

Filling the Gaps

*How to Improve Oil and Gas Reclamation
and Reduce Taxpayer Liability*

Appendix
**Case Studies Approach,
Methodology and Results**

FILLING THE GAPS

HOW TO IMPROVE OIL AND GAS RECLAMATION AND REDUCE TAXPAYER LIABILITY

APPENDIX Case Studies Approach, Methodology and Results

1. HOW THE CASE STUDIES WERE DEVELOPED

The following case studies describe proposed or active oil and gas projects in several western states. They illustrate the wide gulf between the current state and federal requirements for reclamation and financial assurance and the actual tasks and estimated costs of reclamation.

The projects include several types of surface and mineral ownership or leasing combinations, including:

- private lease of state surface land, state mineral rights leased to others;
- private surface ownership, federal mineral rights leased to others; and
- private lease of federal surface land, federal mineral rights leased to others.

These types of ownership combinations are frequently referred to as “split-estates.” Other ownership combinations, including common private ownership of both surface and mineral rights, aren’t included in the case studies.

Oil and gas exploration and development companies are required to provide documents to state and/or federal agencies describing their proposed activities, including information on reclamation. These documents, such as Plans of Development, Surface Use Plans, Water Use or Management Plans, Environmental Assessments, Records of Decision, and other types of reports, were used as the basis for the reclamation cost estimates for the case studies. Documents submitted for federally-owned surface and underlying minerals were in general more complete and detailed than those submitted for state-owned minerals or privately-owned surface over federal minerals.

In many cases, the available documents lacked important details concerning reclamation plans. Some documents contained conflicting information about the sites. Most of the projects selected for the case studies were missing key pieces of information on reclamation and some had very little information even concerning the exploration and development activities. Details on features such as miles of roads and pipelines, numbers and sizes of pits, or even numbers of wells were frequently missing, adding to uncertainty in developing cost estimates. Disturbed areas and cost estimates from the more detailed projects were used to fill in the gaps of projects with less information. Previous professional experience with similar projects also provided missing data.

Each case study lists individual aspects of the company’s proposed reclamation plan described in the available documents. The next section details tasks for each reclamation feature based on either information contained in the documents or on professional experience. The case study includes estimated earthwork quantities and costs to conduct the necessary reclamation tasks. Tables 1 through 5 in each case study list the tasks, quantities, and costs for each feature and the total project reclamation costs. The

final section compares the estimated costs for reclamation to the amount of financial assurance the company provided.

The case study costs are based on a typical reclamation scenario – they portray neither a best case or worst case situation. In the best case operators will conduct their development in a manner to accommodate successful reclamation and might be expected to achieve costs less than those portrayed in this study. In the worst case, Superfund or similar cleanup activities could be required and might be expected to result in costs far in excess of those in this study

2. HOW THE COSTS WERE ESTIMATED

For consistency reclamation and financial assurance cost estimates were based on the following assumptions unless otherwise noted in the individual case study:

- Since drilling companies can go bankrupt at any time, the estimates in the case studies were based on the assumption that no interim reclamation had taken place and no financial assurance had been released. Reclamation of the entire disturbed area was assumed to be necessary.
- If development takes place on both federal and private or state and private surface land, the cost estimates include the private land unless otherwise noted.
- If available documents provided specific disturbed area acreages or right-of-way widths, these values were used in the case study.
- Because in most cases not enough information was provided to determine site specific plans, unit costs (dollars per acre) were used throughout the case studies. In general, this results in estimated reclamation costs that are lower than cost estimates based on a site specific plan. In all cases, a site specific reclamation plan should be the goal, in order to provide the most accurate financial assurance estimates.
- The disturbed area of improved roads is based on a 25 foot width for cut and fill areas and a 15 foot width for upgraded and/or graveled roads. These were combined into a weighted average unit area. The disturbed area of two-track roads is based on a 10 foot width.
- Where proposed roads, pipelines, and underground power are constructed in the same corridor, the road width was used in calculating quantities.
- The disturbed areas of pipelines and power cable are based on a 25 foot width for high pressure gas and a 15 foot width for low pressure gas pipelines, a 15 foot width for water pipelines, and a 15 foot width for buried power cables. The high and low pressure gas line areas were combined into a weighted average unit area.
- Where high pressure gas, low pressure gas, water, and/or underground power lines are constructed in the same corridor, the greatest width required for any single line was used in calculating the disturbed area.
- To more accurately estimate reclamation costs, both direct and indirect costs were used.

- Bureau of Land Management guidance for reclamation standards, tasks, indirect costs, and financial assurance amounts consistent with agency guidelines for mining projects were used unless otherwise noted.
- The Construction Cost Index (www.enr.com) was used to escalate costs established in 2003 dollars to current (2005) dollars. The May 2003 cost index was equal to 6642 and the May 2005 cost index was equal to 7407 indicating costs increased 11.47% during the two year period.

2.1. Basis for Direct Costs

This section details the basis for the direct cost estimates used in the case studies. The accuracy of the cost estimates is +/- 35%. The basis of the cost estimates is consistent with accepted professional engineering cost estimation principles and practices. All costs are based on federal and state requirements in hiring a third party contractor.

Labor

Labor is based on an average prevailing wage rate of \$35.70 per hour for all different labor classifications with no adjustments.

Equipment

Equipment costs are based on RS Means Environmental Remediation Cost Data – Unit Price 2003 escalated to 2005 costs or otherwise based on professional judgment.

Landfill Disposal

The tipping fee for landfill disposal of surface materials is estimated at \$100 per load.

Surface Facilities Removal

The cost is based on two persons laboring for eight hours at each well or facility assisted by one tool and lift truck and one dump truck used to dispose of one load of materials at a certified landfill. Improved and two-track roads removal is based on two persons laboring for two hours per road mile assisted by one excavator, one tool truck, and one dump truck used to dispose of one load of materials for every four miles of road at a certified landfill.

Well Plugging

Well and boring plugging is based on eight inch well abandonment using Portland cement to grout the top 10 feet of the well casing.

Recontouring

Surface recontouring of well sites, gathering facilities, roads, and discharge points is based on using a D6 dozer, one pass, and a motor grader, one pass. Storage impoundment recontouring consists of removal and consolidation of two feet of contaminated soils at the bottom of the pond based on using D9 dozer pushing on 75% of surface area for two foot removal (bottom of repository assumed to occupy 25% of surface area). A D9 dozer is then used to cut/fill to original contours assuming material to be moved approximately equal to 40% of pond volume and finish grading using a motor grader one pass.

Plowing or Disking and Seeding

Plowing and seeding is based on using a tractor and seed drill. Costs include 2000 pounds per acre mulch, 20 pounds per acre seed, and 200 pounds per acre fertilizer.

Land Application Discharge Area

Supplemental water is assumed to be available at no additional cost and soil amendments applied for five-year period. Soil amendment costs are based on 4 tons per acre gypsum and 600 lbs per acre elemental sulfur.

Long-Term Monitoring and Maintenance

Revegetation monitoring is based on one field study and report in year five. Revegetation maintenance is based on supplemental planting on 25% of area in year two and 10% of area in year four, nutrient supplementation in year three. Weed control program is based on annual chemical applications. A lump sum cost of \$550 per acre was estimated for this task.

Total costs on a unit cost (dollar per acre) basis were determined for each feature. Table 2.1 shows the estimated unit costs for reclamation of the various features of the case studies. Not all categories of reclamation activities apply to all of the case studies. The costs range from \$1,366 per acre to \$20,821 per acre.

Table 2.1 - Unit Costs

Feature	Per Unit Costs				Productivity Unit/acre	Total Cost \$/acre	
	Unit	Labor \$/unit	Equipment \$/unit	Materials \$/unit			Total \$/unit
Construction Areas							
Recontour							
D6 Dozer	hour	\$35.67	\$72.36	\$0.00	\$108.03	8.00	\$864
12 G Motor Grader	hour	\$35.67	\$66.88	\$0.00	\$102.55	4.00	\$410
Revegetate							
Tractor w Seed Drill	hour	\$35.67	\$55.74	\$0.00	\$91.41	4.00	\$366
Seed	lb	\$0.00	\$0.00	\$11.15	\$11.15	20.00	\$223
Mulch	ton	\$0.00	\$0.00	\$89.18	\$89.18	1.00	\$200
Amendments - Fertilizer	lb	\$0.00	\$0.00	\$0.28	\$0.28	100.00	\$28
Long-term Monitoring and Maintenance	lot	\$0.00	\$0.00	\$550.00	\$550.00	1.00	\$550
Construction Areas - Subtotal							\$2,641
Wells							
Surface Facilities removal							
Tool Truck	hour	\$35.67	\$55.74	\$0.00	\$91.41	8.00	\$731
Dump Truck	hour	\$35.67	\$49.12	\$0.00	\$84.80	8.00	\$678
Materials Disposal	load				\$100.00	1.00	\$100
Plug Wells	ft	\$24.04	\$73.49	\$2.49	\$100.02	166.67	\$16,670
Recontour							
D6 Dozer	hour	\$35.67	\$72.36	\$0.00	\$108.03	8.00	\$864
12 G Motor Grader	hour	\$35.67	\$66.88	\$0.00	\$102.55	4.00	\$410
Revegetate							
Tractor w Seed Drill	hour	\$35.67	\$55.74	\$0.00	\$91.41	4.00	\$366
Seed	lb	\$0.00	\$0.00	\$11.15	\$11.15	20.00	\$223
Mulch	ton	\$0.00	\$0.00	\$89.18	\$89.18	1.00	\$200
Amendments - Fertilizer	lb	\$0.00	\$0.00	\$0.28	\$0.28	100.00	\$28
Long-term Monitoring and Maintenance	lot	\$0.00	\$0.00	\$550.00	\$550.00	1.00	\$550
Wells - Subtotal							\$20,821

