United States Department of the Interior
Bureau of Land Management

Environmental Assessment UT- 080-05-249
February 2008

Little Canyon Project Area Natural Gas Development Environmental Assessment

Location: **Uintah County, Utah**
Sections 25, 27-36 Township (T) 10 South (S) and Range (R) 20 East
Sections 1-4, 8-12, 17, and 18, T11S, R20E
Sections 13, 14, 15 and 19-36, T11S, R 20E;
Section 6, T11S, R21E
Sections 1-12 and 18, T12S, R20E

Applicant/Address: **XTO Energy**
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IN REPLY REFER TO:
UT-081
1790

February 19, 2008

Dear Public Land User:

The XTO Energy, Inc.'s Little Canyon Unit Environmental Assessment (EA) is available for your review and comment from February 19 through March 19, 2008. The EA analyzes three alternatives in detail: the Proposed Action, the No Action, and a Conservation Alternative. The proposed action describes the potential impacts of XTO's proposal to develop 510 natural gas wells from 362 well pads with associated production facilities. The proposal includes 77 miles of roads, 109 miles of pipelines (following new or existing roads), and the addition of 11,500 horsepower to an existing compressor site. The project would total approximately 1,882 acres of surface disturbance (5.7% of the project area) on Bureau of Land Management (BLM), State, private, and Reservation land in the Hill Creek and Willow Creek area.

The purpose of this EA is to inform the public, and the Decision Maker, of the impacts associated with implementing the proponent's drilling proposal, to evaluate alternatives to the proposal, and to solicit the public for additional information or corrections. After the public comment period, the EA will be finalized and a decision will be documented in a Decision Record.

A compact disk or hard copy of the document can be obtained from the Vernal Field Office Bureau of Land Management. The document is also on-line at http://www.blm.gov/ut/st/en/fo/vernal/planning.html.

If you wish to submit comments on this EA, we request that you make them as specific as possible, with references to page numbers and chapters. Comments that contain only opinions or preferences will not receive a formal response, but will be considered as part of the BLM decision-making process. Written comments will be accepted by fax, email, or letter through March 19, 2008. Please send all comments to:

Bureau of Land Management
ATTN: Stephanie Howard
170 South 500 East
Vernal UT 84078

Fax: 435-781-4410
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Be aware that comment letters in their entirety - including person identifying information such as addresses, phone numbers, or e-mail addresses – may be made publicly available at any time. While individuals may request that the BLM withhold personal identifying information from public review, the BLM cannot guarantee that this information will be withheld. The BLM will not consider anonymous comments. All submissions from organizations and businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, will be available for public inspection in their entirety.

If you have any questions or comments, please contact Stephanie Howard of this office (435) 781-4469.

Sincerely,

William Stringer
Vernal Field Office Manager

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1.0 PURPOSE AND NEED

1.1 INTRODUCTION

This Environmental Assessment (EA) has been prepared to analyze the natural gas development proposed by XTO Energy, Inc. (XTO) in the Hill Creek Unit (HCU), Little Canyon Unit (LCU), and Big Pack Unit (BPU), hereinafter referred to as the Little Canyon Project Area or LCPA. The EA is a conceptual analysis of potential impacts that could result with the implementation of the Proposed Action or alternatives to the Proposed Action. Applications for Permit to Drill (APDs) or right-of-way (ROW) grant applications with substantial deviations from the project description in this EA would be subject to further environmental review, and National Environmental Policy Act analysis as necessary. The EA assists the Bureau of Land Management (BLM) in project planning and ensuring compliance with the NEPA, and in making a determination as to whether any "significant" impacts could result from the analyzed actions. "Significance" is defined by NEPA and is found in regulations 40 Code of Federal Regulations (CFR) 1508.27. An EA provides evidence for determining whether to prepare an Environmental Impact Statement (EIS) or a statement of "Finding of No Significant Impact" (FONSI). If the decision maker determines that this project has "significant" impacts following the analysis in the EA, then an EIS would be prepared for the project. If not, a Decision Record (DR) may be signed for the EA approving the selected alternative, whether the Proposed Action or another alternative. A DR, including a FONSI statement, documents the reasons why implementation of the selected alternative would not result in "significant" environmental impacts (effects) beyond those already addressed in the Book Cliffs Resource Management Plan (RMP) (BLM 1985).

In brief, surface-disturbing activities under the Proposed Action would include the construction, drilling, and completion of up to 510 proposed gas wells drilled from 362 well pads. The Proposed Action also involves the construction of about 77 miles of proposed access roads co-located with pipeline, approximately 32 miles of pipeline located along existing roads, and expansion of the existing LCU Compressor Station by approximately 15 acres in order to accommodate approximately 11,500 horsepower (hp) of additional compression. Pipelines would be buried where operationally and topographically feasible, unless resource considerations, as determined by the appropriate surface management agency (SMA), dictate the necessity for a surface-laid pipeline.

1.2 BACKGROUND

The LCPA encompasses about 33,241 acres of land. Within the LCPA are numerous existing gas gathering pipelines and road ROWs that extend out of the LCPA boundary to provide access to existing sales pipelines and access roads to nearby municipalities. The LCPA is located about 32 miles south of Vernal, Utah (**Appendix A**, **Figure 1-1**), and is near Hill and Willow Creeks. About 73 percent (24,272 acres) of the LCPA occurs on public lands administered by the BLM, about 10 percent (3,277 acres) is administered by the School and Institutional Trust Lands Administration (SITLA), about 14 percent (4,724 acres) is owned by the Ute Tribe, and the remaining 3 percent (968 acres) of the surface lands are privately owned (**Table 1-1**).

XTO has prepared a development plan for the LCPA which includes the HCU, LCU, and BPU. These units are located about 32 miles south of Vernal in northeastern Utah. Background information about each of the three units is provided below. A map showing the location of the three units is provided in **Appendix A** (**Figure 1-2**). The surface and mineral land ownerships in each unit and the total LCPA acreages are provided below in **Tables 1-1** and **1-2**, respectively.

Table 1-1. Surface Ownership of the Hill Creek, Little Canyon, and Big Pack Units[1]

Ownership	Hill Creek Unit (acres)	Little Canyon Unit (acres)	Big Pack Unit (acres)	Total (acres)
BLM	1,064 (20%)	6,126 (76%)	17,082 (86%)	24,272 (73%)
SITLA	0	1,384 (17%)	1,893 (10%)	3,277 (10%)
Ute Tribe	3,993 (75%)	343 (4%)	388 (2%)	4,724 (14%)
Private	291 (4%)	269 (3%)	408 (2%)	968 (3%)
Total	5,348 (100%)	8,122 (100%)	19,771 (100%)	33,241 (100%)

[1]The acreage is approximate, based on Geographic Information System (GIS) data.

Table 1-2. Mineral Ownership of the Hill Creek, Little Canyon, and Big Pack Units[1]

Ownership	Hill Creek Unit (acres)	Little Canyon Unit (acres)	Big Pack Unit (acres)	Total (acres)
BLM	4,473	6,109	17,281	27,863 (84%)
SITLA	640	1,820	1,930	4,390 (13%)
Indian Allotted	348	0	0	348 (1%)
Private/Patented	0	120	520	640 (2%)
Total	5,461	8,049	19,731	33,241 (100%)

[1]The acreage is approximate, based on GIS data.

1.2.1 Hill Creek Unit

The HCU consists of approximately 5,348 acres in Sections 27, 28, 29, 30, 31, 32, 33, and 34, Township (T) 10 South (S), Range (R) 20 East (E). The HCU is located within lands owned or administered by the Bureau of Land Management (BLM), Bureau of Indian Affairs (BIA) – Uintah and Ouray Agency and the Ute Indian Tribe, and private landowners.

1.2.2 Little Canyon Unit

The LCU consists of approximately 8,122 acres in portions of Sections 25, 35, and 36 in T10S, R20E; Sections 1-4, 8-12, 17, and 18 in T11S, R20E; and Section 6, T11S, R21E. Lands within the LCU are owned or administered by the BLM, SITLA, BIA – Uintah and Ouray Agency and the Ute Indian Tribe, and private landowners.

1.2.3 Big Pack Unit

The BPU consists of approximately 19,771 acres in Sections 13, 14, 15 and 19-36, in T11S, R 20E; Sections 1-12 and 18 in T12S, R20E. Land within the BPU is owned or administered by the BLM, SITLA, BIA – Uintah and Ouray Agency and the Ute Indian Tribe, and private landowners. The BPU is an exploratory unit, which means that under Federal lease agreements, both the BLM and leaseholder have specific drilling time frames to meet for obligation wells at specified locations.

1.3 PURPOSE AND NEED FOR THE PROPOSED ACTION

XTO's purpose and need for the proposed project is to exercise their valid lease rights and extract leased natural gas within the LCPA. XTO's objective for the project is to develop the LCPA on approximately 40-acre spacing, as allowed by topography. This development would require expansion of the existing and installation of new infrastructure including roads, pipelines, and supporting facilities such as tanks, dehydrators, and compressors. At full field development, ultimate daily production volume for all 510 wells is anticipated to be approximately 196 million cubic feet per day (MMcf/d) (i.e., from HCU - 38 MMcf/d, LCU - 29 MMcf/d, and BPU - 128 MMcf/d). Over the average 25-year life span of the 510 wells, production could exceed 1,788 billion cubic feet (Bcf) for all 510 wells.

The BLM's need for the proposed project is to allow XTO to commercially develop their current leases within the LCPA in accordance with their valid lease rights. National mineral leasing policies, and the regulations by which they are enforced, recognize the statutory right of leaseholders to develop mineral resources to meet continuing national needs and economic demands, as long as undue environmental degradation is not incurred. Increased development of oil and gas resources in an environmentally responsible manner is necessary to satisfy the Federal Energy Policy (set out by the National Energy Policy Development Group in 2001). BLM's objectives are to consider approval of the Proposed Action and alternatives in a manner that is consistent with management objectives identified in the RMP, is consistent with the lease rights granted to XTO, and prevents unnecessary or undue degradation of public lands.

1.4 CONFORMANCE WITH BLM LAND USE PLANS

The management of BLM public lands and resources within the LCPA is directed and guided by the *Final Environmental Impact Statement on the Book Cliffs RMP* (BLM 1984) and *Record of Decision and Rangeland Program Summary for the Book Cliffs RMP* (BLM 1985). The Book Cliffs RMP allows for processing of APDs and ROW grant applications in support of oil and gas leasing operations with the impacts of construction and operation activities (e.g., construction of roads, drilling of wells, operation of compressor stations, etc.) to be analyzed on a case-by-case basis.

Implementation of Alternative A - the Proposed Action; or Alternative B - Conservation Alternative, would respond to the Book Cliffs RMP management objective by allowing XTO to develop natural gas resources in the LCPA, while minimizing or avoiding the potential impacts of construction and operational activities on natural resources. Alternative B would allow development of natural gas resources in the LCPA by imposing additional environmental protection measures designed to further reduce potential effects of development. Implementation of Alternative C – the No Action Alternative would not approve the proposed development on BLM-administered public lands, but would allow access across BLM-administered public lands for development of natural gas resources on non-BLM-administered public lands. However, Alternative C would be in conformance with the Book Cliffs RMP as it would not preclude future development projects in the area from consideration and potential implementation. Therefore, the Proposed Action and both Alternatives B and C would be in conformance with the existing RMP.

1.5 RELATIONSHIP TO STATUTES, REGULATIONS, OR OTHER PLANS

Oil and gas development on Federal lands is managed by numerous laws and regulations that affect resource recovery and surface management. The statutes relating to mineral development on BLM surface include but are not limited to:

Mineral Leasing Act (1920) (30 USC 181-263), as amended – Authorizes the Secretary of the Interior to issue leases for the extraction of certain minerals (including oil and gas).

Federal Land Policy and Management Act (FLPMA) of 1976 (43 USC 1701 et seq.) as modified – Requires that the BLM consider multiple uses for the lands it administers. FLPMA specifies that the BLM consider the land's inherent natural resources, as well as its mineral resources when making land management decisions.

National Environmental Policy Act (NEPA) of 1969 – NEPA is the national charter for protection of the environment. Any Federal action that has the potential to affect the human environment is subject to NEPA. This EA was prepared by the BLM in accordance with NEPA and in compliance with all applicable regulations and laws passed subsequently, including the President's Council on Environmental Quality regulations. This EA assesses the effects of the Proposed Action and the alternatives on the environment, and also serves to document public participation and the decision-making process of this NEPA action.

The Proposed Action and the alternatives carried through in this assessment are consistent with the Uintah County General Plan, as amended. The Uintah County General Plan generally indicates support for development proposals in its emphasis of multiple-use public land management practices and its emphasis of responsible use and optimum utilization of public land resources. Within the Uintah County General Plan, multiple-use is defined as including, but not limited to, the following historically and traditionally practiced resource uses: grazing, recreation, timber, mining, oil and gas development, agriculture, wildlife habitat, and water resources as they become available or as new technology allows.

There are no comprehensive State of Utah plans for the LCPA. SITLA has leased all of the State lands within the LCPA for oil and gas production. Because the objectives of SITLA are to produce funding for the State's school system, and because production on Federal leases could lead to further interest in drilling State leases in the area, the Proposed Action and the alternatives are assumed to be consistent with the objectives of the State.

Tribal lands within the LCPA are part of the Uintah and Ouray Indian Reservation. Development proposals involving Tribal land are be subject to the authority of the BIA – Uintah and Ouray Agency, and the Ute Indian Tribe. A formal management plan does not exist for the Uintah and Ouray Indian Reservation. The elected Ute Tribe Business Committee and the BIA determine approval of land use activities on Tribal lands. Allottee mineral owners usually receive the benefit of surface damage payment, annual rentals, and royalties. Where Tribal/allottee land is underlain by Federal or State minerals, the Tribe would establish a surface use agreement with XTO and may receive any or all of the following: surface damage payments, annual rentals, and a through-put fee per quantity of gas. Production from Tribal minerals on Tribal surface provides royalties, tax revenues, and surface access and use fees to the Tribe, which contributes to the Tribe's economic independence. The Proposed Action and alternatives set out in this document, except the No Action Alternative, are consistent with the BIA's regulatory responsibilities, which include promoting the economic development objectives of the Ute Indian Tribe under its

government-to-government relationship with, and trust responsibility to, the Tribe. Thus, the range of the BIA's reasonable alternatives is limited to those that would serve the Tribe's economic development objectives consistent with the trust responsibility.

In May 1997, the Utah BLM published Standards for Rangeland Health and Guidelines for Grazing Management for BLM Lands in Utah. These standards for rangeland (ecological) health were developed to ensure that various services, activities, and all renewable resources of the land are environmentally sustainable, and that non-renewable resources are recovered in ways that ensure the long-term health of the land managed by the BLM. These standards cover upland soils, riparian systems, plant and animal communities, threatened and endangered species, and water quality. These standards describe the conditions needed to sustain public health on BLM-managed lands.

1.6 IDENTIFICATION OF ISSUES

On October 17, 2006, announcement of the Proposed Action was posted on the Environmental Notification Bulletin Board which provides notice for of all BLM actions subject to NEPA occurring in each of the Utah Field Offices.

The BLM requires that the type and magnitude of potential impacts to the Critical Elements of the Human Environment (CEHE) be addressed during the NEPA process (BLM 1988; BLM 2003a). All resources considered during the preparation of this EA, including the CEHE, have been identified in the Interdisciplinary Team (IDT) Analysis Record (refer to **Appendix B**). Those elements which are identified in the checklist as "Not Impacted" (NI) or "Not Present" (NP) in the LCPA are not discussed in the text of this EA. The elements or issues with a "Potential Impact" (PI) are considered further in this EA. The elements or issues presented below are discussed in the same order in **Chapter 3** (Affected Environment) and **Chapter 4** (Environmental Effects).

1.6.1 Air Quality

- Fugitive dust, resulting from increased construction and traffic, could affect air quality.
- Emissions from proposed compressors at the existing compressor station could affect air quality.

1.6.2 Water Resources

- Surface-disturbing activities would result in the removal of, or disturbance to, LCPA vegetation and soils during construction activities. Disturbance of soils could potentially lead to increased soil compaction, soil erosion, and sediment yield. Sediment could enter Hill and Willow Creeks and ultimately the Green River, thereby potentially affecting surface water quality and aquatic habitats.
- Construction and operation of wells, pipelines, and associated facilities could potentially result in spills to the Green River. Such spills have the potential to affect surface water quality and aquatic habitats.
- Development within or near floodplains associated with Willow and Hill Creeks could affect these floodplains.

1.6.3 Soils

- Surface-disturbing activities could lead to increased loss of topsoil, which could ultimately reduce site productivity.
- Surface-disturbing activities could lead to increased sediment yield to the Green River.

1.6.4 Vegetation, Including Special Status Plant Species and Fuels/Fire Management

- Surface-disturbing activities could negatively affect individual plants and potential habitat of the Graham's beardtongue (*Penstemon grahamii*).
- Surface-disturbing activities would result in loss of vegetation during construction activities, thereby resulting in an associated loss of wildlife habitats, increased erosion and sediment yield, and the potential for invasive and noxious weed invasion.
- Surface-disturbing activities could negatively affect individual plants and potential habitat of the shrubby reed-mustard (*Schoenocrambe suffrutescens*), clay reed- mustard *(Schoenocrambe argillacea*), and Uinta Basin hookless cactus (*Sclerocactus wetlandicus).*
- LCPA includes vegetation types potentially susceptible to wildfire events and/or planned vegetation management manipulation projects. Therefore, project activities could potentially lead to increased fire risk.

1.6.5 Wetlands/Riparian Zones

- Surface-disturbing activities within or near the riparian zones of Hill and Willow Creeks could affect wetlands and riparian habitats.

1.6.6 Invasive and Noxious Species

- The proposed development could introduce invasive and noxious species to the LCPA.
- The proposed development could contribute to an increase in density and occurrence of invasive and noxious species in and surrounding the LCPA.

1.6.7 Fish and Wildlife, Including Special Status Wildlife Species

- Surface-disturbing activities and surface occupancy by project facilities could result in the loss of and/or disturbance to occupied and/or potential habitat for a variety of wildlife species, including big game species, special status species, and migratory bird species.
- Noise-generating activities associated with ongoing operations such as construction equipment, compressor engines, and increased road traffic, could result in an increase in ambient noise levels and potentially affect wildlife.
- Impacts to the Willow and Hill Creeks could negatively affect endangered fish and their designated critical habitat.
- The proposed development could affect wintering bald eagles habitat within the LCPA.

1.6.8 Livestock Grazing

- Construction and operation of wells, pipelines, and associated facilities could affect livestock management and operation activities in the LCPA, (e.g., increased difficulties in controlling livestock or loss of existing livestock-related structures).

1.6.9 Cultural Resources

- Surface-disturbing activities could result in damage to or loss of cultural resources including sites, structures, and objects.
- Increased human presence and motorized access in the LCPA could increase the level of vandalism and theft of cultural resources.

1.6.10 Native American Religious Concerns

- Surface-disturbing activities could result in damage to or loss of important Native American religious sites and materials including cemetery, burial sites, and materials.
- Increased human presence and motorized access in the LCPA could increase the level of vandalism and theft of important Native American religious sites and materials.

1.6.11 Paleontology

- Disturbance of soils and underlying bedrock could result in damage to and/or loss of fossil resources.
- Disturbance of soils and underlying bedrock could result in discovery and subsequent cataloguing of fossil resources.

1.6.12 Socioeconomics

- The Proposed Action and alternatives would have a positive effect on the socioeconomics of local cities and towns surrounding the LCPA by creating jobs and generating revenues, taxes, and royalties.

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2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

This chapter details XTO's Proposed Action as submitted to the BLM Vernal Field Office (FO) for the LCU, HCU, and BPU (collectively termed in this EA as the LCPA) and two alternatives to the Proposed Action. The alternatives to the Proposed Action consider development strategies with additional environmental protection measures (AEPMs) within the LCPA, and the required No Action Alternative. A total of three alternatives will be analyzed in this EA:

Alternative A - Proposed Action

This alternative consists of the development strategy proposed by XTO to develop natural gas resources within the LCPA (**Appendix A**, **Figure 2-1**).

Alternative B – Conservation Alternative

This alternative is a variation of the Proposed Action that comprises an identical development scenario, but includes AEPMs as a part of the proposed development plan (**Appendix A**, **Figure 2-1**).

Alternative C - No Action

This alternative, required by NEPA and the Council on Environmental Quality regulations, considers no new well pads or wells on Federal lands within the LCPA (**Appendix A**, **Figure 2-2**).

2.2 CHAPTER LAYOUT

The three alternatives share a number of common features related to construction, operation, and reclamation activities. **Section 2.3** provides information on the details common to the three alternatives. Differences between the Proposed Action and the alternatives, or features unique to an individual alternative, are provided within the alternative-specific discussions in **Sections 2.4** through **2.6**. The three alternatives are compared in **Section 2.7.** Two additional alternatives for this project were considered by the BLM, but were eliminated from further analysis. The alternatives considered but dismissed from analysis are discussed in **Section 2.8**.

2.3 DETAILS COMMON TO ALL ALTERNATIVES

The development scenarios presented in **Figures 2-1** and **2-2** (**Appendix A**) are conceptual in nature and are based upon well spacing allowances and geological features. Onsite inspections of individual well pads, access roads, pipelines, and other surface facility locations by the appropriate surface management agency (SMA) would occur during the permitting process and site-specific adjustments to locations, size, and orientation would be made at that time.

2.3.1 Construction, Production and Reclamation

Implementation of the Proposed Action or any of the alternatives would occur in three primary phases: construction, drilling, and completion; production and maintenance; and decommissioning and reclamation. These three development phases are discussed below.

2.3.1.1 Construction, Drilling, and Completion

Construction activities on Federal lands would follow guidelines set out in the *Surface Operating Standards for Oil and Gas Exploration and Development,4th edition* (also known as the "Gold Book") (BLM and USFS 2007), as well as other applicable guidelines, including American Petroleum Institute 1104 *Welding of Pipelines and Related Facilities* (API 1999), or the most recent edition. Construction activities on State and private lands would follow Utah Division of Oil, Gas, and Mining (UDOGM) guidelines.

Well Pads

Prior to well pad construction or surface-disturbing activities, the lessee or operator would obtain approval of an APD or other surface use permit by the appropriate SMA or private land owner. Each permit would contain site-specific Conditions of Approval (COAs) that would apply to construction and well operations.

Well pad construction would consist of roughing in an access road to the well pad location and then leveling a roughly rectangular pad by balancing cut and fill areas. Well pads would be constructed from the native sand/soil/rock materials present. Stockpiles for both topsoil and subsoil would be established and maintained for future use in rehabilitating the location upon abandonment. Depending on the amount of cut and fill required to level each site, these stockpiles would occupy about 0.5 acres along the edge of the well pad.

A small reserve pit would be excavated opposite to the working area of each well pad. To assure stability, the pit would be constructed on the cut portion of the pad. Again, topsoil would be stockpiled for future redistribution. The pit would not be constructed in a natural drainage, where flood hazards exist, or where surface run-off could enter the pit or damage the pit walls. To avoid impacts to soils and shallow groundwater, the pit would be lined with a synthetic liner with a minimum of 16-mm thickness. If bedrock is encountered during excavation, a felt liner pad would be used to protect the synthetic liner from puncture. The depth of the pit would be about 12 feet, with a minimum of 2 feet of freeboard maintained at all times. Three sides of the reserve pit would be fenced before drilling, and the fourth side would be fenced as soon as drilling is completed. Reserve pits would be reclaimed within 180 days from the date of well completion, or as soon as practical, based on weather conditions or other site-specific timing constraints. The subsoil and liner would be pushed back into the pit, and the topsoil would be re-spread and reseeded.

Size of well pads would vary depending upon the number of wells to be drilled from the pad, but would be constructed to safely accommodate drill rigs, associated equipment, vehicles, and ancillary facilities needed for construction, drilling, and completion. Each newly constructed well pad would initially occupy approximately 2.5 acres. However, each well pad utilized for proposed directional drilling would be expanded by about 0.5 acres for each additional directionally drilled well. This acreage would include reopening previously utilized reserve pits (i.e., about 0.4 acres), and expanding the existing pads to accommodate drilling equipment and additional well heads and production facilities. Based on these assumptions, the average initial well pad size would be approximately 2.7 acres[1]. Following all drilling and completion activities,

[1] The following assumptions were used to calculate the average initial well pad size of 2.7 acres. As each well pad would initially occupy about 2.5 acres, surface disturbance associated with drilling 362 vertical wells would be about 905 acres. In addition, as each well pad utilized for proposed directional drilling would be expanded by about 0.5 acres for each additional directionally drilled well, surface disturbance

portions of well pads not needed for production activities would be reclaimed in accordance with the standards of the appropriate SMA.

Drilling and Completion Operations

Drilling operations would be conducted in compliance with all Federal Oil and Gas Onshore Orders, all UDOGM rules and regulations, and all applicable local rules and regulations. The alternatives include a combination of vertical and directional wells. The time required to drill a single vertical well would be about 10 to 15 days. The time required to drill a single directional well varies based upon the geologic characteristics of the location, but generally takes longer than vertical wells, or about 15 to 20 days.

Drilling operations would be conducted in two phases. The first phase would utilize a surface-hole rig and an air mist system to drill to a depth of about 2,000 feet. During the second phase, a larger rotary drilling rig with conventional mud system would be mobilized to drill the remainder of the hole, the total depth of which would be determined by the target formation. The larger rig would pump fresh water as a circulating fluid to drive the mud motor, cool the drill bit, and remove cuttings from the wellbore. Prior to drilling below the surface casing, a blowout preventer (BOP) would be installed on the surface casing and both the BOP and surface casing would be tested for pressure integrity. The BOP and related equipment would meet the minimum requirements of Onshore Oil and Gas Order No. 2.

Drill cuttings from the wellbore (mainly shale, sand, and miscellaneous rock minerals) and drilling fluids carried over with the cuttings would be held in the reserve pit.

Upon drilling the hole to total depth, a series of data-logging tools would be run in the well to evaluate the potential hydrocarbon resource. If the evaluation concludes that adequate hydrocarbon resources are present and recoverable, then steel production casing would be run and cemented in place in accordance with the well design, as approved in the APD, and any applicable COAs. The types of casing used, and the depths to which they are set, would depend upon the physical characteristics of the formations that are drilled. The casing and cementing program would be designed to isolate and protect the various formations encountered in the wellbore and to prohibit pressure communication or fluid migration between zones. Once production casing has been cemented in place, the drill rig would be removed and a completion rig would be moved in.

Well completion consists of running a Cement Bond log to evaluate the cementing integrity, correlating (on depth) the cased hole logs to the open hole logs, perforating the casing across the hydrocarbon producing zones, and initiating a stimulation treatment of the formation to enhance its transmissibility of oil and gas. The typical stimulation used in the LCPA is a hydraulic fracture treatment of the reservoir, wherein freshwater/sand slurry is pumped into the producing formation with sufficient hydraulic horsepower to fracture the rock formation. The sand serves as a proppant to keep the created fractures open, thereby allowing reservoir fluids to move more readily into the well.

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associated with drilling 148 directional wells would be about 74 acres. Therefore, the total surface disturbance associated with drilling up to 510 wells from 362 well pads would be about 979 acres, or approximately 2.7 acres per well pad (i.e., 979 acres ÷ 362 well pads ≈ 2.7 acres per well pad).

Water Use

Water required for the drilling and completion of the proposed gas wells would be hauled by truck from a combination of the permitted water sources described below in **Table 2-1.** The water volume needed to drill and complete an individual well is dependent upon the depth of the well and any losses that might occur during drilling. However, based on the operator's previous experience with wells drilled in the area, approximately 21,000 barrels (bbls) (2.7 acre-feet) of water would be needed to drill and complete each well. While a portion of the water used for drilling and completion of wells would be recycled from other XTO wells, the majority of water used would be fresh water hauled to the proposed wells.

In addition to water for drilling and completion, approximately 1,000 bbls (0.13 acre-feet) of water per well pad and associated access roads would be utilized for dust abatement each year. Other dust suppressants could be used, if determined to be more effective and/or appropriate by the SMA or land owner.

Following drilling and completion activities, water usage would be limited to dust abatement for the life of the project.

