1.0 Introduction and Background

1.1 Introduction

Greencore Pipeline Company, LLC (Greencore), a wholly owned subsidiary of Denbury Resources, Inc. (Denbury), based in Plano, Texas, proposes to construct and operate approximately 231.1 miles of 20-inch-diameter liquid (dense phase) carbon dioxide (CO_2) steel pipeline (the Project) from the ConocoPhillips Lost Cabin Gas Plant in Fremont County, Wyoming, to a point in the Bell Creek oil field in Powder River County, Montana. The CO_2 transported by the pipeline would be used for enhanced oil recovery (EOR) at the existing Bell Creek oil field.

This Environmental Assessment (EA) has been prepared under the direction of the Bureau of Land Management (BLM), serving as the lead agency in compliance with the National Environmental Policy Act of 1969 (NEPA). This document follows the guidelines promulgated by the Council on Environmental Quality (CEQ) for implementing the procedural provisions of NEPA (40 Code of Federal Regulations [CFR] 1500-1508) and BLM's NEPA Handbook (H-1790-1). The Project would be designed, constructed, and operated in accordance with CFR 49 Part 195, Transportation of Hazardous Liquids by Pipeline. These regulations are administered by the United States (U.S.) Department of Transportation (USDOT) Pipeline and Hazardous Materials Safety Administration (PHMSA).

This chapter presents the purpose and need for the Project, including a general discussion of EOR and an overview of CO_2 use in the EOR process. In addition, it also describes the Project location and identifies other authorizing actions necessary for the Project to be constructed. A complete description of the proposed action is provided in Chapter 2.0.

The source of the CO_2 that would be captured and transported by the Project is the Lost Cabin Gas Plant. Currently vented CO_2 would be captured, compressed, and transported to the Bell Creek Field for use in a CO_2 flood. By capturing CO_2 that would otherwise be released into the atmosphere, the Project would reduce CO_2 emissions by approximately 1 million metric tons each year.

The Project would be designed to flow initial start up volumes of 50 million standard cubic feet per day (MMSCFD) of CO_2 and future potential volumes up to 775 MMSCFD with the addition of pump station horsepower along the Project route and additional supply sources of CO_2. Implementation of the EOR Project at the Bell Creek field would result in increased incremental production of oil that would not be recoverable by existing operations. This incremental production would extend the economic life of the fields and benefit both state and local economies.

CO_2 is a common, ordinary compound usually thought of as a gas, although it is quite easily converted to a solid or liquid. In its gaseous state, CO_2 is approximately 1.5 times heavier than air at standard conditions. The following hazards can be associated with CO_2. Frostbite may result from contact with dry ice or liquid CO_2. CO_2 also can act as a simple asphyxiant. Concentrations of 10 percent (100,000 parts per million [ppm]) can produce unconsciousness from oxygen deficiency. A concentration of 5 percent (50,000 ppm) may produce shortness of breath and headaches. Continuous exposure to 1.5 percent (15,000 ppm) may cause changes in some physiological processes (Sittig 1981).

As an oil field ages, the natural oil reservoir pressure declines; thus, pumping becomes less efficient. To recover some of the remaining oil, it becomes necessary to employ enhanced methods of oil recovery such as waterflooding. Waterflooding consists of injecting water into wells and forcing it into the oil reservoir. As the water spreads out from the injection site, it pushes some of the remaining oil towards producing wells. Waterflooding is relatively inexpensive to employ, is effective in displacing oil and increasing the pressure in the reservoir, and increases oil recovery from approximately 15 to 25 percent. Even after these secondary methods have been completed, as much as 60 percent or more of the original oil is left in the ground.

At this point, other tertiary or enhanced recovery methods become necessary to liberate some of the remaining reserves. Injection of CO_2 to increase oil recovery was first patented in 1952. Large-scale commercial CO_2 flooding occurs in Utah, Texas, Mississippi, Colorado, New Mexico, Oklahoma, Louisiana, and Wyoming. The first commercial application of CO_2 flooding in Wyoming was Amoco's Bairoil Project, which began injection of CO_2 in October 1986 (BLM 1989).