Table 2.1 - Unit Costs, continued

Feature	Per Unit Costs					Productivity Unit/acre	Total Cost \$/acre
	Unit	Labor	Equipment	Materials	Total		
		\$/unit	\$/unit	\$/unit	\$/unit		
Gathering/Metering Facilities							
Surface Facilities removal							
Tool Truck	hour	\$35.67	\$55.74	\$0.00	\$91.41	8.00	\$731
Dump Truck	hour	\$35.67	\$49.12	\$0.00	\$84.80	8.00	\$678
Materials Disposal	load				\$100.00	1.00	\$100
Recontour							
D6 Dozer	hour	\$35.67	\$72.36	\$0.00	\$108.03	8.00	\$864
12 G Motor Grader	hour	\$35.67	\$66.88	\$0.00	\$102.55	4.00	\$410
Revegetate							
Tractor w Seed Drill	hour	\$35.67	\$55.74	\$0.00	\$91.41	4.00	\$366
Seed	lb	\$0.00	\$0.00	\$11.15	\$11.15	20.00	\$223
Mulch	ton	\$0.00	\$0.00	\$89.18	\$89.18	1.00	\$200
Amendments - Fertilizer	lb	\$0.00	\$0.00	\$0.28	\$0.28	100.00	\$28
Long-term Monitoring and Maintenance	lot	\$0.00	\$0.00	\$550.00	\$550.00	1.00	\$550
Gathering/Metering Facilities - Subtotal							\$4,150
Improved Roads							
Recontour							
D6 Dozer	hour	\$35.67	\$72.36	\$0.00	\$108.03	8.00	\$864
12 G Motor Grader	hour	\$35.67	\$66.88	\$0.00	\$102.55	4.00	\$410
Revegetate							
Tractor w Seed Drill	hour	\$35.67	\$55.74	\$0.00	\$91.41	4.00	\$366
Seed	lb	\$0.00	\$0.00	\$11.15	\$11.15	20.00	\$223
Mulch	ton	\$0.00	\$0.00	\$89.18	\$89.18	1.00	\$200
Amendments - Fertilizer	lb	\$0.00	\$0.00	\$0.28	\$0.28	100.00	\$28
Long-term Monitoring and Maintenance	lot	\$0.00	\$0.00	\$550.00	\$550.00	1.00	\$550
Improved Roads - Subtotal							\$2,641
2-Track Roads							
Recontour							
D6 Dozer	hour	\$35.67	\$72.36	\$0.00	\$108.03	8.00	\$864
12 G Motor Grader	hour	\$35.67	\$66.88	\$0.00	\$102.55	4.00	\$410
Revegetate							
Tractor w Seed Drill	hour	\$35.67	\$55.74	\$0.00	\$91.41	4.00	\$366
Seed	lb	\$0.00	\$0.00	\$11.15	\$11.15	20.00	\$223
Mulch	ton	\$0.00	\$0.00	\$89.18	\$89.18	1.00	\$200
Amendments - Fertilizer	lb	\$0.00	\$0.00	\$0.28	\$0.28	100.00	\$28
Long-term Monitoring and Maintenance	lot	\$0.00	\$0.00	\$550.00	\$550.00	1.00	\$550
2-Track Roads - Subtotal							\$2,641
Gas Pipeline							
Revegetate							
Tractor w Seed Drill	hour	\$35.67	\$55.74	\$0.00	\$91.41	4.00	\$366
Seed	lb	\$0.00	\$0.00	\$11.15	\$11.15	20.00	\$223
Mulch	ton	\$0.00	\$0.00	\$89.18	\$89.18	1.00	\$200
Amendments - Fertilizer	lb	\$0.00	\$0.00	\$0.28	\$0.28	100.00	\$28
Long-term Monitoring and Maintenance	lot	\$0.00	\$0.00	\$550.00	\$550.00	1.00	\$550
Gas Pipeline - Subtotal							\$1,366
Water Pipeline							
Revegetate							
Tractor w Seed Drill	hour	\$35.67	\$55.74	\$0.00	\$91.41	4.00	\$366
Seed	lb	\$0.00	\$0.00	\$11.15	\$11.15	20.00	\$223
Mulch	ton	\$0.00	\$0.00	\$89.18	\$89.18	1.00	\$200
Amendments - Fertilizer	lb	\$0.00	\$0.00	\$0.28	\$0.28	100.00	\$28
Long-term Monitoring and Maintenance	lot	\$0.00	\$0.00	\$550.00	\$550.00	1.00	\$550
Water Pipeline - Subtotal							\$1,366

Table 2.1 - Unit Costs, continued

Feature	Per Unit Costs					Productivity	Total Cost
	Unit	Labor	Equipment	Materials	Total		
		\$/unit	\$/unit	\$/unit	\$/unit	\$/unit	Unit/acre
Buried Power Cable							
Revegetate							
Tractor w Seed Drill	hour	\$35.67	\$55.74	\$0.00	\$91.41	4.00	\$366
Seed	lb	\$0.00	\$0.00	\$11.15	\$11.15	20.00	\$223
Mulch	ton	\$0.00	\$0.00	\$89.18	\$89.18	1.00	\$200
Amendments - Fertilizer	lb	\$0.00	\$0.00	\$0.28	\$0.28	100.00	\$28
Long-term Monitoring and Maintenance	lot	\$0.00	\$0.00	\$550.00	\$550.00	1.00	\$550
Buried Power Cable - Subtotal							\$1,366
Proposed Discharge Points							
Recontour							
D6 Dozer	hour	\$35.67	\$72.36	\$0.00	\$108.03	8.00	\$864
12 G Motor Grader	hour	\$35.67	\$66.88	\$0.00	\$102.55	4.00	\$410
Revegetate							
Tractor w Seed Drill	hour	\$35.67	\$55.74	\$0.00	\$91.41	4.00	\$366
Seed	lb	\$0.00	\$0.00	\$11.15	\$11.15	20.00	\$223
Mulch	ton	\$0.00	\$0.00	\$89.18	\$89.18	1.00	\$200
Amendments - Fertilizer	lb	\$0.00	\$0.00	\$0.28	\$0.28	100.00	\$28
Long-term Monitoring and Maintenance	lot	\$0.00	\$0.00	\$550.00	\$550.00	1.00	\$550
Proposed Discharge Points - Subtotal							\$2,641
Storage Impoundments							
Recontour							
D9 Dozer	hour	\$35.67	\$239.31	\$0.00	\$274.99	12.00	\$3,300
12 G Motor Grader	hour	\$35.67	\$66.88	\$0.00	\$102.55	4.00	\$410
Revegetate							
Tractor w Seed Drill	hour	\$35.67	\$55.74	\$0.00	\$91.41	4.00	\$366
Seed	lb	\$0.00	\$0.00	\$11.15	\$11.15	20.00	\$223
Mulch	ton	\$0.00	\$0.00	\$89.18	\$89.18	1.00	\$200
Amendments - Fertilizer	lb	\$0.00	\$0.00	\$0.28	\$0.28	100.00	\$28
Long-term Monitoring and Maintenance	lot	\$0.00	\$0.00	\$550.00	\$550.00	1.00	\$550
Storage Impoundments - Subtotal							\$5,076
Reserve and Production Pits							
Waste or Water Disposal							
Haul Truck	ton/mile	\$0.00	\$0.15	\$0.00	\$0.15	1000.00	\$150
Materials Disposal-Class A facility	load				\$100.00	1.00	\$100
Recontour							
D9 Dozer	hour	\$35.67	\$239.31	\$0.00	\$274.99	12.00	\$3,300
12 G Motor Grader	hour	\$35.67	\$66.88	\$0.00	\$102.55	4.00	\$410
Revegetate							
Tractor w Seed Drill	hour	\$35.67	\$55.74	\$0.00	\$91.41	4.00	\$366
Seed	lb	\$0.00	\$0.00	\$11.15	\$11.15	20.00	\$223
Mulch	ton	\$0.00	\$0.00	\$89.18	\$89.18	1.00	\$200
Amendments - Fertilizer	lb	\$0.00	\$0.00	\$0.28	\$0.28	100.00	\$28
Long-term Monitoring and Maintenance	lot	\$0.00	\$0.00	\$550.00	\$550.00	1.00	\$550
Reserve and Production Pits							\$5,326
LAD Areas							
LAD Operations - per year	section				\$55,735	0.002	\$87
Soil Amendments - Per Year							
Gypsum	tons				\$89.18	4.00	\$357
Elemental Sulfur	lbs				\$0.06	600.00	\$33
LAD Areas - Per Year - Subtotal							\$477
LAD Areas - Subtotal							\$2,386

2.2 Basis for Indirect Costs

This section details the basis for the indirect cost estimates used in the case studies. Indirect costs include contingency, engineering redesign, mobilization/demobilization, contractor overhead and profit, agency contract administration and agency indirect costs. These are costs that the responsible state and federal agency or agencies would incur in the event of forfeiture of financial assurance. The responsible agencies would then be in charge of overseeing reclamation conducted by third party contractors.

The BLM has issued guidelines for reviewing financial assurance for hardrock mines as part of the recently revised 43 CFR 3809 Regulations for hardrock mines located on agency administered federal lands. The costs are approximately equal to those which would be incurred by the agency in hiring and overseeing a third party contractor to conduct reclamation activities. The BLM guidelines do not include indirect costs that are required by the states and that could include additional costs for engineering redesign and mobilization/demobilization. For the purposes of these estimates only costs identified by BLM in their guidelines for hardrock mines have been applied to the case studies.

Contingency

Contingency covers costs that result from incomplete design, unforeseen and unpredictable conditions, or uncertainties within the defined project scope. The amount of the contingency will depend on the status of design, procurement, and construction, and the complexity and uncertainties of the component parts of the project.

The BLM guidance calculates the contingency cost as a percentage of the direct cost. The percentages are:

- 10% for project costing up to and including \$500,000;
- 8% for projects over \$500,000 and less than \$5,000,000;
- 6% for projects over \$5,000,000 and less than \$50,000,000;
- 4% for projects over \$50,000,000.

Contractor Overhead and Profit

Management costs normally incurred by the contractor include construction management and coordination, quality engineering, health and safety, and head office/administration. A construction manager is responsible for construction activities with responsibilities that include subcontracting, purchasing, scheduling, and actual construction (particularly on smaller projects). Construction coordination includes field engineering and coordination of field construction. Quality engineering is a function of the size and type of project. It can include costs for field testing and personnel (such as concrete or compaction testing).

The BLM guidance calculates contractor insurance premiums at 1.5% of the total labor costs. Contractor performance bonding is calculated at 1.5% of the total direct cost. Profit is estimated at 10%. For the purposes of this estimate these costs were combined and 1/3 of the total cost was considered to be labor cost so a percentage of 12% was used.

Agency Contract Administration

Agency contract administration includes those activities carried out by state or federal agency staff on a specific project, from the time cleanup begins through the completion of all necessary tasks, or indefinite continuation of some tasks. This includes planning, organizing, directing, controlling and reporting on the status of the project as well as technical and general project management.

The BLM guidance estimates agency contract administration as a percentage of the direct cost. The percentages are:

- 18% for project costing up to and including \$1,000,000;
- 14% for projects over \$1 million and less than \$25 million
- 10% for projects over \$25 million.

Agency Indirect Costs

In their recent guidance BLM introduced a category for Agency Indirect Costs. BLM identified their indirect costs (building rental, electricity, telephone, etc.) as agency indirect costs. The indirect cost rate of 17.8% is based on Federal Acquisition Regulations (FAR).¹The BLM applies the cost rate of 17.8% to the agency contract administration costs.

¹ FAR WO IM 2003-011, October 8, 2002.

