. Water depths in the channels for the same cases are 0.26 and 0.78 inches. These estimates are comparable to Lowham's mean annual flows and are less than 2% of the Q 1.5 estimates by Miller's method. The project discharges are well within the capacities of the existing drainages and should not contribute significantly to natural erosional processes.

Conveyance Loss

Conveyance loss (CL) is the cumulative effect of evaporation, transpiration and infiltration on surface water. Percolation tests (PT) were conducted at two sites in channels receiving water from the project, one at PT 1 in Section 24 and one at PT 2 in Section 27. These points are shown by circles with labels on the Water Management Map. PT 1 resulted in a rate of 3.38 min/inch and PT 2 was 1.68 min/inch. The test holes were presoaked overnight to allow for any clays that might be present to swell. The percolation rates from both of these tests are high. These rates were adjusted to area in a 3 ft wide channel and units of bpd of loss per mile of channel. To account for channel width & sediment variation and the decrease in infiltration rates with increasing saturation, 1% of the CL rates estimated from the percolation tests were used for this analysis. These are 996 and 2012

bpd/mi of channel for PT 1 and PT 2, respectively. Losses to evaporation and transpiration were not added to this factor, but will be significant additional losses.

Table 10A shows the estimated flow distances down tributaries receiving CBNG water assuming a water rate of 550 bpd/well (0.036 cfs/well) and a loss rate of 1500 bpd/mi (0.097 cfs/mi). The maximum flow distance is 2.38 mi for reach 1 & 2 in DB C. Available reach lengths are also included in the table. In this scenario, no produced water will leave drainage basins A, B or C.

Table 10B presents the results for a scenario where the discharge rate is 550 bpd/well (0.036 cfs/well) and the loss rate is 750 bpd/mi (0.049 cfs/mi). The maximum flow distance is 4.77 mi in reaches 1 & 2 in DB C. Again, the water does not leave drainage basins A, B or C.

Water Balance

Three water balance scenarios have been analyzed for the project and are presented in Tables 11a, 11b and 11c. This includes 18 new CBNG wells in the pilot project plus 3 existing CBNG wells. The water balance does not include precipitation and the conveyance loss used in the water balance does not include evaporation. To provide a conservative view, water production is held constant at initial rates and all wells begin production simultaneously. The two existing ponds are used; one taking 550 bpd and one taking 225 bpd. Table 11a is based on production of 550 bpd/well and a loss of 1500 bpd/mi. Table 11b uses production of 1200 bpd/well and loss of 1500 bpd/mi. Table 11c uses production of 550 bpd/well and loss of 750 bpd/mi. All three cases result in a net surplus loss capacity.

For the actual project, 18 wells will gradually be installed over a 3-year period; the water produced from the wells should decline with time; and evaporation will be a significant additional factor in conveyance loss. All of these factors will result in less project water than that used in the water balance cases.

Downstream Impacts

The channels receiving CBNG water should have wetted surfaces below the downstream discharge points no further downstream than 3.7 mi in DB A, 2.2 mi in DB B and 4.8 mi in DB C. Project flows will be much less than natural flows. Velocities for the project flows are less than 2 ft/sec and most are less than 1 ft/sec. These velocities are below erosion thresholds. Impacts within the wetted tributaries include possible minor initial erosion in some of the channels and a vegetation change to riparian species in close proximity to the channels. There are no irrigation activities in the area, so the SAR levels will not have significant impacts.

Erosion Control Plan

Best management practices (BMP's) will be used for erosion control and the diversion of overland flows away from all facilities.

Monitoring & Mitigation

Each discharge point will be monitored monthly for the first year of operation. Inspectors will note the condition of the discharge point, check for evidence of erosion and schedule any remedial work, if required.

All pit/pond outlets and culverts will be checked quarterly, and after major storm events for the first year of operation. Inspectors will note the condition of the outlets and culverts, check for evidence of erosion and schedule any remedial work, if required.

Channels receiving discharge water will be monitored monthly for the first year of operation in that channel. If accelerated erosion is noted (i.e., a vertical change of one ft or a lateral change of three ft), the BLM will be notified and remedial work will be scheduled subject to BLM approval. The GPS locations of the downstream limits of the wetted channels will be documented as part of the inspection process.

After the first year of operation, inspections will only occur annually, unless specific sites have required remedial action. If the wetted limits of the channels are still moving downstream after one year, monthly monitoring and documentation will continue until the channels reach equilibrium.

LESSEE'S OR OPERATOR'S REPRESENTATIVE AND CERTIFICATION

I hereby certify that I, or persons under my direct supervision, have inspected the watershed area(s) affected by our coal bed natural gas drilling and production plans; that I am familiar with the conditions that currently exist; that the statements made in this plan are, to the best of my knowledge, true and correct; and that the work associated with operations proposed herein will be performed by Hudson Group, LLC and its contractors and subcontractors in conformity with this plan and the terms and conditions under which it is approved. This statement is subject to the provisions of 18 U.S.C. 1001 for the filing of a false statement.

Date August 2, 2004

Name s/Kirk W. Hudson
for Hudson Group, LLC

Title Kirk W. Hudson, Petroleum Engineer

HUDSON GROUP, LLC
SCOTTY LAKE CBNG PILOT PROJECT

REFERENCES

Advanced Resources International, Inc. 2002. *Powder River Basin Coalbed Methane Development and Produced Water Management Study*, Advanced Resources International, Inc., U.S Department of Energy, Office of Fossil Energy and National Energy Technology Laboratory

Bureau of Land Management. 2003a. *Final Environmental Impact Statement and Proposed Plan Amendment for the Powder River Basin Oil and Gas Project,* WY-070-02-065, U.S. Department of the Interior, Bureau of Land Management, Buffalo Field Office

_____. 2003b. *Surface Discharge of Produced Water from Picket Lake Unit Wells No. 1, No. 2, and No. 4.* Bureau of Land Management, Rawlins Field Office. Rawlins, Wyoming. February 2003. WY-030-03-EA-053

Love, J.D. & Ann Coe Christiansen. 1985. *Geologic Map of Wyoming*, U.S. Geological Survey

Lowham, H.W. 1988. *Streamflows in Wyoming*, Water-Resources Investigations Report 88-4045, U.S. Geological Survey

Miller, K.A. 2003. *Peak-flow Characteristics of Wyoming Streams*, Water-Resources Investigations Report 03-4107, U.S. Geological Survey

Welder, G.E. & L.J. McGreevy. 1966. *Ground-water Reconnaissance of the Great Divide & Washakie Basins and Some Adjacent Areas, Southwestern Wyoming*, Hydrologic Atlas HA-219, U.S. Geological Survey

Wyoming State Engineer's Office (WSEO). 2004. Electronic water records compiled and maintained by the Wyoming State Engineer's Office. Cheyenne, Wyoming. Information acquired via the Internet at website: http://seo.state.wy.us.

APPENDIX A: TABLES

TABLE 1

HUDSON GROUP, LLC
SCOTTY LAKE CBNG PILOT PROJECT

PROJECT WELLS

Phase	Well Name	API No.	QtrQtr	Section	Tshp.	Range	Lat. N, Dec.	Long. W, Dec.	Coal	Depth, ft	Dischg. Pt(s)
I	Scotty Lake 9	APD Filed	SE NW	24	26N	97W	42.2148	-108.3556	Tfu Scotty Lk	3600	002
I	Scotty Lake 10	APD Filed	SE NE	24	26N	97W	42.2149	-108.3455	Tfu Scotty Lk	3600	003
I	Scotty Lake 11	APD Filed	SE SE	24	26N	97W	42.2087	-108.3482	Tfu Scotty Lk	3600	021
I	Scotty Lake 12	APD Filed	SE SW	24	26N	97W	42.2087	-108.3543	Tfu Scotty Lk	3600	004
II	Scotty Lake 7	APD Not Filed	NE NE	19	26N	96W	42.2162	-108.3242	Tfu Scotty Lk	3600	007/025, 022
II	Scotty Lake 22	APD Not Filed	C SE	18	26N	96W	42.2182	-108.3241	Tfu Scotty Lk	3600	007/025, 022
II	Scotty Lake 23	APD Not Filed	NW NW	20	26N	96W	42.216	-108.3144	Tfu Scotty Lk	3600	023/024
II	Scotty Lake 24	APD Not Filed	C SW	17	26N	96W	42.2179	-108.3123	Tfu Scotty Lk	3600	023/024
II	Scotty Lake 25	APD Not Filed	com. corner	17 18 19 20	26N	96W	42.2179	-108.3167	Tfu Scotty Lk	3600	007/025, 022
III	Scotty Lake 8	APD Not Filed	C com. line	14 23	26N	97W	42.2201	-108.3721	Tfu Scotty Lk	3600	013/026
III	Scotty Lake 13	APD Not Filed	NW SW	14	26N	97W	42.225	-108.3765	Tfu Scotty Lk	3600	013/026
III	Scotty Lake 14	APD Not Filed	NE NW	23	26N	97W	42.2166	-108.3757	Tfu Scotty Lk	3600	014
III	Scotty Lake 15	APD Not Filed	C SW	23	26N	97W	42.2091	-108.3764	Tfu Scotty Lk	3600	015
III	Scotty Lake 19	APD Not Filed	SE SE	22	26N	97W	42.2088	-108.3853	Tfu Scotty Lk	3600	019
III	Scotty Lake 20	APD Not Filed	C NE	22	26N	97W	42.2165	-108.3863	Tfu Scotty Lk	3600	020
III	Scotty Lake 26	APD Not Filed	C NE	23	26N	97W	42.2165	-108.3668	Tfu Scotty Lk	3600	009
III	Scotty Lake 27	APD Not Filed	C SE	14	26N	97W	42.2237	-108.3668	Tfu Scotty Lk	3600	010
III	Scotty Lake 28	APD Not Filed	SE SE	23	26N	97W	42.2074	-108.3646	Tfu Scotty Lk	3600	016