CO_2 works to increase the volume of recoverable oil in several ways. In most reservoirs, CO_2 is easily miscible with the oil and can be thoroughly mixed at relatively low pressures. Once mixed, it is highly soluble. As it dissolves, it swells the oil, yielding a 10 to 30 percent increase in volume (Miller and Jones 1981). This swelling forces more oil out of the reservoir pores, making it available for recovery. In addition, CO_2 decreases the viscosity of oil, allowing it to flow more freely. CO_2 also aids recovery by solution gas drive. Just as CO_2 goes into solution with an increase in reservoir pressure, gas will come out of solution and continue to drive oil into the wellbore. Finally, the slightly acidic nature of the CO_2-water mixture promotes certain injectivity changes. Clays are stabilized due to a reduction in pH, and injectivity is improved in carbonates by increased permeability.

The CO_2 flooding technique is similar to waterflooding except that the CO_2 gas acts as a solvent to reduce the viscosity of oil, rendering it more mobile, while maintaining pressure in the reservoir. According to the Department of Energy (DOE), EOR with CO_2 could add 89 billion barrels to the recoverable oil resources of the U.S. (Techline 2006). It is estimated that the CO_2 injected via the Project would increase oil production of existing wells by as much as 5-fold. Consequently, the Project would access known reserves and supply the growing national need for domestic energy supplies. Wyoming and Montana, states that are largely dependent on the energy industry, can benefit from the development of CO_2 for EOR because vast CO_2 reserves are available and there are many depleted oil reservoirs that are prime candidates for EOR (Ogg et al. 2006).

1.2 Purpose for the Proposed Action

The primary purpose of the Project is to transport currently vented CO_2 from the existing Lost Cabin Natural Gas Plant located near Lost Cabin, Wyoming to the Bell Creek Oil Field located in southeastern Montana for EOR processing of existing oil reserves. The result of the CO_2 EOR would more fully develop and produce the remaining oil reserves in an existing oil field under the rights granted by existing federal, state and local authorities, including federal oil and gas lease(s), as required in 43 CFR 3160, all Onshore Orders, and the Mineral Leasing Act, as amended and supplemented (30 United States Code [U.S.C.] 181 *et seq.*). The increased production would extend the economic life of the field, help to prevent unavoidable loss of oil reserves, as well as reduce CO_2 venting at the plant. The Project would be designed to flow initial start up volumes of 50 MMSCFD of CO_2 and future potential volumes up to 775 MMSCFD with the addition of pump station 27 horsepower along the route and additional supply sources of CO_2. The secondary purpose of the Project is to allow for greater capacity with the pipeline for future CO_2 transportation needs and EOR processing opportunities.

1.3 Need for the Proposed Action

The need for the action is the requirement to grant approval for the construction, operation, maintenance, and termination of a pipeline for the purpose of oil and gas recovery on public lands managed by the BLM under the authority of the Mineral Leasing Act, as amended and supplemented, (30 U.S.C. 181 *et seq.*) and prescribed in 43 CFR Parts 2880 and 3160.

1.4 Decision to be Made

The BLM would decide whether or not to approve the pipeline for transportation of CO_2, and if so, under what terms and conditions.

1.5 Location of the Proposed Action

The Project proposed by Greencore would be located in four Wyoming counties (Fremont, Natrona, Johnson, and Campbell); one Montana county (Powder River); and four BLM field office (FO) areas (Lander, Casper, Buffalo, and Miles City). A map showing the location of the proposed pipeline route is presented in **Figure 1-1**.