CASE STUDY NO. 1

**Fidelity Tongue River Coal Bed Methane Projects
Tongue River Basin, MT
Reclamation Plan and Financial Assurance Estimate**

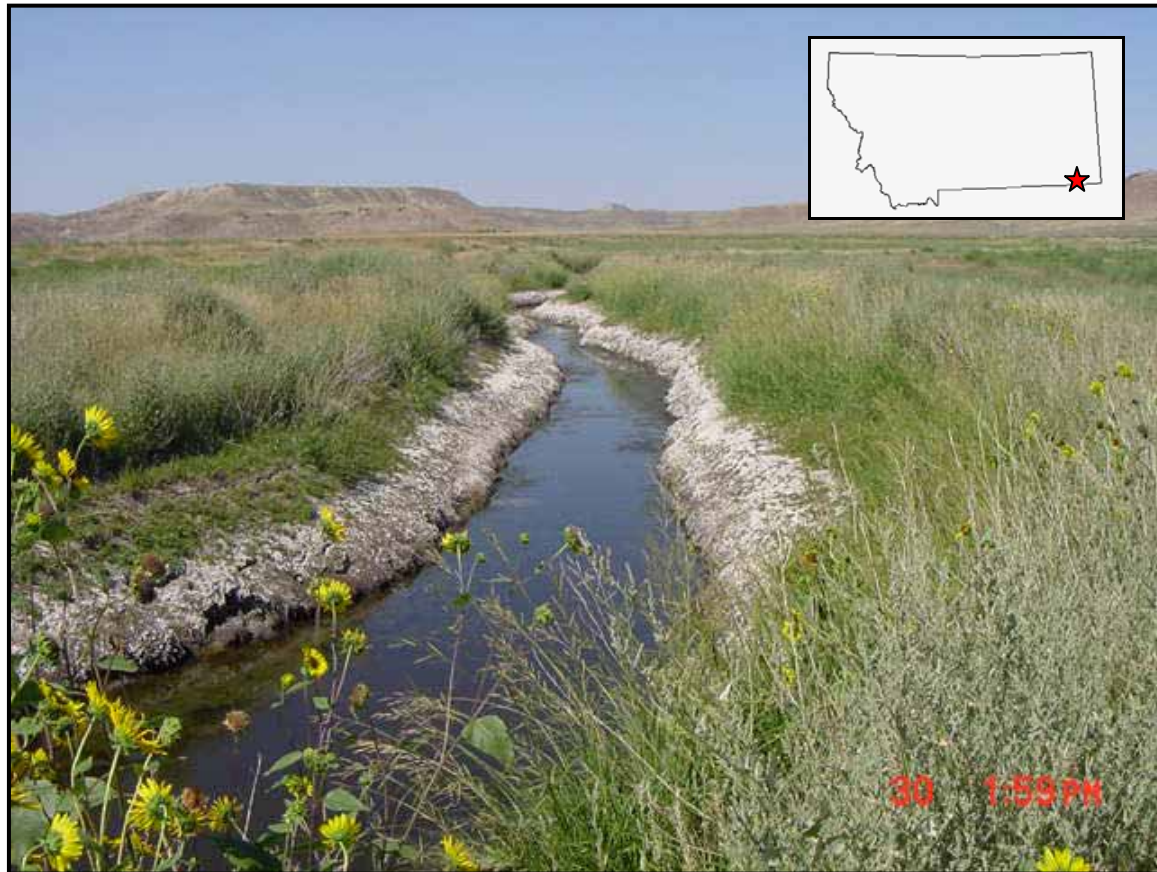


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CASE STUDY NO. 1

Fidelity Tongue River Coal Bed Methane Projects Tongue River Basin, MT Reclamation Cost and Financial Assurance Estimate

1. Project Description and Background

This case study estimates reclamation costs for the purpose of establishing adequate financial assurance for the Fidelity Tongue River CBM Projects in Montana. The Fidelity sites include four distinct drilling and exploration projects: CX, Badger Hills, Dry Creek, and Coal Creek. The Fidelity Projects are located on BLM administered public lands; mineral rights are leased to Fidelity Exploration and Production Company (Fidelity).

The following documents were reviewed for information pertaining to reclamation and financial assurance for this project:

- Plan of Development (Draft), Tongue River-Dry Creek Project, Big Horn County, Montana, November 2003
- Plan of Development (Draft), Tongue River-Dry Creek Project, Big Horn County, Montana, January 2004
- Water Management Plan for The Tongue River - Badger Hills Project (Draft), May 2003
- Wildlife Monitoring and Mitigation Plan, May 2003
- Fidelity Exploration & Production Company Montana 2002 and 2003 Drilling Area Baseline Wildlife Inventory
- BLM Miles City Field Office Environmental Assessment for Fidelity Exploration & Production Co. Tongue River Badger Hills Project Plan of Development, MT-020-2003-327
- Montana Board of Oil and Gas Conservation Environmental Assessment for Fidelity Exploration and Production Company CX Field Expansion and Tongue River Badger Hills Project, August 2003
- Project Plan of Development and Master Surface Use Plan, Coal Creek Federal CBNG Project, August 2003
- Water Management Plan for Coal Creek Federal Project POD, August 2003
- Inter-Mountain Laboratories, Inc., Case Narrative, August 2001

According to the information contained in the documents, Fidelity has proposed constructing a total of CBM 571 wells, 14 gathering and metering facilities, 65 discharge points, and 60 new and existing storage impoundment areas. Plans include building 29 miles of improved roads, 82 miles of two-track roads, and burying 206 miles of underground gas lines, water lines, and power lines. Also included is a 660 acre land application discharge area.

The total project area will disturb approximately 1776 acres.

Fidelity supplied financial assurance in the amount of a \$150,000 federal blanket bond, seven individual \$10,000 federal bonds, and a \$200,000 blanket bond to the state of Montana for the four Tongue River projects.

The cost estimates in this case study are preliminary and are based on limited information and assumptions as stated with an accuracy of +/- 35%. The estimates have been developed consistent with accepted professional engineering cost estimation principles and practices.

2. Reclamation Plan

This section describes reclamation plans submitted by the drilling and exploration company. More often than not, the projects don't have detailed reclamation plans or they address only one aspect of reclamation, such as water management and pit reclamation. If the company didn't supply a plan, this section will instead use a minimum typical reclamation plan to illustrate what should be done, drawing on details from similar sites.

Site specific reclamation plans for the Fidelity Projects were not available. Reclamation information was not included in the federal or state documents or in the permits issued by either state or federal agencies. General reclamation activities were described in the Tongue River CBM Environmental Assessment (EA). Section 2.1.1.3 in the EA, Decommissioning/Reclamation Phase, provides a limited description of the following proposed actions for each feature.

2.1. Wells

All surface facilities will be removed. Wellhead enclosures, above-grade pumping and control equipment, and connections between the well casing and downhole tubing, and flow lines and pipelines will be removed. Well pads will be recontoured, plowed, and seeded consistent with BLM approved reclamation procedures. Exploration borings, test production wells, and depleted production wells will be plugged and abandoned in accordance with state and federal rules.

2.2. Gathering/Metering Facilities

All surface facilities will be removed.

2.3. Improved and Two-Track Roads

Two track routes and access roads will be reclaimed by plowing and seeding after any necessary gravel removal, unless BLM or the surface owner wishes to retain a road and accepts responsibility through execution of a release for future road maintenance. Roads not needed for future use will be blocked, recontoured, reclaimed, and revegetated consistent with the requirements of BLM. All road disturbances will be reseeded with a weed-free seed mixture approved by BLM.

2.4. Gas and Water Pipelines

Underground pipelines will be cleaned, disconnected, and then abandoned in place to avoid additional surface disturbance.

2.5. Buried Power Cable

Underground electric lines will be disconnected and abandoned in place to avoid any additional surface disturbance.

2.6. Information Not Provided

The EA did not include information to reclaim:

- Discharge Points,
- Storage Impoundments,
- Land Application Discharge Areas, or for
- Long-Term Maintenance and Monitoring.

3. Reclamation Tasks

Reclamation can be broken down into cleanup tasks. The scope of cleanup tasks in this case study are based on those described in the Tongue River EA; where no information was provided, professional experience in the area of reclamation planning was used to fill in the gaps. Table 1 lists cleanup tasks for each feature of the Fidelity Projects.

Table 1 - Reclamation Tasks

Disturbance	Assumptions	Tasks
Well Pads	Topsoil salvaged; underlying soils not significantly impacted.	Remove all surface facilities including above-grade pumping and control equipment, piping, well casings.
		Plug all wells and borings.
		Recontour surface; replace topsoil.
		Plow and seed.
Gathering/Metering Facilities	Topsoil salvaged; underlying soils not significantly impacted.	Remove all surface facilities including buildings and above ground piping.
		Recontour surface; replace topsoil.
		Plow and seed.
Improved & 2-Track Roads	Topsoil salvaged; underlying soils not significantly impacted.	Remove all surface facilities including culverts.
		Recontour surface; replace topsoil.
		Plow and seed.
Gas & Water Pipeline Corridors	Only revegetation necessary.	Plow and seed.
Buried Power Cable	Only revegetation necessary.	Plow and seed.
Discharge Points	Discharges into ephemeral draws created eroded areas.	Recontour surface.
		Plow and seed.
Storage Impoundments	Contaminants concentrated in 2 foot layer below pond; buried on-site.	After pond drains/evaporates excavate top 2 feet of sediment including sides. Consolidate in bottom of pond.
		Cover with clean material.
		Recontour surface.
		Plow and seed.
Land Application Discharge Area	Supplemental water assumed to be available at no additional cost	Apply gypsum annually.
		Apply elemental sulfur annually.

4. Reclamation Quantities

Reclamation earthwork quantities for storage impoundments, pipelines, underground power, roads, and other features were derived from the Plans of Development, Surface Use Plans, Water Management Plans, and the EA for the various Fidelity projects. Where data was not available, projects of similar scope were used to estimate quantities.

4.1. Construction and Operations Disturbed Areas

Table 2a lists construction and operations disturbed areas.

Table 2a - Disturbed Areas

Feature	Construction	Operations
Wells	120 ft by 120 ft	50 ft by 50 ft
Gathering/Metering Facilities	200 ft by 200 ft	175 ft by 175 ft
Improved Roads	2.01 acres/mile	2.01 acres/mile
2-Track Roads	1.21 acres/mile	1.21 acres/mile
Gas Pipeline outside Corridor *	1.93 acres/mile	1.93 acres/mile
Water Pipeline outside Corridor	1.82 acres/mile	1.82 acres/mile
Buried Power Cable outside Corridor	1.82 acres/mile	1.82 acres/mile
Proposed Discharge Points	20 ft by 20 ft	10 ft by 10 ft
Storage Impoundments **	5 acres/unit	4 acres/unit

* High pressure gas pipeline disturbed area based on a 25 foot width; low pressure gas pipeline based on a 15 foot width. The areas were combined into a weighted average unit area.

** The 265 total acres of storage impoundments at the CX Field were divided by the number of storage impoundments to arrive at a unit area.

4.2. Estimates for Other Project Areas

The CX Field per unit areas were used as the basis for estimating the disturbed areas at the other projects except as noted in the following sections.

4.2.1. Badger Hills Project – Storage Impoundments

The Badger Hills Project Water Management Plan describes disturbed areas for the new impoundments and expansion of an existing impoundment as reservoir surface areas. New impoundments average 14.54 acres. Expansion of an existing impoundment will cover 0.77 acres. A total of 72.71 acres will be affected.