Table 2-1. Water Sources for Drilling, Completion, and Dust Suppression

Water Right Number	Filing Date	Source	Location	Allowed Annual Withdrawal
43-10991	December 17, 1999	Underground Water Well	N 1,160 ft.; W 500 ft. from NE corner Section 9, T8S, R20E	183.9 acre-feet
49-1645	December 6, 2001	Underground Water Well	N 300 ft.; E 400 ft. from W ¼ Section 9, T8S, R20E	50 acre-feet
49-2262	May 25, 2007	Ponds	N 4,820 ft.; W 1,200 ft. and N 4,850 ft.; W 700 ft. from S1/4 Section 33, T8S, R20E	20 acre-feet
49-2158	April 8, 2003	Green River	S 570 ft.; W 3,150 ft. from NE corner Section 33, T8S, R20E	20 acre-feet
49-2189	October 6, 2004	Green River	S 570 ft.; W 3,150 ft. from NE corner Section 33, T8S, R20E	20 acre-feet
Tribal Resolution 06.183	August 15, 2006	Willow Creek	NE Section 22, T10S, R20E	Not Specified

Access Roads

Under all alternatives, existing roadways would be used where possible and new roads would be constructed where needed. Existing roads in the area would provide the primary trunk roads for access to the new well pads. Proposed roads, which would consist of spurs connecting the trunk roads to the well pads, are expected to cross all surface owners' lands. Prior to any construction, improvement, or maintenance on county-claimed roads, lessees or operators would coordinate with the Uintah County Road Department to obtain appropriate permits for road use, construction, and maintenance.

New access roads would be built in accordance with the "Gold Book" (BLM and USFS 2007). However, site-specific requirements for road construction would be determined according to the specifications of the appropriate SMA or private land owner.

New roads would be constructed within a 75-foot wide ROW which would accommodate both new access roads and proposed pipelines. However, the travel width of the road would only occupy a 22-foot wide running surface. Construction materials necessary for the proposed new and upgraded access roads would consist of native borrow and soil accumulated during road construction. Access roads would be constructed using standard equipment and techniques. Bulldozers and/or road graders would first clear vegetation and topsoil from the ROW. These materials may be windrowed for future redistribution during the reclamation process. The surface would be crowned to facilitate drainage to a borrow ditch designed to minimize erosion potential. New access roads would be crowned (2 to 3 percent), ditched, and constructed to meet the standards of the anticipated traffic flow and all weather requirements, Surface materials would consist of native soil whenever possible. Graveling or capping the roadbed may be performed as necessary to provide a well constructed, safe road. If additional surfacing materials are required beyond those available during excavation and construction, they would be purchased from a local contractor having a permitted source of materials. Prior to construction, the ground would be allowed to dry completely, and no road construction would take place when soils are frozen.

Timing of new road construction would be dependent upon the drilling schedule, topographic constraints, and weather conditions. Roads would generally be constructed two to three weeks prior to well pad construction. The roads would have a design speed of approximately 20 miles per hour (mph).

Dust suppression would occur throughout the LCPA. Water would be utilized for both general and enhanced dust suppression. Other dust suppressants could be used, if determined to be more effective and/or appropriate by the SMA or land owner (refer to AEPMs for details on dust suppression within occupied habitat for special status plant species).

A Transportation Plan for this EA can be found in **Appendix C**.

Pipelines

Gathering (ancillary) pipelines with a 4 to 12-inch outside diameter (OD) would be installed to transport produced gas from the wells to larger lateral (or trunk) lines. Lateral pipelines with up to 30-inch OD would also be installed as needed, depending on well performance and gathering system requirements, to transport gas from the LCPA to sales points outside the LCPA. Both gathering and lateral pipelines would be placed within the 75-foot ROW adjacent to new access roads, or within a 45-foot wide ROW along existing roads. Pipelines would be buried where operationally and topographically feasible, unless resource considerations, as determined by the appropriate SMA, dictate the necessity for surface-laid pipeline. For the purposes of surface disturbance calculations, it is assumed that the entire length of pipeline would be buried.

To ensure safe operation of the pipelines, pipeline systems would be designed to operate at a Maximum Allowable Working Pressure of 913 pounds per square inch (psi) for low-pressure (ancillary) lines and 1,262 psi for high-pressure (trunk) lines. After construction is complete, pipelines would be pressure tested using either established air or water methods to verify the pipeline's integrity. The appropriate SMA would approve the water testing and methods to discharge test water through the site-specific applications. If water is used to test pipelines, water would be obtained from a combination of the permitted water sources described in **Table 2-1.**

Equipment needed to bury the proposed pipelines would include trucks and flat bed trailers for stringing, a bending machine, welding rigs, side-booms, backhoes, and pick-up trucks. This equipment may be present on LCPA roads as each step of the construction process is completed. All equipment used to install the pipelines would use the adjacent access roads as a working surface. The pipelines would be installed to avoid interference with normal travel and maintenance of the roadway. Aggregate material to pad pipeline trenches would primarily be obtained onsite, via the use of materials collected during trench excavation. If additional padding materials are needed, they would be acquired from an approved aggregate borrow site or facility.

2.3.1.2 PRODUCTION AND MAINTENANCE

Well Production

Generally, once producing, a completed well pad could include a well head, a separator, tanks for storing condensate and water, a dehydration unit, a pumping unit, and a meter house. Exact facilities and equipment may vary slightly and additional facilities would be necessary for well pads from which multiple wells are drilled.

During production operations, lessees or operators would maintain a Spill Prevention, Control and Countermeasure (SPCC) Plan, that outlines the methodology to be used in the event of a spill. If any spills of oil, gas, salt water, or other fluids of reportable quantities occur, lessees or operators would immediately contact the appropriate SMA, or private land owner, and any other appropriate regulatory agencies. Cleanup efforts would be initiated immediately in accordance with appropriate regulations.

In general, XTO would use remote telemetry to monitor daily well operations, which would reduce the need for daily visits by pumpers. However, for the purposes of providing a conservative analysis for this project, it is assumed that each well (particularly during initial production) could be visited by a pumper on a daily basis. If workovers are needed, additional vehicles and equipment would be onsite during the workover process.

Currently, produced water and condensate within the LCPA is decanted into external steel tanks that are located on existing well pads. Containment dikes constructed either of compacted subsoil or metal barriers currently surround these facilities and hold 110 percent of the capacity of the largest tank. Currently, each tank is pumped periodically as needed and trucked out of the project area, and water is transported to certified disposal sites or existing water injection wells in other lease areas.

As additional wells come online in the LCPA, the amount of water produced from downhole formations would increase. To decrease the amount of truck traffic that would be needed to transport and dispose of such water, XTO proposes to install produced water pipelines from existing and proposed well pads to two proposed SWD wells where produced water would be reinjected: the HCU 1-28F 28-10S-20E and the LCU 1-2H 2-11S-20E. Permitting requirements for these SWD wells is ongoing.

Produced water pipelines would be placed adjacent to the proposed gas pipelines, within the ROW for co-located roads and pipelines. Pipelines would be buried where operationally and topographically feasible, unless resource considerations, as determined by the appropriate surface management agency (SMA), dictate the necessity for a surface-laid pipeline.

Project Area Maintenance

Trash containers and portable toilets would be located at construction sites during the construction, drilling, and completion phase. Toilet holding tanks would be regularly pumped and their contents would be disposed of at the Vernal municipal sewage facility, in accordance with applicable rules and regulations regarding sewage treatment and disposal. Accumulated trash and nonflammable waste materials would be hauled to the Uintah County landfill once a week or as often as necessary. All debris and waste materials not contained in the trash containers would be cleaned up, removed from the ROW, and disposed of at the Uintah County landfill, as needed. No potentially harmful materials or substances would be left in the LCPA. Scrap metal and other recyclable refuse would be hauled to the XTO yard in Roosevelt, Utah on a regular basis.

Any hydrocarbons remaining in the reserve pit would be removed as soon as possible and processed or disposed of at an appropriate offsite commercial facility. Drilling mud/water would be allowed to evaporate in the reserve pit for a maximum of 180 days, and any remaining fluids would be hauled offsite to a licensed, commercial disposal facility. Cuttings generated during the drilling process would be buried in the reserve pit following the removal of any excess liquids.

Chemicals subject to reporting under SARA Title III (hazardous materials including diesel fuel, produced hydrocarbons, drilling fluids, etc.) would be present during various phases of the project including drilling, testing, completion, and production. Annual Tier II chemical inventory reports would be prepared and submitted to emergency response agencies per Federal and State requirements.

Sanitary facilities would be onsite at all times during drilling and completion operations. Sewage would be placed in a portable chemical facility and disposed of periodically in an approved sewage disposal facility in Vernal, Utah.

Noxious and Invasive Weed Control

Noxious and invasive weed infestations on disturbed surfaces would be controlled by spraying or mechanical removal. Approval by the appropriate SMA or private land owner would be obtained prior to any application of herbicides, pesticides, or other potentially hazardous chemicals. On BLM-administered land, a Pesticide Use Permit would be submitted and approved by the BLM prior to the application of herbicides, pesticides, or other hazardous chemicals.

2.3.1.3 DECOMMISSIONING AND RECLAMATION

Interim Reclamation

Following completion activities, the lessee or operator would reduce the size of each well pad to the minimum surface area needed for production activities, while providing for adequate safety. All disturbed areas not necessary for drilling and production operations would undergo the following reclamation standards after completing dirt work and operations:

- Portions of well pads and ROWs not utilized for the operational phase of the project would be reseeded using seed mixtures determined by the appropriate SMA or private land owner.
- Post-construction seeding applications and reclamation practices would continue as needed, until 70 percent of vegetative cover in a comparative or adjacent area has been reestablished

in the revegetated area. For more detailed reclamation actions, refer to the Reclamation Plan (**Appendix D**) written for this EA.

Well Abandonment and Final Reclamation

Dry holes would be plugged immediately after receiving authorization and plugging instructions from the appropriate mineral estate agency. Well pads, associated roads, and other facilities would be reclaimed as soon as feasible after plugging to minimize erosion.

The life span of individual producing wells may vary. However, the typical life span of a well is estimated to be 20 to 30 years (average of 25 years assumed for analysis purposes). Abandonment of a well and its facilities would be performed in compliance with all applicable regulations. All hydrocarbon- and water-bearing horizons in an abandoned well bore would be isolated via cement plugs. At the time of final abandonment, all aboveground facilities would be removed.

Abandoned well pads, roads, or other disturbed areas would be restored to near original condition. Reclamation includes re-establishing soil conditions and ensuring revegetation of the disturbed areas to the specifications of the appropriate SMA or private land owner at the time of abandonment. All disturbed surfaces would be re-contoured to the approximate natural contours, with reclamation of the well pad and access road performed as soon as practical after final abandonment. Seed mixtures used in the reclamation process would be approved by the appropriate SMA or private land owner. Reclamation practices would continue as needed, until determined successful by the appropriate SMA or the private land owner. For more detailed reclamation actions, refer to the Reclamation Plan (**Appendix D**) written for this EA.

2.4 ALTERNATIVE A - PROPOSED ACTION

2.4.1 Construction, Drilling, and Completion

Under the Proposed Action, XTO proposes to drill a total up to 510 natural gas wells from 362 well pads, to the Wasatch Formation or Mesaverde Group on approximately 40-acre downhole spacing. About 29 percent of the 510 wells, or 148 wells, would be directionally drilled from the 362 well pads. As such, some proposed well pads would accommodate multiple wells. Approximately 77 miles of new access roads co-located with pipelines would be constructed to service the proposed wells. In addition, approximately 32 miles of new pipeline would be located adjacent to existing roads. Pipelines would be buried where operationally and topographically feasible, unless resource considerations, as determined by the appropriate surface management agency (SMA), dictate the necessity for a surface-laid pipeline. Development of the proposed wells, pipelines, access roads, and ancillary facilities is expected to be completed over a 7-year period with 73 wells drilled from 52 well pads annually. However, favorable economic conditions and evaluation of preliminary drilling results would determine the actual drilling timeframe, as well as the total number of wells drilled and the total acres of disturbance required for construction.

Construction of well pads, roads, and pipelines would occur as described in **Section 2.3.1.1**.

As previously discussed, approximately 21,000 bbls (2.7 acre-feet) of water would be needed to drill and complete each well. As such, the drilling and completion of all 510 proposed wells would therefore consume about 1,377 acre-feet of water over a period of 7 years, for approximately 196 acre-feet per year. In addition to water for drilling and completion,

approximately 1,000 bbls (0.13 acre-feet) of water per well pad and associated access road would be utilized for dust abatement each year. As such, water utilized for dust abatement for a maximum of 362 well pads and associated roads would be approximately 47 acre-feet per year over the 25-year project life (1,175 acre-feet total over life of project).

Based upon these water use estimates, approximately 243 acre-feet of water would be used for drilling, completion, and dust abatement each year during the approximate 7-year development phase of the project. Following drilling and completion activities, water usage would then be limited to approximately 47 acre-feet per year for dust abatement for the remainder of the project life.

2.4.2 Production and Maintenance

New gas production under the Proposed Action would require the installation of approximately 11,500 hp of new compression at the existing LCU compressor station located in Section 36 T10S, R20E. The existing station would be expanded to a total of about 15 acres in size in order to accommodate the additional compressor engines. Additional equipment to be installed at the existing LCU compressor station would include a 50 million standard cubic feet (MMscf) dehydrator unit, dewpoint control, four 400-bbl atmospheric production tanks, and one water scrubber. Produced gas would be transported via pipeline to the existing LCU compressor station and then onto the existing Questar, Comet Gas or Canyon Gas pipelines.

2.4.3 Decommissioning and Reclamation

Decommissioning and reclamation of disturbed areas under the Proposed Action would occur as described in **Section 2.3.1.3**.

2.4.4 Summary of Estimated Surface Disturbance Associated with the Proposed Action

On average, each newly constructed well pad would initially occupy approximately 2.5 acres. Each well pad utilized for proposed directional drilling would be expanded by about 0.5 acres for each additional directional well. This acreage would include reopening previously utilized reserve pits (i.e., about 0.4 acres), and expanding the existing pads to accommodate drilling equipment and additional well heads and production facilities. As the proposed well locations are conceptual in nature, initial disturbance for the 362 well pads was calculated at an average of 2.7 acres per pad. Based on these assumptions, the Proposed Action would result in about 977 acres of initial disturbance from well pad construction.

Under the Proposed Action, approximately 77 miles of co-located pipelines and roads would be constructed. As previously described, a ROW width of approximately 75 feet would be needed to construct and install co-located pipelines and roads, resulting in initial disturbance of 715 acres. The proposed 32 miles of new pipelines installed along existing access roads would require a 45 foot wide ROW, resulting in initial surface disturbance of approximately 175 acres. The expanded LCU compressor station is expected to occupy an additional 15 acres.

In total, the well pads, associated road and pipelines, and expanded compressor station would result in about 1,882 acres of initial disturbance occupying about 5.7 percent of the LCPA. **Table 2-2** summarizes estimated surface disturbance associated with the Proposed Action.

Table 2-2. Estimated Surface Disturbance Resulting from the Proposed Action (Alternative A)

Proposed Structure	Number of Well Pads/Miles of Road/Pipe	Width of ROW or size of Well Pads	Surface Disturbance[1]
Well Pads	362	2.7 acres	977 acres
Co-located Access Road and Pipeline	77 miles	75 feet	715 acres
Pipeline along Existing Road	32 miles	45 feet	175 acres
Existing LCU Compressor	NA	NA	15 acres
Totals	**NA**	**NA**	**1,882**
Percent of Total LCPA[2]	**NA**	**NA**	**5.7%**

[1]Calculations are approximate based upon GIS calculation and rounded to the nearest whole number.
[2]LCPA = 33,240 acres.

2.4.5 Required Environmental Protection Measures

Under the Proposed Action, XTO would adhere to all appropriate statutory and non-discretionary regulatory requirements. The following section includes, but is not limited to, required environmental protection measures that would be implemented to help eliminate or minimize impacts to resources within the LCPA. Onsite inspections by the appropriate SMA for each new well pad, road, pipeline, or other activity would identify the need for each measure listed below, and may identify additional site-specific environmental protection measures necessary to protect sensitive resources.

2.4.5.1 Air Quality

- XTO would comply with all applicable EPA Region 8 air quality laws, statutes, and regulations.
- As required by the EPA Region 8, XTO would obtain all necessary air quality permits to construct, test, and operate facilities.

2.4.5.2 Cultural/Historical Resources

- In accordance with the National Historic Preservation Act (NHPA) of 1966, as amended, prior to any project-related surface disturbance, all locations proposed for surface disturbance would be examined by an archaeologist approved by the appropriate SMA to determine the presence of cultural resources (i.e., Class III cultural resource inventories with 100 percent pedestrian field survey would be completed). Consultation would be completed with the Utah State Historic Preservation Office (SHPO) prior to the onset of development, as set out in existing regulations. If any cultural resources eligible for listing to the National Register of Historic Places (NRHP) are identified, recommendations would be made to avoid or recover such resources.
- If cultural resources are uncovered during surface-disturbing activities, XTO would suspend operations at the site and immediately contact the appropriate Authorized Officer (AO), who would arrange for a determination of eligibility in consultation with the Utah SHPO and if necessary, would recommend a recovery or avoidance plan.

2.4.5.3 Geological/Paleontological Resources

- If paleontological resources are uncovered during surface-disturbing activities, the operator would suspend operations at the site if they would further disturb such materials and immediately contact the appropriate AO, who would arrange for a determination of significance and, if necessary, would recommend a recovery or avoidance plan.

2.4.5.4 Health and Safety/Hazardous Materials

- XTO would institute a Hazard Communication Program for its employees and require subcontractor programs to operate in accordance with Occupational Safety and Health Administration (OSHA) (29 CFR 1910.1200).
- As required by OSHA, XTO would place warning signs near hazardous areas and along roadways.
- In accordance with 29 CFR 1910.1200, a Material Safety Data Sheet (MSDS) for every chemical or hazardous material brought onsite would be kept on file in XTO's field office.
- XTO would transport and/or dispose of any hazardous wastes, as defined by the Resource Conservation and Recovery Act (RCRA) of 1976, as amended, in accordance with all applicable Federal, State, and local regulations.
- All storage tanks that contain produced water or condensate, or other fluids which may constitute a hazard to public health or safety, would be surrounded by a secondary means of containment for the entire contents of the tank, plus freeboard for precipitation, or to contain 110 percent of the capacity of the largest tank.
- Production facilities that have the potential to leak produced water or condensate, or other fluids which may constitute a hazard to public health or safety, would be placed within appropriate containment and/or diversionary structures to prevent spilled or leaking fluid from reaching groundwater or surface waters.
- Notice of any reportable spill or leakage, as defined in BLM NTL 3A, would be immediately reported by XTO to the appropriate SMA as required by law. Oral notice would be given as soon as possible, but within no more than 24 hours, and oral notices would be confirmed in writing within 72 hours of any such occurrence.

2.4.5.5 Soils

- On Federal lands, no occupancy or surface disturbance would occur on slopes in excess of 40 percent without written permission of the appropriate AO.
- On Federal lands, the operator may be required to restrict surface disturbance during precipitation events if excessive rutting deeper than 4 inches along a straight vehicle path occurs.
- As generally required in the APD and/or ROW grant, the operator would restrict off-highway vehicle (OHV) activity by employees and contract workers to the immediate area of authorized activity or existing roads and trails.

2.4.5.6 Water Resources

- As required under 40 CFR 112.3(e), XTO would revise and update all existing SPCC plans. In addition, XTO would prepare SPCC plans for all proposed well pads. XTO would also

maintain a copy of the newly created or revised SPCC plan at each facility, if the facility is normally attended at least eight hours per day, or at the nearest field office if the facility is not so attended. XTO would also implement and adhere to SPCC plans in a manner such that if any spills or accidental discharge of oil, gas, salt water, or other fluids of reportable quantities occur, lessees or operators would immediately contact the appropriate SMA or private land owner, and any other appropriate regulatory agencies. Cleanup efforts would be initiated immediately in accordance with appropriate regulations.

2.5 ALTERNATIVE B – CONSERVATION ALTERNATIVE

Development proposed under Alternative B would be identical to the Proposed Action as set out in **Section 2.4** (including surface disturbance calculations outlined in **Table 2-2)**. However, under Alternative B, the operator would adhere to AEPMs to further reduce both direct and indirect impacts to resources from development. These AEPMs are discussed in detail in the following section.

In addition, because of the enhanced dust abatement that would be implemented under the Conservation Alternative, an additional 31 acre-feet of water[1] (approximately 4.4 acre-feet per year over the 7-year development phase) would be needed for dust abatement activities during construction near know shrubby reed-mustard and clay reed-mustard plants (see **Section 2.5.1.5**). Thus total water usage for the 7-year development phase would be approximately 47 acre-feet per year, plus the approximately additional 4.4 acre-feet of water needed during construction activities at locations proposed within 300 feet of shrubby reed-mustard and clay reed-mustard plants, for a total of approximately 51 acre-feet per year during the 7-year development phase, and a total of approximately 1,206 acre-feet for dust abatement over the 25-year life of the producing wells.

2.5.1 Additional Environmental Protection Measures

The following AEPMs were developed during internal scoping to reduce and/or mitigate potential impacts of the proposed natural gas development.

2.5.1.1 Road Usage and Reclamation

- If new road construction would replace an existing road, the operator would reclaim the existing road in accordance with the requirements of the appropriate SMA.

- If it is determined by all parties that a certain access road is no longer used or needed, the operator would reclaim and reseed the road in accordance with the requirements of the ROW owner.

2.5.1.2 Air Quality

- The construction, drilling, and completion crew would be encouraged by the operator to carpool to and from surrounding cities and towns to minimize vehicle-related emissions and fugitive dust.

[1] Conservatively assumes that approximately 1/3 of the proposed well pads would occur within 300 feet of known shrubby reed-mustard and/or clay reed-mustard. Further assumes that to meet the enhanced dust abatement requirement within these areas, three times as much water would be needed for dust abatement.

- Compressor engines would be operated and maintained to minimize emissions.
- XTO would direct well site dehydrator emissions to drip tanks, which would substantially reduce HAP emissions.

2.5.1.3 Water Resources and Floodplains

- Appropriate erosion control and revegetation measures would be employed. In areas with unstable soils where seeding alone may not adequately control erosion, grading would be used to minimize slopes and water bars would be installed on disturbed slopes. Erosion control efforts would be monitored by the operator and necessary modifications would be made to control erosion.
- Where directed by the appropriate SMA, the operator would construct erosion control devices (e.g., riprap, bales, and heavy vegetation) at culvert outlets. All construction activities would be performed to retain natural water flows.
- Removal and disturbance of vegetation would be kept to a minimum through construction site management (e.g., using previously disturbed areas and existing easements where feasible, and, limiting well pad size, etc.).
- On a site-specific basis, berms would be constructed on the side(s) of well pads potentially affected by surface water runoff to minimize the possibility of contaminants entering the floodplains for Hill and Willow Creeks.
- Closed-loop drilling would be utilized for any wells within the 100-year floodplains for Hill and Willow Creeks.
- Production facilities (e.g., well pads, tanks, pipelines, roads, etc.,) would be located outside of the active channels of Willow and Hill Creeks within the LCPA on a site-specific basis.

2.5.1.4 Soil Resources

- Prior to any surface disturbance, site-specific topsoil depths and topsoil storage locations would be determined. Topsoil would be stockpiled for later use.
- Topsoil stockpiles would also be designed to maximize surface area in order to reduce impacts to soil microorganisms.
- Areas used for spoil storage would be stripped of topsoil before soil placement.
- Appropriate erosion control and revegetation measures would be employed in accordance with applicable regulations and in coordination with the appropriate SMA. In areas with unstable soils, where seeding alone may not adequately control erosion, grading would be used to minimize slopes and water bars would be installed on disturbed slopes.
- Erosion control efforts would be monitored by the operator and necessary modifications would be made to control erosion.

2.5.1.5 Vegetation, including Special Status Plant Species, Invasive and Noxious Species, and Fire/Fuel Management

AEPMs designed to reduce direct and indirect impacts to vegetation would include, but not be limited to, the following:

General Vegetation

- Removal and disturbance of vegetation would be kept to a minimum through construction site management (e.g., using previously disturbed areas and existing easements where feasible, and limiting well pad size, etc.).
- Sufficient topsoil or other suitable materials to facilitate revegetation would be segregated from subsoils during all construction operations requiring excavation and would be returned to the surface upon completion of operations. Soils compacted during construction would be ripped and tilled as necessary prior to reseeding. Cut and fill sections on all roads and along pipelines would be revegetated with seed mixtures approved by the appropriate SMA.
- On Federal lands, the operator would work with the BLM to monitor the success of interim and final vegetation reclamation. The operator would monitor sites that have been reclaimed two years prior, as agreed upon by the BLM. The two-year gap would allow seeded areas to become established with vegetation and provide vegetation two full growing seasons for a better measure of success. If the BLM determines that reclamation has not been successful, the operator would reseed the location.

Special Status Plant Species

Graham's Beardtongue

- Measures that would specifically serve to protect Graham's beardtongue include adherence to U.S. Fish and Wildlife Service (USFWS) and BLM jointly developed draft conservation measures for the species, which are provided in **Appendix E**. In brief, these conservation measures include pre-construction surveys in potential habitat, avoidance of known plants, using spatial buffers between surface activities and known populations of plants, limiting off-road travel, and monitoring the effectiveness of these measures.

Shrubby Reed-Mustard

- Measures that would specifically serve to protect the shrubby reed-mustard include adherence to USFWS and BLM jointly developed conservation measures for the species, which are provided in **Appendix E.** The most salient of these measures would include, as feasible, avoidance of surface disturbance within areas that fall within 300 feet of known plants. Where no other option exists and surface disturbance is necessary within 300 feet of known plants, the operators would:
    - Implement enhanced dust abatement techniques during construction activities that occur within 300 feet of known plants. Enhanced dust abatement would specifically entail watering (or the use of other dust suppressants approved by the appropriate SMA and USFWS) on disturbed surfaces every two hours (or as determined necessary by the appropriate SMA and USFWS for other dust suppressants) during active surface-disturbing activities. Exceptions (i.e., when dust suppression would not be necessary) would include periods within 12 hours of a precipitation event or if there is snow cover on the ground where construction activities are occurring.
    - Implement a long-term adaptive monitoring plan that would attempt to document population trends of the plants, and how these populations/plants are affected by construction, drilling, completion, and production activities, including monitoring of invasive and noxious weed infestations. The monitoring plan

would include a study that would identify a representative sample of sites on Federal lands within the LCPA where surface-disturbing activities occur within 300 feet of known plants, as well as a control site where no surface disturbing activities have occurred within 300 feet of known plants. Qualified biologists would monitor these sites on an annual basis for at least three years after surface-disturbing activities during the flowering period to document density of shrubby reed-mustard, general status of the individuals/population, species composition and density of noxious and invasive weeds, and whether additional monitoring is needed. After the first three years of monitoring, the BLM and USFWS would jointly determine on a site-specific basis if additional monitoring is needed. Data collected from these monitoring efforts would be provided to both the BLM and USFWS in an annual formal report. The reports would also include any corrective actions needed to remedy perceived impacts on the shrubby reed-mustard individuals/populations. For example, if the study indicates that noxious and invasive weed infestations are occurring or increasing, the BLM and USFWS would collaborate on the most effective way for the operator to eliminate weeds without affecting the shrubby reed-mustard. Furthermore, if the monitoring efforts indicate that development within 300 feet of known plants appears to be adversely affecting the species, the BLM would re-initiate Section 7 consultation with the USFWS. Specific details of the monitoring plan (e.g., number of survey locations, type of survey technique used, timing of survey, etc.) would be determined by the USFWS and BLM in coordination with the operator.