1.6 Authorizing Actions

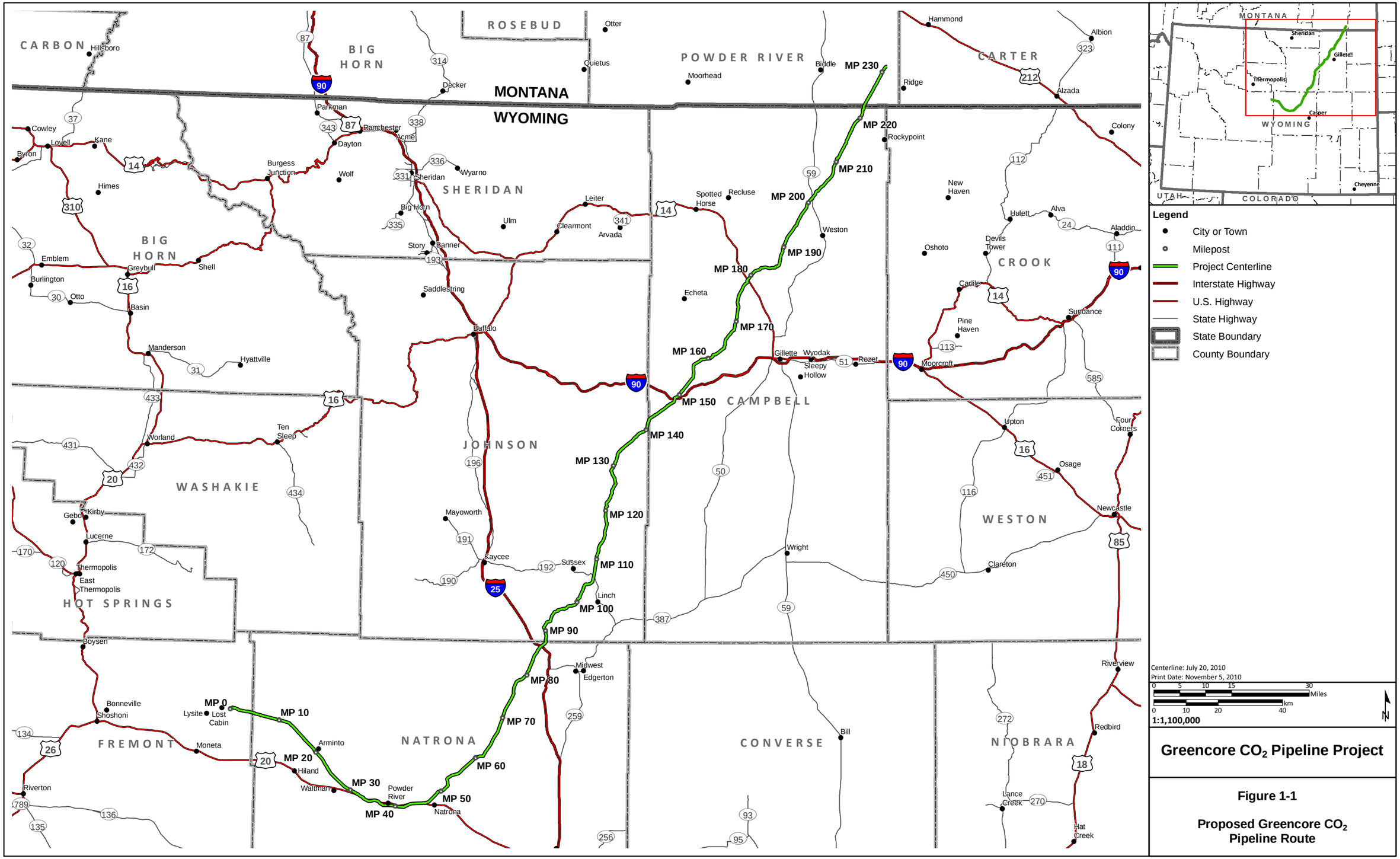
The Project would require federal, state, and local authorizations for many aspects of construction, operation, maintenance, and abandonment. It is the applicant's intent to fulfill all requirements of any applicable statutes, regulations, and policies. **Table 1-1** lists permits, approvals, and reviews necessary for implementation of the Project.