4.2.2. Badger Hills Project – Land Application Discharge Area

The Water Management Plan describes the disturbed area for the LAD. Total disturbed area is 660 acres.

4.2.3. Dry Creek Project – Storage Impoundments

The Water Management Plan describes disturbed area for the expansion of an existing storage impoundment. Total disturbed area is 29.5 acres.

4.2.4. Total Disturbed Areas

Table 2b shows surface features and the number of units (number of wells, for example) or length in miles (of roads, for example.) The EA for the CX Field Project contained the most detailed data including surface areas for various types of disturbances and was used to calculate the per unit surface areas where it was not provided for other Fidelity projects.

Table 2b - Disturbed Area Totals

Feature	No.	Units	Construction		Operations		Construction Only
			Disturbed Area		Disturbed Area		Area
			per unit, acres	total, acres	per unit, acres	total, acres	total, acres
CX Fields Project							
Well Pads	144	units	0.33	47.60	0.06	8.26	39.34
Gathering/Metering Facilities	6	units	0.92	5.51	0.70	4.22	1.29
Improved Roads	19.1	miles	2.01	38.48	2.01	38.48	0.00
2-Track Roads	37.8	miles	1.21	45.82	1.21	45.82	0.00
Gas Pipeline outside Corridor	128.6	miles	1.92	247.39	1.92	247.39	0.00
Water Pipeline outside Corridor	30.2	miles	1.82	54.91	1.82	54.91	0.00
Buried Power Cable outside Corridor	23.8	miles	1.82	43.27	1.82	43.27	0.00
Proposed Discharge Points	53	units	0.01	0.49	0.002	0.12	0.37
Storage Impoundments	53	units	5.00	265.00	4.00	212.00	53.00
Subtotal				748		654	94
Badger Hills Project							
Well Pads	174	units	0.33	57.52	0.06	9.99	47.53
Gathering/Metering Facilities	5	units	0.92	4.59	0.70	3.52	1.08
Improved Roads	4.4	miles	2.01	8.87	2.01	8.87	0.00
2-Track Roads	10	miles	1.21	12.12	1.21	12.12	0.00
Water Pipeline outside Corridor	3.5	miles	1.82	6.36	1.82	6.36	0.00
Buried Power Cable outside Corridor	13.5	miles	1.82	24.55	1.82	24.55	0.00
Proposed Discharge Points	7	units	0.01	0.06	0.00	0.02	0.05
Storage Impoundments (new)	5	units	14.54	72.71	14.54	72.71	0.00
Storage Impoundments (existing expansion)	1	units	0.77	0.77	0.77	0.77	0.00
Land Application Discharge Area	1	unit	660.00	660.00	660.00	660.00	0.00
Subtotal				848		799	49
Dry Creek Project							
Well Pads	36	units	0.33	11.90	0.06	2.07	9.83
2-Track Roads	1.86	miles	1.21	2.25	1.21	2.25	0.00
Buried Power Cable outside Corridor	1.78	miles	1.82	3.24	1.82	3.24	0.00
Proposed Discharge Points	3	units	0.01	0.03	0.00	0.01	0.02
Storage Impoundments (existing expansion)	1	units	29.50	29.50	29.50	29.50	0.00
Subtotal				47		37	10
Coal Creek Project							
Well Pads	217	units	0.33	71.74	0.06	12.45	59.28
Gathering/Metering Facilities	3	units	0.92	2.75	0.70	2.11	0.65
Improved Roads	5.3	miles	2.01	10.68	2.01	10.68	0.00
2-Track Roads	32.65	miles	1.21	39.58	1.21	39.58	0.00
Buried Power Cable outside Corridor	4.34	miles	1.82	7.89	1.82	7.89	0.00
Proposed Discharge Points	2	units	0.01	0.02	0.00	0.00	0.01
Subtotal				133		73	60
Total all Projects		acres		1,776		1,563	212

5. Direct, Indirect and Total Costs

Estimated unit costs for reclamation financial assurance at the Fidelity Projects based on the tasks identified in Section 3 range from \$1,366 per acre to \$20,821 per acre. Table 3 shows a summary of costs per acre for each feature.

Table 3 - Summary of Unit Costs

Type of Disturbance	\$/acre
Construction Areas	\$2,641
Well Pads	\$20,821
Gathering/Metering Facilities	\$4,150
Improved Roads	\$2,641
2-Track Roads	\$2,641
Gas Pipeline	\$1,366
Water Pipeline	\$1,366
Buried Power Cable	\$1,366
Proposed Discharge Points	\$2,641
Storage Impoundments	\$5,076
LAD Areas	\$2,386

Table 4 shows the direct cost estimate for reclamation at the Fidelity Projects based on the unit costs listed above and the disturbed area acreages identified in Table 2b. The total direct costs for each project ranges from \$229,000 to \$2,400,000 and the combined total **direct cost estimate** is **\$5,400,000**.

Table 4 - Direct Cost Estimates

Feature	Construct Only	Operations	Per Unit Costs		Total Costs		
	Disturbed Area	Disturbed Area	Construct	Operations	Construction	Operations	Total
	total acres	total acres	\$/acre	\$/acre	\$	\$	\$
CX Field Project							
Well Pads	39.34	8.26	\$2,641	\$20,821	\$103,888	\$172,073	\$275,960
Gathering/Metering Facilities	1.29	4.22	\$2,641	\$4,150	\$3,410	\$17,508	\$20,918
Improved Roads	0.00	38.48		\$2,641	\$0	\$101,632	\$101,632
2-Track Roads	0.00	45.82		\$2,641	\$0	\$120,999	\$120,999
Gas Pipeline outside Corridor	0.00	247.39		\$1,366	\$0	\$338,046	\$338,046
Water Pipeline outside Corridor	0.00	54.91		\$1,366	\$0	\$75,029	\$75,029
Buried Power Cable outside Corridor	0.00	43.27		\$1,366	\$0	\$59,129	\$59,129
Proposed Discharge Points	0.37	0.12	\$2,641	\$2,641	\$964	\$321	\$1,285
Storage Impoundments	53.00	212.00	\$2,641	\$5,076	\$139,965	\$1,076,210	\$1,216,175
Subtotal	94	654			\$248,227	\$1,960,948	\$2,209,174

Table 4 - Direct Cost Estimates, continued

Feature	Construct Only	Operations	Per Unit Costs		Total Costs		
	Disturbed Area	Disturbed Area	Construct	Operations	Construction	Operations	Total
	total acres	total acres	\$/acre	\$/acre	\$	\$	\$
Badger Hills Project							
Well Pads	47.53	9.99	\$2,641	\$20,821	\$125,531	\$207,921	\$333,452
Gathering/Metering Facilities	1.08	3.52	\$2,641	\$4,150	\$2,842	\$14,590	\$17,432
Improved Roads	0.00	8.87		\$2,641	\$0	\$23,413	\$23,413
2-Track Roads	0.00	12.12		\$2,641	\$0	\$32,010	\$32,010
Water Pipeline outside Corridor	0.00	6.36		\$1,366	\$0	\$8,695	\$8,695
Buried Power Cable outside Corridor	0.00	24.55		\$1,366	\$0	\$33,540	\$33,540
Proposed Discharge Points	0.05	0.02	\$2,641	\$2,641	\$127	\$42	\$170
Storage Impoundments (new)	0.00	72.71		\$5,076	\$0	\$369,110	\$369,110
Storage Impoundments (existing expansion)	0.00	0.77		\$5,076	\$0	\$3,909	\$3,909
Land Application Discharge Area	0.00	660.00		\$2,386	\$0	\$1,574,862	\$1,574,862
Subtotal	49	799			\$128,500	\$2,268,092	\$2,396,592
Dry Creek Project							
Well Pads	9.83	2.07	\$2,641	\$20,821	\$25,972	\$43,018	\$68,990
2-Track Roads	0.00	2.25		\$2,641	\$0	\$5,954	\$5,954
Buried Power Cable outside Corridor	0.00	3.24		\$1,366	\$0	\$4,422	\$4,422
Proposed Discharge Points	0.02	0.01	\$2,641	\$2,641	\$55	\$18	\$73
Storage Impoundments (existing expansion)	0.00	29.50		\$5,076	\$0	\$149,756	\$149,756
Subtotal	10	37			\$26,026	\$203,168	\$229,195
Coal Creek Project							
Well Pads	59.28	12.45	\$2,641	\$20,821	\$156,553	\$259,304	\$415,857
Gathering/Metering Facilities	0.65	2.11		\$4,150	\$0	\$8,754	\$8,754
Improved Roads	0.00	10.68		\$2,641	\$0	\$28,202	\$28,202
2-Track Roads	0.00	39.58		\$2,641	\$0	\$104,513	\$104,513
Buried Power Cable outside Corridor	0.00	7.89		\$1,366	\$0	\$10,782	\$10,782
Proposed Discharge Points	0.01	0.00	\$2,641	\$2,641	\$36	\$12	\$49
Subtotal	60	73			\$156,589	\$411,567	\$568,157
Total all Projects	213	1564			\$559,343	\$4,843,775	\$5,403,118

Table 5 shows the total cost estimate, including indirect costs. The basis for the indirect cost percentages is described in section 2.2 of Case Studies Approach and Methodology. The total **indirect cost estimate** is **\$1,860,000**. Based on the direct and indirect costs the **total reclamation financial assurance amount** is estimated at **\$7,270,000**.

Table 5 - Total Cost Estimate for Reclamation

Direct Reclamation Costs		Total Cost
CX Field Project		\$2,209,174
Badger Hills Project		\$2,396,592
Dry Creek Project		\$229,195
Coal Creek Project		\$568,157
Direct Reclamation Costs - Subtotal		\$5,403,118
Indirect Costs		
Contingency	6.0% of direct costs	\$324,187
Contractor Overhead and Profit	12.0% of direct costs	\$648,374
Agency Contract Administration	14.0% of direct costs	\$756,437
Agency Indirect Costs	17.8% of administration costs	\$134,646
Indirect Costs - Subtotal		\$1,863,643
Total Direct + Indirect Costs		\$7,266,761

6. Potential Liability

Fidelity supplied financial assurance in the amount of a \$150,000 federal blanket bond, seven individual \$10,000 federal bonds, and a \$200,000 blanket bond to the state of Montana for the four Tongue River projects. Based on an estimated reclamation financial assurance amount of \$7,266,761 the potential liability represented by the financial assurance shortfall is approximately \$6.85 million for these projects.

CASE STUDY NO. 2

**Yates TD Southwest Coal Bed Methane Project
Powder River Basin, WY
Reclamation Plan and Financial Assurance Estimate**



Photo by Don Spellman

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CASE STUDY NO. 2

TD Southwest Coal Bed Methane Project Powder River Basin, WY Reclamation Plan and Financial Assurance Estimate

1. Project Description and Background

This case study estimates reclamation costs for the purpose of establishing adequate financial assurance for the Yates TD Southwest CBM Project in Wyoming. The TD Southwest project is located on a section of state land in Wyoming. An adjacent ranch leases the surface rights and Yates Petroleum Corporation (Yates) has leased the mineral rights.