- In addition to adherence to the conservation measures, the operator would fund the collection of shrubby reed-mustard seed in order to partially mitigate potential seed bank loss that could occur as a result of surface disturbance within suitable or occupied habitat for the species. Seeds collected would be used to aid in final reclamation efforts of the LCPA. Specifically, the operator would fund a seed bank collection to be conducted by Red Butte Garden (RBG) in Salt Lake City, Utah. Field work for the collection would require approximately 3 - 4 visits to the LCPA by qualified specialists at RBG to 1) assess the population, 2) determine flowering period/optimal time for seed collection, and 3) conduct the seed collection(s). RBG's current USFWS permit allows for them to collect up to 1,000 seeds of a listed species (but less than 10 percent of total seed). If, during coordination with the USFWS, it is determined that additional seeds are needed for this effort, RBG would need an additional permit or an amendment to their existing permit from the USFWS. Specific details of the seed collection effort would be determined by the USFWS and BLM in coordination with RBG and the operator.
- In shrubby reed-mustard occupied habitat any spills, regardless of volume, would be reported to the BLM and USFWS.

Clay Reed-Mustard

- Measures that would specifically serve to protect the clay reed-mustard include adherence to USFWS and BLM jointly developed conservation measures for the species, which are provided in **Appendix E**. The most salient of these measures would include, as feasible, avoidance of surface disturbance within areas that fall within 300 feet of known plants. Where no other option exists and surface disturbance is necessary within 300 feet of known plants, the operators would:
    - Implement enhanced dust abatement techniques during construction activities that occur within 300 feet of known plants. Enhanced dust abatement would

specifically entail watering (or the use of other dust suppressants approved by the appropriate SMA and USFWS) on disturbed surfaces every two hours (or as determined necessary by the appropriate SMA and USFWS for other dust suppressants) during active surface-disturbing activities. Exceptions (i.e., when dust suppression would not be necessary) would include periods within 12 hours of a precipitation event or if there is snow cover on the ground where construction activities are occurring.

- Implement a long-term adaptive monitoring plan that would attempt to document population trends of the plants, and how these populations/plants are affected by construction, drilling, completion, and production activities, including monitoring of noxious and invasive weed infestations. The monitoring plan would include a study that would identify a representative sample of sites on Federal lands within the LCPA where surface-disturbing activities occur within 300 feet of known plants, as well as a control site where no surface-disturbing activities have occurred within 300 feet of known plants. Qualified biologists would monitor these sites on an annual basis for at least three years after surface-disturbing activities during the flowering period to document density of clay reed-mustard, general status of the individuals/population, and species composition and density of noxious and invasive weeds, and whether additional monitoring is needed. After the first three years of monitoring, the BLM and USFWS would jointly determine on a site-specific basis if additional monitoring is needed. Data collected from these monitoring efforts would be provided to both the BLM and USFWS in an annual formal report. The reports would also include any corrective actions needed to remedy perceived impacts on the clay reed-mustard individuals/populations. For example, if the study indicates that noxious weed infestations are occurring or increasing, the BLM and USFWS would collaborate on the most effective way for the operator to eliminate weeds without affecting the clay reed-mustard. Furthermore, if the monitoring efforts indicate that development within 300 feet of known plants appears to be adversely affecting the species, the BLM would re-initiate Section 7 consultation with the USFWS. Specific details of the monitoring plan (e.g., number of survey locations, type of survey technique used, timing of survey, etc.) would be determined by the USFWS and BLM in coordination with the operator.

- Where surface disturbance is proposed within occupied clay reed-mustard habitat, enhanced erosion control and revegetation measures would be employed. For example, specific erosion control measures would be developed on a site-specific basis that would account for occupied clay reed-mustard habitat, and would avoid or minimize sedimentation or runoff into the occupied habitat. Erosion control efforts would be monitored by the operator and necessary modifications would be made to control erosion.
- In clay reed-mustard occupied habitat (if any occur within the LCPA) any spills, regardless of volume, would be reported to the BLM and USFWS.

Uinta Basin Hookless Cactus

- Measures that would specifically serve to protect the Uinta Basin hookless cactus include adherence to USFWS and BLM jointly developed conservation measures for the species, which are provided in **Appendix E**. The most salient of these measures includes the requirement to avoid surface disturbance within 100 feet of known plants, which would eliminate direct impacts on the species.

Invasive, Noxious Species

- All construction equipment and vehicles coming into the LCPA from outside the Uinta Basin would be power-washed prior to entering the LCPA.
- Prior to any surface-disturbing activities, the BLM would conduct a pre-disturbance baseline, inventory for noxious and invasive weeds along proposed roadways, pipeline routes, well sites, and other facilities within the LCPA. This inventory, which could be completed on a site-by-site basis during the APD process, would form the basis for subsequent monitoring and control actions by the operator in the LCPA. As determined necessary by the BLM, during the life of project, the operator would complete noxious and invasive weed inventories along project-related roadways, pipeline routes, well sites, and other facilities within the LCPA on an annual basis.

Fire Management

- All equipment, including welding trucks, would be equipped with fire extinguishers to minimize the possibility of fires during construction and operation.
- All vehicles would be equipped with spark-arrestors.
- All workers at the project site would be trained in fire prevention and fire control. Brush and dry wood would be removed from work areas.

2.5.1.6 Wildlife (Including Special Status Wildlife)

General

- As feasible, production facilities would be located outside of the 100-year floodplains of the LCPA drainages. Where well pads are proposed near LCPA drainages, shallow groundwater, or floodplains (i.e., where no option exists to locate surface facilities outside of these areas), closed-loop drilling systems, leak detection devices, or self-contained mud systems would be installed.

Big Game

- To mitigate the loss of wildlife within the LCPA, the operator would fund an acre for acre mitigation project that would be designed to improve wildlife habitat. As feasible, the location of the habitat restoration work would be identified within or adjacent to the LCPA. On Federal lands, the details of this mitigation plan would be determined by the BLM and Utah Division of Wildlife Resources (UDWR).

Raptors

- Prior to any construction, raptor surveys would be conducted to determine the potential presence of raptor nests and other important habitats. Surveys would be conducted between February 1st and August 31st, within 0.5 mile of proposed construction sites for the presence of raptor nests. When surveys are required of the operator, the consultant hired must be found acceptable to the appropriate SMA prior to the field survey being conducted. If occupied raptor nests are found, temporary construction activities would not occur within the species-specific buffer radius during the nesting season, as specified in **Table 2-3** (Romin and Muck 2002).
- No permanent infrastructure would be placed within 0.5 mile of raptor nests; however, permanent facilities could be placed within 0.25 mile of a raptor nest if project facilities are obscured from line of sight of the nest and noise levels are minimized.
- The operator and their contractors would contact the UDWR to remove carrion from the roadways, shoulders, and ROWs. This could minimize potential impacts to carrion-feeding raptors from vehicle collisions.
- Where feasible, well pads, access roads, pipelines, and other facilities or infrastructure would be located so as to conceal them from raptor nests by considering topographical or vegetative screening features.

Migratory Birds

- Screening would be placed on stacks and on other openings of heater-treaters or fired vessels to prevent entry by migratory birds.

Special Status Wildlife Species

- Prior to any project-related surface disturbance, all locations proposed for surface disturbance would be evaluated by a wildlife biologist approved by the appropriate SMA to determine if any special status wildlife species are present. If present, the operator would consult with the appropriate SMA prior to initiating any surface-disturbing activities, and would implement appropriate avoidance or mitigation measures. Site-specific species clearances would be performed at the time of the onsite review.

Colorado River Endangered and BLM Sensitive Fish Species

As appropriate (i.e., if water is pumped directly from the Green River or Willow Creek,), the following measures would be applied to reduce or eliminate direct impacts to habitat for the Colorado River fish species downstream of the LCPA in the Green River.

- To avoid entrainment, water should be pumped from an off-channel location (i.e., one that does not connect to the river during high spring flows). An infiltration gallery constructed in a BLM and USFWS approved location is best.
- If the pump head is located in the river channel where larval fish are known to occur, the following measures apply:
    - the pump would not be situated in a low-flow or no-flow area as these habitats tend to concentrate larval fishes;

  - the amount of pumping would be limited, to the greatest extent possible, during that period of the year when larval fish may be present (see above); and
  - the amount of pumping would be limited, to the greatest extent possible, during the pre-dawn hours as larval drift studies indicate that this is a period of greatest daily activity.

- All pump intakes would be screened with ¼-inch mesh material.
- Any fish impinged on the intake screen would be reported to the USFWS (801-975-3330) and the UDWR.
- Where directed by the appropriate SMA, the operator would construct erosion control devices (e.g., riprap, bales, and heavy vegetation) at culvert outlets. All construction activities would be performed to retain natural water flows.
- On a site-specific basis, berms would be constructed on the side(s) of well pads potentially affected by surface water runoff to minimize the possibility of contaminants entering the floodplains for Hill and Willow Creeks.
- Closed-loop drilling would be utilized for any wells within the 100-year floodplains for Hill and Willow Creeks.
- Production facilities (e.g., well pads, tanks, pipelines, roads, etc.,) would be located outside of the active channels of Willow and Hill Creeks within the LCPA on a site-specific basis.
- Appropriate erosion control and revegetation measures would be employed. In areas with unstable soils where seeding alone may not adequately control erosion, grading would be used to minimize slopes and water bars would be installed on disturbed slopes. Erosion control efforts would be monitored by the operator and necessary modifications would be made to control erosion.

Special Status Raptor Species

- Prior to any construction, raptor surveys would be conducted to determine the potential presence of special status raptor nests and other important habitats. Surveys would be conducted between November 1st and August 31st, within 0.5 of proposed construction sites for the presence of raptor nests. When surveys are required of the lessee/operator, the consultant hired must be found acceptable to the appropriate SMA prior to the field survey being conducted. If occupied raptor nests are found, temporary construction activities would not occur within the species-specific buffer radius during the nesting season, as specified in **Table 2-3** (Romin and Muck 2002).
- No permanent infrastructure would be placed within 0.5 mile of special status raptor nests; however, permanent facilities could be placed within 0.25 mile of a special status raptor nest if project facilities are obscured from line of sight of the nest and noise levels are minimized.
- The operator and their contractors would contact the UDWR to remove carrion from the roadways, shoulders, and ROWs. This could minimize potential impacts to carrion-feeding raptors from vehicle collisions.
- Where feasible, well pads, access roads, pipelines, and other facilities or infrastructure would be located so as to conceal them from raptor nests by considering topographical or vegetative screening features.

- As feasible, the placement of wells, roads, or pads on or through active prairie dog colonies would be avoided.

Table 2-3. Nesting Periods and Recommended Spatial Buffers for Raptor Nests in Utah

Species	Spatial Buffer (miles)	Seasonal Buffer	Incubation # Days	Breeding # Days Post-Hatch	Fledging # Days Post-Hatch	Post-Fledge Dependency to Nest # Days[1]
Bald Eagle	1.0	1/1-8/31	34-36	21-28	70-80	14-20
Golden Eagle	0.5	1/1-8/31	43-45	30-40	66-75	14-20
N. Goshawk	0.5	3/1-8/15	36-38	20-22	34-41	20-22
N. Harrier	0.5	4/1-8/15	32-38	21-28	42	7
Cooper's hawk	0.5	3/15-8/31	32-36	14	27-34	10
Ferruginous hawk	0.5	3/1-8/1	32-33	21	38-48	7-10
Red-tailed hawk	0.5	3/15-8/15	30-35	35	45-46	14-18
Sharp-shinned hawk	0.5	3/15-8/31	32-35	15	24-27	12-16
Swainson's hawk	0.5	3/1-8/31	33-36	20	36-40	14
Turkey vulture	0.5	5/1-8/15	38-41	14	63-88	10-12
California condor	1.0	NN yet	56-58	5-8 weeks	5-6 months	2 months
Peregrine falcon	1.0	2/1-8/31	33-35	14-21	35-49	21
Prairie falcon	0.25	4/1-8/31	29-33	28	35-42	7-14
Merlin	0.5	4/1-8/31	28-32	7	30-35	7-19
American kestrel	NN[2]	4/1-8/15	26-32	8-10	27-30	12
Osprey	0.5	4/1-8/31	37-38	30-35	48-59	45-50
Boreal owl	0.25	2/1-7/31	25-32	20-24	28-36	12-14
Burrowing owl	0.25	3/1-8/31	27-30	20-22	40-45	21-28
Flammulated owl	0.25	4/1-9/30	21-22	12	22-25	7-14
Great horned owl	0.25	12/1-9/31	30-35	21-28	40-50	7-14
Long-eared owl	0.25	2/1-8/15	26-28	20-26	30-40	7-14
N. saw-whet owl	0.25	3/1-8/31	26-28	20-22	27-34	7-14
Short-eared owl	0.25	3/1-8/1	24-29	12-18	24-27	7-14
Mex. Spotted Owl	0.5	3/1-8/31	28-32	14-21	34-36	10-12
N. Pygmy owl	0.25	4/1-8/1	27-31	10-14	28-30	7-14
W. Screech owl	0.25	3/1-8/15	21-30	10-14	30-32	7-14
Common Barn-owl	NN[2]	2/1-9/15	30-34	20-22	56-62	7-14

[1] Length of post-fledge dependency period to parents is longer than reported in this table. Reported dependency periods reflect the amount of time the young are still dependent on the nest site; (i.e., they return to the nest for feeding).
[2] Due to apparent high population densities and ability to adapt to human activity, a spatial buffer is not currently considered necessary for maintenance of American kestrel or common barn-owl populations. Actions resulting in direct mortality of individual birds or take of known nest sites are unlawful.
Source: Romin and Muck 2002

Greater Sage-grouse

- In the event that a sage-grouse lek is discovered or becomes established in the LCPA, prior to any construction between March 15th and June 15th, all sagebrush habitats within a two-mile radius of proposed construction sites would be surveyed for the presence of active sage-

grouse leks. If active sage-grouse leks are located, surface-disturbing activities would be avoided within 0.6 mile (1 km) of active sage-grouse leks during the breeding season (March 15 – June 15) from one hour before sunrise to three hours after sunrise (UDWR 2002). This measure would not apply to workover rigs or maintenance and operation of producing wells.

- Roads, fences, poles, and utility lines would not be placed within 1,300 feet (400 meters) of a sage-grouse lek to prevent predation by raptor species (UDWR 2002).

White-tailed Prairie Dogs

- As feasible, the placement of wells, roads, or pads on or through active prairie dog colonies would be avoided.

2.5.1.7 Livestock Grazing

- No roads, pipelines, well pads, or other gas facilities would be placed within 200-meters (660-foot) of livestock reservoirs, rain gauges, corrals, springs, and guzzlers. If there is no means to avoid these existing range facilities, these facilities would be replaced, as needed.
- The operator would repair or replace to appropriate SMA standards any fences, cattleguards, gates, drift fences, and natural barriers that are damaged as a result of development.

2.5.1.8 Cultural Resources/Native American Religious Concerns

- The operator and their contractors would inform their employees about Federal regulations intended to protect archaeological and cultural resources.

2.5.1.9 Paleontological resources

- Paleontological surveys would be conducted prior to any surface-disturbing activities and monitoring completed during any excavations within areas known to have high potential for significant paleontological resources.

2.6 ALTERNATIVE C – NO ACTION

Under Alternative C – the No Action Alternative, the proposed natural gas development would not occur on Federal lands. However, exploration and development would continue on non-Federal lands within the LCPA (**Appendix A**, **Figure 2-2**) and reasonable access to those developments would be provided across Federal lands under Title IV of the FLPMA, as necessary.

2.6.1 Construction, Drilling, and Completion

Under the No Action Alternative, a total of about 81 wells would be drilled from 62 well pads within the LCPA. In accordance with existing regulations, the BLM must consider reasonable access for roads and pipelines across Federal lands to leases on non-Federal lands. Thus, under the No Action Alternative, approximately 15 miles of new access road co-located within new pipelines, and 30 miles of new pipeline located along existing roads would be constructed. Pipelines would be buried where operationally and topographically feasible, unless resource considerations, as determined by the appropriate surface management agency (SMA), dictate the necessity for a surface-laid pipeline. As under the Proposed Action, the existing LCU

Compressor Station would be expanded by approximately 15 acres to accommodate approximately an additional 11,500 hp of compression.

Construction of well pads, roads, and pipelines would occur as described in **Section 2.3**, Details Common to All Alternatives.

As previously discussed, approximately 21,000 bbls (2.7 acre-feet) of water would be needed to drill and complete each well. As such, the drilling and completion of all 81 proposed wells would therefore consume about 219 acre-feet of water over a period of 3 years, for approximately 73 acre-feet per year. In addition to water for drilling and completion, approximately 1,000 bbls (0.13 acre-feet) of water per well pad and associated access road would be utilized for dust abatement each year. As such, water utilized for dust abatement for a maximum of 62 well pads and associated roads would be approximately 8 acre-feet per year over the 25-year life of the producing wells (total of 201 acre-feet).

Based upon these water use estimates, approximately 81 acre-feet of water would be used for drilling, completion, and dust abatement each year for the 3-year development phase of the project. Following drilling and completion activities, water usage would then be limited to approximately 8 acre-feet per year for dust abatement for the life of the producing wells.

2.6.2 Production and Maintenance

Production and maintenance aspects associated with Alternative C would be as set out in **Section 2.3**, Details Common to All Alternatives.

2.6.3 Decommissioning and Reclamation

Decommissioning and reclamation of disturbed surface associated with this alternative would be as set out in **Section 2.3,** Details Common to All Alternatives.

2.6.4 Summary of Estimated Surface Disturbance Associated with the No Action Alternative (Alternative C)

On average, each newly constructed well pad would initially occupy approximately 2.5 acres. Each well pad utilized for proposed directional drilling would be expanded by 0.5 acres for each additional directional well. This acreage would include reopening previously utilized reserve pits (i.e., 0.4 acres), and expanding the existing pads to accommodate drilling equipment and additional well heads and production facilities. As the proposed well locations are conceptual in nature, initial disturbance for the 62 well pads was calculated at an average of 2.7 acres per pad. Based on these assumptions, the No Action Alternative would result in about 167 acres of initial disturbance from well pad construction.

Under the No Action Alternative, approximately 15 miles of new access road co-located within new buried pipelines, and 30 miles of new pipeline buried along existing roads would be constructed. As previously described, a ROW width of approximately 75 feet would be needed to construct and install co-located pipelines and roads, resulting in initial/short-term disturbance of 141 acres. New pipelines buried along existing roads would require a 45-foot wide ROW, resulting in initial disturbance of approximately 163 acres. Expansion of the existing LCU compressor station is expected to occupy an additional 15 acres. For a summary of estimated disturbance resulting from the No Action Alternative see **Table 2-4**.

Table 2-4. Estimated Surface Disturbance Resulting from the No Action Alternative (Alternative C)

Proposed Structure	Number of Well Pads/Miles of Road/Pipe	Initial Width of ROW or size of Well Pads	Initial Disturbance[1]
Well Pads	62	2.7 acres	167 acres
Co-located Access Road and Pipeline	15 miles	75 feet	141 acres
Pipeline along Existing Road	30 miles	45 feet	163 acres
Existing LCU Compressor	NA	NA	15 acres
Totals	**NA**	**NA**	**486**
Percent of Total LCPA[2]	NA	NA	1.5%

[1]Calculations are approximate based upon GIS calculation and rounded to the nearest whole number.
[2]LCPA = 33,240 acres.

2.7 COMPARISON OF ALTERNATIVES

Table 2-5 displays a quantitative comparison of the various development scenarios associated with the Proposed Action, Conservation Alternative, and No Action Alternative.

Table 2-5. Comparison of Surface Disturbance by Alternative

	Alternatives A & B		Alternative C	
Well Pads	362	977 acres	62	167 acres
Co-located Access Road and Pipeline	77 miles	715 acres	15 miles	141 acres
Pipeline along Existing Road	32 miles	175 acres	30 miles	163 acres
Existing LCU Compressor	NA	15 acres	NA	15 acres
Totals	**NA**	**1,882 acres**	**NA**	**486 acres**

2.8 ALTERNATIVES CONSIDERED, BUT ELIMINATED FROM FURTHER ANALYSIS

2.8.1 Surface-laid Pipelines

During the preliminary scoping phases of the LCU project, the previous operator (Dominion Exploration & Production, Inc.) was proposing to install surface-laid pipelines. The current operator of the LCPA leases and unit holder, XTO, is proposing to bury all proposed pipelines. As pipeline burial is a preferred Best Management Practice (BMP) of the BLM Vernal FO where feasible, the original surface-laid pipeline alternative was dismissed from further analysis.

2.8.2 Directional Drilling On 160-Acre or 80-Acre Spacing

BLM and XTO considered the inherent qualities of the natural resources within the LCPA during the project planning process and incorporated measures within the Proposed Action to minimize surface disturbance. One measure of XTO's commitment to protect natural resources is the

proposal to reduce surface impacts by directionally drilling up to 148 wells from multiple-well pads. XTO's proposal to utilize directional wells, where economically feasible, allows for the retention of 222 acres within the Project Area that would otherwise be disturbed if only vertical wells on 40-acre spaced pads were utilized.

The application of directional drilling techniques within the LCPA presents certain risks and associated increases in costs. XTO's examples of lost drilling time and the related negative economic impact provide compelling evidence of the risks involved with directional drilling. Despite the negative economic impacts, XTO is committed to employ directional technology to reduce surface impacts. However, directional well technology can only be applied under economically feasible circumstances, which are dictated largely by additional costs and risks associated with directional drilling in conjunction with the realized price of natural gas. Given current economics, development of directional wells within the LCPA is feasible only in the HCU and possibly the northern portions of the LCU, where the larger reserve volumes allow for increased costs of directional well development. If directional drilling is required for the entire LCPA, negative economic impacts would preclude the development of much of the LCU and BPU, resulting in significant untapped reserves and a waste of valuable resources that could preclude XTO and the BLM from meeting the purpose and need for the project. For this reason, directional drilling on 160-acre or 80-acre spacing throughout the LCPA was eliminated from detailed analysis. A full analysis on directional drilling in the LCPA is available upon request from the BLM Vernal FO.

3.0 AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter presents the potentially affected existing environment (i.e., the physical, biological, social, and economic values and resources) of the impact area as identified in the IDT Analysis Record Checklist found in **Appendix B** and presented in **Chapter 1** of this assessment. This chapter provides the baseline for comparison of impacts described in **Chapter 4**.

3.2 GENERAL SETTING

The LCPA is located about 32 miles south of Vernal in Uintah County in northeast Utah. The small community of Ouray is about 15 miles north of the LCPA. Major access routes in the LCPA include: Hill Creek Road, Willow Creek Road, and Big Pack Mountain Loop Road. The Willow Creek Road (#5120) is a Uintah County Class 1-B, graveled road and Big Pack Mountain Loop Road (#5230) is both a Uintah County Class 1-B, graveled road and Class D, un-maintained road. The Hill Creek Road is a Ute Tribe graveled road.

The LCPA is located in the Uinta Basin, a bowl-shaped structural and sedimentary basin which trends roughly east-west. The Basin is about 115 miles wide at the widest part and narrows toward the west. The Basin is bounded on the east by the Douglas Creek Arch, on the South by the Book Cliffs-Roan Plateau, on the West by the Wasatch Hinterlands, and to the north by the Uinta Mountains (Stokes 1986). The LCPA lies within the Tavaputs Plateau Topographic District described by Clark (1957). This District consists of a series of broad, discontinuous plateaus underlain largely by sandstones and shales. Both flowing streams and dry washes are deeply incised in canyons that are up to 1,000 feet deep in the plateau. The elevation of the LCPA ranges from about 4,900 to 6,400 feet. The climate of the Basin is semi-arid, mid-continental, i.e., typified by dry windy conditions and limited rainfall. The LCPA contains two large streams Hill Creek and Willow Creek, which join in the north edge of the HCU and ultimately flow into the Green River about 9 miles downstream (north). The vegetation in the LCPA is dominated by mixed desert shrub and sagebrush with limited riparian habitat along the two creeks. The LCPA is outside the BLM designated Hill Creek Wild Horse Herd Management Area; however wild horses are known to frequent the PA in search of water and forage.

3.3 CRITICAL ELEMENTS OF THE HUMAN ENVIRONMENT AND OTHER RESOURCES BROUGHT FORWARD FOR ANALYSIS

3.3.1 Air Quality

The EPA has primary regulatory authority for implementing various environmental statutes established by Congress. EPA retains the authority for implementing the Federal Clean Air Act and the permitting and operational compliance of air emission sources within the LCPA.

Climate in the Uinta Basin plays a major role in air quality – temperature, precipitation, and wind all play their roles in defining, monitoring and maintaining air quality. **Table 3-1** provides a breakdown by season of average temperature ranges, total precipitation and total snowfall.

Table 3-1. 50-Year Average Climatic Information for the Uinta Basin

Season	Average Temperature Range (° F)	Average Total Precipitation (inches)	Average Total Snowfall (inches)
Spring	33.2 – 65.6	1.9	2.1
Summer	53.3 – 91.3	1.7	0.0
Fall	32.1 – 65.3	2.2	2.3
Winter	6.7 – 33.3	1.1	11.0
	31.3 – 63.9	6.9	15.4

Source: Western Regional Climate Center 2005. Collected from Ouray, Utah.

Air masses originating from the Pacific Ocean are typically interrupted by the western mountain ranges before reaching the Uinta Basin. As a result, the LCPA receives relatively low amounts of precipitation. The annual mean precipitation at Ouray is only 6.9 inches and ranges from a minimum of 3.0 inches recorded in 1958, to a maximum of 12.2 inches recorded in 1965.

The surrounding area has an annual mean temperature of 48° Fahrenheit (F). However, abundant sunshine and rapid nighttime cooling result in a wide daily range in temperature. Wide seasonal temperature variations typical of a mid-continental climate are also common. Recorded extreme temperatures are negative 43°F in 1990 and 108°F in 2001.

The transportation and dilution of air pollutants are primarily a function of wind speed and direction. Winds dictate the direction in which pollutants are transported. As wind speed increases, the dispersion of emitted pollutants also increases, thereby reducing pollutant concentrations. Winds affecting the LCPA originate predominately from the east-northeast 16.7 percent of the time. The average measured wind speed is 6.8 miles per hour (UDEQ-DAQ 1998).

The degree of stability in the atmosphere is also important to the dispersion of emitted pollutants. During stable conditions, vertical movement in the atmosphere is limited and the dispersion of pollutants is inhibited. Temperature inversions can result in very stable conditions with virtually no vertical air motion, thereby restricting dispersion. Conversely, during unstable conditions, upward and downward movement in the atmosphere prevails, and the vertical mixing of pollutants in the atmosphere is enhanced.

The potential for atmospheric dispersion is relatively high for the LCPA due to the frequency of strong winds. However, calm periods and nighttime cooling may enhance air stability, thereby inhibiting air pollutant transport and dilution. The region can experience frequent temperature inversions in winter when cold stable air masses settle into the valleys and snow cover and shorter periods of daylight inhibit ground-level warming. Temperature inversions are less common during the summer months when daytime ground-level heating rapidly leads to inversion break-up and increased vertical mixing. The higher locations of the LCPA generally will remain warmer at night and less prone to the temperature inversions common to the valleys and drainages.

The LCPA exhibits slightly stable atmospheric conditions the majority of the time (31.6% of the time), followed by neutral conditions (27.1% of the time) and moderately stable conditions (16.3% of the time) (UDEQ-DAQ 1998).

National and Utah Ambient Air Quality Standards (NAAQS) have been promulgated for the purpose of protecting human health and welfare with an adequate margin of safety. Pollutants for

which standards have been set include sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), and particulate matter (PM) less than 10 or 2.5 microns in aerodynamic diameter (PM_{10} and $PM_{2.5}$). Existing air quality in the region is acceptable based on EPA standards for the protection of human health. The Uinta Basin is designated as an attainment area, meaning that the concentration of criteria pollutants in the ambient air is less than the NAAQS. Site-specific air quality monitoring data are not available for the LCPA, however, background criteria pollutant concentrations for the Uinta Basin (**Table 3-2**) are relatively low and consistent with a rural area having low levels of industrial development (UDEQ-DAQ 2005). The air quality discussion and assessment of impacts associated with this EA tier to two air quality technical reports associated with the ongoing BLM draft RMP/EIS (BLM 2005a) and the final EIS for the Resource Development Group, Uinta Basin Natural Gas Project (BLM 2006a). The information contained in these reports is incorporated by reference. Copies of these reports are available from the Vernal FO.