Table 1-1 Federal, State, and Local Permits, Approvals, and Reviews Required for Construction and Operation of the Greencore Project

Agency	Nature of Action	Authority
Federal Permits, Approvals, and Reviews		
U.S. Department of the Interior (USDOI), BLM	Grant rights-of-way (ROWs) and issue temporary use permits	Section 28 of the Mineral Leasing Act of 1920
	Issue materials sales contracts	Materials Act of 1947, as amended; 30 U.S.C. 601, 602; 43 CFR 3600
	Issue cultural resource permit to excavate or remove cultural resources on federal lands	Archaeological Resources Protection Act of 1979, 16 U.S.C. Section 470aa-47011; 43 CFR Part 3
	Approve pesticide use proposal	BLM Manual 9011.1, Guidelines for Conducting Chemical Pest Control Program
U.S. Fish and Wildlife Service (USFWS)	Section 7 Consultation process for endangered or threatened species	Endangered Species Act (ESA) of 1973; 16 U.S.C. 1531 et seq.
USDOT Federal Highway Administration (FHA)	Issue permits to cross federal-aid highways	23 U.S.C. Sections 116, 123, 23 CFR Part 645 Subpart B
U.S. Army Corps of Engineers (USACE)	Issue Section 404 permit for placement of dredged or filled material in Waters of the U.S. (WUS)	Section 404 of the Clean Water Act of 1972 (40 CFR 122-123); 33 U.S.C. Section 1344; 33 CFR Parts 323, 325
	Issue Section 10 permit for crossing navigable water in the U.S.	Section 10 of the Rivers and Harbors Act of 1899, 33 U.S.C. 401-413
U.S. Department of the Treasury Bureau of Alcohol, Tobacco and Firearms	Issue permits to purchase, store, and use explosives	Section 1102(a) of the Organized Crime Control Act of 1970, 18 U.S.C. Section 841-848; 27 CFR Part 181
Advisory Council on Historic Preservation (ACHP)	Review and compliance activities related to cultural resources	Section 106 National Historic Preservation Act (NHPA) (16 U.S.C. 470) (36 CFR Part 80)
State of Wyoming		
Department of Environmental Quality (DEQ) – Water Quality Division	Issue National Pollutant Discharge Elimination System (NPDES) Permit for discharges; approves Storm Water Pollution Prevention Plan	Wyoming Environmental Quality Act, W.S. 35-11-301

Table 1-1 Federal, State, and Local Permits, Approvals, and Reviews Required for Construction and Operation of the Greencore Project

Agency	Nature of Action	Authority
Wyoming Highway Department	Issue permits for oversize and overweight loads	Chapters 17 and 20 of the Wyoming Highway Department Rules and Regulations
	Issue encroachment permits	Chapter 12 of the Wyoming Highway Department Rules and Regulations
State Land Board	Issue easements to cross state lands	W.S. 35-20 and 36-20
Wyoming State Engineer's Office	Grant permit to appropriate water for hydrostatic testing, dust control, and other uses	W.S.41-121 through 147
State Historic Preservation Office (SHPO)	Review compliance activities related to cultural resources	Section 106 NHPA (16 U.S.C. 470) (36 CFR Part 80)
Wyoming Public Service Commission	Issue certificate of public convenience and necessity	W.S. 1977 and Wyoming Administrative Procedures Act
County Commissioners	Road crossing permits, land use permits, and licenses	County zoning regulations
County Health Departments	Temporary sanitation facilities	County sanitation requirements
State of Montana		
DEQ – Director's Office	Review and comment on environmental activities; review and use federal EA to meet Montana Environmental Policy Act (MEPA) requirements	MEPA
DEQ – Permitting and Compliance Division - Water Protection Bureau	Issue Montana Pollution Discharge Elimination System (MPDES) Permit for discharges; approve Storm Water Pollution Prevention Plan; 318 Authorization (short-term water quality standard for turbidity); Section 401 Water Quality Certification	Montana Water Quality Act Montana Code Annotated (MCA) 75-5-101
Department of Natural Resources and Conservation (DNRC) – Water Resources Division	Issue Water Appropriation Permits (Beneficial Water Use Permit) and/or Water Wells Drilling/Alteration for hydrostatic testing and dust control	Montana Water Use Act of 1973
DNRC – Trust Land Management Division	Review and process applications for ROWs and easements across state-administered surface lands and navigable waterways	MCA 77-1-130
DNRC – Conservation Districts Bureau; and Floodplain Management Section	Issue 310 Permits to physically alter or modify bed or banks of perennial streams; Floodplain Development Permits for new construction within a designated 100 year floodplain	Montana Natural Streambed and Land Preservation Act; Montana Floodplain and Floodway Management Act
Department of Fish, Wildlife and Parks	SPA124 permit issuance; comment on the Project and effects on natural resources and sensitive species	Montana Stream Protection Act
Montana Department of Transportation (MDT)	Issue permits for state highway crossing permits and permits for oversize and overweight loads	MDT Rules and Regulations
	Issue encroachment permits	MDT Rules and Regulations
SHPO	Review and compliance activities related to cultural resources	Section 106 NHPA (16 U.S.C. 470) (36 CFR Part 80)
Counties	Issue road crossing permits, land use permits, licenses, and authorization for temporary sanitation facilities	County zoning and sanitation regulations