The following documents were reviewed for information pertaining to reclamation and financial assurance for this project:

- Coal Bed Methane Water Management Plan, prepared for Office of State Lands and Investments, 5/14/04;
- Notice of Intent – Coal Bed Methane Produced Water Discharges to Containment Units, 5/5/04;
- NPDES application, 5/5/04; and
- Off-Channel Reservoir Reclamation Cost Estimates, 1/19/04 and 5/11/04.

According to the information contained in the documents, Yates has proposed constructing a total of 17 CBM wells, a compressor site, two discharge points under Option 1 and three discharge points under Option 2. They propose constructing or enlarging two off-channel pits under Option 1 and three on-channel reservoirs under Option 2. Plans include building two miles of improved two-track road and burying eight miles of underground gas lines, water lines, and power lines. The total project area will cover approximately one section (about 640 acres) and the total estimated disturbance area will cover 31 acres, including some areas not on the state section.

The proposed compressor site and a section of the road and utilities are just west and north of the state land on privately owned surface land; the mineral rights leaseholder is unknown but may be Yates. These features are included in the reclamation totals since presumably they'll have to be reclaimed at some future date.

The water management plan and NPDES application submitted by Yates describe two options for discharging and storing produced water. The map shows a pit not described in the plan and does not show a reservoir that is described in the plan. The intent is not completely clear so the cost estimate in this case study is based on five storage impoundments.

Yates supplied the state of Wyoming reclamation bonds totaling \$52,802 for the two off-channel storage impoundments.

The cost estimates in this case study preliminary and are based on limited information and assumptions as stated with an accuracy of +/- 35%. The estimates have been developed consistent with accepted professional engineering cost estimation principles and practices.

2. Reclamation Plan

This section describes any reclamation plans submitted by the drilling and exploration company. More often than not, the projects don't have a detailed reclamation plan or the plan addresses only one aspect of reclamation, such as water management and pit reclamation. If the company didn't supply a plan, this section will instead use a minimum typical reclamation plan to illustrate what should be done, drawing on details from similar sites.

Reclamation plans were not available for the TD Southwest site. Aside from cost estimates on reclaiming the two off-channel pits, reclamation information was not included in the Water Management Plan or in the NPDES permit. The following typical reclamation plan is based on information from the Tongue River Projects documents and other projects of similar scope.

2.1. Wells

All surface facilities will be removed. Wellhead enclosures, above-grade pumping and control equipment, and connections between the well casing and downhole tubing, and flow lines and pipelines will be removed. Well pads will be recontoured, plowed, and seeded consistent with state-approved reclamation procedures. Exploration borings, test production wells, and depleted production wells will be plugged and abandoned in accordance with state rules.

2.2. Compressor Site

All surface facilities will be removed.

2.3. Improved Two-Track Roads

Two track roads will be reclaimed by plowing and seeding after any necessary gravel removal, unless the state or the surface owner wishes to retain a road and accepts responsibility through execution of a release for future road maintenance. Roads not needed for future use will be blocked, recontoured, reclaimed, and revegetated consistent with the requirements of the state. All road disturbances will be reseeded with a weed-free seed mixture approved by the state.

2.4. Gas and Water Pipelines

Underground pipelines will be cleaned, disconnected, and then abandoned in place to avoid additional surface disturbance.

2.5. Buried Power Cable

Underground electric lines will be disconnected and abandoned in place .

2.6. Discharge Points

Discharge points will be recontoured, plowed, and seeded.

2.7. Storage Impoundments

Contaminated sediment in the storage impoundments will be consolidated in the bottom of the pit and covered with clean material. The area will be recontoured, plowed, and seeded.

2.8. Long-Term Maintenance and Monitoring

Reclaimed areas will be monitored periodically for effectiveness of revegetation. Areas where vegetation has not become established will be reseeded.

3. Reclamation Tasks

Reclamation can be broken down into cleanup tasks. The scope of cleanup tasks in this case study are based on the Tongue River Projects documents and professional experience in the area of reclamation planning.

Table 1 lists cleanup tasks for each feature at the TD Southwest site.

Table 1 - Reclamation Tasks

Disturbance	Assumptions	Tasks
Wells	Topsoil salvaged; underlying soils not significantly impacted.	Remove all surface facilities including above-grade pumping and control equipment, piping, well casings.
		Plug all wells and borings.
		Recontour surface; replace topsoil.
		Plow and seed.
Compressor Site	Topsoil salvaged; underlying soils not significantly impacted.	Remove all surface facilities including buildings and above ground piping.
		Recontour surface; replace topsoil.
		Plow and seed.
Improved 2-Track Roads	Topsoil salvaged; underlying soils not significantly impacted.	Remove all surface facilities including culverts.
		Recontour surface; replace topsoil.
		Plow and seed.
Gas & Water Pipeline Corridors	Only revegetation necessary.	Plow and seed.
Buried Power Cable	Only revegetation necessary.	Plow and seed.
Discharge Points	Discharges into ephemeral draws created eroded areas.	Recontour surface.
		Plow and seed.
Storage Impoundments	Contaminants concentrated in 2 foot layer below pond; buried on-site.	After pond drains/evaporates excavate top 2 feet of sediment including sides. Consolidate in bottom of pond.
		Cover with clean material.
		Recontour surface.
		Plow and seed.

4. Reclamation Quantities

Reclamation earthwork quantities for storage impoundments, pipelines, underground power, roads, and other features were derived from maps and statements of work in the Water Management Plan. Where data was not available, the Tongue River Projects and other projects of similar scope were used to estimate quantities.

4.1. Construction and Operations Disturbed Areas

Table 2a lists construction and operations disturbed areas.

Table 2a - Disturbed Areas

Feature	Construction	Operations
Wells	120 ft by 120 ft	50 ft by 50 ft
Compressor Site	200 ft by 200 ft	175 ft by 175 ft
2-Track Roads	1.21 acres/mile	1.21 acres/mile
Gas Pipeline outside Corridor *	1.82 acres/mile	1.93 acres/mile
Water Pipeline outside Corridor*	1.82 acres/mile	1.82 acres/mile
Buried Power Cable outside Corridor *	1.82 acres/mile	1.82 acres/mile
Proposed Discharge Points	20 ft by 20 ft	10 ft by 10 ft
Storage Impoundments-new, off channel **	3.95 acres/unit	2.95 acres/unit
Storage Impoundments-existing, on-channel **	2.93 acres/unit	1.93 acres/unit

* Gas lines are assumed to be low pressure. Most of the gas pipeline, water pipeline, and power cable are buried in a single trench.

** The unit area of storage impoundments is equal to the estimated total acreage of storage impoundments divided by the number of impoundments.

Table 2b shows surface use broken down by feature and the number of units (number of wells, for example) or length in miles (of roads, for example.) Where information wasn't provided, surface area estimates for the various types of disturbances were derived from the Tongue River Projects and other projects similar in scope to the TD Southwest site. No areas were given for the existing storage impoundments in the TD Southwest documents; they were estimated from maps and NPDES permit application.

Table 2b - Disturbed Area Totals

Feature	No.	Units	Construction		Operations		Construction Only
			Disturbed Area		Disturbed Area		Area
			per unit, acres	total, acres	per unit, acres	total, acres	
Wells	17	units	0.33	5.62	0.06	0.98	4.64
Compressor Site	1	units	0.92	0.92	0.70	0.70	0.22
Improved 2-track Roads	2.0	miles	1.21	2.44	1.21	2.44	0.00
Gas & Water Pipelines Combined	1.0	miles	1.82	1.76	1.82	1.76	0.00
Gas, Water, & Power Combined	1.5	miles	1.82	2.64	1.82	2.64	0.00
Water Pipeline	0.2	miles	1.82	0.38	1.82	0.38	0.00
Proposed Discharge Points	5	units	0.01	0.05	0.002	0.01	0.03
Storage Impoundments-new, off channel	2	units	3.95	7.90	2.950	5.90	2.00
Storage Impoundments-existing, on-channel	3	units	2.93	8.80	1.93	5.80	3.00
Total				30.5		20.6	9.9

5. Direct, Indirect and Total Costs

Estimated unit costs for reclamation at the TD Southwest site based on the tasks identified in Section 3 range from \$1,366 per acre to \$20,821 per acre. Table 3 shows a summary of costs per acre for each feature.

Table 3 - Summary of Unit Costs

Type of Disturbance	\$/acre
Construction Areas	\$2,641
Wells	\$20,821
Compressor Site	\$4,150
Improved 2-Track Roads	\$2,641
Gas & Water Pipelines	\$1,366
Gas, Water, & Power	\$1,366
Water Pipeline	\$1,366
Proposed Discharge Points	\$2,641
Storage Impoundments - new and existing	\$5,076

Table 4 shows the direct cost estimate for reclamation at the TD Southwest site based on the unit costs in Table 3 above and the disturbed area acreages identified in Table 2b. The total **direct cost estimate** is **\$121,750**.

Table 4 - Direct Cost Estimates

Feature	Construct Only	Operations	Per Unit Costs		Total Costs		
	Disturbed Area	Disturbed Area	Construct	Operations	Construct	Operations	Total
	total acres	total acres	\$/acre	\$/acre	\$	\$	\$
Wells	4.64	0.98	\$2,641	\$20,821	\$12,265	\$20,314	\$32,579
Compressor Site	0.22	0.70	\$2,641	\$4,150	\$568	\$2,918	\$3,486
Improved 2-Track Roads	0.00	2.44		\$2,641	\$0	\$6,434	\$6,434
Gas & Water Pipelines Combined	0.00	1.76		\$1,366	\$0	\$2,410	\$2,410
Gas, Water, & Power Combined	0.00	2.64		\$1,366	\$0	\$3,602	\$3,602
Water Pipeline	0.00	0.38		\$1,366	\$0	\$522	\$522
Proposed Discharge Points	0.03	0.01	\$2,641	\$2,641	\$91	\$30	\$121
Storage Impoundments-new, off channel	2.00	5.90	\$2,641	\$5,076	\$5,282	\$29,951	\$35,233
Storage Impoundments-existing, on-channel	3.00	5.80	\$2,641	\$5,076	\$7,923	\$29,443	\$37,366
Total	7	15			\$26,128	\$95,625	\$121,753

Table 5 shows the total cost estimate, including indirect costs. The basis for the indirect cost percentages is described in section 2.2 of Case Studies Approach and Methodology. The total **indirect cost estimate** is **\$52,600**. Based on the direct and indirect costs the **total cost of reclamation** is estimated at **\$174,400**.

Table 5 - Total Cost Estimate for Reclamation

Cost Area	Total Cost
Direct Reclamation Costs - Total	\$121,753
Indirect Costs	
Contingency 10.0% of direct costs	\$12,175
Contractor Overhead and Profit 12.0% of direct costs	\$14,610
Agency Contract Administration 18.0% of direct costs	\$21,916
Agency Indirect Costs 17.8% of administration costs	\$3,901
Indirect Costs - Subtotal	\$52,602
Total Direct + Indirect Costs	\$174,355

6. Potential Liability

Yates supplied the state of Wyoming reclamation bonds totaling \$52,802 for the two off-channel storage impoundments only. This is slightly more than the line item reclamation cost estimate of \$50,500 for these two impoundments arrived at by the unit cost method used in this case study.