OPTIONAL WELLS

III	Scotty Lake 16	APD Not Filed	C com. Line	23 26	26N	97W	42.2057	-108.3716	Tfu Scotty Lk	3600	016
III	Scotty Lake 17	APD Not Filed	NW NW	26	26N	97W	42.2022	-108.3772	Tfu Scotty Lk	3600	017
III	Scotty Lake 18	APD Not Filed	C NE	26	26N	97W	42.2018	-108.3667	Tfu Scotty Lk	3600	018

EXISTING WELLS

I	Picket Lake 1	49-037-21309	NW SE	24	26N	97W	42.2119	-108.3509	Tfu Scotty Lk	3600	001
----	Picket Lake 2	49-037-21388	SE NW	19	26N	96W	42.2149	-108.3355	Tfu Scotty Lk	3600	006
III	Picket Lake 4	49-037-21387	NW SE	23	26N	97W	42.2115	-108.3699	Tfu Scotty Lk	3600	008

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 - www.energylab.com

LABORATORY ANALYTICAL REPORT

TABLE 2a

Client: Hudson Group LLC
Project: WY0049662
Lab ID: C03030279-001
Client Sample ID: PL1

Report Date: 03/25/03
Collection Date: 03/09/03 17:00
Date Received: 03/10/03
Matrix: Aqueous

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
MAJOR IONS							
Alkalinity, Total as CaCO3	821	mg/L		1.0		A2320 B	03/11/03 10:59 / slb
Bicarbonate as HCO3	1000	mg/L		1.0		A2320 B	03/11/03 10:59 / slb
Calcium	4.4	mg/L		1.0		E200.7	03/14/03 14:30 / cp
Chloride	74.1	mg/L		5.0		A4500-Cl B	03/12/03 13:25 / jl
Fluoride	5.3	mg/L		0.1		A4500-F C	03/17/03 10:02 / slb
Magnesium	ND	mg/L		1.0		E200.7	03/14/03 14:30 / cp
Potassium	5.9	mg/L		1.0		E200.7	03/14/03 14:30 / cp
Sodium	411	mg/L		1.0		E200.7	03/14/03 14:30 / cp
Sulfate	ND	mg/L		10		E200.7	03/14/03 14:30 / cp
NON-METALS							
Phenolics, Total Recoverable (Distilled)	20	ug/L		10		E420.1	03/12/03 15:12 / jl
Cyanide, Total Automated	ND	ug/L		5		E335.3	03/12/03 11:17 / eli-b
PHYSICAL PROPERTIES							
Conductivity	1750	umhos/cm		5.0		A2510 B	03/10/03 14:15 / js
Hardness as CaCO3	14	mg/L		10		A2340 B	03/20/03 11:36 / ks
pH	8.24	s.u.		0.10		A2320 B	03/11/03 10:59 / slb
Solids, Total Dissolved TDS @ 180 C	1060	mg/L		5		A2540 C	03/10/03 15:22 / sp
Sodium Adsorption Ratio (SAR)	42.9	unitless		0.10		Calculation	03/20/03 16:10 / ks
Calcium, SAR	0.220	meq/L		0.050		E200.7	03/14/03 14:30 / cp
Magnesium, SAR	ND	meq/L		0.080		E200.7	03/14/03 14:30 / cp
Sodium, SAR	17.9	meq/L		0.040		E200.7	03/14/03 14:30 / cp
METALS - DISSOLVED							
Boron	0.21	mg/L		0.10		E200.7	03/14/03 14:30 / cp
Cadmium	0.1	ug/L		0.1		E200.8	03/14/03 22:36 / smd
Chromium	ND	ug/L		1		E200.8	03/14/03 22:36 / smd
Copper	7	ug/L		1		E200.8	03/14/03 22:36 / smd
Iron	212	ug/L		30		E200.7	03/14/03 14:30 / cp
Lead	ND	ug/L		2		E200.8	03/14/03 22:36 / smd
Manganese	ND	ug/L		10		E200.8	03/14/03 22:36 / smd
Mercury	0.15	ug/L		0.06		E200.8	03/14/03 22:36 / smd
Nickel	ND	ug/L		10		E200.8	03/14/03 22:36 / smd
Silver	ND	ug/L		3		E200.8	03/14/03 22:36 / smd
Zinc	ND	ug/L		10		E200.8	03/14/03 22:36 / smd

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

TRACKING NO. PAGE NO.
030279R0001

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 · www.energylab.com

LABORATORY ANALYTICAL REPORT

TABLE 2a

Client: Hudson Group LLC
Project: WY0049662
Lab ID: C03030279-001
Client Sample ID: PL1

Report Date: 03/25/03
Collection Date: 03/09/03 17:00
Date Received: 03/10/03
Matrix: Aqueous

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
METALS - TOTAL							
Aluminum	188	ug/L		50		E200.8	03/14/03 22:10 / smd
Antimony	ND	ug/L		5		E200.8	03/14/03 22:10 / smd
Arsenic	1	ug/L		1		E200.8	03/14/03 22:10 / smd
Barium	8440	ug/L		100		E200.8	03/14/03 22:10 / smd
Beryllium	ND	ug/L	D	0.2		E200.8	03/14/03 22:10 / smd
Selenium	ND	ug/L		5		E200.8	03/14/03 22:10 / smd
Thallium	ND	ug/L		10		E200.8	03/14/03 22:10 / smd
RADIONUCLIDES - TOTAL							
Radium 226	1.6	pCi/L		0.2		E903.0	03/18/03 23:55 / es
Radium 226 precision (±)	0.2	pCi/L				E903.0	03/18/03 23:55 / es
DATA QUALITY							
A/C Balance (± 5)	-1.17	%				Calculation	03/25/03 15:31 / ks
Anions	18.8	meq/L				Calculation	03/25/03 15:31 / ks
Cations	18.4	meq/L				Calculation	03/25/03 15:31 / ks
Solids, Total Dissolved Calculated	1000	mg/L				Calculation	03/25/03 15:31 / ks
TDS Balance (0.80 - 1.20)	1.05	dec. %				Calculation	03/25/03 15:31 / ks
ORGANIC CHARACTERISTICS							
Total Petroleum Hydrocarbons	1.5	mg/L		1.0		E418.1	03/21/03 08:42 / bah

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.

TRACKING NO. PAGE NO.
030279R0002

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 • www.energylab.com

TABLE 2b

LABORATORY ANALYTICAL REPORT

Client: Hudson Group LLC
Project: Scotty Lake
Lab ID: C04050523-001
Client Sample ID: Osborne Springs

Report Date: 06/08/04
Collection Date: 05/06/04 11:04
Date Received: 05/07/04
Matrix: Aqueous

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
MAJOR IONS							
Calcium	26.2	mg/L		1.0		E200.7	05/17/04 15:07 / cp
Chloride	68.2	mg/L		5.0		A4500-Cl B	05/18/04 13:16 / jl
Fluoride	0.9	mg/L		0.1		A4500-F C	05/19/04 08:33 / nlm
Magnesium	3.7	mg/L		1.0		E200.7	05/17/04 15:07 / cp
Potassium	4.5	mg/L		1.0		E200.7	05/17/04 15:07 / cp
Sodium	590	mg/L	D	1.2		E200.7	05/17/04 15:05 / cp
Sulfate	652	mg/L		10.0		E200.7	05/17/04 15:05 / cp
PHYSICAL PROPERTIES							
Conductivity	2400	umhos/cm		5.0		A2510 B	05/14/04 15:41 / js
Hardness as CaCO3	81	mg/L		10		A2340 B	05/18/04 10:04 / ck
Solids, Total Dissolved TDS @ 180 C	2300	mg/L		6.4		A2540 C	05/13/04 16:54 / js
Calcium, SAR	1.3	meq/L		0.05		E200.7	05/17/04 15:07 / cp
Magnesium, SAR	0.3	meq/L		0.08		E200.7	05/17/04 15:07 / cp
Sodium, SAR	25.7	meq/L	D	0.05		E200.7	05/17/04 15:05 / cp
Sodium Adsorption Ratio (SAR)	28.5	unitless		0.10		Calculation	06/04/04 11:33 / ck
METALS - DISSOLVED							
Boron	0.2	mg/L		0.1		E200.7	05/17/04 15:07 / cp
Cadmium	ND	ug/L	D	0.6		E200.8	05/27/04 23:00 / bws
Chromium	20	ug/L	D	2		E200.8	05/27/04 23:00 / bws
Copper	120	ug/L	D	1		E200.8	05/27/04 23:00 / bws
Iron	5620	ug/L		30.0		E200.7	05/17/04 15:07 / cp
Lead	19	ug/L		2		E200.8	05/27/04 23:00 / bws
Manganese	166	ug/L		10		E200.8	05/27/04 23:00 / bws
Mercury	ND	ug/L		0.06		E200.8	05/27/04 23:00 / bws
Nickel	48	ug/L		10		E200.8	05/27/04 23:00 / bws
Silver	ND	ug/L		3		E200.8	05/27/04 23:00 / bws
Zinc	85	ug/L		10		E200.8	05/27/04 23:00 / bws
METALS - TOTAL							
Antimony	ND	ug/L		5		E200.8	05/28/04 14:12 / bws
Arsenic	0.162	mg/L	D	0.002		E200.8	05/28/04 14:12 / bws
Barium	146	ug/L		100		E200.8	05/28/04 14:12 / bws
Beryllium	ND	mg/L	D	0.001		E200.8	05/28/04 14:12 / bws
Thallium	ND	ug/L		10		E200.8	05/28/04 14:12 / bws
METALS - TOTAL RECOVERABLE							
Aluminum	8460	ug/L		50		E200.8	05/28/04 14:12 / bws
Selenium	ND	ug/L	D	6		E200.8	05/28/04 14:12 / bws