Under the Prevention of Significant Deterioration (PSD) provisions of the Clean Air Act, incremental increases of specific pollutant concentrations are limited above a legally defined baseline level. Many national parks and wilderness areas are designated as PSD Class I. The PSD program protects air quality within Class I areas by allowing only slight incremental increases in pollutant concentrations. Areas of the State not designated as PSD Class I are classified as Class II. For Class II areas, greater incremental increases in ambient pollutant concentrations are allowed as a result of controlled growth. The area surrounding the LCPA is designated as PSD Class II. The PSD increments for Class II areas are presented in **Table 3-2**.

Table 3-2. Ambient Criteria Pollutant Concentrations in the Uinta Basin

Criteria Pollutant	Averaging Period(s)	Uinta Basin Background Concentration[a] (µg/m^3)	NAAQS (µg/m^3)	PSD Class II Increments (µg/m^3)
SO_2	Annual 24-hour 3-hour	5 10 20	80 365 1,300	512 91 20
NO_2	Annual	5	100	25
PM_{10}	Annual 24-hour	10 28	50 150	30 17
CO CO	8-hour 1-hour	1,111 1,111	10,000 40,000	None None
O_3 O_3	1-hour 8-hour	157 105	235 157	None None

[a] Source: UDEQ-DAQ 2005.

Hazardous Air Pollutants (HAPs) are those pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental impacts. The EPA has classified 189 air pollutants as HAPs. Examples of listed HAPs associated with the oil and gas industry include formaldehyde, BTEX compounds (benzene, toluene, ethylbenzene, isomers of xylene), and normal-hexane (n-hexane).

There are no applicable Federal or State of Utah ambient air quality standards for assessing potential HAP impacts to human health. Therefore, reference concentrations (RfC) for chronic inhalation exposure and Reference Exposure Levels (REL) for acute inhalation exposures are applied as significance criteria. **Table 3-3** provides the HAP RfCs and RELs. RfCs represent an estimate of the continuous (i.e., annual average) inhalation exposure rate to the human population (including sensitive subgroups such as children and the elderly) without an appreciable risk of harmful effects. The REL is the acute (i.e., one-hour average) concentration at or below which no

adverse health effects are expected. Both the RfC and REL guideline values are for non-cancer effects.

Table 3-3. Hazardous Air Pollutant Reference Exposure Levels and Reference Concentrations

HAPs	Reference Exposure Level [REL 1-hr Average] ($\mu g/m^3$)	Reference Concentration [a] [RfC Annual Average] ($\mu g/m^3$)
Benzene	1,300 [b]	30
Toluene	37,000 [b]	400
Ethylbenzene	350,000 [c]	1,000
Xylenes	22,000 [b]	100
n-Hexane	390,000 [c]	200
Formaldehyde	94 [b]	9.8

[a] EPA Air Toxics Database, Table 1 (EPA 2002)
[b] EPA Air Toxics Database, Table 2 (EPA 2002)
[c] Immediately Dangerous to Life or Health (IDLH)/10, EPA Air Toxics Database, Table 2 (EPA 2002) since no available REL

The State of Utah has adopted Toxic Screening Levels (TSLs), which are applied during the air permitting process to assist in the evaluation of hazardous air pollutants released into the atmosphere (UDEQ-DAQ 2000). The TSLs are derived from Threshold Limit Values (TLVs) published in the American Conference of Governmental Industrial Hygienists – "Threshold Limit Values for Chemical Substances and Physical Agents" (ACGIH 2003). These levels are aspirational standards, not mandatory minimums. **Table 3-4**, below, lists the corresponding TSLs for the applicable HAP.

Table 3-4. Hazardous Air Pollutant Utah Toxic Screening Levels

HAP and Averaging Time	Toxic Screening Levels [b] ($\mu g/m^3$)
Formaldehyde (1-hour)	37
Benzene [a] (24-hour)	53
Toluene (24-hour)	6,280
Ethylbenzene (1-hour)	54,274
Ethylbenzene (24-hour)	14,473
Xylene (1-hour)	65,129
Xylene (24-hour)	14,473
n-Hexane (24-hour)	5,875

[a] Although there exists an acute threshold limit values (TLV) for benzene, the State of Utah does not apply a comparison to an acute TSL since the chronic TSL is more stringent.
[b] Source: UDEQ-DAQ (2000).

Areas of special concern, including some Class I and II wilderness areas and national parks, are monitored for Air Quality Related Value (AQRV) impacts. These AQRVs include terrestrial and aquatic deposition and visibility impairment.

Visibility is usually characterized by two parameters, visual range (VR) and the light-extinction coefficient (b_{ext}). The visual range parameter represents the greatest distance that a large dark object can be seen, while the light extinction coefficient represents the attenuation of light per unit distance due to scattering and absorption by gases and particulate matter in the atmosphere.

Under typical conditions, the visual range and b_{ext} parameters are inversely related to each other. Good visibility conditions are represented by long visual ranges and low b_{ext} values, while poor visibility conditions are represented by short visual ranges and high b_{ext} values. The dimensions of visual range are length, and the parameter is usually expressed in kilometers (km). The units of b_{ext} are 1/length (inverse length) and the coefficient is typically expressed as "inverse kilometers" (km^{-1}), or "inverse megameters" (Mm^{-1}), the reciprocal of 1 million meters.

No background visibility data are available specifically for the LCPA. However, the nearest measurements, recorded at nearby Class I areas, are available from the 2000 Federal Land Managers' Air Quality Related Values Workgroup report (FLAG 2000). A standard annual visual range of 251 km (b_{ext} of 15.6) is reported for Arches and Canyonlands National Parks, and 249 km (b_{ext} of 15.7) for Flat Tops Wilderness.

Atmospheric deposition refers to the processes by which air pollutants are removed from the atmosphere and deposited on terrestrial and aquatic ecosystems, and is reported as the mass of material deposited on an area in a period of time (kilograms per hectare per year or kg/ha/yr). Air pollutants are deposited by wet deposition (precipitation) and by dry deposition (gravitational settling of particles and adherence of gaseous pollutants). Total deposition refers to the sum of airborne material transferred to the earth's surface by both wet and dry deposition.

Aquatic bodies such as lakes and streams are important resources in most Class I areas. Acid deposition resulting from industrial emissions of sulfur and nitrogen based compounds can have a toxic effect on the flora and fauna of an aquatic ecosystem. Lakes and streams differ in their inherent sensitivity to inputs of acidifying compounds from the atmosphere. For pristine watersheds, the acid neutralization capacity (ANC) is a good indicator of the sensitivity and buffering capacity of the water body to acid deposition. The ANC for fresh surface waters can be characterized by the combined concentrations of base cations (calcium, magnesium, potassium, and sodium), expressed in microequivalents per liter (µeq/l). The lower the ANC, the more sensitive the water body to acidifying compounds and their toxic effects.

Existing sources of air pollution in the Uinta Basin include the following:

- Exhaust emissions, primarily CO, oxides of nitrogen (NOx), and formaldehyde, from natural gas fired compressor engines used in production of natural gas;
- Natural gas dehydrator still-vent emissions of BTEX and n-hexane;
- Gasoline and diesel-fueled vehicle tailpipe emissions of volatile organic compounds (VOC), NOx, CO, SO_2, PM_{10}, and $PM_{2.5}$;
- Fugitive dust (in the form of PM10 and PM2.5) from vehicle traffic on unpaved roads, wind erosion in areas of soil disturbance, and road sanding during winter months; and
- Long range transport of pollutants from distant sources contributing to regional haze.

3.3.2 Water Resources

The LCPA is drained by two perennial streams: Willow Creek and Hill Creek. These creeks flow to the north and join the Green River near the town of Ouray, Utah. The Green River is a major river in the western United States. It originates in Wyoming along the Continental Divide, flows through Desolation Canyon, and joins the Colorado River 110 miles south of the town of Green River, Utah. The flow in the Green River is partially controlled by the Flaming Gorge Dam. Major tributaries to the Green River include the Duchesne River and the White River. The White

River drains the eastern portion of the Uinta Basin, including those portions of the Basin within Colorado. Within the Uinta Basin, the State of Utah has classified five drainages as hydrological sub-units: the Upper Green, the Green, the Ashley-Brush, the Duchesne/Strawberry, and the White River subunits (Utah Division of Water Resources 2006). The LCPA lies within the Green River sub-unit.

3.3.2.1 Surface Water

The majority of the LCPA lies within the Outlet Hill Creek and Jim Little Canyon-Willow Creek watersheds, as shown in **Figure 3-1** (**Appendix A**). Small portions of the LCPA lie within the Outlet Willow Creek, Willow Creek above Outlet Willow Creek, Johnson Draw-Hill Creek, and Agency Draw watersheds.

Figure 3-2 (**Appendix A**) shows the surface water features and floodplains in the vicinity of the LCPA. The LCPA is drained by Hill Creek, Willow Creek, and ephemeral tributaries to these streams. A small portion of the LCPA drains directly to the Green River.

With the exception of Hill Creek and Willow Creek, other streams in the LCPA are ephemeral and only flow in direct response to rainfall events. These streams have developed a dendritic drainage pattern and are incised with rills and gullies typical of badland topography.

Stream Classification

The Utah Water Quality Board classifies Utah surface water resources according to quality and degree of protection (UWQB 2000). All streams and water bodies in Utah are assigned to one of five classes. All streams within the LCPA are classified as Class 2B, 3A, and 4. Class 2B streams are protected for secondary contact recreation such as boating, wading, or similar uses. Class 3A streams are protected for cold water species of game fish and other cold water aquatic life. Class 4 streams are protected for agricultural uses including irrigation of crops and stock watering.

Stream Flow

Two U.S. Geological Survey (USGS) surface water gauging stations are located on Hill Creek and two stations are located on Willow Creek. The two stations on Hill Creek were only monitored for discharge until September 1981, and the two stations on Willow Creek were only monitored until 1983, but these data are still useful for determining flow conditions for these streams. One gauging station is located upgradient from the LCPA on the Green River near the town of Ouray, and one station is located downgradient on the Green River near the town of Green River, Utah. **Table 3-5** presents summary flow data for the six stations.

Table 3-5. Stream Flow Data for USGS Gauging Stations

USGS Gauging Station Name and Number	Range of Monthly Mean Discharge (cfs)	Peak Daily Discharge (cfs)	Mean Annual Discharge (cfs)	Period of Record
Willow Creek above Diversions near Ouray, Utah #09307500	12.0 (January) to 50.2 (May)	259 (March 28, 1962)	20.6	August 1950 – September 1983

USGS Gauging Station Name and Number	Range of Monthly Mean Discharge (cfs)	Peak Daily Discharge (cfs)	Mean Annual Discharge (cfs)	Period of Record
Willow Creek near Ouray, Utah #09308000	10.4 (September) to 66.5 (May)	500 (August 27, 1952)	25.6	July 1947 – September 1983
Hill Creek above Towave Reservoir near Ouray, Utah #09307800	5.29 (September) to 22.3 (May)	98 (May 25, 1979)	9.85	October 1974 – September 1981
Hill Creek Mouth near Ouray, Utah #09307900	0.67 (September) to 16.7 (May)	88 (May 26, 1979)	5.40	October 1974 – September 1981
Green River near Ouray, Utah #09307000	1,925 (January) to 17,000 (June)	14,100 (June 11, 1952)	5,614	October 1947 – September 1966
Green River at Green River, Utah #09315000	2,301 (January) to 18,620 (June)	66,700 (June 27, 1917)	6,132	October 1894 – September 2004

Source: http://waterdata.usgs.gov/nwis/

Surface Water Quality

Water quality refers to biological, chemical, and physical characteristics of a water sample. The sample results may then be compared to a standard defined for protection of drinking water, aquatic organisms, and other water uses. Important indicators of water quality include temperature, specific conductance (a measure of the ability of water to conduct electric current), and pH (a measure of the hydrogen ion activity). A pH less than 7 indicates the water is acidic and a pH greater than 7 indicates alkaline water. Chemical water quality is determined by the concentration of various chemical constituents in the water, including metals, ionic constituents such as chloride and bicarbonate, and total dissolved solids (TDS). Hardness (a measure of the amount of calcium and magnesium) is also an important indicator and is reported in milligrams per liter (mg/L) of calcium carbonate ($CaCO_3$). Hardness determines the soap-consuming capacity of water as well as the tendency to leave a mineralized crust on plumbing fixtures. For a more thorough explanation of water quality, see Fetter (1980).

The EPA has established primary and secondary drinking water standards for approximately 90 water contaminants as required by the Safe Drinking Water Act, as amended in 1996, and Clean Water Act (CWA) of 1987, as amended (EPA 2003). These regulations specify maximum contaminant levels (MCLs) and secondary standards for specific contaminants. The MCLs are health-based. Although these MCLs legally apply only to public drinking water supplies, they are also useful as general indicators of water quality. The secondary standards are for constituents that cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. The CWA delegated the administration of these standards to cooperating States and Tribes, so long as the State and Tribal standards were at least as stringent as the Federal standards. Most states, including Utah, now have primacy for the administration of the CWA and have also adopted state water-quality standards (UWQB 2000).

Salinity and Sodium Hazards

Salinity refers to the total amount of salts in solution in surface waters. Sodium is one part of total salinity. The sodium hazard of irrigation water is estimated by the sodium adsorption ratio

(SAR), which is the proportion of sodium to calcium plus magnesium in the water. SAR values are calculated using the formula:

$$SAR = Na^{+} / [(Ca^{+2} + Mg^{+2})/2]^{1/2}$$
(all ions reported in milliequivalents)

Waters with SAR values in the range 0 to 6 can generally be used on all soils with little problem of a sodium buildup. When SAR values range from 6 to 9, chances for soil permeability problems increase (Hergert et al. 1997). Water with a SAR value greater than 9 should not be used for irrigation, even if the total salt content is relatively low. Continued use of water having a high SAR values leads to a breakdown in the physical structure of the soil. The sodium replaces calcium and magnesium adsorbed on the soil clays and causes dispersion of soil particles. This dispersion results in breakdown of soil aggregates and causes the soil to become hard and compact when dry and increasingly impervious to water penetration. Salinity and sodium hazard classes developed by the U.S. National Salinity Laboratory (1954) are presented in **Tables 3-6** and **3-7**.

Table 3-6. Salinity Hazard Classes

Salinity Hazard Class	Specific conductance (µS/cm at 25° C)	Characteristics
Low	0-250	Low salinity water can be used for irrigation on most soil with minimal likelihood that soil salinity will develop.
Medium	251-750	Medium salinity water can be used for irrigation if a moderate amount of drainage occurs.
High	751 – 2,250	High salinity water is not suitable for use on soil with restricted drainage. Even with adequate drainage, special management for salinity control may be required.
Very High	> 2,250	Very high salinity water is not suitable for irrigation under normal conditions

Source: U.S. National Salinity Laboratory 1954.

Table 3-7. Sodium Hazard Classes

Sodium Hazard Class	SAR (at SC = 2,250)	Characteristics
Low	0 to 4	Low sodium water can be used for irrigation on most soil with minimal danger of harmful levels of exchangeable sodium.
Medium	4 to 9	Medium sodium water will present an appreciable sodium hazard in fine textured soil having high cation exchange capacity.
High	9 to 14	High sodium water may produce harmful levels of exchangeable sodium in most soils.
Very High	More than 14	Very high sodium water is generally unsatisfactory for irrigation purposes.

Source: U.S. National Salinity Laboratory 1954.

LCPA Surface Water Quality

The waters in Willow Creek are described as calcium-magnesium-sodium bicarbonate-sulfate type waters with high to very high hardness (330 to 580 mg/L as $CaCO_3$). TDS ranges from 520 to 1,100 mg/L, and averages 747 mg/L; both are in excess of the secondary standard of 500 mg/L,. Specific conductance increases greatly in the downstream direction along Willow Creek and ranges from 780 to 2,020 uS/cm with an average of 1,140 uS/cm at the downgradient station. These values are generally in the high salinity class and indicate that the waters can be used for irrigation only with special management practices. SAR values range from 1 – 3 and average

2.13. These are considered to be safe values for SAR. The average concentration of sulfate exceeds the secondary standard of 250 mg/L. Arsenic and copper exceed the aquatic standards for one or more samples, and manganese is high (550 ug/L to 1,400 ug/L) and exceeds the secondary standard of 50 ug/L for all samples.

3.3.2.2 Floodplains

Floodplains are typically dry land that is susceptible to being inundated by adjacent rivers or streams. The extent of floodplain inundation depends in part on the flood magnitude. Floodplains generally contain unconsolidated sediments, often extending below the bed of the stream or river, which generally consists of accumulations of sand, gravel, loam, silt, and/or clay.

Floodplains support rich ecosystems, both in quantity and diversity. Nutrient levels, primary productivity, and macroinvertebrate populations are highest in the floodplain depressions following a flood event (Montana Water Center 2006). The Green River floodplains, to the west of the LCPA, serve as important nursery habitat for the endangered razorback sucker. In the LCPA, floodplains are also found along Hill Creek, Willow Creek, and other washes, as shown on **Figure 3-2** (**Appendix A**). Approximately 1,160 acres of the LCPA are designated as 100-year floodplains.

3.3.3 Soils

The development of soils is governed by many factors, including climatic conditions (the amount and timing of precipitation, temperature, and wind), the parent material that the soil is derived from, topographic position (slope, elevation, and aspect), and vegetation type and cover. For evaluation of potential environmental impacts to soils, the key attributes are the soils' erosion potential and ease of reclamation after soil disturbance. Erosion potential can vary widely among soil units within a given area, and is dependent on the particle size distribution of the soil, the slopes on which it is found, and the amount and type of vegetative cover. Reclamation potential is dependent on soil structure, pH conditions, and soil salinity. Excessive salinity (salt content), acidity, or alkalinity can inhibit the growth of desirable vegetation.

Soil mapping conducted by the US Department of Agriculture (USDA) typically provides information about each soil type within the mapped area that can be used to evaluate the erosion potential and reclamation potential of each soil unit. These data include the slope, soil pH (i.e., soils' acidity or alkalinity), salinity, clay content, hydrological group, and erosion factor. Each of these factors is discussed below. The erosion potential of a soil is directly related to the slopes on which it is found. Typically, soils found on steeper slopes have a higher erosion hazard than those found on gentler slopes. According to the USDA-NRCS (2004), all soils occurring on slopes greater than 40 percent have poor reclamation potential based upon their high erosion rates.

Soil acidity or alkalinity (pH) is important for evaluation of reclamation potential because excessive acidity or alkalinity can inhibit plant growth. According to the USDA-NRCS (2004), all soils with a pH lower than 4.5 or greater than 9.1 have a poor potential for reclamation based upon poor fertility and plant community stabilization.

The salinity of soils is determined by the quality of water that is applied to it and the frequency of water applications. Evaporation of water containing high concentrations of salts can lead to deposition of salts on the surface of the soil. The salts can be leached downward to depths of about 5 feet and inhibit plant growth, which can in turn negatively affect the ability of the soil to withstand erosion. Soil salinity is evaluated by measuring the electrical conductivity of a water

extract of the soil. According to the USDA-NRCS (2004), all soils with salinity greater than 9 millimhos per centimeter (mmhos/cm) have a poor reclamation potential based upon poor fertility and plant community stabilization.

Particle size analysis is typically performed for soils and is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification. The amount and kind of clays affect the physical condition of the soil, the ability of the soil to absorb cations and retain moisture, and soil fertility. The presence of clays influences shrink-swell potential, saturated hydraulic conductivity, plasticity, the ease of soil dispersion, and other soil properties. According to the USDA-NRCS (2004), all soils with clay content greater than 60 percent have a poor potential for reclamation based upon the adverse effects on plant growth and soil fertility.

Hydrologic groups are used to estimate surface water runoff where soils are not protected by vegetation (USDA-NRCS 2004). The amount of runoff in turn influences the erosion potential of the soil. The classification of hydrologic groups (A through D) is based on the amount of infiltration of water that can occur through the soils. In general, the slower the rate of infiltration, the greater the amount of surface water runoff that will occur from the soil unit. Group A soils have high rates of infiltration. These soils consist mainly of deep, well-drained to excessively-drained soils or gravelly sands. Group B soils have moderate rates of infiltration and consist of moderately deep to deep, moderately well-drained to well-drained soils that have a moderately fine to coarse texture. Group C soils have a slow rate of infiltration and have a layer that impedes the downward movement of water or soils with a moderately fine texture. Group D soils have a very slow rate of infiltration. These soils consist of clays that have high shrink-swell potential, soils that have a high water table, soils that contain caliche layers (layers of very hard, impervious clay), and shallow soils developed over nearly impervious material.

The Soil Survey Geographic database (USDA-NRCS 2004) rates each of the soil units according to its soil erosion potential (K). The erosion potential indicates the general susceptibility of a soil to sheet and rill erosion. These estimates are based primarily on the percentage of clay, silt, sand, and organic matter present in the soil. Erosion hazards become critical issues when protective vegetation is removed during and following activities such as access road and well pad construction. Typically, soils found on steeper slopes have a higher erosion hazard than those found on gentler slopes. Fine soils are at greater risk of wind erosion, and soils with more gravel and/or stones have a lower risk of wind erosion. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

3.3.3.1 LCPA Soils

There are 16 soil complexes within the LCPA, as shown on **Figure 3-3** (**Appendix A**). Each of these soil complexes is composed of one or more soil types that are found in close association with each other. The table in **Appendix F** summarizes the 29 soil types that make up the 16 soil complexes which occur in the LCPA. Included in this table are the factors that influence erosion and reclamation potential.

No soil units within the LCPA contain soils that have clay contents greater than 60 percent, and no soils have estimated erosion factors (K factor) over 0.50. However, three soil complexes (map units 12, 34, and 36) contain soils that potentially occur on slopes greater than 40 percent.

Thirteen soil complexes (map units 12, 34, 35, 36, 38, 42, 78, 128, 152, 154, 242, 256, and 266) have one or more factors that may inhibit successful reclamation. Ten of the thirteen soil

complexes (all but 78, 128, and 242) are classified as hydrologic Group D. Six of the soil complexes (map units 12, 34, 42, 78, 128, and 242) contain soils that have both high alkalinity (pH > 9) and high salinity (> 9 mmhos/cm). In addition, map unit 152 has high salinity and map unit 154 has high alkalinity.

3.3.4 Vegetation, Including Special Status Plant Species (Other than USFWS Listed Species), and Fire/Fuel Management

3.3.4.1 Vegetation Communities

Vegetation communities in the Uinta Basin are controlled by various factors including elevation, slope, and soil parent material. Arid and semi-arid desert shrub communities, primarily consisting of rabbitbrush, greasewood, and horsebrush are found within the lower elevation areas of the Basin. As the plateau gently rises, the vegetation generally shifts to sagebrush, pinyon-juniper woodlands, and then to mixed coniferous forests. Riparian corridors and grasslands also occur along perennial streams and springs throughout the Basin.

The composition and extent of native plant communities within the Uinta Basin have been modified by livestock grazing, residential development, development of oil and gas resources, and other land uses. Livestock grazing has decreased native plant species composition and has promoted establishment of noxious weeds where overgrazing has occurred. However, while populations of undesirable weedy species are common where native plant communities have been disturbed or removed, they do not appear to be invasive in undisturbed communities.

The vegetation communities identified in this section are described using data obtained from the USDA-NRCS Soil Survey Geographic Database (UDSA-NRCS 2004). No vegetation mapping currently exists for Tribal lands in the LCPA. However, it can be assumed that plant communities in these adjacent areas would be similar to those found in other areas of the LCPA. Badlands/rock outcrop areas occur in all vegetation communities. For the sake of discussion Gardner saltbush community has been combined with the desert shrub community. **Figure 3-4** (**Appendix A**) provides a map of the vegetation communities occurring within the LCPA. Elevation in the LCPA ranges from about 4,900 to 6,400 feet, and the rolling topography creates a conglomerate of changing slopes across the landscape. **Table 3-8** provides a breakdown of vegetation communities occurring within the LCPA. A brief discussion of each of the following communities follows.

Table 3-8. Vegetation Communities within the LCPA.

Vegetation Community	Estimated Total Acres	Percent of LCPA
Badlands/Rock Outcrop	6,647	23
Black Sagebrush	7,450	26
Wyoming Sagebrush	1,662	6
Desert Shrub (including Gardner's Saltbush)	10,982	38
Greasewood	1,518	5
Pinyon-Juniper Woodlands	425	1
Estimated Total Acres	**28,684**	**NA**

Sagebrush

Sagebrush shrublands occur throughout Utah typically at elevations between 4,000 and 7,000 feet. This community type is found most often on mountain flattops, plains, and valley bottoms, near drainages. In the LCPA, this community type is characterized by a somewhat sparse to dense shrub layer (20% to 80%) dominated by mountain big sagebrush (*Artemisia tridentata ssp. wyomingensis*) or black sagebrush (*Artemisia nova*), depending on soil type. The understory within this community includes a variety of perennial grasses such as Sandburg bluegrass (*Poa secunda*), needle-and-thread grass (*Stipa comata*), sand dropseed (*Sporobolus cryptandrus*), western wheatgrass (*Agropyron smithii*), Indian ricegrass (*Stipa hymenoides*), galleta grass (*Hilaria jamesii*), and localized populations of cheatgrass (*Bromus tectorum*). Sagebrush shrublands span the southeast central portion of the LCPA. Potential for successful revegetation following surface disturbance varies with soil characteristics and effective precipitation.

Desert Shrub

The salt desert shrub vegetative community tends to be variable in its composition and dominance by shadscale (*Atriplex confertifolia*), fourwing saltbush (*Artiplex canescens*), rabbitbrush (*Chrysothamnus viscidiflorus*), and Gardner's saltbush (*Atriplex gardnernii*). Soils in this community group range from shallow clay loam to deep sands, which along with soil chemistry have set the pattern of scrub dominance and species composition on various sites. The desert shrub community is the most dominant and variable vegetative community in the LCPA and is found throughout the landscape. Transition areas of this community with badlands and rock outcrops tend to have shallow soils, low water holding capacity and are sparsely vegetated. Potential for successful revegetation following surface disturbance varies with soil characteristics, such as depth, texture, and effective precipitation.

Black Greasewood

Black greasewood (*Sarcobatus vermiculatus*) dominates the major drainage bottoms in the LCPA, including Willow and Hill Creeks. The community is usually elevated above and outside of any active riparian zones associated with perennial drainages, and is closely associated with highly saline soils. Black greasewood occurs on silty to clay-loam soils in drainages and is a tenacious occupant. Potential for successful revegetation following surface disturbance in this community would require additional treatment to control the resprouting of black greasewood.

Pinyon-Juniper Woodlands

Only about one percent of the LCPA, near the southern portion of the LCPA, contains pinyon-juniper woodlands. Juniper woodlands are typically dominated by juniper (*Juniperus osteosperma*), pinyon pine (*Pinus edulis*), and mountain mahogany (*Cercocarpus ledifolius*). Associated understory shrub species include sagebrush and blackbrush (*Coleogyne ramosissima*).

3.3.4.2 BLM Sensitive Plant Species

The BLM Vernal FO's current List of Special Status Plant Species consists of 15 sensitive species that occur or have the potential to occur on lands administered by the Vernal FO. Refer to the Summary of Potential Occurrence of Special Status Wildlife and Plant Species for the LCPA (**Appendix G**) for a detailed justification of special status plant species that have the potential to occur in the LCPA. According to BLM data, only one BLM sensitive plant species has the potential to occur within the LCPA (BLM 2002a).

Graham's beardtongue (*Penstemon grahamii*) is endemic to the Uinta Basin in Carbon, Duchesne, and Uintah Counties, Utah, and in Rio Blanco County, Colorado (Welsh et al. 1993). A member of the figwort family, Graham's beardtongue grows on semi-barren knolls, ridges, and steep slopes in a mix of fragmented white shale and silty clay soils of the Green River Formation. Specifically, Graham's beardtongue is found in associations of pinyon-juniper woodlands, desert shrub communities, and Salina wildrye at elevations ranging between 5,000 and 6,680 feet (UNHP-UDWR 2007). Potential habitat for this species exists throughout the LCPA on exposures of the Green River Formation (i.e., white shale lenses).