Based on an estimated reclamation financial assurance amount of \$174,400 the potential liability represented by the financial assurance shortfall is approximately \$121,550 for these projects.

In April, 2005, the state of Wyoming issued guidance for reclamation and bonding of on-channel reservoirs. All on-channel reservoirs constructed after April, 2005 must be bonded. The amount of bonding will depend on the volume of earthwork estimated to be moved during construction and reclamation.

CASE STUDY NO. 3

**Yates Plateau CS Coal Bed Methane Project
Powder River Basin, WY
Reclamation Plan and Financial Assurance Estimate**



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CASE STUDY NO. 3

Yates Plateau CS Coal Bed Methane Project Powder River Basin, WY Reclamation Cost and Financial Assurance Estimate

1. Project Description and Background

This case study estimates reclamation costs for the purpose of establishing adequate financial assurance for the Plateau CS federal Plan of Development (POD) CBM Project in Wyoming. Yates Petroleum Corporation (Yates) has leased the federal mineral rights under both privately owned surface lands and federal lands at this site in Wyoming.

The following documents were reviewed for information pertaining to reclamation and financial assurance for this project:

- Water Management Plan for Plan of Development Plateau CS Federal CBM Project (this document included Engineer's Estimate of Reclamation Costs for Containment Structures and State of Wyoming Applications for Permit to Appropriate Surface Water for the all of the proposed storage impoundments; and
- Surface and Damage Agreement between Yates and William and Marjorie West;

As of late May the POD had not been submitted to the BLM. A NPDES had been submitted to Wyoming DEQ; a copy was unavailable.

According to the information contained in these documents, Yates has proposed constructing a total of 23 CBM wells, 18 discharge points, and numerous rubber tire stock tank sites. They propose constructing 17 off-channel pits and one on-channel reservoir. The extent of metering/gathering facilities, roads, and underground gas line, water line, or power line construction is not known. The total project area will cover portions of seven sections (approximately 640 acres per section.) The total disturbance area is estimated to cover 64 acres, including both private and federal surface lands. The landowners, a ranching family, have expressed deep concerns over the number, size, and placement of the storage impoundments; the fact that Yates does not plan to line the impoundments, which will likely result in damage to the land from the produced water; and that re-injection of produced water is not being considered, using an existing re-injection well on their property.

Yates supplied financial assurance in the amount of a \$150,000 federal blanket bond for the Plateau CS project. They have not yet supplied financial assurance to the state of Wyoming for this particular project. The engineer's analysis in the Water Management Plan estimates that a total of \$248,000 would be needed to reclaim the 18 storage impoundments. No other cost estimates for reclamation were provided.

The cost estimates in this case study are preliminary and are based on limited information and assumptions as stated with an accuracy of +/- 35%. The estimates have been developed consistent with accepted professional engineering cost estimation principles and practices.

2. Reclamation Plan

This section describes reclamation plans submitted by the drilling and exploration company. More often than not, the projects don't have detailed reclamation plans or they address only one aspect of reclamation, such as water management and pit reclamation. If the company didn't supply a plan, this section will instead use a typical minimum reclamation plan to illustrate what should be done, drawing on details from similar sites.

Reclamation procedures for only the storage impoundments were described in the Water Management Plan. Additional limited information was taken from the Surface and Damage Agreement Yates entered into with the surface landowners. The following typical reclamation plan is based on these documents, the Tongue River Projects documents, and other projects of similar scope.

2.1. Wells

All surface facilities will be removed. Wellhead enclosures, above-grade pumping and control equipment, and connections between the well casing and downhole tubing, and flow lines and pipelines will be removed. Well pads will be recontoured, plowed, and seeded consistent with state-approved reclamation procedures. Exploration borings, test production wells, and depleted production wells will be plugged and abandoned in accordance with state rules.

2.2. Compressor Site

All surface facilities will be removed.

2.3. Two-Track Roads

Two track roads will be reclaimed by plowing and seeding after any necessary gravel removal, unless the state or the surface owner wishes to retain a road and accepts responsibility through execution of a release for future road maintenance. Roads not needed for future use will be blocked, recontoured, reclaimed, and revegetated consistent with the requirements of the state. All road disturbances will be reseeded with a weed-free seed mixture approved by the state.

2.4. Gas and Water Pipelines

Underground pipelines will be cleaned, disconnected, and then abandoned in place to avoid additional surface disturbance.

2.5. Buried Power Cable

Underground electric lines will be disconnected and abandoned in place to avoid any additional surface disturbance.

2.6. Discharge Points

Discharge points will be recontoured, plowed, and seeded.

2.7. Storage Impoundments

Outlet structures will be removed, if necessary, and embankment fill excavated. Fill dirt will be placed and compacted in the reservoir and covered with reserved topsoil. The area will be seeded.

2.8 Long-Term Maintenance and Monitoring

Reclaimed areas will be monitored periodically for effectiveness of revegetation. Areas where vegetation has not become established will be reseeded.

3. Reclamation Tasks

Reclamation can be broken down into cleanup tasks. The scope of cleanup tasks in this case study are based on the Water Management Plan, Tongue River Projects documents, and professional experience in the area of reclamation planning.

Table 1 lists cleanup tasks for each feature at the Plateau CS site.

Table 1 - Reclamation Tasks

Disturbance	Assumptions	Tasks
Wells	Topsoil salvaged; underlying soils not significantly impacted.	Remove all surface facilities including above-grade pumping and control equipment, piping, well casings.
		Plug all wells and borings.
		Recontour surface; replace topsoil.
		Plow and seed.
Compressor Site	Topsoil salvaged; underlying soils not significantly impacted.	Remove all surface facilities including buildings and above ground piping.
		Recontour surface; replace topsoil.
		Plow and seed.
2-Track Roads	Topsoil salvaged; underlying soils not significantly impacted.	Remove all surface facilities including culverts.
		Recontour surface; replace topsoil.
		Plow and seed.
Gas & Water Pipeline Corridors	Topsoil salvaged, if applicable.	Repack and recontour surface.
		Replace topsoil, if applicable.
		Plow and seed.
Buried Power Cable	Only revegetation necessary.	Plow and seed.
Discharge Points	Discharges into ephemeral draws created eroded areas.	Recontour surface.
		Plow and seed.
Storage Impoundments	Topsoil salvaged.	After pond drains/evaporates excavate top 2 feet of sediment including sides. Consolidate in bottom of pond. Excavate embankment fill.
		Place and compact fill.
		Recontour surface; replace topsoil.
		Plow and seed.

4. Reclamation Quantities

Reclamation earthwork quantities for storage impoundments were derived from the Water Management Plan. Where data was not available, the TD Southwest project, similar in scope and located in the same area, was used to estimate quantities.

4.1. Construction and Operations Disturbed Areas

Table 2a lists construction and operations disturbed areas.

Table 2a - Disturbed Areas

Feature	Construction	Operations
Wells	1 acre	0.5 acre
Compressor Site	200 ft by 200 ft	175 ft by 175 ft
2-Track Roads*	1.21 acres/mile	1.21 acres/mile
Gas Pipeline outside Corridor *	2.42 acres/mile	2.42 acres/mile
Water Pipeline outside Corridor *	2.42 acres/mile	2.42 acres/mile
Buried Power Cable outside Corridor *	2.42 acres/mile	2.42 acres/mile
Proposed Discharge Points	20 ft by 20 ft	10 ft by 10 ft
Storage Impoundments-off channel	1.54 acres/unit	1.4 acres/unit
Storage Impoundments-on channel	.57 acres/unit	.52 acres/unit

* Area based on maximum 20 foot right of way for pipelines; 15 feet for roads; 20 feet for cuts and fills.

Table 2b shows surface use broken down by feature and number of units (number of wells, for example) or length in miles (of roads, for example.) Where information wasn't provided, surface area estimates for various types of disturbances were derived from the TD Southwest project and other projects similar in scope to the Plateau CS site.

Table 2b - Disturbed Area Totals

Feature	No.	Units	Construction		Operations		Construction Only
			Disturbed Area		Disturbed Area		Area
			per unit, acres	total, acres	per unit, acres	total, acres	total, acres
Wells	23	units	1.00	23.00	0.50	11.50	11.50
Compressor Site	1	units	0.92	0.92	0.70	0.70	0.22
2-track Roads	2.7	miles	1.82	4.94	1.82	4.94	0.00
Gas & Water Pipelines Combined	1.3	miles	2.42	3.18	2.42	3.18	0.00
Gas, Water, & Power Combined	2.0	miles	2.42	4.76	2.42	4.76	0.00
Water Pipeline	0.3	miles	2.42	0.69	2.42	0.69	0.00
Proposed Discharge Points	18	units	0.01	0.17	0.002	0.04	0.12
Storage Impoundments-off channel	17	units	1.54	26.12	1.40	23.75	2.37
Storage Impoundments-on channel	1	units	0.57	0.57	0.52	0.52	0.05
Total				64		50	14

5. Direct, Indirect and Total Costs

Estimated unit costs for reclamation at the Yates Plateau CS site based on the tasks identified in Section 3 range from \$1,366 per acre to \$20,821 per acre. Table 3 shows a summary of costs per acre for each feature.

Table 3 - Summary of Unit Costs

Type of Disturbance	\$/acre
Construction Areas	\$2,641
Wells	\$20,821
Compressor Site	\$4,150
2-track Roads	\$2,641
Gas & Water Pipelines	\$1,366
Gas, Water, & Power	\$1,366
Water Pipeline	\$1,366
Proposed Discharge Points	\$2,641
Storage Impoundments - on and off channel	\$5,076

Table 4 shows the direct cost estimate for reclamation at the Yates Plateau CS site based on the unit costs in Table 3 above and the disturbed area acreages identified in Table 2b. The total **direct cost estimate** is **\$428,000**.

Table 4 - Direct Cost Estimates

Feature	Construct Only	Operations	Per Unit Costs		Total Costs		
	Disturbed Area	Disturbed Area	Construct	Operations	Construction	Operations	Total
	total acres	total acres	\$/acre	\$/acre	\$	\$	\$
Wells	11.50	11.50	\$2,641	\$20,821	\$30,370	\$239,439	\$269,809
Compressor Site	0.22	0.70	\$2,641	\$4,150	\$568	\$2,918	\$3,486
2-Track Roads	0.00	4.94		\$2,641	\$0	\$13,057	\$13,057
Gas & Water Pipelines Combined	0.00	3.18		\$1,366	\$0	\$4,347	\$4,347
Gas, Water, & Power Combined	0.00	4.76		\$1,366	\$0	\$6,498	\$6,498
Water Pipeline	0.00	0.69		\$1,366	\$0	\$941	\$941
Proposed Discharge Points	0.12	0.04	\$2,641	\$2,641	\$327	\$109	\$437
Storage Impoundments-off channel	2.37	23.75	\$2,641	\$5,076	\$6,272	\$120,559	\$126,831
Storage Impoundments-on channel	0.05	0.52	\$2,641	\$5,076	\$136	\$2,618	\$2,754
Total	14	50			\$37,673	\$390,487	\$428,161

Table 5 shows the total cost estimate, including indirect costs. The basis for the indirect cost percentages is described in section 2.2 of Case Studies Approach and Methodology. The total **indirect cost estimate** is **\$185,000**. Based on the direct and indirect costs the **total cost of reclamation** is estimated at **\$613,000**.