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.

TABLE 3

HUDSON GROUP, LLC
SCOTTY LAKE CBNG PILOT PROJECT

SURFACE WATER RIGHTS

Appropriation	Township	Range	Section	Quarter	QtrQtr	Head Gate-Outlet-Well	Status	Supply Type	SW Permit Uses	SW Permit Facility Name	SW Permit Applicant	SW Permit Priority	SW Permit Amount	SW Permit Unit	SW Permit Source
P1325R	26N	97W	3	9	NESW	X	ADJ	ORI	STO, DOM	Lower Seven Lake Reservoir	William Daley Co.	7/6/1908	35	ACFT	Sand Creek
P4935R	26N	97W	4	13	NESE	X	PUO	ORI	STO, IRR, DOM	Third Lake Reservoir	Arthur R. Carpenter	11/7/1938	1801	ACFT	Alkali Creek
C29/289A	26N	97W	8	5	NENW	X	ADJ	ORI	ND	ND	ND	ND	ND	ND	ND
P1332R	26N	97W	8	5	NENW	X	ADJ	ORI	STO, DOM	Upper Seven Lake Reservoir	Angus Murray	7/6/1908	85	ACFT	Sand Creek
P4934R	26N	97W	8	4	SENE	X	EXP	ORI	STO, IRR, DOM	Second Lake Reservoir	Arthur R. Carpenter	11/7/1938	2103.5	ACFT	Sulphur Creek

ND = No Data Available

TABLE 4

HUDSON GROUP, LLC
SCOTTY LAKE CBNG PILOT PROJECT

GROUND WATER RIGHTS

Permit #	Priority	Status	Township	Range	Section	QtrQtr	Applicant	Facility Name	Uses	Yld Act	Well Depth	Static Depth	Mwbz Top	Mwbz Bottom	Well Log	Chemical Analysis	County
P49870W	7/16/1979	CAN	26N	96W	7	NWSW	DAVIS OIL CO.**USDI, BLM	MICHELLE FEDERAL #1	MIS	ND	ND	ND	ND	ND	No	ND	Sweetwater
P41983W	2/20/1978	CAN	26N	96W	8	SWSW	USDI, BLM**OGLE PETROLEUM, INC.	JAKE #1	MIS	40	350	130	230	350	Yes	No	Sweetwater
P46938W	3/5/1979	CAN	26N	96W	17	SWSW	DAVIS OIL CO.**USDI, BLM	#1 ZEPHYR FEDERAL WATER	MIS	50	810	105	672	679	Yes	No	Sweetwater
P46336W	1/11/1979	CAN	26N	96W	18	Lot 8	DAVIS OIL COMPANY**USDI, BLM	PICKETT LAKE WATER WELL #3	MIS	ND	ND	ND	ND	ND	No	ND	Sweetwater
P46335W	1/11/1979	CAN	26N	96W	19	Lot 5	DAVIS OIL COMPANY**USDI, BLM	PICKETT LAKE WATER WELL #2	MIS	ND	ND	ND	ND	ND	No	ND	Sweetwater
P155777W	5/6/2003	GSI	26N	96W	19	Lot 3	USDI, BUREAU OF LAND MANAGEMENT**WILLIAM H. & SALLY JOLLEY	PICKETT LAKE #2	STO	ND	ND	ND	ND	ND	No	ND	Sweetwater
36/9/246W	4/26/2004	UNA	26N	96W	19	SWNW	HUDSON GROUP, LLC	PICKET LAKE #2	CBM	ND	ND	ND	ND	ND	No	ND	
P46936W	3/5/1979	CAN	26N	96W	28	SENW	DAVIS OIL CO.**USDI, BLM	FLAT BUTTES UNIT #2	MIS	ND	ND	ND	ND	ND	No	ND	Sweetwater
P50167W	9/21/1979	CAN	26N	96W	28	SENW	DAVIS OIL CO.**USDI, BLM	FLAT BUTTE #1	MIS	ND	ND	ND	ND	ND	No	ND	Sweetwater
P49876W	7/16/1979	CAN	26N	96W	30	SENW	DAVIS OIL COMPANY**USDI, BLM	PICKETT LAKE UNIT #7	MIS	ND	ND	ND	ND	ND	No	ND	Sweetwater
P62166W	7/20/1982	CAN	26N	96W	31	SESW	USDI, BLM**OGLE PETROLEUM INC.	ATLAS #1	MIS	40	380	155	270	320	Yes	No	Sweetwater
P41981W	2/20/1978	CAN	26N	96W	31	SESW	ROCKY MOUNTAIN ENERGY COMPANY**USDI, BLM	ATLAS #1	MIS	40	380	155	270	320	Yes	No	Sweetwater
P49009W	6/27/1979	CAN	26N	97W	4	SENE	DAVIS OIL CO.**USDI, BLM	SUN UNIT #1	MIS	ND	ND	ND	ND	ND	No	ND	Sweetwater
P51030W	2/4/1980	CAN	26N	97W	7	SWNE	DAVIS OIL CO.**USDI, BLM	SCOTTY LAKE UNIT #2	MIS	ND	ND	ND	ND	ND	No	ND	Sweetwater
P51032W	2/4/1980	CAN	26N	97W	12	NESW	DAVIS OIL CO.**USDI, BLM	PICKETT LAKE UNIT #10	MIS	ND	ND	ND	ND	ND	No	ND	Sweetwater
P98702W	4/4/1995	CAN	26N	97W	13	NESE	USDI, BLM** PRESIDIO EXPLORATION, INC.	PICKET LAKE 40-13 WW	MIS	90	600	210	460	530	Yes	No	Sweetwater
P49015W	7/3/1979	CAN	26N	97W	13	SWNE	DAVIS OIL CO.**USDI, BLM	PICKETT LAKE UNIT #5	MIS	50	532	200	472	480	Yes	No	Sweetwater
P145371W	6/3/2002	GST	26N	97W	13	SWSE	HUDSON GROUP, LLC** USDI, BUREAU OF LAND MANAGEMENT	PICKET LAKE 40-13 WATER WELL	STO, MIS	25	600	210	460	530	No	No	Sweetwater
P145384W	6/12/2002	GSI	26N	97W	13	SWNE	HUDSON GROUP, LLC** USDI, BUREAU OF LAND MANAGEMENT	PICKET LAKE # 5	STO, MIS	ND	ND	ND	ND	ND	No	ND	Sweetwater
P49873W	7/16/1979	CAN	26N	97W	14	SWNE	DAVIS OIL CO.**USDI, BLM	PICKETT LAKE UNIT #9	MIS	ND	ND	ND	ND	ND	No	ND	Sweetwater
P46337W	1/11/1979	CAN	26N	97W	23	NWSE	DAVIS OIL COMPANY**USDI, BLM	PICKETT LAKE WATER WELL #4	MIS	ND	ND	ND	ND	ND	No	ND	Sweetwater
P155776W	5/6/2003	GST	26N	97W	23	NWSE	USDI, BUREAU OF LAND MANAGEMENT**WILLIAM H. & SALLY JOLLEY	PICKETT LAKE #4	STO	20	600	350	ND	ND	No	No	Sweetwater
36/8/246W	4/26/2004	UNA	26N	97W	23	NWSE	HUDSON GROUP, LLC	PICKET LAKE #4	CBM	ND	ND	ND	ND	ND	No	ND	
P156176W	5/6/2003	GST	26N	97W	24	NWSE	WILLIAM H. & SALLY JOLLEY	PICKETT LAKE # 1	STO	20	600	200	ND	ND	No	No	Sweetwater
P43948W	6/16/1978	CAN	26N	97W	24	NWSE	DAVIS OIL CO.**USDI, BLM	DAVIS PICKETT LAKE UNIT #1 WATER	MIS	60	500	150	300	400	No	No	Sweetwater