On January 19, 2006 (71 Federal Register 3158), the USFWS proposed to list Graham's beardtongue as a threatened species with critical habitat under authority of the Endangered Species Act (ESA) of 1973, as amended. However, based on the USFWS' analysis of existing information compiled since that date, on December 19, 2006, the USFWS "…determined that listing is not warranted because threats to the species as identified in the January 19, 2006, proposed rule are not significant, and available data does not indicate that the threats to the species and its habitat, as analyzed under the five listing factors described in Section 4(a)(1) of the Act, are likely to threaten or endanger the species in the foreseeable future throughout all or a significant portion of its range." (USFWS 2006a) With this determination, the USFWS also removed the species from the candidate species status afforded by the Act (71 FR 76024). A portion of the USFWS' rationale is founded on their conclusion that the BLM has the necessary regulatory mechanisms (e.g., conservation measures) in place to provide for the conservation of Graham's beardtongue and the protection of its habitat through existing land management regulations, land use planning and specific lease and use stipulations (USFWS 2006a, p. 76034). The conservation measures for this species are located in **Appendix E**.

3.3.4.3 Fuels/Fire Management

Fire is a natural process that alters vegetation in the Uinta Basin. Low intensity, short duration burns of sagebrush occur due to summer thunderstorms (McNab 1994). The LCPA includes approximately 425 acres of pinyon-juniper woodlands and 9,112 acres of sagebrush. The Final EIS on the Book Cliffs RMP (BLM 1984) describes the fire management techniques prescribed for the resource area. They consist of "extinguishing any and all wildfires, wherever they occur, in order to protect property and other resource values."

3.3.5 Threatened and Endangered Plant Species

In accordance with the ESA, the lead agency, in coordination with the USFWS, must ensure that any Federal action to be authorized, funded, or implemented would not adversely affect a Federally-listed threatened or endangered species. Existing BLM files were examined for the presence of known locations of Federally-listed plant species, and the potential for Federally-listed plant habitat to occur within the LCPA was evaluated. Of the five Federally-listed plant species occurring within the Uinta Basin, three are known to occur or have the potential to occur within the LCPA. These species are: the shrubby reed-mustard (*Schoenocrambe [Glaucocarpum] suffrutescens)*, currently listed as endangered; clay reed-mustard (*Schoenocrambe argillacea*), currently listed as threatened; and the Uinta Basin hookless cactus (*Sclerocactus wetlandicus*), currently listed as threatened. Refer to the Summary of Potential Occurrence of Special Status Species (**Appendix G**) for occurrence information on other special status plant species. Additional information on the three Federally listed species with the potential to occur within the LCPA is included in the Biological Assessment (BA) prepared for this EA, which is available upon request at the BLM Vernal FO.

3.3.5.1 Shrubby Reed-Mustard

The shrubby reed-mustard (*Schoenocrambe suffrutescens*) was Federally-listed as endangered under the ESA on October 6, 1987, under the name toad-flax cress (*Glaucocarpum suffrutescens*) (52 FR 37416). The name was changed to shrubby reed-mustard (*Schoenocrambe suffrutescens)* on January 14, 1992 (USFWS 1994a).

Shrubby reed-mustard occurs in the Uinta Basin in Duchesne County and Uintah County, Utah. Shrubby reed-mustard grows along semi-barren, white-shale layers of the Evacuation Creek Member of the Green River Formation, where it is found in xeric, shallow, and fine textured soils intermixed with shale fragments. The species grows in mixed desert shrub and pinyon-juniper communities, at elevations ranging from 5,100 to 6,700 feet above mean sea level (amsl). Dominant shrub species associated with shrubby reed-mustard populations include pygmy sagebrush (*Artemesia pygmaea*) and saltbush (*Atriplex spp*.).

According to Utah Natural Heritage Program (UNHP) 2003 data, approximately 12 distinct populations of shrubby reed-mustard have been documented. Potential habitat for the shrubby reed-mustard exists throughout the LCPA. BLM data show shrubby reed-mustard habitat in the western portion of the LCPA, west of Big Pack Mountain (BLM 2002a). Field surveys have been conducted for shrubby reed-mustard in portions of the LCPA by Buys & Associates (B&A) in 2006 and 2007.

In 2006, B&A conducted site-specific clearances for proposed well pads and associated road and pipeline ROWs in the HCU and LCU portions of the LCPA (B&A 2006a). Numerous wells and associated ROWs were cleared of occupied habitat, but several populations of shrubby reed-mustard were documented during the survey (B&A 2006a). Due to the high density of plants in the western portion of the LCU, block surveys were conducted in these areas. During the block surveys, approximately 1,389 acres (or approximately 4% of the LCPA) were surveyed for occupied shrubby reed-mustard habitat. Approximately 26 acres of occupied habitat were identified in the block surveyed areas (B&A 2006d). Although this study was not designed to inventory the population of shrubby reed-mustard within the LCPA, field notes roughly estimate a minimum of 1,820 plants within the block surveyed area. All populations of the shrubby reed-mustard populations were buffered by 300 feet, and locations of proposed well pads and associated road and pipeline ROWs were relocated to avoid these areas.

In 2007, B&A conducted block surveys on approximately 10,454 acres (or approximately 31% of the LCPA) in the northern portions of the BPU of the LCPA. These block surveys were conducted to identify suitable habitat for shrubby reed-mustard. Of the 10,454 acres surveyed, approximately 1,680 acres of suitable habitat were identified during the survey (B&A 2007).

3.3.5.2 Clay Reed-Mustard

The clay reed-mustard (*Schoenocrambe argillacea*) was Federally-listed as threatened under the ESA on January 14, 1992 (57 FR 1398).

Clay reed-mustard is endemic to the Uinta Basin in Uintah County, Utah, and typically grows on exposed bedrock, scree, and fine-textured soils derived from the Evacuation Creek Member of the Green River Formation. The species has also been documented below the rocky contact zone of the Uinta Formation and the Evacuation Creek Member. The species most commonly occurs on steep north-facing slopes, at elevations ranging from 4,721 to 5,790 feet amsl (UNHP-UDWR 2007). Clay reed-mustard is associated with the mixed desert shrub community. Dominant shrub

species associated with clay reed-mustard populations include Utah serviceberry (*Amelanchier utahensis*), black sagebrush (*Artemisia nova*), Castle Valley clover (*Atriplex gardneri cuneata*), shadscale saltbush (*Atriplex confertifolia)*, and green rabbitbrush (*Chrysothamnus viscidiflorus*) (USFWS 1994a; UNHP-UDWR 2007).

Potential habitat for the clay reed-mustard exists throughout the LCPA. BLM data show areas of clay reed-mustard habitat throughout the LCPA (BLM 2002a). In 2006, B&A conducted site-specific clearances for proposed well pads and associated road and pipeline ROWS in the HCU and LCU portions of the LCPA (B&A 2006a). All surveyed locations were cleared of clay reed-mustard occupied habitat (B&A 2006a). In 2007, B&A conducted surveys for suitable clay reed-mustard habitat in the entire BPU of the LCPA. Of the approximately 19,690 acres assessed (or approximately 59% of the LCPA), about 1,177 acres were identified as suitable clay reed-mustard habitat (B&A 2007).

3.3.5.3 Uinta Basin Hookless Cactus

The Uinta Basin hookless cactus (*Sclerocactus glaucus*) was Federally-listed as threatened under the ESA on October 11, 1979 (USFWS 1979). Recently, *S. glaucus* was reclassified and three species, which were collectively recognized as S. *glaucus* previously, are now recognized separately as *S. glaucus, S. brevispinus, and S. wetlandicus* (USFWS 2007). Of these three species, *S. glaucus* occurs only in Colorado and *S. brevispinus* is thought to only occur in the area surrounding the Pariette Draw ACEC, and therefore these species are not discussed in this EA. However, *S. wetlandicus* is discussed in this EA as it potentially occurs within the LCPA.

Habitat for Uinta Basin hookless cactus generally consists of gravelly or rocky surfaces on river terrace deposits and lower mesa slopes (USFWS 1990a). The species occurs on varying exposures, but is more abundant on south-facing exposures on slopes to about 30 percent grade, and where terrace deposits break from level tops to steeper side slopes. Uinta Basin hookless cactus is found at elevations ranging from 4,400 to 6,200 feet amsl within the desert scrub vegetation community (USFWS 2006b). Species in the surrounding plant communities include the prickly pear cactus (*Opuntia polyacantha*), winterfat (*Ceratoides lanata*), yucca (*Yucca harrimaniae*), snakeweed (*Guiterrezia saroithrae*), low rabbitbrush (*Chrysothamnus viscidiflorus*), sand dropseed (*Sporobolus cryptandrus*), and Salina wildrye (*Elymus salinus*).

Although potential habitat for the Uinta Basin hookless cactus exists within the LCPA, the quality of potential habitat is considered poor for the species with largely sandy soils that lack a cobble surface (B&A 2006a). BLM data show only a small area of Uinta Basin hookless cactus habitat present in the southwestern portion of the LCPA (BLM 2002a).

Field surveys have been conducted for Uinta Basin hookless cactus and its suitable habitat in portions of the LCPA by B&A. In 2006, B&A conducted site-specific clearances for proposed well pads and associated road and pipeline ROWS in the HCU and LCU of the LCPA (B&A 2006a). All surveyed locations were cleared of Uinta Basin hookless cactus occupied habitat (B&A 2006a). Also in 2006, B&A conducted a block survey on approximately 1,389 acres of the western portion of LCU. Neither populations nor suitable habitat of the Uinta Basin cactus were identified during the block survey (B&A 2006d). In 2007, a block survey was conducted on approximately 10,454 acres in the northern portion of the BPU, which was designed to document suitable habitat of the cactus. Suitable habitat for the cactus was not identified during this survey (B&A 2007).

3.3.6 Wetlands/Riparian Zones

Wetlands/riparian zones within the LCPA are too small to be mapped separately according to the existing vegetation data created by the Natural Resources Conservation Service. However, there are approximately 1.5 miles of BLM-mapped wetland/riparian areas within the LCPA. These wetland/riparian areas occur in ten sporadic linear stretches, mainly along Willow Creek. Utah BLM policies for riparian resources include the following: to encourages avoidance of surface disturbance unless the disturbance can be fully mitigated, there is no other reasonable alternative, or the short-term disturbance would enhance riparian values.

3.3.7 Invasive and Noxious Species

The spread of invasive and noxious weeds is a concern in areas proposed for surface development activities. Noxious weeds are plants that are designated by a Federal, State, or county government as injurious to public health, agriculture, recreation, wildlife, or property. A noxious weed is commonly defined as a plant that grows out of place and is competitive, persistent, and pernicious (James et al. 1991). Invasive weeds include plants that are not listed as noxious, but are not native to the area. Both invasive and noxious weeds can spread through areas undeterred, producing significant changes to native vegetation communities. Specific negative effects of noxious and invasive weeds can include: 1) reduction in the overall visual character of any area; 2) competition with, or elimination of, native plants; 3) reduction or fragmentation of wildlife habitats; and 4) increased soil erosion.

Invasive weed establishment is moderate to high within the LCPA. The most common weed locations include existing disturbance areas such as well pads, roadsides, pipeline ROWs, adjacent washes, and areas where grazing has removed native species. Biological invasion is facilitated by roads, where disturbed roadside habitats are invaded by exotic invasive plant and animal species. Invasive and noxious weeds are also dispersed by wind, water, vehicles, and other human activities. Roads may be the first points of entry for exotic species into a new landscape.

The most common invasive species in the LCPA are Russian thistle (*Salsola iberica*), halogeton (*Halogeton glomeratus*), and cheatgrass (*Bromus tectorum*). African mustard (*Malcolmia africana*), a newly emerging weed species, is also present in the LCPA. Perennial pepperweed is present in the LCPA along Willow Creek. Salt cedar (*Tamarix ramosissima*) and Russian olive (*Elaeagnus angustifolia*) are listed by Uintah County as noxious weeds that occur in the LCPA along drainages, ponds, and sites where water collects along roads.

The following weeds are officially designated and published as noxious for the State of Utah, as per the authority vested in the Commissioner of Agriculture under Section 4-17-3, Utah Noxious Weed Act:

- Bermudagrass (*Cynodon dactylon*)
- Canada thistle (*Cirsium arvense*)
- Diffuse knapweed (*Centaurea diffusa*)
- Dyers woad *(Isatis tinctora*)
- Field bindweed (*Convolvulus arvensis*)
- Perennial pepperweed (*Lepidium latifolium*)
- Perennial sorghum (*Sorghum halepense & S. almum*)
- Purple loosestrife (*Lythrum salicaria*)
- Quackgrass (Agropyron repens)
- Russian knapweed (*Centaurea repens*)

- Hoary cress (*Cardaria draba*)
- Johnsongrass (*Sorghum halepense*)
- Leafy spurge (*Euphorbia esula*)
- Medusahead (*Taeniatherum caput-medusae*)
- Musk thistle (*Carduus mutans*)
- Scotch thistle (*Onopordum acanthium*)
- Spotted knapweed (*Centaurea maculosa*)
- Squarrose knapweed (*Centaurea squarrosa*)
- Yellowstarthistle (*Centaurea solstitialis*)

3.3.8 Fish and Wildlife, Including Special Status Wildlife Species (Other than USFWS Listed Species)

The LCPA supports a diversity of wildlife and wildlife habitats. Species occurrences are typically dependent on habitat availability, carrying capacities, and the degree of existing habitat disturbance. The LCPA consists of about 33,240 acres of potential wildlife habitat encompassing large, fairly contiguous upland habitats, dissected by incised drainages and canyons. Water resources are limited within the LCPA and therefore provide the greatest habitat values for wildlife.

3.3.8.1 General Wildlife

Small mammals potentially found within the LCPA and surrounding region include cottontail rabbits (*Sylvilagus* spp.), black-tailed jackrabbit (*Lepus californicus*), white-tailed prairie dog (*Cynomys leucurus*), coyote (*Canis latrans*), badger (*Taxidea taxus*), striped skunk (*Mephitis mephitis*), western spotted skunk (*Spilogale gracilis*), and various species of rodents and bats. Herptiles potentially found in the region include the wandering garter snake (*Thamnophis elegans vagrans*), Great Basin gopher snake (*Pituophis catenifer deserticola*), Great Basin spadefoot toad (*Scaphiopus intermontana*), western whiptail (*Cnemidophorus tigris*), sagebrush lizard (*Sceloporus graciosus*), and shorthorned lizard (*Phymosoma douglassii*).

Although all of these species are important members of wildland ecosystems and communities, most are common and have wide distributions within the region. Consequently, the relationship of most of these species to the proposed project is not discussed in the same depth as species that are threatened, endangered, sensitive, of special economic interest, or are otherwise of high interest or unique value.

3.3.8.2 Big Game

Three resident big game species are known to occur within the LCPA: pronghorn antelope (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), and elk (*Cervus elaphus*). Big game seasonal ranges designated by the BLM Vernal FO and Utah Division of Wildlife Resources (UDWR) have been mapped for this EA in **Figures 3-5** through **3-7**; however, it is important to note that seasonal restrictions, as outlined by the Book Cliffs RMP are applicable only to BLM-designated big game ranges. The UDWR has also identified various types of seasonal ranges (i.e., summer, winter, yearlong) that occur within the LCPA.

The BLM Vernal FO big game ranking is defined below:

- *Crucial*: Range on which a species depends for survival. No alternative range is available due to climate conditions or other limiting factors (BLM 1985).

The UDWR habitat value rankings are defined below:

- *Crucial*: Habitat on which the local population of a wildlife species depends for survival because there are no alternative ranges or habitats available. Crucial value habitat is essential to the life history requirements of a wildlife species. Degradation or unavailability of crucial value habitat will lead to significant declines in carrying capacity and/or numbers of the wildlife species in question (UDWR 2005a).
- *Substantial*: Habitat that is used by a wildlife species but is not crucial for population survival. Degradation or unavailability of substantial value habitat will not lead to significant declines in carrying capacity and/or numbers of the wildlife species in question (UDWR 2005a).
- Big game species utilizing Tribal lands in the LCPA are managed by the BIA - Uintah and Ouray Agency and the Ute Indian Tribe. These lands are not considered an area of concern for big game. Mule deer may occur on Tribal lands in the LCPA during the winter, but have not been observed during surveys. Pronghorn and elk do not utilize tribal lands within the LCPA (Corts 2007).

Pronghorn Antelope

Pronghorn typically inhabit grasslands and semi-desert shrublands of the western and southwestern United States. This species is most abundant in short- and mixed-grass habitats between 4,000-6,000 feet. Pronghorn are typically less abundant in xeric habitats, preferring areas that average 12-15 inches of precipitation per year. Home ranges for pronghorn can vary between 400 and 5,600 acres, according to factors including season, habitat quality, population characteristics, and local livestock occurrence. Typically, daily movements do not exceed six miles. Some pronghorn make seasonal migrations between summer and winter habitats, but these migrations are often triggered by availability of succulent plants and not local weather conditions (Fitzgerald et al. 1994).

Within the LCPA, pronghorn occupy upland mesas above Hill Creek and Willow Creek on a year-round basis. The UDWR has identified pronghorn habitats in the LCPA consisting of about 6,316 acres of year-long, crucial value habitat in the HCU and northeast portion of the LCU. Additionally, they have identified approximately 22,910 acres of substantial value year-long habitat throughout much of the LCPA. The BLM has identified approximately 2,655 acres of crucial value winter pronghorn antelope habitat in the northern portion of the LCPA (**Appendix A**, **Figure 3-5**); however, the Book Cliffs RMP does not stipulate any spatial and/or timing restrictions for this habitat. Pronghorn that occupy the LCPA are considered to be a part of the Book Cliffs (Herd Unit #10) pronghorn herd unit. Population estimates have shown that this herd falls below management population objectives established by the UDWR. According to the 2005 aerial trend study, the herd was estimated to contain 152 individuals, 298 under the target size of 450 pronghorn (approximately 34% of the target size) (UDWR 2005b).

Mule Deer

Mule deer are common state-wide in Utah, where they can be found in many types of habitat, ranging from open deserts to high mountains to urban areas. Typical habitats include short-grass and mixed-grass prairies, sagebrush and other shrublands, coniferous forests, and forested and shrubby riparian areas. Mule deer are usually migratory, spending the warmer months at higher elevations. During this time mule deer prefer foraging on the succulent regrowth of forbs and the new twigs of trees and shrubs. As summer progresses and the herbaceous plants mature and dry,

the diet shifts more toward woody browse. This diet then continues as the deer are driven down to foothill areas in winter (Wilson and Ruff 1999).

Mule deer occupy much of the LCPA on a year-round basis. The UDWR has identified about 645 acres of crucial value winter habitat and about 12,934 acres of substantial value winter habitat in the LCPA (**Appendix A**, **Figure 3-6**). No BLM-designated mule deer habitat occurs within the LCPA. Mule deer that occupy the LCPA are part of the Book Cliffs (Herd Unit #10) herd unit, which currently falls below the UDWR-population objective for this herd. Winter population studies estimated the mule deer herd at 9,700 individuals, 5,300 shy of population objective of 15,000 (UDWR 2005c). Although this population estimate shows the herd below management objectives, it should be noted that the herd steadily increased in size from 7,100 individuals in 2002 to 9,700 individuals in 2005 (UDWR 2005c).

Rocky Mountain Elk

Elk are common in most mountainous regions of Utah, where they can be found in mountain meadows and forests during the summer and in foothills and valley grasslands during the winter. The seasonal changes in elevation allow elk to avoid deep snow and find food year-round (UNHP-UDWR 2007). Like other members of the deer family, this species relies on a combination of browse, grasses, and forbs, depending on their availability throughout the year. Elk may be active during both day and night, but most activity occurs at dusk and dawn (UNHP-UDWR 2007).

The UDWR has identified about 25,460 acres of the LCPA as substantial value winter range (**Appendix A, Figure 3-7**). No BLM-designated elk habitat occurs within the LCPA. Elk that occupy the LCPA are part of the Book Cliffs (Herd Unit #10) elk herd unit, which currently falls below the UDWR-population objective for this herd. The target herd size is 7,500 elk; the herd contained 2,525 individuals (approximately 34 percent of the target size) as of 2005 winter population estimates (UDWR 2005c). The herd declined in size from 3,200 individuals in 2002 to 2,525 individuals in 2005 (UDWR 2005c).

3.3.8.3 Migratory Birds

The Migratory Bird Treaty Act (MBTA), as amended, was implemented for the protection of migratory birds. Unless permitted by regulations, the MBTA makes it unlawful to pursue, hunt, kill, capture, possess, buy, sell, purchase, or barter any migratory bird, including the feathers or other parts, nests, eggs, or migratory bird products. In addition to the MBTA, Executive Order 13186 sets forth the responsibilities of Federal agencies to further implement the provisions of the MBTA by integrating bird conservation principles and practices into agency activities and by ensuring that Federal actions evaluate the effects of actions and agency plans on migratory birds.

Numerous migratory bird species may occupy the LCPA. Those migratory bird species that are of unique value are addressed in **Section 3.3.8.6**. This section addresses migratory birds that may inhabit the LCPA, including those species classified as High-Priority birds by Utah Partners-in-Flight (UPIF). High-Priority species are denoted by an asterisk (*). UPIF is a cooperative partnership among Federal, State, and local government agencies as well as public organizations and individuals organized to emphasize the conservation of birds not covered by existing conservation initiatives. Migratory bird species, other than raptor species (see **Section 3.3.8.4** for raptor species), are addressed according to the habitat types in which they are found within the LCPA.

Sagebrush/Desert Shrub Habitat

Migratory bird species associated with the sagebrush/desert shrub communities that may occur in the LCPA include the horned lark (*Eremophila alpestris*), sage sparrow* (*Amphispiza belli*), vesper sparrow (*Pooecetes gramineus*), black-throated sparrow (*Amphispiza bilineata*), sage thrasher* (*Oreoscoptes montanus*), Brewer's sparrow* (*Spizella breweri*), western kingbird (*Tyrannus verticalis*), Say's phoebe (*Sayornis saya*) (Parrish 2002).

Juniper Habitat

A small portion of the LCPA along the Hill Creek drainage includes juniper habitat. Bird species associated with pinyon-juniper habitat within the LCPA include ash-throated flycatcher (*Myiarchus cinerascens*), black-chinned hummingbird (*Archilochus alexandri*), black-throated gray warbler (*Dendroica nigrescens*), blue-gray gnatcatcher (*Polioptila caerulea*), bushtit (*Psaltriparus minimus*), common nighthawk (*Chordeiles minor*), common poorwill (*Phalaenoptilus nuttallii*), gray flycatcher (*Empidonax wrightii*), gray vireo (*Vireo vicinior*), juniper titmouse (*Baeolophus ridgwayi*), and pinyon jay (*Gymnorhinus cyanocephalus*)(Parrish et al. 2002).

Riparian Habitats

BLM had mapped approximately 1.5 linear miles of sporadic riparian habitat within the LCPA. Although riparian areas in the LCPA are infrequent and small, migratory bird species associated with riparian habitats may be found in the LCPA. Migratory bird species associated with riparian habitats include hermit thrush (*Catharus guttatus*), veery (*Catharus fescescens*), yellow-breasted chat (*Icteria virens*), Cordilleran flycatcher (*Empidonax occidentalis*), Lewis' woodpecker* (*Melanerpes erythrocephalus*), Wilson's warbler (*Wilsonia pusilla*), black-chinned hummingbird* (*Archilochus alexandri*), broad-tailed hummingbird* (*Selasphorus platycercus*), and Swainson's thrush (*Catharus ustulatus*) (Parrish 2002).

3.3.8.4 Raptors

All raptor species and their nests are protected from "take" or disturbance under the MBTA of 1918 (16 U.S.C, 703 et seq.); however, those species that are considered special status raptor species are addressed in **Section 3.3.8.6**. The LCPA provides diverse breeding and foraging habitat for raptors: cool desert shrub communities, rocky outcrops, riparian zones, and lower elevation shrublands. An aerial raptor nest survey was conducted by helicopter in the LCPA on May 23, 2006 (B&A 2006b; B&A 2006c). A total of 18 raptor nests were reported in the LCPA, of which four were active. Three of the active nests were occupied by red-tailed hawks (*Buteo jamaicensis*) and one was occupied by a golden eagle (*Aquila chrysaetos*). All of the documented nests were located on cliffs or rock outcrops. Based on topography and existing vegetative cover, other raptor species have the potential to nest and forage in the LCPA.

3.3.8.5 Fish

The LCPA is located within the Upper Colorado River Basin. Both Hill Creek and Willow Creek flow through the LCPA, emptying into the Green River approximately 11.5 miles downstream of the LCPA. Although these creeks are perennial, their relatively low flow generally does not hold enough water to support fish populations. Some common fish species that could occur downstream of the LCPA in the Green River include: carp (Cyprinus carpio), channel catfish (Ictalurus punctatus), flathead minnow (Pimephales promelas), northern pike (Esox lucius) and

red shiner (Cyprinella lutrensis). Those fish species that are Sensitive are addressed in **Section 3.3.8.6** and those that are Federally-listed under the ESA, are addressed in **Section 3.3.9**.

3.3.8.6 Special Status Wildlife Species Other than Federally-Listed Species

This section discusses wildlife species that have a special-status designation, which includes:

- Species listed as sensitive by the BLM Vernal FO;
- Species listed as sensitive by the UDWR, including both wildlife species of concern and species receiving special management under a Conservation Agreement in order to preclude the need for Federal listing;
- Species protected under certain specified regulations; and
- Species of unique value.

It is the BLM's current policy that State-sensitive species also are managed to prevent a future Federal listing as threatened or endangered. Special status wildlife species that have a potential to occur within the LCPA or potentially be affected by development activities within the LCPA are discussed below. Refer to **Appendix G** for a complete list of special status species potentially occurring in the LCPA.

Flannelmouth Sucker

The flannelmouth sucker (*Catostomus latipinnis*) is listed as a Utah State sensitive species found in the Upper Colorado River Basin. Flannelmouth suckers typically inhabit deep water habitats of large rivers, but are also found in small streams and occasionally in lakes. Flannelmouth suckers spawn during March and April in the southern portions of Utah and from May to June in northern Utah at higher elevations. Fecundity of females is proportional to fish size and varies with environmental conditions (UNHP-UDWR 2007).

Flannelmouth sucker populations can be found in the Green River at the Colorado River confluence upstream to Flaming Gorge Reservoir, and in the White River from the Green River confluence to Kenny Reservoir, Colorado. Recent investigations of historical accounts and museum specimens indicate that flannelmouth suckers occupy about 50 percent of their historic range in the Upper Colorado River Basin (Utah, Wyoming, Colorado, and New Mexico). Populations have declined since the 1960s due to impoundment of the Green River in Wyoming and Utah (Flaming Gorge Reservoir) and the Colorado River in Glen Canyon, Utah (Lake Powell) (UNHP-UDWR 2007).

Bluehead Sucker

The bluehead sucker (*Catostomus discobolus*) is a Utah State sensitive species found in the Upper Colorado River Basin. Bluehead suckers occur in small to large streams, rivers and tributaries in the Upper and Lower Colorado River Basin. Large adult bluehead may inhabit stream environments as deep as two to three meters, although they most commonly feed in riffles and swift runs. Life expectancy is typically six to eight years. Spawning occurs in spring and early summer at lower elevations and mid- to late summer in higher, colder waters. Spawning occurs on gravel beds in shallow water (UNHP-UDWR 2007).

Populations of this species currently occur in the mainstream Green River from the Colorado River confluence upstream to Lodore, Colorado, and in the White River from the Green River

confluence upstream to Meeker, Colorado. In the upper Colorado River Basin (Utah, Wyoming, Colorado, and New Mexico), bluehead suckers currently occupy about 45 percent of their historical habitat. Recent declines of the species have occurred in the White River below Taylor Draw Dam, and in the upper Green River (UNHP-UDWR 2007).

Roundtail Chub

The roundtail chub (*Gila robusta*) is listed as a Utah State threatened species and is found in the Upper Colorado River Basin. Roundtail chub populations occur in the Green River from the Colorado River confluence upstream to Echo Park and in the White River from the Green River confluence upstream to near Meeker, Colorado. In the Upper Colorado River Basin (New Mexico, Utah, Colorado and Wyoming), the species has been extirpated from about 45 percent of its historical range, including the Price River and portions of the San Juan, Gunnison and Green Rivers. Data on smaller tributary systems are largely unavailable, and population abundance estimates are available only for short, isolated areas (UNHP-UDWR 2007).