Table 5 - Total Cost Estimate for Reclamation

Cost Area	Total Cost
Direct Reclamation Costs - Total	\$428,161
Indirect Costs	
Contingency 10.0% of direct costs	\$42,816
Contractor Overhead and Profit 12.0% of direct costs	\$51,379
Agency Contract Administration 18.0% of direct costs	\$77,069
Agency Indirect Costs 17.8% of administration costs	\$13,718
Indirect Costs - Subtotal	\$184,983
Total Direct + Indirect Costs	\$613,143

6. Potential Liability

Yates supplied financial assurance in the amount of a \$150,000 federal blanket bond for the Plateau CS project. They have not yet supplied financial assurance to the state of Wyoming for this particular project. The engineer's analysis in the Water Management Plan estimates that a total of \$247,665 would be needed to reclaim the 18 storage impoundments. This is considerably more than the line item reclamation cost estimate of \$185,571 for these impoundments arrived at by the unit cost method used in this case study.

Based on an estimated reclamation financial assurance amount of \$613,000 the potential liability represented by the financial assurance shortfall is approximately \$463,000 for these projects.

CASE STUDY NO. 4

**EnCana Grass Mesa Natural Gas Project
Garfield County, Colorado
Reclamation Plan and Financial Assurance Estimate**



Photo provided by Peggy Utesch

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CASE STUDY NO. 4

EnCana Grass Mesa Natural Gas Project Garfield County, Colorado Reclamation Plan and Financial Assurance Estimate

1. Project Description and Background

This case study estimates reclamation costs for the purpose of establishing adequate financial assurance for the EnCana Grass Mesa project which is extracting natural gas from tight sands formations in Colorado. The Grass Mesa site is located on BLM administered public lands and privately owned surface land. This case study does not include the small amount of privately owned surface and privately owned minerals at this site. Federal mineral rights are leased to EnCana Oil & Gas, Inc. (EnCana).

The following documents were reviewed for information pertaining to reclamation and financial assurance for this project:

- Environmental Assessment: Grass Mesa Geographic Area Plan, Bureau of Land Management Glenwood Springs Field Office, 11/04/04 – this document includes a Surface Use Plan; and
- Oil & Gas Leasing & Development – Draft Supplemental Environmental Impact Statement, Glenwood Springs Resource Area, June 1998.

EnCana has proposed drilling up to 100 natural gas wells, using one existing well pad and 16 new well pads. A typical well location will include the wellhead, a separation and dehydration unit, aboveground storage tanks, and a temporary reserve and/or production pit. EnCana will use existing compressor stations and an existing water treatment facility. Plans include building 6 miles of new roads, and burying 9 miles of underground gas and water lines. The total project area will cover approximately 15.3 sections or 9,792 acres; of this BLM administers over 40% of the area and nearly 60% is owned by private landowners. The total disturbance area will cover about 150 acres.

EnCana supplied financial assurance in the amount of a \$300,000 federal blanket bond and a \$235,000 blanket bond to the state of Colorado for the Grass Mesa project.

The cost estimates in this case study are preliminary and are based on limited information and assumptions as stated with an accuracy of +/- 35%. The estimates have been developed consistent with accepted professional engineering cost estimation principles and practices.

2. Reclamation Plan

This section describes reclamation plans submitted by the drilling and exploration company. More often than not, the projects don't have detailed reclamation plans or they address only one aspect of reclamation, such as water management and pit reclamation. If the company didn't supply a plan, this section will instead use a minimum typical reclamation plan to illustrate what should be done, drawing on details from similar sites.

Site specific reclamation plans, including interim reclamation procedures, for some aspects of the Grass Mesa site were described in the Grass Mesa Environment Assessment (EA). General reclamation requirements for oil and gas development were described in the Oil and Gas Leasing and Development

Draft Supplemental Environmental Impact Statement (DSEIS). For example, the DSEIS states that topsoil will be stockpiled at all disturbed areas, with the possible exception of pipeline construction, and subsoil stockpiles are to be isolated from topsoil stockpiles. Projects of similar scope supplied information that was lacking in the EA and DSEIS.

2.1. Wells

The well pads and surrounding area will be cleared of debris, trash and materials. All surface facilities will be removed. Wellhead enclosures, above-grade pumping and control equipment, and connections between the well casing and downhole tubing, and flow lines and pipelines will be removed. Well pads will be reclaimed consistent with BLM approved procedures. Exploration borings, test production wells, and depleted production wells will be plugged and abandoned in accordance with federal rules.

2.2. Improved Roads

Access roads will be reclaimed using BLM approved procedures, unless BLM or the surface owner wishes to retain a road and accepts responsibility through execution of a release for future road maintenance. All road disturbances will be reseeded with a weed-free seed mixture approved by BLM.

2.3. Gas and Water Pipelines

Underground pipelines will be cleaned, disconnected, and then abandoned in place to avoid additional surface disturbance.

2.4. Reserve and Production Pits

Before reserve and production pits are reclaimed, all residue will be removed off-site to an approved disposal site. Mud will be confined to the pit and not forced out and allowed to mix with the overburden. A minimum of three feet of cover will be placed over the pit.

2.5. Long-Term Maintenance and Monitoring

Periodic monitoring of revegetation is required. Soil testing may be required at some sites. Reclaimed areas will be fenced from livestock.

3. Reclamation Tasks

Reclamation can be broken down into cleanup tasks. The scope of cleanup tasks in this case study are based on the Grass Mesa EA and professional experience in the area of reclamation planning.

Table 1 lists cleanup tasks for each feature for the Grass Mesa site.

Table 1 - Reclamation Tasks

Disturbance	Assumptions	Tasks
Well Pads	Topsoil salvaged; underlying soils not significantly impacted.	Remove all surface facilities including above-grade pumping and control equipment, piping, well casings, storage tanks.
		Plug all wells and borings.
		Recontour surface; replace topsoil.
		Disk and roller pack. Drill or broadcast seed.
Improved Roads	Topsoil salvaged; underlying soils not significantly impacted.	Remove all surface facilities including any culverts.
		Rip road surface; recontour; replace topsoil.
		Disk and roller pack. Drill or broadcast seed.
Gas & Water Pipeline Corridors	Only revegetation necessary.	Disk and seed.
Temporary Reserve and/or Production Pits	Contaminants concentrated in 2 foot layer below pond; buried on-site.	After pond drains/evaporates excavate top 2 feet of sediment including sides. Consolidate in bottom of pond.
		Cover with clean material.
	Topsoil salvaged.	Recontour surface.
		Plow and seed.

4. Reclamation Quantities

Reclamation earthwork quantities for well pads, reserve and production pits, pipelines, underground power, roads, and other features were derived from the Surface Use Plan in the EA for the EnCana project.

4.1. Construction and Operations Disturbed Areas

Table 2a lists construction and operations disturbed areas.

Table 2a - Disturbed Areas

Feature	Construction	Operations
Well Pads - new	6 acres/unit	1 acre/unit
Well Pads - existing	Not applicable	1 acre/unit
Improved Roads	1.21 acres/mile	1.21 acres/mile
Gas & Water Pipeline Corridors	1.82 acres/mile	1.82 acres/mile
Temporary Reserve and/or Production Pits *	.23 acres/unit	Not applicable

* Reserve pit acreage is included in the well pad construction disturbed area acreage.

Table 2b shows surface use broken down by feature and the number of units (number of wells, for example) or length in miles (of roads, for example.) Surface area estimates for the various types of disturbances were determined from the Grass Mesa EA.

Table 2b - Disturbed Area Totals

Feature	No.	Units	Construction		Operations		Construction Only
			Disturbed Area		Disturbed Area		Area
			per unit, acres	total, acres	per unit, acres	total, acres	total, acres
Well Pads - new	17	units	6.00	102.00	1.00	17.00	85.00
Well Pads - existing	1.0	units	0.00	0.00	1.00	1.00	0.00
Gas, Water, & Improved Road Corridors	6.0	miles	4.61	27.64	3.64	21.82	5.82
Gas & Water Pipeline Corridors	9.0	miles	1.82	16.36	1.82	16.36	0.00
Temporary Reserve and/or Production Pits *	17	units	0.23	3.90	0.000	0.00	3.90
Total				146		56	91

* Reserve pit acreage is included in the well pad construction disturbed area acreage.

5. Direct, Indirect and Total Costs

Estimated unit costs for reclamation at the EnCana Grass Mesa site based on the tasks identified in Section 3 range from \$1,366 per acre to \$20,821 per acre. Table 3 shows a summary of costs per acre for each feature.

Table 3 - Summary of Unit Costs

Type of Disturbance	\$/acre
Construction Areas	\$2,641
Well Pads	\$20,821
Gas, Water, & Improved Roads	\$2,641
Gas & Water Pipelines	\$1,366
Reserve and Production Pits	\$5,326

Table 4 shows the direct cost estimate for reclamation at the EnCana Grass Mesa site based on the unit costs in Table 3 above and the disturbed area acreages identified in Table 2b. The total **direct cost estimate** is **\$705,000**.

Table 4 - Direct Cost Estimates

Feature	Construct Only	Operations	Per Unit Costs		Total Costs		
	Disturbed Area	Disturbed Area	Construct	Operations	Construction	Operations	Total
	total acres	total acres	\$/acre	\$/acre	\$	\$	\$
New Well Pads (minus reserve pits)	81.10	17.00	\$2,641	\$20,821	\$214,165	\$353,953	\$568,119
Well Pads - existing	0.00	1.00		\$20,821	\$0	\$20,821	\$20,821
Gas, Water, & Improved Roads	5.82	21.82	\$2,641	\$2,641	\$15,365	\$57,618	\$72,983
Gas & Water Pipeline Corridors	0.00	16.36		\$1,366	\$0	\$22,360	\$22,360
Reserve/Production Pits	3.90	0.00	\$5,326	\$0	\$20,787	\$0	\$20,787
Total	91	56			\$250,318	\$454,752	\$705,070

Table 5 shows the total cost estimate, including indirect costs. The basis for the indirect cost percentages is described in section 2.2 of Case Studies Approach and Methodology. The total **indirect cost estimate**

is **\$290,000**. Based on the direct and indirect costs the estimated **total cost of reclamation** is just under one million dollars at **\$996,000**.