TABLE 4 - Continued

HUDSON GROUP, LLC
SCOTTY LAKE CBNG PILOT PROJECT

GROUND WATER RIGHTS

Permit #	Priority	Status	Township	Range	Section	Trot	Applicant	Facility Name	Uses	Yld Act	Well Depth	Static Depth	Mwbz Top	Mwbz Bottom	Well Log	Chemical Analysis	County
P135633W	6/6/2001	GST	26N	97W	24	NWSE	HUDSON GROUP, LLC** USDI, BUREAU OF LAND MANAGEMENT	PICKET LAKE UNIT # 1 WATER WELL	STO, MIS	20	500	150	300	400	No	No	Sweetwater
36/1/247W	4/26/2004	UNA	26N	97W	24	SENE	HUDSON GROUP, LLC	SCOTTY LAKE #10	CBM	ND	ND	ND	ND	ND	No	ND	Sweetwater
36/10/246W	4/26/2004	UNA	26N	97W	24	NWSE	HUDSON GROUP, LLC	PICKET LAKE #1	CBM	ND	ND	ND	ND	ND	No	ND	Sweetwater
36/2/247W	4/26/2004	UNA	26N	97W	24	SWSE	HUDSON GROUP, LLC	SCOTTY LAKE #11	CBM	ND	ND	ND	ND	ND	No	ND	Sweetwater
36/6/246W	4/26/2004	UNA	26N	97W	24	SESW	HUDSON GROUP, LLC	SCOTTY LAKE #12	CBM	ND	ND	ND	ND	ND	No	ND	Sweetwater
36/7/246W	4/26/2004	UNA	26N	97W	24	SENW	HUDSON GROUP, LLC	SCOTTY LAKE #9	CBM	ND	ND	ND	ND	ND	No	ND	Sweetwater
P49871W	7/16/1979	CAN	26N	97W	25	SWNE	DAVIS OIL COMPANY**USDI, BLM	PICKETT LAKE UNIT #6	MIS	ND	ND	ND	ND	ND	No	ND	Sweetwater
P49872W	7/16/1979	CAN	26N	97W	26	SWNE	DAVIS OIL COMPANY**USDI, BLM	PICKETT LAKE UNIT #8	MIS	ND	ND	ND	ND	ND	No	ND	Sweetwater
P53086W	7/16/1980	CAN	26N	97W	31	SWNE	DAVIS OIL COMPANY**USDI, BLM	FAIR UNIT #1	MIS	ND	ND	ND	ND	ND	No	ND	Sweetwater
P3687P	12/31/1880	GST	26N	97W	32	SESW	CORP. OLSON SISTERS	OSBORNE SPRING #1	STO	7	10	-4	ND	ND	Yes	ND	Sweetwater
P3686P	6/10/1916	GST	26N	97W	36	NWSW	STATE OF WYOMING**CORP. OLSON SISTERS	OLSON #1	DOM, STO	20	192	65	ND	ND	No	ND	Sweetwater
P83969W	10/1/1990	CAN	26N	97W	36	SWNW	WYO BOARD OF LAND COMMISSIONERS**WILLIAM H. JOLLEY	CYCLONE WELL #1	STO	ND	ND	ND	ND	ND	No	ND	Sweetwater

ND = No Data Available

TABLE 5

HUDSON GROUP, LLC
SCOTTY LAKE CBNG PILOT PROJECT

OBSERVATION POINT LOCATIONS

Obs. Pt.	Locations					
	Quarter Secs.	Section	Twnshp., N	Range, W	Latitude, DMS, N	Long., DMS, W
1	SE NW	24	26	97	42 12 54.1	-108 21 19.9
2	SE SW	24	26	97	42 12 29.5	-108 21 13.7
3	SE SW	24	26	97	42 12 29.9	-108 21 17.3
4	SE NE	24	26	97	42 12 53.4	-108 20 42.7
5	NE SW SE	24	26	97	42 12 30.5	-108 20 56.6
6	NE SW SE	24	26	97	42 12 30.3	-108 20 58.0
7	SW SE SE	24	26	97	42 12 24	-108 20 50.6
8	NW SE NW	19	26	96	42 12 54.2	-108 20 12.2
9	SW NW SE	23	26	97	42 12 34.7	-108 22 11.8
10	SW NW SE	23	26	97	42 12 38.8	-108 22 14.6
11	E/2 NE SW	23	26	97	42 12 45.3	-108 22 19.7
12	SW NE NE	19	26	96	42 12 47.6	-108 19 29.9
13	NE NW SE	19	26	96	42 12 41.6	-108 19 32.3
14	C NW SE	19	26	96	42 12 39.5	-108 19 37.4
15	SW SE	19	26	96	42 12 28.6	-108 19 48.4
16	SW SW SE	19	26	96	42 12 26.4	-108 19 51.9
17	SW SW NE	23	26	97	42 12 50.0	-108 22 10.9
18	SW NE NE	24	26	97	42 12 00.9	-108 20 50.1
19	SW NW SE	24	26	97	42 12 38.4	-108 21 3.2
20	SW NE	19	26	96	42 12 55.6	-108 19 41.7
21	SW NE	19	26	96	42 12 53.8	-108 19 46.4
22	SE SE NW	19	26	96	42 12 49.0	-108 19 54.9
23	NE SW NE	19	26	96	42 12 52.4	-108 19 36.7
24	SE SW NW	20	26	96	42 12 46	-108 18 52
25	NW NE SW	20	26	96	42 12 41.9	-108 18 50.1
26	C SW	20	26	96	42 12 33.1	-108 18 50.9
27	NW NW	30	26	96	42 12 14.3	-108 20 20.6
28	NW SE	24	26	97	42 12 39.8	-108 20 59.4
29	SW NW	27	26	97	42 12 00.8	-108 23 55.7
30	NE NW	25	26	97	42 12 15.3	-108 21 57.7
31	NW NE NE	26	26	97	42 12 18.7	-108 21 56.4
32	SE SE SW	23	26	97	42 12 23.5	-108 22 21.4
33	NE NE NW	26	26	97	42 12 19.2	-108 22 19.8
34	NE NE NW	26	26	97	42 12 16.7	-108 22 18.3
35	SW NE	26	26	97	42 12 5.9	-108 22 5.3
36	SW SW NE	26	26	97	42 12 4	-108 22 12
37	NE NW NW	26	26	97	42 12 17.3	-108 22 41.2
38	NE SW SW	23	26	97	42 12 32.2	-108 22 38.8
39	NW SW	23	26	97	42 12 38.1	-108 22 41.7
40	NW SW	23	26	97	42 12 40.9	-108 22 42.7
41	NW NW SW	23	26	97	42 12 42.1	-108 22 46.6
42	NW NW SW	23	26	97	42 12 41.4	-108 22 50.4
43	C SE	22	26	97	42 12 32.3	-108 23 11.2

TABLE 6

HUDSON GROUP, LLC
SCOTTY LAKE CBNG PILOT PROJECT

DISCHARGE POINTS

Discharge Point # (Outfall)	**Immediate Receiving Stream**	**Mainstem**	**Distance from outfall to mainstem (stream miles)**	**Quarter / Quarter**	**Section**	**Township**	**Range**	**Latitude** (decimal degree format, accuracy to nearest 5 seconds)	**Longitude** (decimal degree format, accuracy to nearest 5 seconds)	**Project Phase**	**Water from Well #**	**Reservoir Name**
001 ex	Ephem. Trib.	Red Creek	6.5 miles	NW SE	24	26	97	42.21252	-108.34922	I EX	1	PL 1 Stock
002	Ephem. Trib.	Red Creek	7.2 miles	SW NE	24	26	97	42.21388	-108.34988	I	9	N/A
003	Ephem. Trib.	Red Creek	6.9 miles	SW NE	24	26	97	42.21538	-108.34883	I	10	N/A
004	Ephem. Trib.	Red Creek	6.6 miles	SE SW	24	26	97	42.20595	-108.35261	I	12	N/A
006 ex	Ephem. Trib.	Red Creek	7.8 miles	SE NW	19	26	96	42.21434	-108.33578	EX	2	N/A
007/025	Ephem. Trib.	Red Creek	7.8 miles	NW SE	19	26	96	42.21194	-108.32625	II	7, 22, 25	N/A
008 ex	Ephem. Trib.	Red Creek	8.0 miles	NW SE	23	26	96	42.21085	-108.37110	III EX	4	PL 4 Rechg
009	Ephem. Trib.	Red Creek	6.7 miles	NW NE	23	26	97	42.21639	-108.36830	III	26	N/A
010	Ephem. Trib.	Red Creek	7.0 miles	SE SE	14	26	97	42.22251	-108.36629	III	27	N/A
013/026	Ephem. Trib.	Red Creek	7.1 miles	NE NW	23	26	97	42.21994	-108.37137	III	8, 13	N/A
014	Ephem. Trib.	Red Creek	6.7 miles	SE NW	23	26	97	42.21632	-108.37479	III	14	N/A
015	Ephem. Trib.	Red Creek	6.0 miles	NW SW	23	26	97	42.21131	-108.37973	III	15	N/A
016	Ephem. Trib.	Red Creek	5.8 miles	NW NE	26	26	97	42.20415	-108.37033	III	(16) 28	N/A
(017)	Ephem. Trib.	Red Creek	5.5 miles	SW NW	26	26	97	42.19961	-108.38068	III	(17)	N/A
(018)	Ephem. Trib.	Red Creek	5.2 miles	NW NE	26	26	97	42.20198	-108.36866	III	(18)	N/A
019	Ephem. Trib.	Red Creek	6.3 miles	SW SE	22	26	97	42.20860	-108.38667	III	19	N/A
020	Ephem. Trib.	Red Creek	6.6 miles	SE NE	22	26	97	42.21440	-108.38573	III	20	N/A
021	Ephem. Trib.	Red Creek	6.9 miles	C SE	24	26	97	42.20847	-108.34865	I	11	N/A
022	Ephem. Trib.	Red Creek	7.9 miles	SW NE	19	26	96	42.21445	-108.32947	II	7, 22, 25	N/A
023/024	Ephem. Trib.	Red Creek	8.0 miles	C W/2	20	26	96	42.21258	-108.31436	II	23, 24	N/A