Greencore CO_2 Pipeline Project

Figure 1-1

Proposed Greencore CO_2 Pipeline Route

In order to obtain a ROW grant from federal land management agencies or easements across private land, several steps must be taken. For federally administered lands, an applicant must submit a ROW application to the appropriate federal agency along with a fee to cover the costs of processing the application and granting and administering the ROW. The agency then prepares an environmental document (such as this EA) as required under NEPA to determine potential impacts on all lands (regardless of ownership) that may occur as a result of implementing the Proposed Action.

Protective measures to avoid and minimize adverse impacts are proposed by the applicant and referenced throughout this document as design features. In addition to these commitments, the agency requires standard protective measures on federal lands.

After the EA is prepared and the agency preferred alternative is selected, the BLM prepares a Decision Record. The Decision Record documents and provides the legal record for any decisions made regarding the requested ROW on federal lands.

Before the ROW can be granted, Greencore must prepare a Plan of Development (POD) detailing construction of all Project facilities on federal land. This POD must be submitted to the authorizing agencies for approval. POD approval is concurrent with the ROW approval. The POD contains Project information and site-specific procedures for the following:

- Fire protection;
- Erosion control, revegetation, and reclamation;
- Water resources protection;
- Transportation;
- Communications;
- Cultural resources protection;
- Threatened or endangered species protection;
- Wildlife protection;
- Blasting;
- Dust control;
- Weed control;
- Health and safety;
- Construction schedule;
- Construction facilities and housing;
- Pipeline testing;
- Construction monitoring;
- Operations and maintenance; and
- Abandonment.

Prior to construction, the applicant would be required to conduct site-specific surveys on the proposed ROW, additional temporary work space (ATWS), and ancillary facilities for sensitive plants and animals, including threatened and endangered species and federally protected raptors; jurisdictional waters of the U.S.; cultural, historical, and paleontological resources and noxious weeds. The BLM then applies stipulations to protect site-specific resources. When possible, these stipulations are incorporated into the POD.

The process used by pipeline companies to obtain easements across private lands is different from that used for state or federal lands. The company's ROW agent first contacts the landowner for permission to determine the proposed pipeline's centerline across the owner's property. At the same time, the ROW agent seeks the landowner's permission to conduct the same surveys required to obtain permits to cross federal and state lands (such as cultural and wildlife surveys).

A plat is prepared after the surveyor obtains the necessary data for locating the pipeline. This plat shows the relationship of the planned pipeline to the property boundaries. The ROW agent meets with the landowner to initiate negotiations for an easement across the property.

Across federal, state, and private lands, Greencore has requested a 50-foot-wide permanent easement and an additional 50-foot-wide temporary construction easement on level terrain. ATWS (**Appendix A**), typically 50 feet by 200 feet on both sides of the construction ROW, would be required at most road, railroad, arroyo, and water crossings, as well as vehicle turn-around areas. Construction techniques and reclamation procedures would be the same on private and public lands, or as specified by the landowner.