Table 5 - Total Cost Estimate for Reclamation

Cost Area	Total Cost
Direct Reclamation Costs - Total	\$705,070
Indirect Costs	
Contingency	8.0% of direct costs
Contractor Overhead and Profit	12.0% of direct costs
Agency Contract Administration	18.0% of direct costs
Agency Indirect Costs	17.8% of administration costs
Indirect Costs - Subtotal	\$290,517
Total Direct + Indirect Costs	\$995,587

6. Potential Liability

EnCana supplied financial assurance in the amount of a \$300,000 federal blanket bond and a \$235,000 blanket bond to the state of Colorado for the Grass Mesa project. Based on an estimated reclamation financial assurance amount of \$995,587 the potential liability represented by the financial assurance shortfall is approximately \$460,600 for this project.

CASE STUDY NO. 5

Zinke & Trumbo Foreman Butte Oil Drilling Project McKenzie County, ND Reclamation Plan and Financial Assurance Estimate



Photo provided by Cindy Klein

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CASE STUDY NO. 5

Zinke & Trumbo Foreman Butte Oil Drilling Project McKenzie County, ND Reclamation Plan and Financial Assurance Estimate

1. Project Description and Background

This case study estimates reclamation costs for the purpose of establishing adequate financial assurance for the Foreman Butte oil field project which also produces associated gas in North Dakota. The Foreman Butte project is located on private surface, state surface, and BLM and Forest Service administered public land; federal and state mineral rights are leased to Zinke & Trumbo, Inc. (Zinke & Trumbo).

The following documents were reviewed for information pertaining to reclamation and financial assurance for this project:

- US Forest Service Dakota Prairie Grasslands/BLM Montana State Office Oil and Gas Leasing Record of Decision, June 2003,
- BLM Cultural Resources Class III Inventory Report, 3/31/04,
- BLM Surface Use Plans for the following well sites: Killebrew #1-28H, Mays #1-20H, McGwire #1-27H, Mantle #1-21H, and Robinson #1-17H, 2004,
- State Sundry Notices and Reports on Wells for several wells in the project, 2004-2005.

Zinke & Trumbo has proposed constructing 43 oil wells, an unknown number of gathering and metering facilities, and 43 temporary reserve and/or production pits. Plans include building approximately 15 miles of improved roads, and burying an unknown number of miles of underground gas and oil lines, produced water lines, and power lines. Though documents that Zinke & Trumbo submitted to regulatory authorities stated otherwise, they are also drilling a number of water wells which may affect nearby domestic wells.

The total project area will affect parts of three townships and the total estimated disturbance area will cover over 500 acres.

Zinke & Trumbo supplied financial assurance in the amount of a \$150,000 federal blanket bond and a \$100,000 blanket bond to the state of North Dakota for the Foreman Butte project.

The cost estimates in this case study are preliminary and are based on limited information and assumptions as stated with an accuracy of +/- 35%. The estimates have been developed consistent with accepted professional engineering cost estimation principles and practices.

2. Reclamation Plan

This section describes reclamation plans submitted by the drilling and exploration company. More often than not, the projects don't have detailed reclamation plans or they address only one aspect of reclamation, such as water management and pit reclamation. If the company didn't supply a plan, this section will instead use a minimum typical reclamation plan to illustrate what should be done, drawing on details from similar sites.

Except for some information on reclaiming reserve pits, site specific reclamation plans for the Foreman Butte site were not available. The Cultural Resources Inventory Report (CRIP), BLM Surface Use Plans (SUP), State Sundry Notices (Sundry Notices), and the Dakota Prairie Grasslands Oil and Gas Leasing Record of Decision (ROD) provided some information on aspects of the project such as well pad areas and lengths of some new roads. A limited description of reserve pit reclamation requirements was included in the Sundry Notices. Projects of similar scope were used to provide information that was lacking in these documents.

2.1. Wells

All surface facilities will be removed. Wellhead enclosures, above-grade pumping and control equipment, and connections between the well casing and downhole tubing, and flow lines and pipelines will be removed. Well pads will be recontoured, plowed, and seeded consistent with BLM approved reclamation procedures. Exploration borings, test production wells, injection wells, and depleted production wells will be plugged and abandoned in accordance with state and federal rules.

2.2. Gathering/Metering Facilities

All surface facilities will be removed.

2.3. Improved and Two-Track Roads

Two track routes and access roads will be reclaimed by plowing and seeding after any necessary gravel removal, unless BLM or the surface owner wishes to retain a road and accepts responsibility through execution of a release for future road maintenance. Roads not needed for future use will be blocked, recontoured, reclaimed, and revegetated consistent with the requirements of BLM. All road disturbances will be reseeded with a weed-free seed mixture approved by BLM.

2.4. Gas, Oil, and Water Pipelines

Underground pipelines will be cleaned, disconnected, and then abandoned in place to avoid additional surface disturbance.

2.5. Buried Power Cable

Underground electric lines will be disconnected and abandoned in place to avoid any additional surface disturbance.

2.6. Reserve and Production Pits

Before reserve and production pits are reclaimed, all produced water will be removed via pipeline to area injection well. After drying dried mud and cuttings will be at least four feet below the final grade. Stockpiled fill and topsoil will be used to fill pit. Pit will be contoured to original condition as closely as possible and reseeded.

2.7. Long-Term Maintenance and Monitoring

Reclaimed areas will be monitored periodically for effectiveness of revegetation. Areas where vegetation has not become established will be reseeded.

3. Reclamation Tasks

Reclamation can be broken down into cleanup tasks. The scope of cleanup tasks in this case study are based on limited information in the SUPs and Sundry Notices and professional experience in the area of reclamation planning.

Table 1 lists cleanup tasks for each feature of the Foreman Butte site.

Table 1 - Reclamation Tasks

Disturbance	Assumptions	Tasks
Well Pads	Topsoil salvaged; underlying soils not significantly impacted.	Remove all surface facilities including above-grade pumping and control equipment, piping, well casings, storage tanks.
		Plug all wells and borings.
		Recontour surface; replace topsoil.
		Disk and roller pack. Drill or broadcast seed.
Improved and Temporary Roads	Topsoil salvaged; underlying soils not significantly impacted.	Remove all surface facilities including any culverts.
		Rip road surface; recontour; replace topsoil.
		Disk and roller pack. Drill or broadcast seed.
Gas, Oil & Water Pipelines and Underground Power Corridors	Only revegetation necessary.	Disk and seed.
Temporary Reserve and/or Production Pits	Contaminants consolidated at least 4 feet below grade.	Pit water stored in tanks, hauled to injection well or other approved site.
	Topsoil and excess dirt from pit salvaged.	Pit allowed to dry.
		Fill pit with salvaged dirt, cover with topsoil.
		Recontour surface.
		Plow and seed.

4. Reclamation Quantities

Reclamation earthwork quantities for reserve pits, roads, well pads, and other features were derived from the SUPs, CRIP, and Sundry Notices for the Foreman Butte site. Where data was not available, projects of similar scope were used to estimate quantities.

4.1. Construction and Operations Disturbed Areas

Table 2a lists construction and operations disturbed areas.

Table 2a - Disturbed Areas

Feature	Construction	Operations
Well Pads	10 acres/unit	5 acre/unit
Improved Roads	1.21 acres/mile	1.21 acres/mile
Pipelines, Power & Improved Road Corridors	1.82 acres/mile	1.82 acres/mile
Temporary Reserve and/or Production Pits *	.21 acres/unit	Not Applicable

* Reserve pit acreage is included in the well pad construction disturbed area acreage.

4.2. Total Disturbed Areas

Table 2b shows surface features and the number of units (number of wells, for example) or length in miles (of roads, for example.) The SUPs and Sundry Notices contained the most detail, including surface areas for reserve pits, and were used to calculate the per unit surface areas where it was not provided for other Foreman Butte well sites.

Table 2b - Disturbed Area Totals

Feature	No.	Units	Construction		Operations		Construction Only
			Disturbed Area		Disturbed Area		Area
			per unit, acres	total, acres	per unit, acres	total, acres	total, acres
Well Pads	43	units	10.00	430.00	5.00	215.00	215.00
Pipelines, Power & Improved Road Corridors	14.8	miles	4.85	71.52	4.85	71.52	0.00
Pipeline Routes	5.0	miles	1.82	9.09	1.82	9.09	0.00
Temporary Reserve and/or Production Pits *	43	units	0.21	8.88	0.000	0.00	8.88
Total				511		296	215

* Reserve pit acreage is included in the well pad construction disturbed area acreage.

5. Direct, Indirect and Total Costs

Estimated unit costs for reclamation at the Foreman Butte site based on the tasks identified in Section 3 range from \$1,366 per acre to \$20,821 per acre. Table 3 shows a summary of costs per acre for each feature.

Table 3 - Summary of Unit Costs

Type of Disturbance	\$/acre
Construction Areas	\$2,641
Well Pads	\$20,821
Pipelines & Improved Roads	\$2,641
Pipeline Routes	\$1,366
Reserve and Production Pits *	\$5,076

* Water disposed of through produced water pipeline to injection well.

Table 4 shows the direct cost estimate for reclamation at the Foreman Butte site based on the unit costs in Table 3 above and the disturbed area acreages identified in Table 2b. The total **direct cost estimate** is **\$5,300,000**.

Table 4 - Direct Cost Estimates

Feature	Construct Only	Operations	Per Unit Costs		Total Costs		
	Disturbed Area	Disturbed Area	Construct	Operations	Construction	Operations	Total
	total acres	total acres	\$/acre	\$/acre	\$	\$	\$
Well Pads (minus reserve pit area)	206.12	215.00	\$2,641	\$20,821	\$544,319	\$4,476,469	\$5,020,788
Pipelines & Improved Roads	0.00	71.52	\$2,641	\$2,641	\$0	\$188,860	\$188,860
Pipeline Routes	0.00	9.09	\$0	\$1,366	\$0	\$12,422	\$12,422
Reserve/Production Pits	8.88	0.00	\$5,076	\$0	\$45,101	\$0	\$45,101
Total	215	296			\$589,420	\$4,677,752	\$5,267,172

Table 5 shows the total cost estimate, including indirect costs. The basis for the indirect cost percentages is described in section 2.2 of Case Studies Approach and Methodology. The total **indirect cost estimate** is **\$1,820,000**. Based on the direct and indirect costs the **total cost of reclamation** is estimated at **\$7,080,000**.

Table 5 - Total Cost Estimate for Reclamation

Cost Area	Total Cost
Direct Reclamation Costs - Total	\$5,267,172
Indirect Costs	
Contingency	6.0% of direct costs
Contractor Overhead and Profit	12.0% of direct costs
Agency Contract Administration	14.0% of direct costs
Agency Indirect Costs	17.8% of administration costs
Indirect Costs - Subtotal	\$1,816,753
Total Direct + Indirect Costs	\$7,083,924

6. Potential Liability

Zinke & Trumbo supplied total financial assurance in the amount of \$250,000 for the Foreman Butte sites. Based on an estimated reclamation financial assurance amount of **\$7,080,000** the potential liability represented by the financial assurance shortfall is approximately \$6.8 million for this project.