TABLE 7

HUDSON GROUP, LLC
SCOTTY LAKE CBNG PILOT PROJECT

PIT/POND SPECIFICATIONS

Pit/Pond	LOCATION				Length, ft	Width, ft	Depth, ft	Area, ac	Volume, ac-ft
	Qtrs.	Sec	Twnshp, N Lat, N dms	Range, W Long, W dms					
PL #1	SW NW SE	24	26 42 12 38.4	97 -108 21 3.2	156	64	11	0.23	2.5
PL #4	E/2 NE SW	23	26 42 12 45.3	97 -108 22 19.7	88	80	6	0.16	0.97

TABLE 8

HUDSON GROUP, LLC
SCOTTY LAKE CBNG PILOT PROJECT

PEAK FLOW ESTIMATES

INPUT: **High Desert**

Drainage Basin	Area, mi	Lat. N, dd	Geog. Factor	Avg. Ann. Precip., in
A	6.51	42.1416600	0.65	9.8
B	3.97	42.1378695	0.65	9.8
C	10.07	42.1218762	0.65	9.8

PEAK FLOW ESTIMATES:
cfs

	Miller, 2003			Lowham, 1988		
Drainage Basin	**A**	**B**	**C**	**A**	**B**	**C**
Q 1.5	16.7	12.3	22.2			
Q 2	27.0	20.0	35.6	48.4	37.2	60.7
Q 2.33	33.1	24.7	43.5			
Q 5	68.7	52.0	89.1	118	91.8	146.3
Q 10	110.7	84.8	142.1	185.3	144.8	228.9
Q 25	180.5	139.9	229.5	301.8	238.0	369.9
Q 50	245.2	191.6	309.7	405.2	321.0	494.8
Q 100	321.5	253.1	403.4	530.3	422.0	645.0
Q 200	410.1	325.0	511.8	663.9	528.2	807.5
Q 500	546.2	436.4	676.6	893.2	713.9	1082.2
FOR CULVERTS: cfs/sq mi						
Q 10	17.00	21.35	14.11	28.47	36.48	22.73
Q 25	27.72	35.24	22.79	46.36	59.96	36.74
MEAN ANNUAL FLOW: cfs				0.17	0.11	0.24

TABLE 9

HUDSON GROUP, LLC
SCOTTY LAKE CBNG PILOT PROJECT

ESTIMATED VELOCITIES & DISCHARGE RATES FOR CBNG SURFACE WATER

Drainage Basin	Reach	Channel Width, ft	Gradient	# Wells	Velocity, ft/sec	Discharge, cfs	Water Depth, ft	Water Depth, in
A	1	3	0.0183	1	0.5	0.037	0.023	0.28
	2	4	0.017	5	0.9	0.179	0.051	0.61
	3	2	0.0222	2	0.9	0.07	0.041	0.49
B	EAST (3 & 4)	3	0.0225	3	0.9	0.107	0.041	0.49
	WEST (1 & 2)	3	0.02	1	0.5	0.036	0.022	0.26
C	EAST (4 & 5)	3	0.0178	3.5	0.9	0.128	0.049	0.59
	WEST (1a & 1b)	3	0.024	6.5	1.2	0.236	0.065	0.78

NO CONVEYANCE LOSS

TABLE 10a

HUDSON GROUP, LLC
SCOTTY LAKE CBNG PILOT PROJECT

FLOW DISTANCES IN TRIBUTARIES USING CONVEYANCE LOSS FACTOR

INPUT

LOSS FACTOR	1500	BPD/MI
	0.097	CFS/MI
	43.7	GPM/MI
WATER RATE/WELL	550	BPD
	0.036	CFS
	16.0	GPM

ASSUME EACH PIT TAKES THE PRODUCTION OF 1 WELL (2 PITS)

DRAINAGE BASIN	CHANNEL REACH	REACH LENGTH	# WELLS	DISCHARGE			FLOW DISTANCE
		MI		BPD	CFS	GPM	MI
A	1	1.3	0	0	0.000	0.0	0.00
			1	550	0.036	16.0	0.37
	2, 4, 5 & 6	7.2	2	1100	0.071	32.1	0.73
			5	2750	0.179	80.2	1.83
	3	1.83	2	1100	0.071	32.1	0.73
B	EAST (3 & 4)	3.13	3	1650	0.107	48.1	1.10
			1	550	0.036	16.0	0.37
	WEST (1 & 2)	5.15	1	550	0.036	16.0	0.37
			0	0	0.000	0.0	0.00
C	EAST (4 & 5)	9.05	3.5	1925	0.125	56.1	1.28
	WEST (1 & 2)	7.89	6.5	3575	0.232	104.3	2.38

ANALYST: CSB
DATE: 6/4/2004

TABLE 10b

HUDSON GROUP, LLC
SCOTTY LAKE CBNG PILOT PROJECT

FLOW DISTANCES IN TRIBUTARIES USING CONVEYANCE LOSS FACTOR

INPUT

LOSS FACTOR	750	BPD/MI
	0.049	CFS/MI
	21.9	GPM/MI
WATER RATE/WELL	550	BPD
	0.036	CFS
	16.0	GPM

ASSUME EACH PIT TAKES THE PRODUCTION OF 1 WELL (2 PITS)

DRAINAGE BASIN	CHANNEL REACH	REACH LENGTH	# WELLS	DISCHARGE			FLOW DISTANCE
		MI		BPD	CFS	GPM	MI
A	1	1.3	0	0	0.000	0.0	0.00
			1	550	0.036	16.0	0.73
	2, 4, 5 & 6	7.2	2	1100	0.071	32.1	1.47
			5	2750	0.179	80.2	3.67
	3	1.83	2	1100	0.071	32.1	1.47
B	EAST (3 & 4)	3.13	3	1650	0.107	48.1	2.20
			1	550	0.036	16.0	0.73
	WEST (1 & 2)	5.15	1	550	0.036	16.0	0.73
			0	0	0.000	0.0	0.00
C	EAST (4 & 5)	9.05	3.5	1925	0.125	56.1	2.57
	WEST (1 & 2)	7.89	6.5	3575	0.232	104.3	4.77

ANALYST: CSB
DATE: 6/4/2004

TABLE 11a

HUDSON GROUP, LLC
SCOTTY LAKE CBNG PILOT PROJECT

WATER BALANCE - DRAINAGE BASINS A, B & C

550 BPD; 1500 BPD/MI

INFLOW excluding precipitation

# of wells	Formation	Rate			Total project flow (cfs)	Annual flow volume (cu feet)	**Annual project flow volume (acre-feet)**
		bpd/well	gpm/well	cfs/well			
21	Scotty Lake	550	16.0	0.036	0.755	23794091	**546**

OUTFLOW

Reservoirs		Capacity (acre-feet)	Estimated combined evapotranspiration and seepage Rate (bpd)	(gpm)	(cfs)	**Estimated annual losses due to evaporation, transpiration and seepage (acre-feet)**
P #1		2.73	550	16.0	0.036	26
P #2		1	225	6.6	0.015	11
	Totals	**3.73**	**775**	**22.6**	**0.051**	**37**

Tributaries		Length (mi)	Width (ft)	Conveyance Loss (bpd/mi)	(gpm/mi)	(cfs/mi)	**Estimated annual conveyance loss (ac-ft)**
All in DB A, B & C		35.58	3	1500	43.7	0.098	**2511**

OUTFLOW (acre-feet/yr)	**-**	**INFLOW (acre-feet/yr)**	**=**	**EXCESS CAPACITY (acre-feet/yr)**	
2511		**546**		**1965**	**TRIBUTARY LOSS ONLY**
2548		**546**		**2001**	**TRIBS. & RESVS.**