Sage-Sparrow

The sage sparrow (*Amphispiza belli*) is a Utah Partners in Flight species of concern. In Utah, this species occurs locally throughout the State in spring and summer, and primarily in the southwestern portion of the State during the winter. Sage sparrows forage on the ground and eat insects, spiders, fruits, and seeds. The sage sparrow is active during the day. The sage sparrow prefers shrubland, grassland and desert habitats are found in portions of the LCPA.

Bald Eagle

Under the authority of the ESA, the USFWS delisted the bald eagle (*Haliaeetus leucocephalus*) in the lower 48 States from the Federal list of endangered and threatened wildlife, effective August 8, 2007 (72 FR 37346). However, the bald eagle is still protected under the Bald and Golden Eagle Protection Act (BGEPA) and the MBTA. In addition, the USFWS, in cooperation with State agencies and in compliance with Section 4(g)(1) of the ESA, would monitor the status of the bald eagle over a 20-year period with sampling events held once every five years (USFWS Bald Eagle Monitoring Team 2007). The result of the post-delisting monitoring plan would be to determine if the population of bald eagles in the lower 48 States warrants expanded monitoring, additional research, and/or resumption of Federal protection under the ESA (USFWS Bald Eagle Monitoring Team 2007).

Although bald eagles have shown recovery across their range, the number of nesting pairs in Utah is low; to date there are only nine known bald eagle breeding pairs in the State of Utah (72 FR 37346). Although no bald eagle nesting sites exist within or near the LCPA, known winter roost sites are located along the Green River approximately 5 miles west of the LCPA (BLM 2006b). Winter roosting usually occurs from early November through late March, and bald eagles may use the LCPA as foraging habitat during this period.

Golden Eagle

The golden eagle (*Aquila chrysaetos*) is protected under the BGEPA, based upon the similarity of the juvenile bald eagle's physical appearance to that of the adult golden eagle. Throughout the summer, golden eagles are found in mountainous areas, canyons, shrub-land and grassland. During the winter, they inhabit shrub-steppe vegetation, as well as wetlands, river systems and estuaries. Golden eagles are quite common to Uintah County and the Book Cliffs Resource Area. Nesting and foraging habitat is found throughout the LCPA. Currently, thirteen golden eagle

nests are known within the LCPA. Three of these nests were documented as occupied during the 2007 breeding and nesting season (B&A 2007b).

Ferruginous Hawk

The ferruginous hawk (*Buteo regalis*) is classified by the UDWR as a Wildlife Species of Concern. Throughout its range, ferruginous hawks have been found nesting on a wide variety of habitats (Evans 1982) and are common in western, northeastern, and southeastern Utah. The species nests on junipers, pinyon pines, cottonwoods, low hills, cliffs, and artificial structures (Smith and Murphy 1978). Ferruginous hawks lay eggs from mid-March through early April and the young fledge from early June to early July (Call 1978). No ferruginous hawks were observed in the LCPA during spring 2007 raptor surveys (B&A 2007b).

Short-eared Owl

The short-eared owl (*Asio flammeus*) is classified by the UDWR as a Wildlife Species of Concern (UNHP-UDWR 2007). In northern and central Utah, this species typically occurs in open desert and semi-desert habitats, particularly near wetland vegetation. The population of this species is declining in Utah because of habitat loss associated with agricultural and urban development. Limited nesting habitat for the short-eared owl, which is associated with intermittent drainages containing greasewood and big sagebrush, exists within the LCPA. Although potential habitat for the short-eared owl exists near Hill and Willow Creeks, nests have not been documented in the LCPA (B&A 2007b).

Western Burrowing Owl

The western burrowing owl (*Athene cunicularia*) is a UDWR Wildlife Species of Concern. They are summer residents on the plains over much of Utah and usually arrive on breeding grounds from late March to mid-April (Johnsgard 1988). The species is associated with dry, open habitat which has short vegetation and contains an abundance of burrows (Thomsen 1971; Wedgwood 1978; Haug and Oliphant 1990). In Utah, prairie dog burrows are the most important source of western burrowing owl nest sites. As the range and abundance of prairie dogs has decreased, the abundance of western burrowing owls has also declined. No burrowing owl nests have been identified within the LCPA (B&A 2006a). However, as scattered prairie dog colonies occur throughout portions of the LCPA, the burrowing owl has the potential to occur there.

Swainson's Hawk

The Swainson's hawk (*Buteo swainsoni)* is a State of Utah sensitive species. This raptor is found statewide in Utah in the summer and migrates to South America in the winter. In Utah, this species is found primarily in mid-elevation shrub and grassland habitats in the western and northern parts of the State. It builds nests on various surfaces including bare ground, trees, or cliffs. The species prefers open plains and prairie habitats, but also utilizes juniper woodlands. No Swainson's hawks were observed in the LCPA during spring 2007 raptor surveys (B&A 2006a).

Greater Sage-grouse

The greater sage-grouse (*Centrocercus urophasianus*) is an important game bird found in the Uinta Basin and is listed as a sensitive species in the State of Utah. This species occupies large tracts of sage-brush vegetation often in close proximity to riparian areas. The loss of sagebrush habitat due to development and degradation has reduced the population of the sage-grouse in

Utah. It has been estimated that at least one-half of the original area occupied by sage-grouse is no longer capable of supporting this species (Braun et al. 1976, Braun 1995). Since 1967, the attendance of male grouse on breeding grounds in Utah has declined by about 50 percent. Brood counts and harvest data show similar trends.

Approximately 28,181 acres of greater sage-grouse brooding habitat has been identified throughout the LCPA, and approximately 322 acres of sage-grouse crucial value winter habitat has been identified on the eastern boundary of the LCU portion of the LCPA (**Appendix A**, **Figure 3-8**). No leks have been recorded in the LCPA.

White-Tailed Prairie Dog

The white-tailed prairie dog (*Cynomys leucurus*) is a UDWR Wildlife Species of Concern. This species occurs in the eastern portion of the state, primarily in the Uinta Basin and the northern portion of the Colorado Plateau. White-tailed prairie dogs inhabit mountain valleys, semi-desert grasslands, agricultural areas, and open shrublands.

White-tailed prairie dogs are listed as sensitive species, based on their importance to the black footed ferret (*Mustela nigripes*), a Federally-listed endangered species. In Utah, white-tailed prairie dog colonies provide essential habitat for black-footed ferrets. Ferrets also depend on prairie dogs for food (Fagerstone 1987). In accordance with the USFWS' current threshold for white-tailed prairie dog colonies, a minimum of 200 acres of contiguous habitat and a minimum density of eight active burrows per acre is required to sustain a viable ferret population (USFWS 1989).

The main threat to white-tailed prairie dog populations has been the introduction of sylvatic plague (*Yersinia pestis*) into North America since the late 1930's (Lechleitner et al. 1968, Cully 1993). Other threats include habitat loss, conversion of land to agriculture, and Federal and State sponsored eradication campaigns. Pressure from recreational shooting is capable of reducing prairie-dog numbers on a local scale, in conjunction with outbreaks of plague (Knowles 2002). Although prairie dog colonies are scattered throughout portions of the LCPA, no prairie dog colony surveys or burrow density estimates have been conducted.

Townsend's Big-Eared Bat

The Townsend's big-eared bat (*Corynorhinus townsendii*) is a UDWR Wildlife Species of Concern and occurs in western North America, from southwestern Canada to Mexico. Isolated populations of the species also occur in areas of the central and eastern United States. The species occurs statewide in Utah at elevations below 9,000 feet.

The Townsend's big-eared bat is typically found near forested areas. Caves, mines, and buildings are used for day roosting and winter hibernation. Townsend's big-eared bats eat flying insects, particularly moths, and individuals are often seen foraging near trees. Like most bats, this species is nocturnal, and individuals typically do not leave their roosts until well after sunset (UNHP-UDWR 2007). Potential habitat for this species may occur in the LCPA.

Big Free-tailed Bat

The big free-tailed bat (*Nyctinomops macrotis*) is a UDWR Wildlife Species of Concern and occurs in the western United States, as well as in much of Latin America. The species is rare in Utah, occurring primarily in the southern half of the State, although individuals may rarely occur in northern Utah. .

The big free-tailed bat prefers rocky and woodland habitats, where roosting occurs in caves, mines, old buildings, and rock crevices. The species is typically active year-round, spending summers in temperate North America and migrating to warmer areas in North America and South America for the winter. Big free-tailed bats eat insects, primarily moths. Females may give birth to a single offspring during late spring or early summer each year (UNHP-UDWR 2007). Potential habitat for this species may occur in the LCPA.

3.3.9 Endangered Fish Species

In accordance with the ESA, the BLM, in coordination with the USFWS, must ensure that any Federal action to be authorized, funded, or implemented does not adversely affect a Federally-listed threatened or endangered species. It is the BLM's current policy that candidate species also are managed to prevent a future Federal listing as threatened or endangered. Federally-listed fish and wildlife species have the potential to occur in, and be affected by, energy development activities within the LCPA. A brief description of each of the Federally-listed species with the potential to occur in the LCPA (or downstream of the LCPA as in the case of fish species) is presented below. Refer to **Appendix G** for a complete Summary of Potential Occurrence of Special Status Wildlife and Plant Species. Additional information can also be found in the BA prepared for this project, which is available upon request at the BLM Vernal FO.

3.3.9.1 Colorado River Fish

The LCPA is located in the Upper Colorado River Basin. Both Hill Creek and Willow Creek flow through the LCPA, emptying into the Green River approximately 11.5 miles downstream of the LCPA. Although these creeks are perennial, they generally do not hold enough water to support fish populations.

The USFWS (1994b) identified four Federally-listed endangered fish species (collectively known as the Colorado River fish) historically associated with the Upper Colorado River Basin: Colorado pikeminnow (*Ptychochelius lucius*), humpback chub (*Gila cypha*), bonytail (*Gila elegans*), and razorback sucker (*Xyrauchen texanus*). These species have experienced severe population declines. Portions of the Green River and its 100-year floodplain, occurring downstream from the LCPA, have been designated as critical habitat for the four endangered fishes (USFWS 1994b). Species-specific descriptions are provided below:

<u>Colorado Pikeminnow</u>

The Colorado pikeminnow is a Federally-listed endangered species. The habitat of this species consists of swift flowing muddy rivers with quiet, warm backwaters. Colorado pikeminnow are primarily piscivorous (fish-eaters), but juveniles also eat insects and other invertebrates. The species spawns during the spring and summer over riffle areas with gravel or cobble substrate (Sigler and Sigler 1996).

Colorado pikeminnow were historically found in the mainstream Colorado River and its tributaries from Wyoming to the Sea of Cortez. Currently, wild populations of pikeminnow persist only in the upper Colorado River basin, including the Green River. The highest densities of the Colorado pikeminnow occur in the White River, which serves as a migration corridor to the Green and Yampa Rivers.

Humpback Chub

The humpback chub is a Federally-listed endangered species found in the Upper Colorado River Basin. The humpback prefers deep, fast-moving, turbid waters often associated with large boulders and steep cliffs. Historically, the humpback chub inhabited canyons of the Colorado River and four of its tributaries: the Green, Yampa, White, and Little Colorado rivers. Today, populations currently exist near the Colorado/Utah border in Westwater Canyon in Utah and at Black Rocks, in Colorado. Smaller numbers have been found in the Yampa and Green Rivers in Dinosaur National Monument, Desolation and Gray Canyons on the Green River in Utah, Cataract Canyon on the Colorado River in Utah and Arizona. The largest known population of the humpback chub is in the Little Colorado River in the Grand Canyon, where there may be up to 10,000 fish. There are no population estimates available for the rest of the Upper Colorado River Basin (USFWS 1994b).

Bonytail

The bonytail is a Federally-listed endangered species found in the Upper Colorado River Basin. This fish typically inhabits large, fast-flowing waterways of the Colorado River system. However, its distribution and habitat status is largely unknown. The fish spawn in the spring and summer over gravel substrate. Bonytail are now raised in fish hatcheries, with the juveniles released into the wild when they are large enough to survive in the altered Colorado River system environment (Sigler and Sigler 1996).

Bonytail once were common in portions of the upper and lower Colorado River basins. The bonytail is now the rarest of the endangered fish species in the Colorado River basin. Upstream of Lake Powell, this fish is nearly extinct, and in the last decade only a handful have been captured on the Yampa River in Dinosaur National Monument, on the Green River at Desolation and Gray Canyons and on the Colorado River at the Colorado/Utah border. In the lower basin, bonytail exist in Lake Mohave and Lake Havasu (USFWS 1994b).

Razorback Sucker

The razorback sucker is a Federally-listed endangered species found in the Upper Colorado River Basin. Razorbacks are found in deep, clear to turbid waters of large rivers and some reservoirs over mud, sand or gravel. Breeding males turn black up to the lateral line, with brilliant orange extending across the belly (Sigler and Sigler 1996).

Historically, the razorback sucker inhabited the Colorado River and its tributaries from Wyoming to the Sea of Cortez. The current distribution of razorback suckers in the Upper Colorado River Basin is confined to small groups of fish in several widely distributed locations. Most of these fish occur in the lower Yampa River and in the Green River from Dinosaur National Monument to its confluence with the Duchesne River. Small populations may also occur in the lower Green River, the Colorado River at Grand Valley, and in the San Juan River upstream from Lake Powell (USFWS 1997).

3.3.10 Livestock Grazing

The LCPA contains portions of eight grazing allotments on BLM, State, and reservation lands owned and administered by the BIA- Uintah and Ouray Agency and Ute Indian Tribe. All eight allotments in the LCPA are utilized by sheep or cattle during various grazing periods.

An animal unit month (AUM) is defined as the amount of forage needed to feed one cow, one goat, or five sheep for one month. Between the eight allotments, there are approximately 16,934 acres of usable BLM land allotted for grazing within the boundaries of the LCPA, involving about 1,512 livestock AUMs. Details on each allotment within the LCPA are summarized below in **Table 3-9**. The grazing allotments involved with this project are shown on **Figure 3-9** (**Appendix A**). Livestock grazing also occurs throughout portions of the LCPA on Tribal lands. Formal allotments and grazing seasons have not been identified on Tribal or private lands.

Table 3-9. Grazing Allotment Acres and AUMs Within the LCPA

Allotment Name	Type	Total Allotment Acres	Total BLM Allotment Acres	Usable[1] Allotment Acres w/in LCPA	AUMs W/in LCPA	Usable[1] BLM Acres w/in LCPA	BLM AUMs w/in LCPA
Big Pack Mountain	Sheep	14,627	13,633	9,561	812	8,847	688
Brewer	Cattle	2,808	2,770	58	4	58	3
Hatchbroome Bartholomew	Cattle	1,659	1,346	1,257	105	979	78
Lower Showalter	Cattle	21,514	16,772	29	2	10	1
Oil Shale	Sheep	41,339	14,990	3,510	97	3,347	254
Sand Wash	Cattle	74,424	52,062	2,942	232	2,057	323
Thorne-Ute-Broome	Cattle	5,441	3,699	2,017	108	1,288	86
Wild Horse Bench	Sheep	9,115	8,671	378	102	348	79
Total		**170,927**	**113,943**	**19,752**	**1,462**	**16,934**	**1,512**

Source: BLM 2007, Rangeland Administration System
[1] Usable land is defined as land that has a slope of 40% or lower.

3.3.11 Cultural Resources

A Class I cultural resource inventory was conducted to identify the extent of previous cultural resource surveys within the LCPA, which is located on lands administered by the BLM Vernal FO, the SITLA, the BIA – Uintah and Ouray Agency and the Ute Indian Tribe, and private landownership. Record searches for this project were performed at the Utah Division of State History, Utah SHPO, and the BLM Vernal FO. The objectives of the inventory were to identify the extent of previous cultural resource investigations within the LCPA and the number, locations, types, and significance of those previously documented cultural resources. The Class I data review conducted for the LCPA was used to make predictions about the type and potential site density of cultural resources within the LCPA, and provided a basis for assessing the potential impact to archaeological sites in areas where surface-disturbing activities are proposed.

The cultural resource inventory was conducted in compliance with Federal and State legislation including Section 106 of the NHPA, the NEPA, the Archaeological and Historic Preservation Act of 1974, the Archaeological Resources Protection Act of 1979, and the American Indian Religious Freedom Act of 1978. The NHPA sets forth national policy and procedures regarding "historic properties"—that is, regions, sites, buildings, structures, and objects included in or eligible for the NRHP. Section 106 of the NHPA requires Federal agencies to consider the effects of their undertakings on such properties, following regulations issued by the Advisory Council on Historic Preservation (ACHP) (36 CFR 800).

The cultural-chronological sequence in the LCPA includes the Paleoindian (ca. 12,000-8,000 years before present [B.P.]); the Archaic (ca. 8,000-1,500 B.P.), which can be further subdivided into Early, Middle, and Late periods; the Fremont (*Anno Domini* [A.D.] 500-1300); the Protohistoric (A.D. 1200-1750), and Euro-American stage, which began with the arrival of Europeans in the eighteenth century.

The Class I inventory resulted in the identification of 62 previous cultural resource inventories that have been conducted in the LCPA, as a whole. Most of the inventories were conducted in advance of oil and gas development, including seismic lines, well pad, and pipeline corridor construction. Forty-seven (about 76 percent) of these previous cultural resource inventories resulted in a finding of no cultural resources. Fifteen (about 24 percent) of these previous cultural resource inventories identified a total of 38 archaeological sites within the LCPA. These known archeological resources in the LCPA are dominated by historic sites (89 percent of the sites identified). Historic temporary camps/sheepherder camps (n=14) account for 37 percent of the total sites identified. In addition, five historic/Ute inscriptions, two corrals, one corral with derrick, one road segment, one historic structure, three ditches, three rock cairns, three trash scatters, and one prospector's pit were documented. Prehistoric site types include one lithic scatter, two sites containing petroglyph panels, and one hearth.

As outlined in **Section 2.4.5.2**, current regulations require that Class III cultural resource inventories (i.e., 100 percent pedestrian field survey) be completed prior to any surface-disturbing activity and that Section 106 consultation with the Utah SHPO occur with respect to all findings. Refer to **Table 6-1** for information regarding consultations,

3.3.12 Native American Religious Concerns

The LCPA is bounded by the Hill and Willow Creek drainages. Areas near permanent water or within immediate proximity of a semi-permanent water source are likely to have a high probability for Native American sites of cultural and/or religious significance. Juniper woodlands are also likely to have high potential for these types of sites (BLM 2005a). These areas may include Traditional Cultural Properties (TCPs) – sites and resources that have an association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community (16 U.S.C. 470, as amended). The American Indian Religious Freedom Act of 1978 directs Federal agencies to identify the presence or absence of Native American Religious sites through Tribal consultation and coordination. The BLM is responsible for consultation and coordination as part of the NEPA process. Refer to **Table 6-1** for information regarding consultations,

3.3.13 Paleontology

The following sections describe fossil resources within the LCPA.

3.3.13.1 Stratigraphy

Exposed portions of the Uinta Formation, the Green River Formation, and Quaternary alluvium comprise the ground surface in the LCPA. The lower part of the Uinta Formation covers approximately 54 percent of the ground surface in the LCPA. The Green River Formation covers approximately 36 percent of the ground surface in the LCPA. Quaternary alluvium occurs in valley bottoms of the LCPA along Willow Creek and Hill Creek. These sediments make up about 10 percent of the land surface.

3.3.13.2 Paleontological Resources

BLM Handbook H-8270, General Procedural Guidance for Paleontological Resource Management (1998) guides paleontological research on BLM-administered lands. The handbook presents a classification system for ranking areas and geologic formations according to their potential to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils.

More than 70 genera of fish, reptiles and mammals are known from the Uinta Formation (Madsen et al. 1981). Though not as plentiful or as well known, the Uinta Formation also has invertebrate fossils, plants, and trace fossils in the form of invertebrate burrows, bird and mammal tracks, and coprolites (Hamblin 1987; Hamblin et al. 1998; Hamblin et al. 1999).

The Green River Formation has also received much attention, with vertebrate and invertebrate fossils having been discovered throughout the formation (Bradley 1931; Grande 1984). The Uinta and Green River Formations are ranked as "Condition 1" formations (areas that are known to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils) according to the BLM's classification system.

3.3.13.3 Paleontology of the LCPA

Small paleontological resource surveys, primarily associated with oil and gas field developments, have taken place in the LCPA, but the bulk of the area is largely unsurveyed. A total of 14 fossil localities have been recorded in the LCPA. Nine of the localities occur in the Uinta Formation. Much of this fossil material consists of turtle shells, but mammal and crocodilian fossils have also been found. The remaining five fossil localities are in the Green River Formation. Four of these locations include plant material and one is a vertebrate (turtle shell fragments) site.

3.3.14 Socioeconomics

The LCPA is located in Uintah County, Utah, about 10 miles south of Ouray. Uintah County, which is the 11th most populated county in the State, constitutes the study area for the socioeconomic analysis in this EA. The municipalities and taxing districts that provide public facilities and services to the LCPA are also considered.

3.3.14.1 Demographics

Over the last 30 years, the communities in Uintah County have experienced varying degrees of population growth or decline in response to changes in the economy and in the energy industry, in particular. From the 1970s through 1983, the population of Uintah County grew steadily, then declined gradually from 1983 through 1989, and finally began a trend of re-growth in the 1990's that continues today. This fluctuation has mirrored the price fluctuations and employment trends seen in the energy sector in the County. It is projected that this growth would continue into the future, with gradual population increases forecasted into the year 2020 (Utah Department of Workforce Services 2004).

The key population centers within a reasonable commuting distance of the LCPA are the cities of Vernal (Uintah County), Roosevelt (Duchesne County), and Ft. Duchesne (Duchesne County). In 2002, Uintah County had a population of 26,155. The City of Vernal comprised about 30 percent of the County's population with 7,879 residents. The majority of Uintah County's population is concentrated along Highway 40 and to the north of Highway 40 in unincorporated communities. These areas were estimated to comprise about 62 percent of the County's population in 2002 (U.S. Census Bureau 2002).

Demographics of the Ute Indian Tribe

Approximately 14 percent of the lands within the LCPA are owned by the Ute Indian Tribe or Tribal allottees associated with the Uintah and Ouray Indian Reservation (Reservation). The Reservation was established in 1861, and was confirmed and modified by subsequent Acts of Congress. The Reservation was officially settled in 1905. Encompassing 4.5 million acres, the Reservation covers a large portion of Duchesne and Uintah Counties. According to the Tribe's Department of Vital Statistics, the enrolled membership of the Tribe is presently 3,120 members (Utah Department of Community and Economic Development 2004). The governing council of the Tribe is the elected Tribal Business Committee. Two representatives from each of the three Ute bands (Uintah, White River, and Uncompahgre) are elected to serve two-year terms on the Tribal Business Committee. According to the Utah Division of Indian Affairs (2006), there are 703 households on the Reservation. About 85 percent of Ute Tribe members live on the Reservation.

Local Economy and Employment

Uintah County has experienced broad economic swings over the last 25 years. The local economy has historically been, and remains, heavily dependent on the oil and gas industry. Economic conditions in Uintah County continue to mirror the state of that industry. Education, health services, leisure, and hospitality industries have added to Uintah County's economic diversification in recent years (Utah Department of Workforce Services 2004).

Major sources of employment in Uintah County include: the mining and oil and gas industries; local, State, and Federal government; wholesale and retail trade; and services (Utah Governor's Office of Planning and Budget 2004). **Table 3-10** provides a breakdown of non-agricultural sources of employment by economic sector in Uintah County.

As of March 2004, the unemployment rate in Uintah County was 5.3 percent, which was comparable to the State of Utah and United States as a whole, which were at 5.0 and 5.6 percent unemployment, respectively (Utah Department of Workforce Services 2004).

Table 3-10. Sources of Employment in Uintah County by Sector in 2002

Employment Sector	Number of Jobs	Percent of Total
Mining, Oil and Gas	1,612	16.2
Construction	503	5.0
Manufacturing	194	1.9
Trade (Wholesale and Retail), Transportation and Utilities	2,172	21.8
Information Services	120	1.2
Professional Services[a]	792	8.0
Education and Health Services	763	7.7
Services[b]	1,213	12.2
Government	2,589	26.0
Total	**9,958**	**100**

Source: Utah Governor's Office of Planning and Budget 2004.
[a] Professional Services include finance, insurance, real estate, and other professional services.
[b] Services include leisure, hospitality, and other services.

Due to the prevalence of the oil and gas and trade industries in Uintah County, wages are generally higher than in other rural counties in Utah. Uintah County's average monthly wage of $2,201 ranks 11th in the State, and is about 88 percent of the State's average of $2,510 (Utah Department of Workforce Services 2004).

Local Government Fiscal Conditions and Revenues from Oil and Gas Activities

Oil and gas operations contribute considerable revenue to various local, State, and Federal government entities through payment of various royalties and taxes. The following types of revenue are typically generated by oil and gas development: property tax revenue, Federal mineral lease royalties, sales and use tax revenue, and severance tax.

Property Tax Revenue

Among the most important sources of revenue in Uintah County are property taxes levied on assessed property. This revenue source is used by the county to fund a wide variety of services and community facilities. Given their generally high assessed value, oil and gas and other types of industrial operations often contribute a significant portion of a county's property tax base. The total assessed value of oil and gas extraction operations in 2003 for Uintah County was $418,801,897, which amounts to about 26 percent of Uintah County's total assessed valuation of $1,593,779,187 (Uintah County Clerk Auditor's Office 2004).

In addition to property tax payments, Uintah County also collects payments-in-lieu of taxes (PILT) from the Federal government for public lands within the county. In 2003, Federal PILT taxes paid to Uintah County amounted to about $1.2 million.

Federal Mineral Lease Royalties

Federal mineral lease royalties are collected from oil and gas, gas plant products, gilsonite, and phosphate extraction operations located on Federally-administered public lands in Uintah County. At present, the Federal royalty rate for gas is based on a step scale that varies by production rate. Federal mineral leasing regulations require the return of 50 percent of royalties collected from these operations to the State of origin. In 2001, total Federal mineral lease royalties generated by operations in Uintah County amounted to about $35.6 million, about $3.2 million of it was returned directly to the county, which then went to the county recreation and transportation special service districts (Minerals Management Service 2002).

Sales and Use Tax Revenue

Sales taxes are paid by oil and gas operations when purchases of equipment, materials, or supplies are made in the local area. Examples of purchases that generate sales tax revenue include gravel, pipe, fuel, and other supplies purchased locally. Use taxes are imposed by a State to compensate for the sales tax lost when an item is purchased outside of the State, but is used within the State. Similar to property tax revenue, sales and use tax revenues are used by local cities and counties to fund a wide variety of important services and community facilities. Currently, the sales and use tax rate in Uintah County is 6.5 percent (4.75 percent State, 1.75 percent county/local). In 2003, taxable sales in Uintah County yielded tax revenues of about $2.2 million (Uintah County Clerk Auditor's Office 2004).

Severance Tax

Severance tax is a tax on production and is currently a split rate. For example, the first $13.00 per barrel of oil is taxed at 3 percent; everything over $13.00 is taxed at 5 percent. The first $1.50 per mcf of gas is taxed at 3 percent; everything over that is taxed at 5 percent. This is a State of Utah tax that is charged by and paid to the State tax commission, and is placed into the general fund.

Ute Tribe Fiscal Revenues from Oil and Gas Activities

Revenue generated through mineral extraction is an important source of revenue for Tribal members. There is a complex mix of Federal and Tribal ownership of mineral rights within the Uintah and Ouray Indian Reservation. The Hill Creek Extension of the Reservation, within which a portion of the LCPA falls, is Tribal owned with mineral rights being held by the Federal government. Within this area, the Tribe benefits economically from revenue derived from granting ROWs to the oil and gas industry across Tribal surface. The Tribe also receives undisclosed revenues generated through Federal leasing agreements.

4.0 ENVIRONMENTAL EFFECTS

4.1 INTRODUCTION

The elements of the human environment or resource issues outlined in Chapter 1 that have the potential to be affected by the Proposed Action, Alternatives B and C are: Air quality; cultural resources; floodplains; invasive and noxious species; Native American religious concerns; threatened, endangered or candidate plant species; threatened, endangered or candidate animal species; water quality (drinking and ground); wetlands and riparian; livestock grazing; vegetation including special status species other than USFWS species; fish and wildlife including special status species other than USFWS species (e.g., migratory birds); soils and paleontology. The potential impacts related to each of these elements or resources are discussed in the above-listed order in the following sections by alternative.