1.7 Conformance with Land Use Plans

The Project would be located within the BLM's Lander, Casper, Buffalo, and Miles City FO areas, each of which has an approved Resource Management Plan (RMP) (BLM 2010a,b,c, 2007a, 2001a, 2000a, 1987, 1985a). The Proposed Action is in conformance with these plans. In addition, the Project would be within designated utility corridors along greater than 90 percent of the route. None of the Project disturbance areas would be located within areas where ROWs are prohibited. The RMPs do identify restrictions on ROW placement (e.g., Interstate 25 [I-25] and I-90 segments). However, linear projects are allowed to cross I-25 and I-90. Specific land use plan and applicable statutory/regulatory information is provided in Chapter 3.0.

1.8 Project Interrelationships

1.8.1 Interrelated Projects

Development of the Project would be related to EOR activities at the Bell Creek and other potential oil fields (see **Figure 1-1**). EOR in the Bell Creek oil field would be initiated subsequent to construction of the Project, and NEPA analysis for that action and in any other fields would be subject to approval under separate granted ROW. Initially, Denbury would be the only operator to implement EOR activities at their wells in the Bell Creek field. A summary of recent production in the Bell Creek field is provided in **Table 1-2**.

Table 1-2 Summary of Oil Production in the Bell Creek Oil Field

Oil Production Information	Bell Creek Field
Number of Producing Wells in 2010	104
Production Initiated (Year)	1967
Barrels of Oil Produced in 2008	405,624
Barrels of Oil Produced Since Inception	134,524,927

Source: http://bogc.dnrc.state.mt.us/PDF/AnnualReview/AR_2008.pdf.

Denbury would upgrade the Bell Creek Field infrastructure to handle higher water injection and production volumes, to facilitate injection and production of CO_2, and to re-inject produced water and CO_2 streams. Denbury would attempt to reactivate or use existing wells in the field and possibly drill additional wells as required. The types of changes that would occur in the Bell Creek field as a result of the Project and subsequent upgrades to the Bell Creek field include the following:

- Aboveground pipeline connection to the CO_2 source;
- New buried injection lines;
- New buried gathering lines;
- New CO_2 or recycling facility; and
- Field meter/manifold sites.

Trenching would be required for the injection and gathering lines, with the depth of approximately 4 to 6 feet and a width of 4 feet.

Since the EOR activities would occur at existing active wells, limited new development would occur.

Greencore also would construct processing and pumping facilities at the Lost Cabin Gas Plant to liquefy the CO_2 and to pump it through the pipeline to the Bell Creek field.

Other facilities to support future system supply and delivery capacities include:

1. Future Natrona Hub – (an approximate 10-acre site at Milepost [MP] 39.5) – future southern extension interconnect and pump station. This future site would be designed to support future CO_2 supplies and deliveries.
2. Future Mid-Point pump station (an approximate 5-acre site at MP 144.0).
3. Future Bell Creek end point pump station and delivery site (an approximate 5-acre site at MP 231.1).

1.8.2 Special Management Areas

The Project would not cross any Wilderness Study Areas (WSAs) or Areas of Critical Environmental Concern (ACECs). However, the Project would cross the Wind River Management Area near Waltman, Wyoming, and would pass within 5 miles of the Salt Creek Management Area near Midwest, Wyoming. See Chapters 3.0 and 4.0, Land Use and Recreation, for additional discussion of these special management areas.

1.9 Public Involvement, Scoping, and Issues

As part of Section 106 compliance, BLM notified all federally recognized Native American groups residing in or with cultural ties to the Project area (see Chapter 3.0, Section 3.14.4).

Greencore Public Relations representatives met with individuals and groups between October 5 and 10, 2009, to introduce the Project, provide public awareness, and assess public sentiment regarding the Project. The vast majority of individuals and groups were positive and supportive of the Project.

Formal scoping meetings have not been conducted as part of the NEPA process. However, Greencore engineers, lands specialists, and consultants have interacted with agencies and land owners extensively to develop a preferred layout that would avoid or minimize impacts to the environment.