ANALYST: CSB
DATE: 6/3/2004

TABLE 11b

HUDSON GROUP, LLC
SCOTTY LAKE CBNG PILOT PROJECT

WATER BALANCE - DRAINAGE BASINS A, B & C

1200BPD/WELL; 1500BPD/MI

INFLOW excluding precipitation

# of wells	Formation	Rate			Total project flow (cfs)	Annual flow volume (cu feet)	**Annual project flow volume (acre-feet)**
		bpd/well	gpm/well	cfs/well			
21	Scotty Lake	1200	35.0	0.078	1.646	51914381	**1192**

OUTFLOW

Reservoirs		Capacity (acre-feet)	Estimated combined evapotranspiration and seepage Rate (bpd)	(gpm)	(cfs)	**Estimated annual losses due to evaporation, transpiration and seepage (acre-feet)**
P #1		2.73	550	16.0	0.036	26
P #2		1	225	6.6	0.015	11
	Totals	**3.73**	**775**	**22.6**	**0.051**	**37**

Tributaries	Length (mi)	Width (ft)	Conveyance Loss (bpd/mi)	(gpm/mi)	(cfs/mi)	**Estimated annual conveyance loss (ac-ft)**
All in DB A, B & C	35.58	3	1500	43.7	0.098	**2511**

OUTFLOW (acre-feet/yr)	**-**	**INFLOW (acre-feet/yr)**	**=**	**EXCESS CAPACITY (acre-feet/yr)**	
2511		**1192**		**1319**	**TRIBUTARY LOSS ONLY**
2548		**1192**		**1356**	**TRIBS. & RESVS.**

ANALYST: CSB
DATE: 6/3/2004

TABLE 11c

HUDSON GROUP, LLC
SCOTTY LAKE CBNG PILOT PROJECT

WATER BALANCE - DRAINAGE BASINS A, B & C

550 BPD/WELL; 750 BPD/MI

INFLOW excluding precipitation

# of wells	Formation	Rate			Total project flow (cfs)	Annual flow volume (cu feet)	**Annual project flow volume (acre-feet)**
		bpd/well	gpm/well	cfs/well			
21	Scotty Lake	550	16.0	0.036	0.755	23794091	**546**

OUTFLOW

Reservoirs		Capacity (acre-feet)	Estimated combined evapotranspiration and seepage Rate (bpd)	(gpm)	(cfs)	**Estimated annual losses due to evaporation, transpiration and seepage (acre-feet)**
P #1		2.73	550	16.0	0.036	26
P #2		1	225	6.6	0.015	11
	Totals	**3.73**	**775**	**22.6**	**0.051**	**37**

Tributaries	Length (mi)	Width (ft)	Conveyance Loss (bpd/mi)	(gpm/mi)	(cfs/mi)	**Estimated annual conveyance loss (ac-ft)**
All in DB A, B & C	35.58	3	750	21.9	0.049	**1255**

OUTFLOW (acre-feet/yr)	**-**	**INFLOW (acre-feet/yr)**	**=**	**EXCESS CAPACITY (acre-feet/yr)**	
1255		**546**		**709**	**TRIBUTARY LOSS ONLY**
1292		**546**		**746**	**TRIBS. & RESVS.**