As discussed in Chapter 2, the Proposed Action, Alternative B and Alternative C include interim reclamation in areas not needed for production. However, recent BLM monitoring has documented that interim reclamation efforts in oil and gas development areas have largely been unsuccessful due to the arid environmental of the Uinta Basin. Successful implementation of interim reclamation and revegetation practices would effectively reduce the initial disturbance resulting from the project, thus the long-term disturbance could be substantially less. However, regardless of the potential for reclamation success, for impact analyses within the following sections of this EA, direct and indirect impacts have been analyzed using the initial disturbance acreages disclosed in Chapter 2. Where interim reclamation efforts are successful, initial surface disturbances and subsequent impacts from surface disturbance could potentially be reduced.

It is also important to note that total resource-specific surface disturbances within the analyses in this chapter may differ slightly from the total surface disturbances calculations presented in Chapter 2. These minor differences are the result of both the conceptual nature of the project components and GIS-based analysis. Resource-specific total surface disturbance calculations may differ from total surface disturbances presented in Chapter 2 as a result of GIS-based buffer and clip functions. These GIS functions, when used in combination, effectively remove any areas of overlap between resources (e.g., clipping minor overlap between two vegetation communities) and/or feature buffers (e.g., overlapping well pads and ROWs). Therefore, the GIS analysis for Chapter 4 leads to a lower total disturbance value than those presented in the alternative descriptions.

4.2 DIRECT/INDIRECT IMPACTS

4.2.1 Air Quality

Direct and indirect impacts to air quality are discussed in the following sections.

4.2.1.1 Proposed Action

The primary emission sources would include those resulting from well development and well production. This includes increased vehicle traffic and drilling activity during the development phase of the Proposed Action, followed by continuous emissions from condensate storage tanks, associated production unit heaters, and compressor engines. Air pollutant emissions from these sources would include NO_X, CO, particulate matter less than 10 and 2.5 microns in effective diameter, and VOCs. Results indicate that BTEX compounds, n-hexane, and formaldehyde

would be the primary HAPs emitted from the Proposed Action sources. A copy of the detailed emission inventory is available upon request from the BLM Vernal FO.

During the construction and drilling phase over the first seven years, vehicle and fugitive dust emissions would increase within the Project Area. Vehicle emissions would result from work crews commuting to and from the work site and from the transportation and operation of equipment to construct wells pads, access roads, and pipelines. Vehicle tailpipes would emit small quantities of NO_X, SO_2, and CO. Fugitive dust concentrations would increase with additional vehicle traffic on unpaved roads and from wind erosion in areas of soil disturbance. Drill rig operations would result mainly in an increase of NO_X and CO emissions, with lesser amounts of SO_2. Emission rates were calculated using applicable EPA emission factors and anticipated level of operational activities, such as estimated vehicle trips, load factors, and hours of operation. These emissions would produce elevated pollutant levels but would be short-term and localized for the duration of the activities.

After construction, NO_x, CO, VOC, and HAP emissions would result from the long-term operation of compressor engines and dehydrators, heaters for the 3-phase separator on each well pad, and stock tank vents. Additionally, vehicles servicing wells would generate road dust (PM_{10} and $PM_{2.5}$).

Total estimated emissions are shown in **Table 4-1**. All development-related emission calculations, including well pad and road construction, well drilling, and well completion, assume a maximum development rate of 100 wells and 71 pads per year. The average development rate of 73 wells per year for seven years could be exceeded in any given year. Production emissions are calculated for the full-field development of 510 wells and one compressor station with 8,160 additional horsepower of compression and ancillary equipment.

Table 4-1. Little Canyon Proposed Action Emission Summary

Emissions (Tons/Year)				
Pollutant	**Development**	**Production**	**Compressor Stations**	**Total**
NO_x	171	169	118	458
CO	185	149	150	484
VOC	205	4,537	39.4	4,782
SO_2	9.4	0.05	0.17	9.58
PM_{10}	691	39.2	2.86	733
$PM_{2.5}$	110	15.4	2.86	128
Benzene	0	455	0.13	455
Toluene	0	859	0.12	860
Ethylbenzene	0	25.0	0.01	25.0
Xylene	0	340	0.05	341
n-Hexane	0	113	0.32	113
Formaldehyde	0.11	0.13	20.5	20.7

Criteria Pollutant Ambient Air Quality Impacts

Dispersion modeling was performed to predict the impacts of pollutant emissions against significance criteria for NO_x, CO, PM_{10} and $PM_{2.5}$ for both the development and operational phases of the Proposed Action. Because SO_2 emissions would be less than one ton per year for operations, no SO_2 modeling was done. **Table 4-2** shows the maximum predicted air quality

impacts with the appropriate NAAQS and applicable PSD Class II increments. As shown, the predicted impacts would be less than the applicable NAAQS and PSD Class II increments during long-term operations. Any comparisons with PSD increments are intended only to evaluate potential significance, and do not represent a regulatory PSD increment consumption analysis. PSD increment consumption analyses are typically applied to large industrial sources during the permitting process, and are solely the responsibility of the State of Utah and the EPA.

Table 4-2. Criteria Pollutants Ambient Air Maximum Impact Summary

Criteria Pollutant	Period	Project Impact (µg/m^3)	Percent of PSD Class II Increment (%)	Uinta Basin Background Concentration (µg/m^3)	Maximum Project Impact Plus Background (µg/m^3)	National and Utah Ambient Air Quality Standard (µg/m^3)	Percent of NAAQS
SO_2	3-Hour	8.17	1.6%	20	28.2	1300	2.2%
	24-Hour	2.34	2.6%	10	12.3	365	3.4%
	Annual	0.28	1.4%	5	5.28	80	6.6%
NO_2	Annual Mean	69.8	279%	5	74.8	100	75%
PM_{10}	24-hour Max Avg	38.6	129%	28	66.6	150	44%
$PM_{2.5}$	Annual Mean	2.35	NA	9	11.35	15	76%
	24-hour Max Avg[a]	7.6	NA	25	32.6	35	93%
CO	1-hour Max	4599	NA	1,111	5710	40,000	14%
CO	8-hour Max Avg	1279	NA	1,111	2390	10,000	24%

[a] Concentration estimate represents a three year average of the 8th highest 24-hour $PM_{2.5}$ concentrations.

Hazardous Pollutant Ambient Air Impacts

HAP impacts resulting from ongoing operations were evaluated for a representative gas processing facility surrounded by a grid of well pad locations. Potential HAP impacts included formaldehyde, BTEX, and n-hexane emissions from central compressor engines, central dehydrators, well pad dehydrators, well pad separators, and well pad and central condensate storage tanks.

HAP emissions were evaluated against State of Utah thresholds. The State of Utah has adopted TSLs which are applied during the air permitting process to assist in the evaluation of hazardous air pollutants released into the atmosphere (UDEQ-DAQ 2000). These levels are not standards that must be met, but screening thresholds which if exceeded, would suggest that additional information is needed to evaluate potential health and environmental impacts. The TSLs for formaldehyde, BTEX compounds, and n-hexane were compared against modeling concentrations for each pollutant. As shown in **Table 4-3**, the potential concentration for benzene and formaldehyde are above the TSL. Therefore, additional analysis was conducted.

Table 4-3. Comparison of Proposed Action Predicted Emissions to State of Utah Toxic Screening Levels

HAP and Averaging Period	Ambient Air Concentration (µg/m^3)[a]		
	Predicted	Toxic Screening Levels[c]	% of TSL
Benzene [b] (24-hour)	341	53	643%
Toluene (24-hour)	653	6,280	10%
Ethylbenzene (1-hour)	128	54,274	0.24%
Ethylbenzene (24-hour)	19.1	14,473	0.13%
Xylene (1-hour)	1,749	65,129	2.69%
Xylene (24-hour)	262	14,473	1.81%
n-Hexane (24-hour)	242	5,875	4.12%
Formaldehyde (1-hour)	91.0	37	246%

[a] µ/m^3 is micrograms of pollutant per cubic meter of air
[b] Although there exists an acute TLV for benzene, the State of Utah does not apply a comparison to an acute TSL since the chronic TSL is more stringent.
[c] Source: UDEQ-DAQ 2000.

Short-term impacts from HAP exposure were assessed by comparing one-hour average impacts to the HAP-specific acute REL and annual average impacts to the HAP-specific RfC (for continuous inhalation exposure). The REL is the acute concentration at or below which no adverse health effects are expected. The RfC is the average concentration (i.e., an annual average) at or below which no long-term adverse health effects are expected. Both of these guideline values are for non-carcinogenic effects.

Table 4-4 presents the acute RELs and RfCs for non-carcinogenic effects for the Proposed Action. The predicted maximum concentrations of all HAPs are compared against the REL and RfC for each pollutant. Predicted concentrations for benzene and formaldehyde exceed the reference exposure level for Alternative A.

Table 4-4. Proposed Action Non-Carcinogenic Acute REL and RfC Impacts

HAP	REL (µg/m^3)	Predicted Maximum One-Hour Impact (µg/m^3)	Percent of REL	RfC[d] (µg/m^3)	Predicted Maximum Annual Impact (µg/m^3)	Percent of RfC
Benzene	1,300 [a,b]	873	67%	30	14.8	49%
Benzene	160,000[c]	2,286	1.4%			
Toluene	37,000 [a]	4,372	11.8%	400	28.0	7.0%
Ethylbenzene	350,000 [c]	128	0.04%	1,000	0.81	0.08%
Xylenes	22,000 [a]	1,749	7.95%	100	11.1	11.1%
n-Hexane	390,000 [c]	1,482	0.38%	200	17.4	8.7%
Formaldehyde	94 [a]	91.0	97%	9.8	2.02	21%

[a] EPA Air Toxics Database, Table 2 (EPA 2002)
[b] REL for benzene is based on a 6-hr exposure (OEHHA 1999), predicted concentration is a 6-hr average.
[c] Immediately Dangerous to Life or Health (IDLH)/10, EPA Air Toxics Database, Table 2 (EPA 2002) since no available REL
[d] EPA Air Toxics Database, Table 1 (EPA 2002)

The risk from long-term exposure to carcinogenic HAP emissions is assessed by comparison to the generally acceptable risk range of one additional cancer per one million exposed persons (1 x 10^{-6}) to one additional cancer per ten thousand exposed persons (1 x 10^{-4}) (40 CFR § 300.430 (e) (2) (i) (A)). Benzene and formaldehyde, the project HAP carcinogens, are evaluated.

Screening level risk assessment involves application of a HAP specific unit risk factor. The unit risk factor is an upper-bound estimate of the probability of one additional person contracting cancer based on continuous exposure to 1-μg/m^3 of the substance over a 70-year lifetime. Exposure adjustment factors are calculated to adjust for actual exposure times. Cancer risk is estimated for two exposure scenarios: the most likely exposure (MLE) that individuals will experience, and the maximally exposed individual (MEI).

The MLE is to people living in the LCPA. For the MLE exposure adjustment factor, it is assumed a family stays at a residence an average of nine years and spends 64 percent of the day away from the home (EPA 1997). It is further assumed that households are exposed to one-quarter of the maximum concentration the remaining (36 percent) of the time. This results in an adjustment factor of 0.095 [(9/70)*((0.64*1)+(0.36*0.25))].

An example of an MEI could be an XTO pumper that visits well sites daily and lives near a well pad. For the MEI exposure adjustment factor, exposure is assumed to occur continuously (24 hours per day, 365 days per year) for the life of project (assumed to be 25 years). This results in an adjustment factor of 0.357 [25/70].

Table 4-5 presents the unit risk factor, exposure adjustment factor, and the estimated cancer risk for the MLE and MEI exposure scenarios for benzene and formaldehyde. A range of unit risk factors is available for benzene. Individuals are exposed to both pollutants at the same time so the risk is cumulative. There is uncertainty involved in adding cancer risk estimates together, however it is common when carcinogens have similar target organs or modes of action. Benzene is a known human carcinogen, exposure is known to cause leukemia. Formaldehyde is a probable carcinogen, exposure is suspected to cause leukemia. The risk range for the MLE is 5.6 x 10^{-6} to 1.3 x 10^{-5}. The risk range for the MEI is 2.1 x 10^{-5} to 8.0 x 10^{-5}. Both cancer risk ranges are in the acceptable range of cancer risk.

Table 4-5. Proposed Action Carcinogenic HAP Risk

Exposure Scenario	HAP	Unit Risk Factor (1/μg/m^3)	Exposure Adjustment Factor	Modeled Annual Impact (μg/m^3)	Cancer Risk
MLE	Benzene	2.2 x 10^{-6} to 7.8 x 10^{-6}	0.095	14.8	3.1 x 10-^{6} to 1.9 x 10^{-5}
MLE	Formaldehyde	1.3 x 10^{-5}	0.095	2.02	2.5 x 10^{-6}
MEI	Benzene	2.2 x 10^{-6} to 7.8 x 10^{-6}	0.357	14.8	1.2 x 10^{-5} to 4.1 x 10^{-5}
MEI	Formaldehyde	1.3 x 10^{-5}	0.357	2.02	9.4 x 10^{-6}

4.2.1.2 Alternative B – Conservation Alternative

The primary air emission sources resulting from Alternative B operation and development activities would be the same as those sources presented under Alternative A however with implementation of directing well site dehydrator emissions to a drip tank; hazardous air pollutant emissions from well site dehydrators would be reduced. A copy of the detailed emission inventory is available upon request from the BLM Vernal FO. **Table 4-6** shows the total estimated emissions for Alternative B.

Table 4-6. Little Canyon Alternative B Emission Summary

Emissions (Tons/Year)				
Pollutant	**Development**	**Production**	**Compressor Stations**	**Total**
NO_x	171	169	118	458
CO	185	149	12	346
VOC	205	3,303	27.6	3,536
SO_2	9.36	0.05	0.17	9.58
PM_{10}	691	39.2	2.86	733
$PM_{2.5}$	110	15.4	2.86	128
Benzene	0.00	442	0.13	442
Toluene	0.00	846	0.12	847
Ethylbenzene	0.00	24.9	0.01	24.9
Xylene	0.00	339	0.05	339
n-Hexane	0.00	65.1	0.32	65.4
Formaldehyde	0.11	0.13	1.0	1.29

Since criteria pollutant emissions for Alternative A were below the NAAQS and emissions for CO are lower for Alternative B, it is assumed criteria pollutant emissions for alternative B would also be below NAAQS levels.

Hazardous Pollutant Ambient Air Impacts

HAP emissions were evaluated against State of Utah thresholds. The State of Utah has adopted TSLs which are applied during the air permitting process to assist in the evaluation of hazardous air pollutants released into the atmosphere (UDEQ-DAQ 2000). These levels are not standards that must be met, but screening thresholds which if exceeded, would suggest that additional information is needed to evaluate potential health and environmental impacts. The TSLs for formaldehyde, BTEX compounds, and n-hexane were compared against modeling concentrations for each pollutant. As shown in **Table 4-7**, none of the potential concentrations for HAPs are above the TSL. For comparison to Alternative A the same additional analysis were completed.

Table 4-7. Comparison of Alternative B Predicted Emissions to State of Utah Toxic Screening Levels

HAP and Averaging Period	Ambient Air Concentration ($\mu g/m^3$)[a]		
	Predicted	**Toxic Screening Levels[c]**	**% of TSL**
Benzene [b] (24-hour)	82.6	53	156%
Toluene (24-hour)	96.9	6,280	2%
Ethylbenzene (1-hour)	5.84	54,274	0.01%
Ethylbenzene (24-hour)	1.62	14,473	0.01%
Xylene (1-hour)	57.0	65,129	0.09%
Xylene (24-hour)	16.0	14,473	0.11%
n-Hexane (24-hour)	242	5,875	4.12%
Formaldehyde (1-hour)	91.0	37	246%

[a] μ/m^3 is micrograms of pollutant per cubic meter of air
[b] Although there exists an acute TLV for benzene, the State of Utah does not apply a comparison to an acute TSL since the chronic TSL is more stringent.
[c] Source: UDEQ-DAQ 2000.

Short-term impacts from HAP exposure were assessed by comparing one-hour average impacts to the HAP-specific acute REL and annual average impacts to the HAP-specific RfC (for continuous inhalation exposure). The REL is the acute concentration at or below which no adverse health effects are expected. The RfC is the average concentration (i.e., an annual average) at or below which no long-term adverse health effects are expected. Both of these guideline values are for non-carcinogen effects.

Table 4-8 presents the acute RELs and RfCs for non-carcinogen effects for the Proposed Action. The predicted maximum concentrations of all HAPs are compared against the REL and RfC for each pollutant. Predicted concentrations for Alternative B are all below the reference exposure level.

Table 4-8. Alternative B Non-Carcinogenic Acute REL and RfC Impacts

HAP	REL ($\mu g/m^3$)	Predicted Maximum One-Hour Impact ($\mu g/m^3$)	Percent of REL	RfC[d] ($\mu g/m^3$)	Predicted Maximum Annual Impact ($\mu g/m^3$)	Percent of RfC
Benzene	1,300 [a,b]	109	8.4%	30	6.03	20.1%
Benzene	160,000 [c]	296	0.19%			
Toluene	37,000 [a]	348	0.94%	400	7.06	1.8%
Ethylbenzene	350,000 [c]	5.84	0.00%	1,000	0.12	0.01%
Xylenes	22,000 [a]	57.0	0.26%	100	1.17	1.2%
n-Hexane	390,000 [c]	885	0.23%	200	17.2	8.6%
Formaldehyde	94 [a]	91.0	97%	9.8	2.02	20.6%

[a] EPA Air Toxics Database, Table 2 (EPA 2002)
[b] REL for benzene is based on a 6-hr exposure (OEHHA 1999), predicted concentration is a 6-hr average.
[c] Immediately Dangerous to Life or Health (IDLH)/10, EPA Air Toxics Database, Table 2 (EPA 2002) since no available REL
[d] EPA Air Toxics Database, Table 1 (EPA 2002)

The risk from long-term exposure to carcinogenic HAP emissions is assessed by comparison to the generally acceptable risk range of one additional cancer per one million exposed persons (1×10^{-6}) to one additional cancer per ten thousand exposed persons (1×10^{-4}) (40 CFR § 300.430 (e) (2) (i) (A)). Benzene and formaldehyde, the project HAP carcinogens, are evaluated.

Screening level risk assessment involves application of a HAP specific unit risk factor. The unit risk factor is an upper-bound estimate of the probability of one additional person contracting cancer based on continuous exposure to 1-$\mu g/m^3$ of the substance over a 70-year lifetime. Exposure adjustment factors are calculated to adjust for actual exposure times. Cancer risk is estimated for two exposure scenarios: MLE that individuals will experience, and the MEI.

The MLE is to people living in the LCPA. For the MLE exposure adjustment factor, it is assumed a family stays at a residence an average of nine years and spends 64 percent of the day away from the home (EPA 1997). It is further assumed that households are exposed to one-quarter of the maximum concentration the remaining (36 percent) of the time. This results in an adjustment factor of 0.095 [(9/70)*((0.64*1)+(0.36*0.25))].

An example of an MEI could be an XTO pumper that visits well sites daily and lives near a well pad. For the MEI exposure adjustment factor, exposure is assumed to occur continuously (24

hours per day, 365 days per year) for the life of project (assumed to be 25 years). This results in an adjustment factor of 0.357 [25/70].

Table 4-9 presents the unit risk factor, exposure adjustment factor, and the estimated cancer risk for the MLE and MEI exposure scenarios for benzene and formaldehyde. A range of unit risk factors is available for benzene. Individuals are exposed to both pollutants at the same time so the risk is cumulative. There is uncertainty involved in adding cancer risk estimates together, however it is common when carcinogens have similar target organs or modes of action. Benzene is a known human carcinogen, exposure is known to cause leukemia. Formaldehyde is a probable carcinogen, exposure is suspected to cause leukemia. The risk range for the MLE is 3.8×10^{-6} to 7.0×10^{-6}. The risk range for the MEI is 1.4×10^{-5} to 2.6×10^{-5}. Both cancer risk ranges are in the acceptable range of cancer risk.

Table 4-9. Proposed Action Carcinogenic HAP Risk

Exposure Scenario	HAP	Unit Risk Factor ($1/\mu g/m^3$)	Exposure Adjustment Factor	Modeled Annual Impact ($\mu g/m^3$)	Cancer Risk
MLE	Benzene	2.2×10^{-6} to 7.8×10^{-6}	0.095	6.03	$1.3 \times 10\text{-}^{6}$ To 4.5×10^{-6}
MLE	Formaldehyde	1.3×10^{-5}	0.095	2.02	2.5×10^{-6}
MEI	Benzene	2.2×10^{-6} to 7.8×10^{-6}	0.357	6.03	4.7×10^{-6} To 1.7×10^{-5}
MEI	Formaldehyde	1.3×10^{-5}	0.357	2.02	9.4×10^{-6}

4.2.1.3 Alternative C – No Action

The primary air emission sources resulting from Alternative C operation and development activities would be the same as those sources presented under Alternative A. However, given a reduced number of wells, emissions from well development and well operations would be expected to be roughly 30 % of those calculated for Alternative A. Not expanding compressor station emissions would reduce emissions to roughly 25% of Alternative A. A copy of the detailed emission inventory is available upon request from the BLM Vernal FO. **Table 4-10** summarizes the emissions inventory for Alternative C. Given these assumptions, NO_2, CO, and HAP maximum concentrations from the Little Canyon compressor station would be roughly 25% of those predicted under Alternative A, while fugitive dust impacts (PM_{10} and $PM_{2.5}$) would be roughly 30 % of those predicted. Since Alternative A impacts were below all ambient air quality standards, it follows that significant impacts to ambient air quality are not anticipated for Alternative C.

Table 4-10. Little Canyon No Action Emission Summary

Project Emissions (tons/year)			
Pollutant	**Well Development**	**Well Production**	**Emissions Total**
NO_X	167	26.7	194
CO	180	23.7	204

Project Emissions (tons/year)			
Pollutant	**Well Development**	**Well Production**	**Emissions Total**
VOC	167	1,004	1,171
SO_2	9.1	0.0	9.15
PM_{10}	550	28.4	579
$PM_{2.5}$	88.2	4.7	93
Benzene	0.0	124	124
Toluene	0.0	212	212
Ethylbenzene	0.0	5.4	5.38
Xylene	0.0	67.5	67.5
n-Hexane	0.0	21.7	21.7
Formaldehyde	0.12	0.0	0.12

Mitigation Measures

The following recommended mitigation measures would further reduce impacts to air quality resources:

- The construction, drilling, and completion crew would be encouraged by the operator to carpool to and from surrounding cities and towns to minimize vehicle-related emissions and fugitive dust.
- Compressor engines would be operated and maintained to minimize emissions. from these sources.
- XTO would use flares to reduce well site dehydrator and tank flash emissions, to drip tanks, which would substantially reduce HAPs emissions.

4.2.2 Water Resources

This section addresses potential impacts to surface water and floodplains resulting from the development of natural gas wells in the LCPA. The BLM has determined that there would be no impacts to groundwater (see **Appendix B** for the IDT checklist).

4.2.2.1 Alternative A – Proposed Action

Surface Water

The potential impacts to surface water are:

- Increased sedimentation and turbidity of surface water as a result of ground disturbance and increased erosion into surface waters via runoff;
- Alteration of stream flow regimes such as depletion of water flow in the Green River due to project-related water consumption; and
- Effects on water quality – i.e., potential contamination of surface water resources with drilling fluids, petroleum, or other chemicals used for natural gas drilling and production activities.

The potential for impacts would be greatest shortly after the start of construction activities and would decrease in time due to natural stabilization, reclamation, and revegetation efforts. The magnitude of these potential impacts to surface water resources depends on several factors, including the proximity of the disturbance to the water influence zone of surface water drainages or ponds, slope aspect and gradient, soil type, the duration and timing of the construction activity, and the success or failure of reclamation and mitigation measures. The water influence zone is defined as the riparian buffer zone that includes the floodplain, riparian vegetation, inner gorge, unstable areas, or highly erodible soils located adjacent to a stream or other water body. Each of the potential impacts is discussed below.

Erosion and Sedimentation

Increased erosion and subsequent increased sedimentation of perennial streams and ephemeral drainages within the LCPA is possible, especially during the construction of the project facilities. The increased erosion could also potentially lead to an increase in turbidity in Hill Creek and Willow Creek and other drainages. Increase in both sedimentation and turbidity could have negative impacts on aquatic habitat within affected drainages.

Soil loss calculations indicate that an estimated 5,458 tons per year of additional erosion could be expected to occur as a result of the Proposed Action. This erosion estimate is subject to considerable uncertainty. Over time, short-duration precipitation events and snowmelt could cause soil loss from the proposed facilities in the LCPA to reach the drainages of adjacent ephemeral watersheds. This fine sediment could then eventually be transported down the ephemeral drainages to Hill Creek and Willow Creek, and then on to the Green River. In sufficient amounts, the additional sediment from construction activities and operational facilities could clog stream channels, cause accelerated siltation of livestock ponds, degrade aquatic habitat by covering stream substrates with fine sediment, increase the turbidity within the streams during the short-term, and act as a carrier for other pollutants (trace metals, pesticides, plant nutrients, etc).

With the proper application and maintenance of erosion control measures, the actual amount of sediment that could potentially be transported to Willow Creek, Hill Creek, and the Green River would be much less than the additional gross erosion estimated above. The amount of additional sediment that could potentially reach the drainages in the LCPA depends on natural factors and the effectiveness of the erosion control measures employed. Natural factors which attenuate the transport of sediment into creeks include water available for overland flow, the texture of the eroded material, the amount and kind of ground cover, the slope shape, gradient, and length, and surface roughness (Barfield et al 1981).

The erosion control measures employed would be of two types: non-structural controls and structural controls. Non-structural controls include: proper clearing, grading, and construction practices, including surface roughening and crowning and ditching of roadways. Structural controls would be used along the proposed access roads, at drilling locations, and at other project facilities to minimize the amount of sediment that reaches any ephemeral drainage in the LCPA, where needed. The structural controls used would be specified during the APD process for each project facility.

Studies concerning the effectiveness of the structural erosion controls for oil and gas sites have not been conducted. However, several studies conducted in urban settings provide insight into the potential effectiveness of the structural erosion controls that would likely be employed for erosion control in the LCPA. EPA (1997) estimated that the theoretical total suspended solids (TSS) removal efficiency for retention basins, infiltration basins, and vegetated filter strips are all

in the range of 50-80 percent. Actual performance for these structural erosion controls was measured at urban sites and was reported to be 70 percent for retention basins, 89 percent for infiltration basins, and 81 percent for vegetated filter strips. In another study, EPA (2002) reported ranges of TSS removal of 58-78 percent for retention basins, 75 percent for infiltration basins, and 54-84 percent for vegetated filter strips. Using these studies as examples, it is assumed that the structural erosion controls employed would be about 70 percent effective in removing TSS from surface waters that run off from the project facilities. Therefore, for the purposes of estimating the amount of increased sediment delivery, it is assumed that 30 percent of the increased erosion calculated could be expected to eventually be delivered to Willow Creek, Hill Creek, and the Green River.

If the natural factors that affect sediment delivery are ignored, the estimated additional sediment delivery from the Proposed Action is about 1,637 tons per year.

Based on data collected at the USGS gauging stations (the median of the calculated sediment loadings in tons/year), existing sediment loading in Hill Creek near the mouth averages about 7,665 tons/year, and existing sediment loading in Willow Creek is considerably higher and averages about 91,615 tons/year. Annual sediment loading in the Green River at Ouray, Utah is about 6,789,000 tons. The highest sediment loading occurs during the months of May and June from snowmelt runoff. If it is assumed that all sediment from the construction of the project facilities would eventually be transported to the Green River, the increased sediment loading to the Green River would be about 0.02 percent.

Stream Flow Regimes

As previously discussed, approximately 21,000 bbls (2.7 acre-feet) of water would be needed to drill and complete each well. As such, the drilling and completion of all 510 proposed wells would therefore consume about 1,377 acre-feet of water over a period of 7 years, for approximately 196 acre-feet per year. In addition to water for drilling and completion, approximately 1,000 bbls (0.13 acre-feet) of water per well pad and associated access road would be utilized for dust abatement each year. As such, water utilized for dust abatement, for a maximum of 362 well pads and associated roads, would be approximately 47 acre-feet per year over the 25-year project life (1,175 acre-feet). Based upon these water use estimates, approximately 243 acre-feet of water would be used for drilling, completion, and dust abatement each year during the approximate 7-year development phase of the project. Following drilling and completion activities, water usage would then be limited to approximately 47 acre-feet per year for dust abatement for the remainder of the project life.