ANALYST: CSB
DATE: 6/3/2004

APPENDIX B: FIGURES

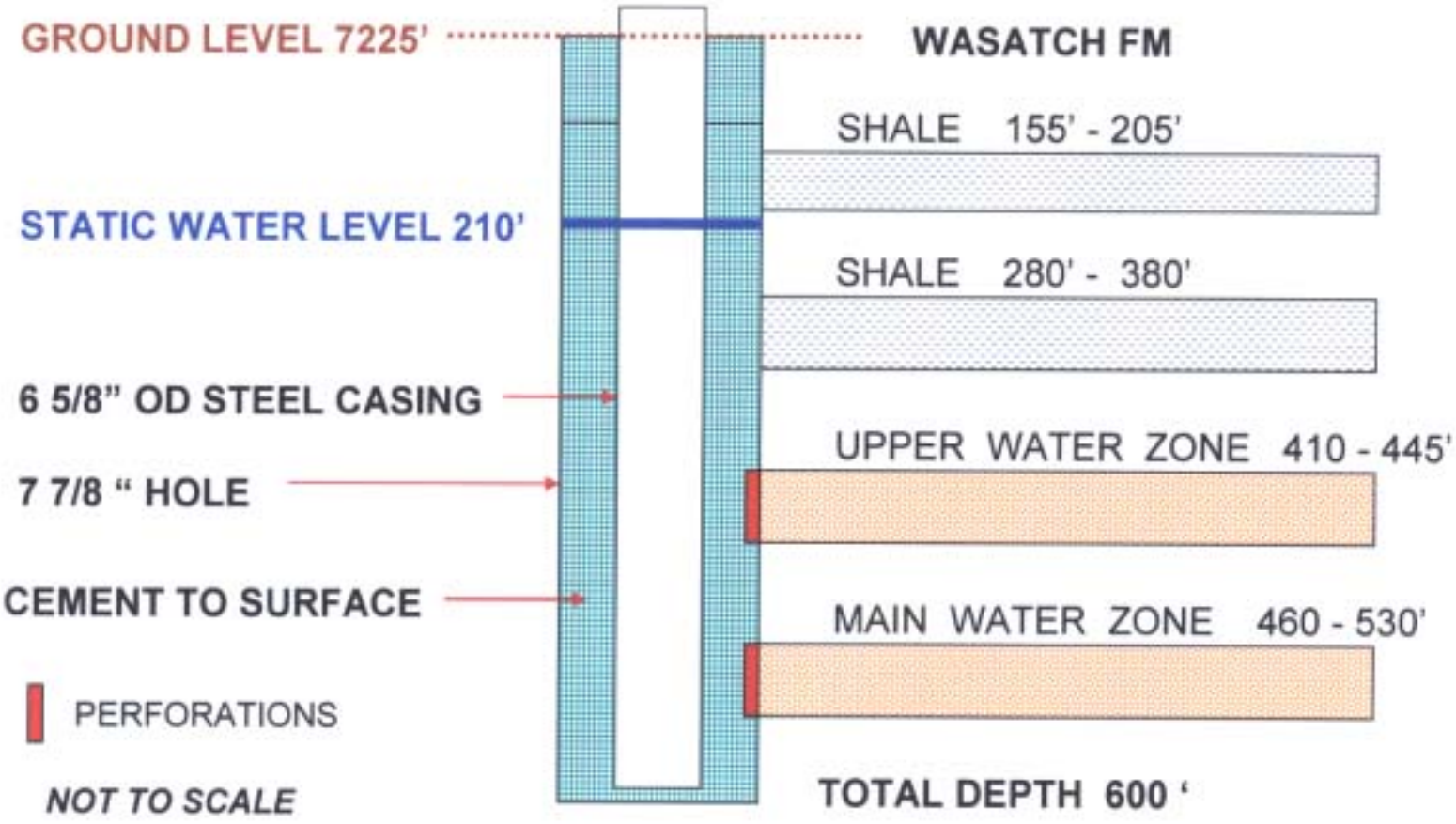
FIGURE 1

HUDSON GROUP, LLC

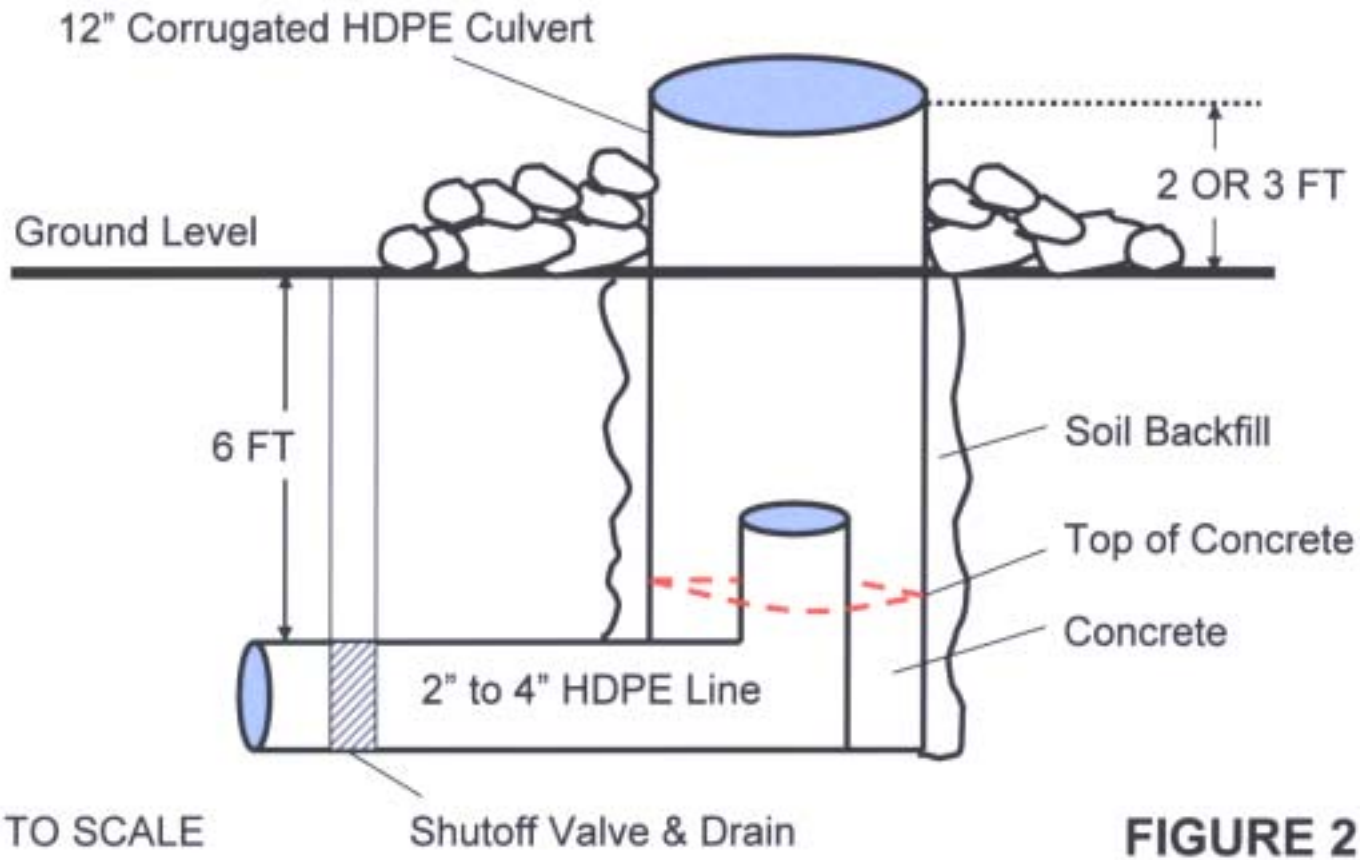
SCOTTY LAKE CBNG PROJECT

WELL DIAGRAM - # 40-13 WATER WELL

SE/4 SECTION 13-T26N-R97W



HUDSON GROUP, LLC
SCOTTY LAKE CBNG PILOT PROJECT
TYPICAL OUTFALL DESIGN



NOT TO SCALE

FIGURE 2

APPENDIX C: PHOTOGRAPHS

HUDSON GROUP, LLC
SCOTTY LAKE CBNG PILOT PROJECT

PHOTOGRAPHS

Observation Point	Description
13	View down tributary to reach 4 near DP #7/25 in DB C; channel slope 3°, width 1 to 2', depth < 1'
38	View down tributary to reach 2b near well #15 in DB A; slope 2.4°, width 1 to 2', depth < 1'
31	View up tributary to reach 3 in DB B south of well #28;slope 0.5°, width 3 to 4', depth 0.5'
16	View up reach 4 in DB C; water is snowmelt; slope 1.5°, width 3 to 4', depth 1'
27	View up reach 4 in DB C; water is snowmelt; slope 0.5°, width 6', depth 1.5 to 2'
42	View up reach 2c in DB A near DP #15; slope 1.2°, width 2 to 3', depth 0.5'
29	View down reach 5 in DB A @ site of PT 2; slope < 1°, width 5 to 6', depth 1.5 to 2'
34	1 to 3' head cut on tributary 3 in DB B, above DP #16
18	5 to 6' head cut on tributary 1a in DB C, above DP #3
8	DP #6 near well #2; perforated pipe in rip-rap blanket in channel
10	Rip-rap inlet to recharge pond at well #4
19	Stock pond at well #1

USDI/BLM flowing well in Section 25, T23N, R96W:

a. Outlet from pond receiving well water

b. Channel below pond outlet; width 1 to 2', depth < 0.5'

HUDSON GROUP, LLC
SCOTTY LAKE CBNG PILOT PROJECT

PHOTOGRAPHS

OP 13 view down tributary to reach 4 near DP #7/25 in DB C; channel slope 3°, width 1 to 2', depth < 1'

OP 38 view down tributary to reach 2b near well #15 in DB A; slope 2.4°, width 1 to 2', depth < 1'

OP 31 left - view up tributary to reach 3 in DB B south of well #28; slope 0.5°, width 3 to 4', depth 0.5'

OP 16 right - view up reach 4 in DB C; water is snowmelt; slope 1.5°, width 3 to 4', depth 1'

OP 27 view up reach 4 in DB C; water is snowmelt; slope 0.5°, width 6', depth 1.5 to 2'

OP 42 view up reach 2c in DB A near DP #15; slope 1.2°, width 2 to 3', depth 0.5'

OP 29 view down reach 5 in DB A @ site of PT 2; slope < 1°, width 5 to 6', depth 1.5 to 2'

OP 34 1 to 3' head cut on tributary 3 in DB B, above DP #16

OP 18 5 to 6' head cut on tributary 1a in DB C, above DP #3

OP 8 DP #6 near well #2; perforated pipe in rip-rap blanket in channel

OP 10 rip-rap inlet to recharge pond at well #4

OP 19 stock pond at well #1

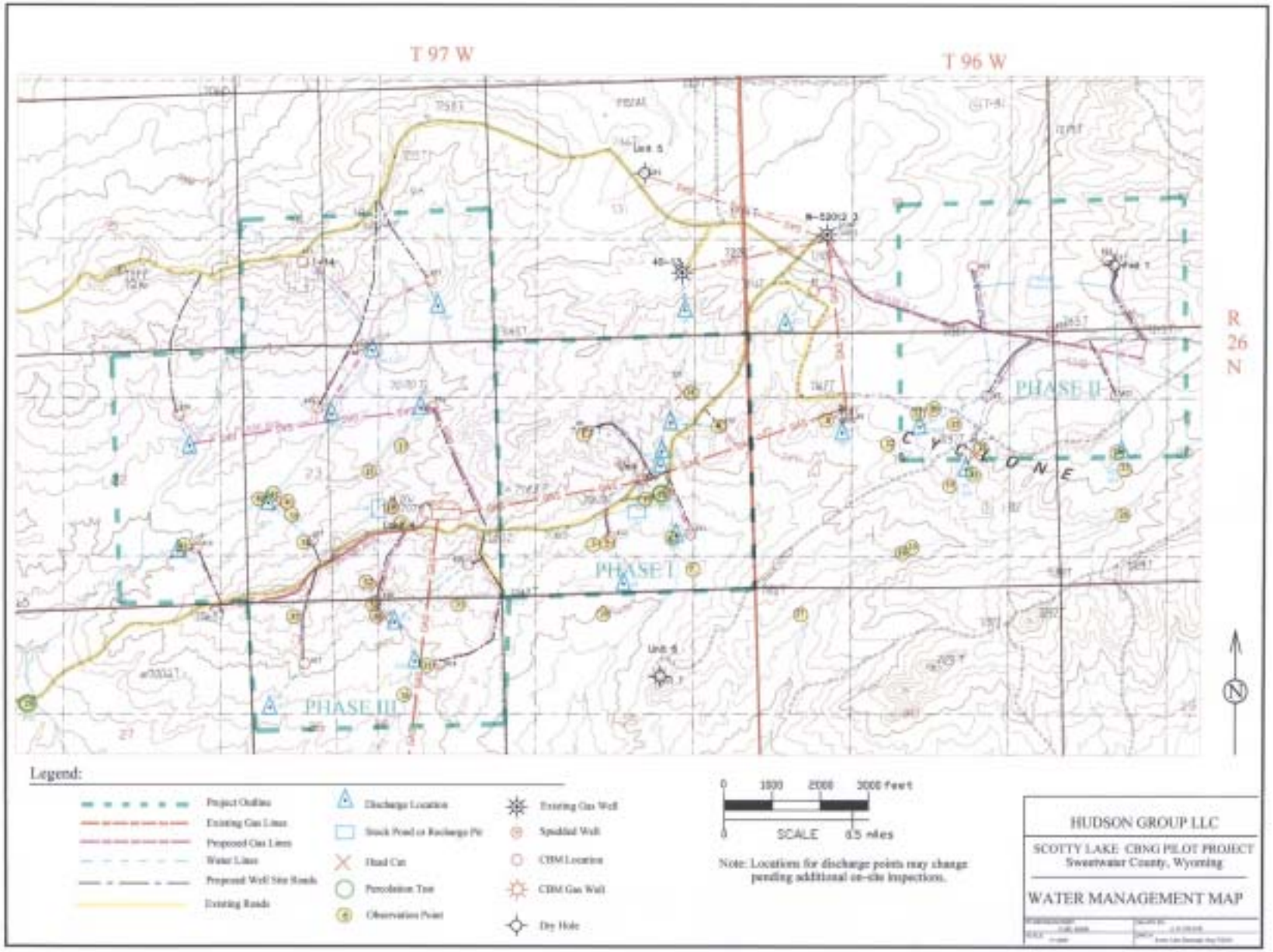
a.

b.

USDI/BLM flowing well in section 25, T23N-R96W:

a. Outlet from pond receiving well water
b. Channel below pond outlet; width 1 to 2', depth < 0.5'

APPENDIX D: MAPS AND CHARTS


T 97 W
T 96 W
R 26 N
PHASE II
CYCLONE
PHASE I
PHASE III
N
Legend:
Project Outline
Existing Gas Lines
Proposed Gas Lines
Water Lines
Proposed Well Site Roads
Existing Roads
Discharge Location
Stock Pond or Recharge Pit
Head Cut
Percolation Test
Observation Point
Existing Gas Well
Spudded Well
CBM Location
CBM Gas Well
Dry Hole
0 1000 2000 3000 Feet
SCALE 0.5 miles
Note: Locations for discharge points may change pending additional on-site inspections.
HUDSON GROUP LLC
SCOTTY LAKE CBNG PILOT PROJECT
Sweetwater County, Wyoming
WATER MANAGEMENT MAP
PROFESSIONAL GEOLOGIST
CARLTON SCOTT BASS
PG-579
WYOMING

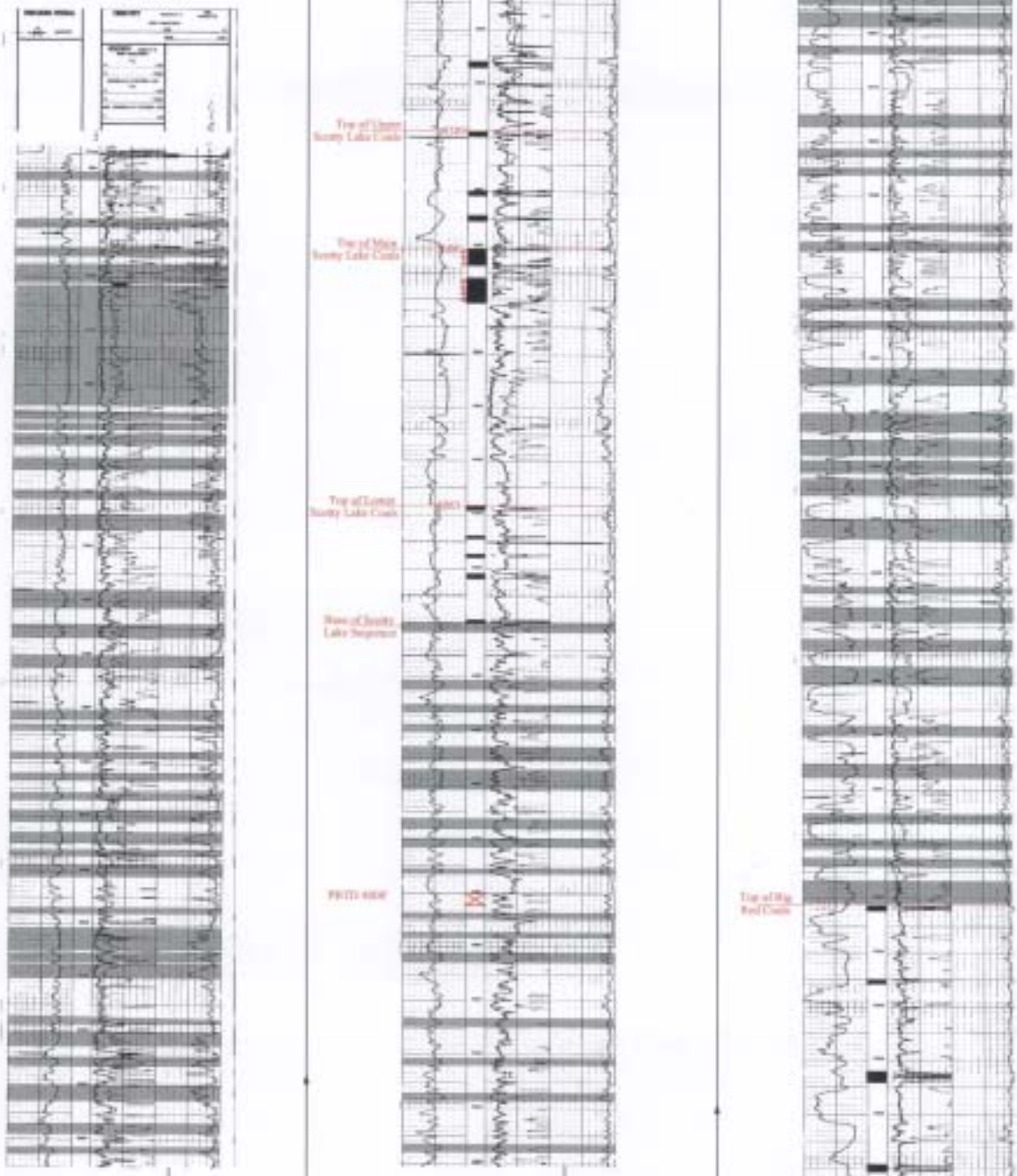
TYPE LOG - SCOTTY LAKE CBNG PILOT PROJECT

Sweetwater County, Wyoming

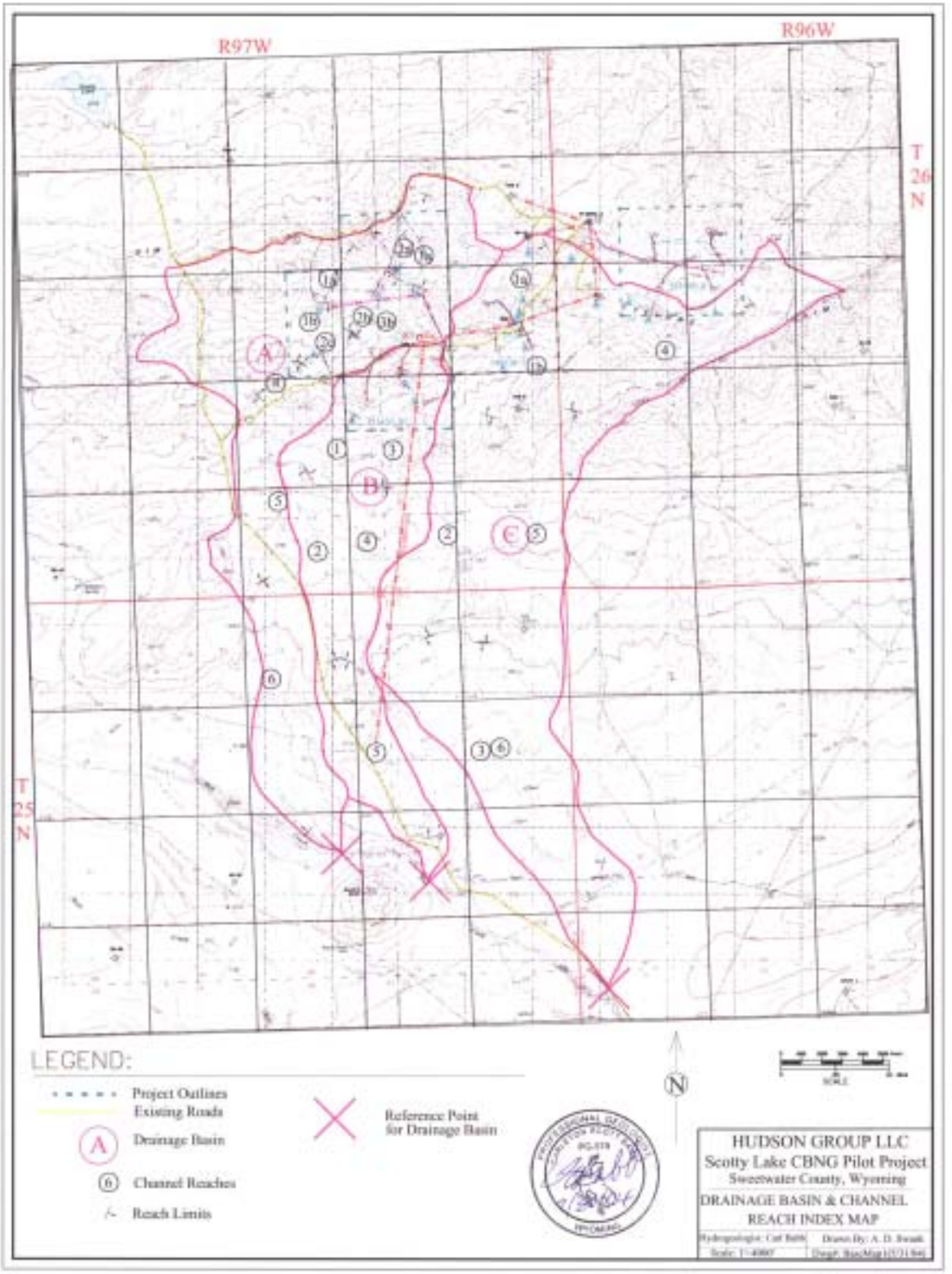
Vertical Scale: 1"=200'

HUDSON PICKET LAKE NO.1
NWSE Sec 24, T26N R97W

3721309A
KB 7095 '
TD 13,652'
PBTD 4800'



Shale Layers >10' Thick Coal Seams Perforations


R97W
R96W
T 26 N
T 25 N
A
B
C
LEGEND:
Project Outlines
Existing Roads
Drainage Basin
Channel Reaches
Reach Limits
Reference Point for Drainage Basin
N
SCALE
HUDSON GROUP LLC
Scotty Lake CBNG Pilot Project
Sweetwater County, Wyoming
DRAINAGE BASIN & CHANNEL REACH INDEX MAP
Hydrologist: Carl Robb
Scale: 1"=4000'
Drawn By: A. D. Swank