Water would be obtained from a variety of permitted sources listed in **Table 2-1**. Assuming that all water withdrawn from the sources depletes the flow of the Green River, the Proposed Action could potentially deplete the flow of the Green River by a maximum of about 0.006 percent. Thus, the project-related flow depletion would be negligible from a hydrologic standpoint.

Since water needed for drilling and completion activities and dust suppression would be obtained from offsite sources, no diversions or alterations of flow regimes of Hill Creek or Willow Creek would occur. Soils compacted on existing roads, new access roads, and well pads contribute slightly greater runoff than undisturbed sites. The increased runoff could lead to slightly higher peak flows in Hill Creek and Willow Creek, potentially increasing erosion of the channel banks. The increased erosion could also potentially increase turbidity in these streams during storm events.

Water Quality

Sources of potential surface water contamination include leaks from wellheads, gathering pipelines, produced water and condensate storage tanks, tanker trucks, and leaching of contaminants from impacted soils near these facilities. In addition, accidental spills of hydrocarbon products, such as equipment fuels and produced petroleum products, would have the potential to contaminate surface waters. The impacts from a potential spill would be localized and have little chance of migrating to the Green River. Since surface disturbance within close proximity to streams have the greatest potential for impacting water resources, rapid and successful reclamation/re-vegetation of temporarily disturbed areas would be particularly important in minimizing water quality impacts.

Standard industry practices and safety measures associated with the installation of roads, pipelines, and well pad facilities, and the containment of storage tanks in bermed areas would be implemented to minimize the potential for accidental spills or introduction of contaminants to LCPA drainages. To minimize the potential for hydrocarbon contamination of surface water, pipelines and associated collection piping would be designed to minimize the potential for spills and leaks. Storage tanks would be surrounded by berms capable of holding at least 110 percent of the volume of the largest tank within the berm. All produced water would be removed from the LCPA and disposed of at an off-site permitted facility. In addition, the reserve pit at each drilling location would be lined with a synthetic liner, as described in **Chapter 2**. These measures would reduce the potential for adverse impacts to surface water resources.

Hydrofracturing of the Wasatch and Mesaverde formations for the proposed new wells would be conducted as part of the Proposed Action. Hydrofracturing is commonly used to enhance the recovery of natural gas from relatively impermeable "tight" sandstones, and involves the injection of water or other fluids, which may contain some petroleum constituents, and sand or some other "proppant" into the formation. Studies conducted for a proposed natural gas project targeting the Mesaverde Formation in western Colorado show that the maximum fracture distance would extend approximately 500 feet radially from each well (Wright Water Engineers 2003). Hydrofracturing would occur at depths that are at least 8,000 feet or more below the surface. Therefore, the potential for impacts to surface water resources from the proposed hydrofracturing is considered to be negligible.

Floodplains

Floodplains are protected by Executive Order 11988 which requires that all Federal agencies take action to reduce the risk from floods, such as minimizing the impact of floods on human safety, health, and welfare, as well as restoring and preserving the natural and beneficial values served by floodplains. Potential impacts to floodplains from the Proposed Action include increased sedimentation, pollution of surface water due to accidental spills or loss of containment of petroleum products, fuels and other chemicals, and damage to or loss of riparian vegetation.

Increased erosion from construction activities could increase the sedimentation rate to floodplains and potentially reduce water nutrients and diversity of organisms. The eroded soil could also enter Willow Creek and Hill Creek and potentially result in the mortality of the macroinvertebrates and other organisms present in these creeks. Accidental spills of natural gas condensate or produced water could also result in mortality of the flora and fauna that are characteristic of the floodplains. Under Alternative A, approximately 25 well pads are proposed within the 100-year floodplains of Hill and Willow Creeks in the LCPA.

4.2.2.2 Alternative B – Conservation Alternative

Potential impacts to surface water and floodplains in the LCPA from Alternative B are similar to those for the Proposed Action. The majority of the additional environmental protection measures would decrease the potential for other adverse impacts as compared to the Proposed Action.

Erosion and Sedimentation

Increased erosion and subsequent increased sedimentation of perennial streams and ephemeral drainages within the LCPA is possible, especially during the construction of the project facilities. The increased erosion could also potentially lead to an increase in turbidity in Hill Creek and Willow Creek and other drainages. Both of these effects could have negative impacts on aquatic habitat within affected drainages.

Soil loss calculations indicate that an estimated 5,458 tons per year of additional erosion could be expected to occur under Alternative B, the same as for the Proposed Action. As described in **Section 4.2.3.1**, this erosion estimate is subject to considerable uncertainty. The actual amount of additional sediment that would reach the drainages in the LCPA depends on natural factors and the effectiveness of the structural erosion controls employed, as described under the Proposed Action. Under Alternative B, the erosion control devices used would be specified by the appropriate SMA for each project facility. In addition, erosion control efforts would be monitored by the operator and necessary modifications would be made to control erosion.

If the natural factors that affect sediment delivery are ignored, the analysis presented shows that the estimated additional sediment delivery from Alternative B is about 1,637 tons per year, or the same as for the Proposed Action. However, application of the additional environmental protection measures (**Section 2.5.1**) would reduce the actual increased sediment delivery below these estimates, especially over the long-term. Under Alternative B, drainage controls would be employed along all new roads as described in **Section 2.5.1**. Stream crossings would be constructed in a manner that would maintain stable bank conditions and occur at right angles to the stream. Sedimentation control devices would be used as directed by the appropriate SMA along new roads and at drilling locations to minimize the amount of sediment that reaches any stream in the LCPA. With the implementation of the additional mitigation measures, the overall impact of the increased sediment loading to Hill Creek and Willow Creek from construction of the project facilities would be lower than that for the Proposed Action.

Stream Flow Regimes

Because of the enhanced dust abatement that would be required under the Conservation Alternative, an additional 31 acre-feet of water[1] (approximately 4.4 acre-feet per year during the 7-year development phase) would be needed for enhanced dust abatement activities during construction near known plants of the shrubby reed-mustard and clay reed-mustard (see **Section 2.5.1.5**). Thus total water usage for the 7-year development phase would be approximately 47 acre-feet per year, plus the additional 31 acre-feet of water needed for enhanced dust abatement, for a total of 51 acre-feet per year during the 7-year development phase. This additional potential depletion would still be negligible from a hydrologic standpoint.

[1] Conservatively assumes that approximately 1/3 of the proposed well pads would occur within 300 feet of occupied habitat of the shrubby and/or clay reed-mustard. Further assumes, that to meet the enhanced dust abatement requirement within these areas, three times as much water would be needed for dust abatement.

No diversions or alterations of flow regimes of Hill Creek or Willow Creek would occur under Alternative B. Soils compacted on existing roads, new access roads, and well pads would contribute slightly to greater runoff and could lead to slightly higher peak flows in Hill Creek and Willow Creek, potentially increasing erosion of the channel banks. The increased erosion would also potentially increase turbidity in these streams during storm events. However, under Alternative B compacted soils would be ripped prior to reclamation. Therefore, the amount of increased runoff would be slightly lower under Alternative B than for the Proposed Action.

Water Quality

Leaks from wellheads, gathering pipelines, storage tanks, and tanker trucks, leaching of contaminants from impacted soils near these facilities, and accidental spills of hydrocarbon products would have the potential to contaminate surface waters. The impacts from such a spill would be localized and have little chance of migrating to the Green River. Rapid and successful reclamation/re-vegetation of temporarily disturbed areas, and implementation of the additional mitigation measures to reduce erosion, would be particularly important in minimizing water quality impacts.

Standard industry practices and safety measures associated with the installation of roads, pipelines, and well pad facilities, and the containment of storage tanks in bermed areas would be implemented to minimize the risk of accidental spills or introduction of contaminants to LCPA drainages, as described above for the Proposed Action. In addition, under Alternative B, the use of berms around well pads, drainage ditches, closed-loop drilling, and locating facilities away from the drainages would be evaluated and considered on a site-by-site basis to minimize the potential for surface water contamination.

As described above for the Proposed Action, the potential for impacts to surface water resources from the proposed hydrofracturing is considered to be negligible.

Floodplains

Potential impacts to floodplains from Alternative B are similar to those for the Proposed Action. However, under Alternative B, construction of berms around pads, the use of closed-loop drilling, and locating facilities away from drainages would be considered on a site-by-site basis to minimize the possibility of contaminants entering floodplains. In addition, where directed by the appropriate SMA, the operator would construct erosion control devices (e.g., riprap, bales, and heavy vegetation) at culvert outlets, and all construction activities would be performed to retain natural water flows. These additional mitigation measures would lessen the potential for adverse impacts to floodplains.

4.2.2.3 Alternative C – No Action

Under the No Action Alternative, new wells would not be allowed on Federal lands. However, wells would still be drilled on private, SITLA, and Tribal allotted lands within the LCPA and reasonable access would be permitted across Federal lands. A total of 81 wells could be drilled under the No Action Alternative, as compared to 510 wells under the Proposed Action.

Erosion and Sedimentation

Soil loss calculations indicate that an estimated 1,410 tons per year of additional erosion could be expected to occur under the No Action Alternative, or about one-fourth of that for the Proposed Action. As described in **Section 4.2.3.1**, this erosion estimate is subject to considerable

uncertainty. If the natural factors that affect sediment delivery are ignored, the estimated potential additional sediment delivery from Alternative B is about 423 tons per year.

Stream Flow Regimes

As previously discussed, approximately 21,000 barrels (2.7 acre-feet) of water would be needed to drill and complete each well. As such, the drilling and completion of all 81 proposed wells would therefore consume about 219 acre-feet of water over a period of 3 years, for approximately 73 acre-feet per year. In addition to water for drilling and completion, approximately 1,000 barrels (0.13 acre-feet) of water per well pad and associated access road would be utilized for general dust abatement each year. As such, water utilized for general dust abatement for a maximum of 62 well pads and associated roads would be approximately 8 acre-feet per year over the 25-year life of the producing wells (total of 201 acre-feet). Based upon these water use estimates, approximately 81 acre-feet of water would be used for drilling, completion, and dust abatement each year for 3-year development phase of the project. Following drilling and completion activities, water usage would then be limited to approximately 8 acre-feet per year for dust abatement for the life of the producing wells. Assuming that all water is withdrawn from the sources in **Table 2-1** deplete the flow in the Green River, the No Action Alternative would deplete the flow by a less than 0.002 percent. This project-related flow depletion would be negligible from a hydrologic standpoint.

No diversions or alterations of flow regimes of Hill Creek or Willow Creek would occur. Soils compacted on existing roads, new access roads, and well pads would contribute slightly greater runoff and could lead to slightly higher peak flows in Hill Creek and Willow Creek, potentially increasing erosion of the channel banks. The increased erosion would potentially increase turbidity in these streams during storm events.

Water Quality

Leaks from wellheads, gathering pipelines, storage tanks, and tanker trucks, leaching of contaminants from impacted soils near these facilities, and accidental spills of hydrocarbon products would have the potential to contaminate surface waters.

Standard industry practices and safety measures associated with the installation of roads, pipelines, and well pad facilities, and the containment of storage tanks in bermed areas would be implemented to minimize the potential for accidental spills or introduction of contaminants to LCPA drainages, as described above for the Proposed Action.

As described above for the Proposed Action, the potential for impacts to surface water resources from the proposed hydrofracturing is considered to be negligible.

Floodplains

Potential impacts to floodplains from the No Action Alternative are similar to those for the Proposed Action, but would be reduced due to the lower surface disturbance associated with Alternative C. Under Alternative C, approximately 6 well pads are proposed within the 100-year floodplains of Hill and Willow Creeks in the LCPA.

Mitigation Measures

To mitigate impacts to water resources and floodplains, the following mitigation measures are recommended:

- Appropriate erosion control and revegetation measures would be employed. In areas with unstable soils where seeding alone may not adequately control erosion, grading would be used to minimize slopes and water bars would be installed on disturbed slopes. Erosion control efforts would be monitored by the operator and necessary modifications would be made to control erosion.
- Where directed by the appropriate SMA, the operator would construct erosion control devices (e.g., riprap, bales, and heavy vegetation) at culvert outlets. All construction activities would be performed to retain natural water flows.
- Removal and disturbance of vegetation would be kept to a minimum through construction site management (e.g., using previously disturbed areas and existing easements where feasible, and, limiting well pad size, etc.).
- On a site-specific basis, berms would be constructed on the side(s) of well pads potentially affected by surface water runoff to minimize the possibility of contaminants entering the floodplains for Hill and Willow Creeks.
- Closed-loop drilling would be utilized for any wells within the 100-year floodplains for Hill and Willow Creeks.
- Production facilities (e.g., well pads, tanks, pipelines, roads, etc.,) would be located outside of the active channels of Willow and Hill Creeks within the LCPA on a site-specific basis.

4.2.3 Soil Resources

Direct and indirect impacts to soil resources are discussed in the following sections.

4.2.3.1 Alternative A – Proposed Action

Potential impacts to soils in the LCPA from the Proposed Action include disturbance of soils caused by the removal of vegetation, mixing of soil horizons, soil compaction, increased susceptibility of soils to wind and water erosion, contamination of soils with petroleum products, and loss of topsoil productivity.

A total of about 1,882 acres of soils would be disturbed during the construction of well pads, access roads, pipelines, and expansion of the existing compressor station. This represents about 5.7 percent of the total land surface in the LCPA.

The primary effect of surface disturbances on soil resources is the potential for increased erosion and the resulting potential increase in sediment yield to nearby ephemeral drainages, perennial streams, and livestock ponds. Excavation of proposed well pads could potentially result in increased erosion of LCPA soils. Additional erosion may also result from the construction of access roads, compressor stations, and pipelines, which could potentially lead to increased sedimentation in watercourses, siltation of ponds, and loss of vegetative cover.

The current average erosion rate for soils within the Uinta Basin is reported to be about 1.45 tons per acre per year (BLM 1984). The majority of the sediment included in this average rate is thought to be derived from erosion of the badland areas that occur to the northeast of the LCPA (BLM 1984). Badlands have higher erosion rates than other areas. Because the LCPA contains fewer badlands than the area in which the average erosion rate was derived, erosion rates for individual soil types within the LCPA are likely to be lower than this estimate.

Studies of increased erosion from the development of oil and gas facilities in the Uinta Basin have not been conducted. However, two studies conducted on sediment yield from disturbed surfaces provide some insight into the amount of increased erosion that could be expected from the construction of well pads, access roads, and other project facilities in the LCPA. Lusby and Toy (1976) reported that yields from reclaimed surface mines were initially 300 percent to 600 percent higher than from undisturbed surfaces. Frickel et al. (1975) found that yields increased to about 2.9 tons per acre per year (about a 100 percent increase) in the Piceance Basin of Colorado after construction of oil shale project facilities. Using these studies as examples, it is assumed that average erosion rates for disturbed soils in the LCPA could potentially triple from about 1.45 tons per acre per yr to about 4.35 tons per acre per yr. This increased erosion rate could generate approximately 5,458 tons of additional erosion annually during construction of the proposed project facilities. Using Relative Percent Difference (a standard statistical measure), this would represent a theoretical increase of about 10.7 percent for the total erosion rate for the LCPA.

The analysis described above represents one estimate of increased erosion that could be expected from construction of the proposed well pads, expansion of the existing compressor station, access roads, and pipelines. These erosion estimates, as is the case for all erosion estimates, are subject to considerable uncertainty. Factors which contribute to the uncertainty include the exact location of the various facilities, the actual road and pipeline gradients, the effectiveness of erosion control devices, and climatic conditions. The actual current erosion rate for areas where the proposed facilities would be built is likely lower that the 1.45 tons per acre per yr rate determined for the Book Cliffs Resource Area that includes badland areas (BLM 1984). In addition, the studies conducted by Frickel et al. (1975) and Lusby and Toy (1976) are not directly applicable to oil and gas facilities. As such, these estimates should be considered to be accurate within a range of +/- 50 percent, or perhaps greater. However, because these estimates were made using the same set of assumptions for each alternative, they provide a valuable way to compare the potential increased erosion that could result under the various alternatives.

Under the Proposed Action, XTO would adhere to all COAs and stipulations associated with the existing leases and other regulatory requirements. As outlined in **Section 2.4.5.5**, no occupancy or surface disturbance would occur on Federal lands on slopes in excess of 40 percent without written permission of the appropriate AO. Construction activities would proceed in accordance with the design standards presented in the "Gold Book" (BLM and USFS 2007). In addition, construction would not occur during saturated soil conditions when vehicles would leave ruts greater than four inches deep in a straight line travel route.

It is expected that following re-vegetation and five to eight growing seasons, the erosion rate would drop to near baseline conditions from well pads and pipeline corridors, but would remain at slightly elevated levels for new access roads. This is because portions of the well pads and pipeline ROWs would be reclaimed and revegetated, whereas the access road surfaces would continue to be eroded over the life of the project, even in the absence of high traffic volumes.

Rangeland health standards were adopted by the Utah BLM to assist in the planning process for grazing, recreation, and other activities on BLM lands (BLM 1997). These standards are applicable to the construction of new roads and well pads on BLM lands. Rangeland Health Standard No. 1 states that "upland soils should exhibit permeability and infiltration rates that sustain or improve site productivity, considering the soil type, climate, and landform." The Proposed Action would have a minor impact on the attainment of this standard, due to compaction and blending of soils in some locations. Compaction due to construction activities at the well pads and along access roads would reduce aeration, permeability, and water-holding

capacity of the soils. An increase in surface runoff could be expected, potentially causing increased sheet, rill, and gully erosion.

As part of the Proposed Action, topsoil would be conserved. Topsoil excavated from well pads and new and upgraded roads would be stockpiled for interim and final reclamation. At the completion of the project, or if a well is not productive, the well pads would be reclaimed. Reclamation would generally consist of backfilling reserve pits, regrading the area to the approximate natural contours, spreading stockpiled soils over the disturbed area, and reseeding with a seed mixture approved by the appropriate SMA.

Contamination of surface and subsurface soils near gas facilities can occur in oil and gas fields. Sources of potential contamination include leaks or spills of natural gas condensate liquids from wellheads, reserve pits, and condensate storage tanks located on the well pads, leaks or spills from produced water pipelines. Of these materials, leaks or spills of natural gas condensate would have the greatest potential environmental impact to soil resources. Leaks or spills of produced water, hydrofracturing chemicals, fuels, and lubricants could also result in soil contamination.

Depending on the size and type of spill, the impact to soil resources would primarily consist of the potential loss of soil productivity. Implementation of SPCC plans would minimize this potential impact by providing safeguards against spills and detailing reporting and cleanup measures to be taken in the event of a reportable spill.

4.2.3.2 Alternative B – Conservation Alternative

Potential impacts to soils in the LCPA from Alternative B are similar to those for the Proposed Action, as the calculated surface disturbance for Alternative B is the same as for the Proposed Action. A total of about 1,882 acres of soils would be initially disturbed (5.7 percent of the total land surface of the LCPA). However, the application of AEPMs (refer to **Section 2.5.1**) would decrease the potential impacts to soil resources as compared to the Proposed Action. These measures include: provisions to use closed-loop drilling near drainages to minimize contaminants from entering the floodplains; use appropriate erosion-control devices and revegetation measures to stabilize soils; and monitor erosion control efforts and modify erosion control as necessary.

4.2.3.3 Alternative C – No Action

Under the No Action Alternative, impacts to soil resources would be similar in nature to those described under the Proposed Action; however, these impacts would be lower in magnitude as less development would occur within the LCPA. A total of about 62 wells could be drilled under the No Action Alternative, as compared to about 510 wells under the Proposed Action. As such, a total of about 486 acres of soils would be disturbed during the construction of well pads, access roads, pipelines, and expansion of the existing compressor station (or about 25 percent of that for the Proposed Action).

Construction of proposed well pads, access roads, compressor stations, and pipelines for the No Action Alternative would potentially result in increased erosion of LCPA soils. If it is assumed that average erosion rates for soils in the LCPA would triple from about 1.45 tons per acre per yr to about 4.35 tons per acre per yr on the disturbed surfaces, approximately 1,410 tons of additional erosion could occur annually during construction of the proposed project facilities before interim reclamation measures are conducted (or about 25 percent of that for the Proposed Action). This represents a theoretical increase of about 2.9 percent of the total erosion rate for the LCPA.

If implemented, recommended mitigation measures listed below would further reduce impacts to soil resources.

Recommended Mitigation Measures

To mitigate impacts to soils under the No Action Alternative, the following mitigation measures are recommended:

- Prior to any surface disturbance, site-specific topsoil depths and topsoil storage locations would be determined. Topsoil would be stockpiled for later use.
- Topsoil stockpiles would also be designed to maximize surface area in order to reduce impacts to soil microorganisms.
- Areas used for spoil storage would be stripped of topsoil before soil placement.
- Appropriate erosion control and revegetation measures would be employed in accordance with applicable regulations and in coordination with the appropriate SMA. In areas with unstable soils, where seeding alone may not adequately control erosion, grading would be used to minimize slopes and water bars would be installed on disturbed slopes.
- Erosion control efforts would be monitored by the operator and necessary modifications would be made to control erosion.

4.2.4 Vegetation, Including Special Status Plant Species (Other than USFWS Listed Species), and Fire/Fuel Management

Direct and indirect impacts to vegetation are discussed in the following sections.

4.2.4.1 Alternative A - Proposed Action

Vegetation Communities

Existing vegetation would be removed from a total of about 1,882 acres (6%) of the LCPA. **Table 4-11** provides a breakdown of disturbance by vegetation community from the Proposed Action.

Table 4-11. Surface Disturbance by Vegetation Community from the Proposed Action

Vegetation Community	Disturbance Acres
Badlands/Rock Outcrop	166
Black Sagebrush	377
Wyoming Sagebrush	193
Desert Shrub (including Gardner's Saltbush)	680
Greasewood	140
Pinyon-Juniper Woodlands	13

Vegetation removal and soil handling associated with the Proposed Action would have both direct and indirect impacts on vegetation resources. Direct impacts would include removal of vegetation, and modification of species composition and structure. Indirect impacts may include

increased potential for weed invasion, increased exposure of soils to accelerated erosion, and degradation and loss of topsoil and soil microorganisms.

Specific actions set out under the Proposed Action, such as revegetation of disturbed areas, stockpiling of topsoil for later use, and controlling noxious weeds would reduce impacts to vegetation communities in the LCPA. The ability of each vegetation community to successfully recover to pre-disturbance production levels would depend on the disturbed site's specific characteristics.

BLM Sensitive Plant Species

As discussed in **Section 3.3.4.2**, potential habitat for the Graham's beardtongue is present on exposures of the Green River Formation (i.e., white shale lenses) in the LCPA. Activities under the Proposed Action could have direct and indirect impacts on this species. Direct impacts include potential destruction of individual Graham's beardtongue plants or its habitat and would not be mitigated under the Proposed Action.

Increased roadway infrastructure and vehicle traffic in the LCPA could lead to indirect impacts to the Graham's beardtongue. These indirect impacts include loss/modification of potential habitat, spread of invasive weed species, and an increase in fugitive dust. Weed species may compete with individual Graham's beardtongue, potentially resulting in loss of individuals and/or degradation of potential habitat. Fugitive dust from areas cleared of vegetation (such as roadways) may affect photosynthesis, respiration, transpiration, and allow the penetration of phytotoxic gaseous pollutants (Farmer 1993). Specific actions set out under the Proposed Action that would reduce some indirect impacts to the Graham's beardtongue include treatment and control of noxious and invasive plant species, and general dust abatement.

Residual impacts including potential destruction of individual plants, if any were to occur, the effects of dust on plants, and loss/modification of habitat would remain under the Proposed Action. As such, the Proposed Action may lead in a trend towards Federal listing of the Graham's beardtongue.

Fire/Fuels Management

The Proposed Action would result in a loss of about 1,882 acres of vegetation. The presence of shrubby and woodland vegetation increases the potential of accidental fires that may occur during construction, drilling, and completion operations, and potentially any time during the life of the project. The central portion of the LCPA consists of sagebrush communities, where as the southern portion of the LCPA consists of pinyon-juniper vegetation. In addition, disturbance to native vegetation in these areas could result in invasion of noxious weeds, which are more likely to burn in the event of an accidental fire than other vegetation types. In accordance with the decisions in the Book Cliffs RMP (BLM 1985), fires would be suppressed, unless otherwise directed by the BLM Vernal FO and other State and Federal agencies responsible for fire management.

4.2.4.2 Alternative B – Conservation Alternative

Vegetation Communities

Surface disturbance and direct impacts to vegetation resources from implementation of Alternative B would be similar to those identified above for the Proposed Action. However,

implementation of AEPMs (**Section 2.5.1**) would further reduce impacts to vegetation resources compared to those identified under the Proposed Action. Implementation of monitoring actions to ascertain the success of noxious weed control as well as enhanced interim and final revegetation efforts could positively impact vegetation resources by providing data on the effectiveness of current revegetation practices and seed mixes.

BLM Sensitive Plant Species

Direct and indirect impacts under Alternative B would be greatly reduced from those outlined under the Proposed Action due to the application of AEPMs (**Section 2.5.1**). These AEPMs include added invasive species monitoring, dust abatement, and adherence to species-specific conservation measures **(Appendix E**). The species-specific conservation measures include pre-construction surveys in potential habitat, avoidance of known plants, use of buffers between surface activities and known populations of plants, limiting off road travel, and monitoring the effectiveness of these measures. Based on this information, Alternative B would not likely lead in a trend towards Federal listing of the Graham's beardtongue.

Fire/Fuels Management

Impacts to fire and fuel management from implementation of Alternative B would be similar to those described under the Proposed Action. However, implementation of additional environmental protection measures (described in **Section 2.5.1**) that include proving fire extinguishers, installing spark arrestors on equipment, conducting fire prevention and control training for project site workers, and removing brush from work areas would greatly reduce the potential of a human-caused fire.

4.2.4.3 Alternative C – No Action

Vegetation Communities

Impacts to vegetation resources from implementation of Alternative C would be lower than from those identified under the Proposed Action. Surface disturbance under Alternative C would be approximately 486 acres. **Table 4-12** provides a breakdown of surface disturbance by vegetation community from implementation of Alternative C.

Table 4-12. Surface Disturbance by Vegetation Community from Implementation of the No Action Alternative

Vegetation Community	Disturbance Acres
Badlands/Rock Outcrop	20
Black Sagebrush	53
Wyoming Sagebrush	56
Desert Shrub (including Gardner's Saltbush)	191
Greasewood	77
Pinyon-Juniper Woodlands	7

To further reduce impacts to vegetation resources under Alternative C, the operator should follow recommended mitigation measures **(see below**). These recommended mitigation measures would reduce bare ground, conserve topsoil on site, and enhance revegetation which would further reduce impacts to vegetation resources. Implementation of monitoring actions to ascertain the success of interim and final revegetation efforts would be a positive impact by providing data of the effectiveness of current revegetation practices and seed mixes.

BLM Sensitive Plant Species

Under Alternative C, impacts to the Graham's beardtongue would be less than under the Proposed Action as less development would occur under this alternative. However, similar to the Proposed Action, impacts to the Graham's beardtongue would not be mitigated. Residual impacts including potential destruction of individual plants, if any were to occur, the effects of dust on plants, and loss/modification of habitat would also remain under Alternative C. As such, Alternative C may lead in a trend towards Federal listing of the Graham's beardtongue.

However, if recommended mitigation measures listed below are implemented, direct and indirect impacts to the Graham's beardtongue would be effectively offset. Recommended mitigation measures include invasive species monitoring, dust abatement, and adherence to species-specific conservation measures **(Appendix E**). The species-specific conservation measures include pre-construction surveys in potential habitat, avoidance of known plants, use of buffers between surface activities and known populations of plants, limiting off road travel, and monitoring the effectiveness of these measures. As such, assuming that recommended mitigation measures are adhered to, Alternative C would not likely lead in a trend towards Federal listing of the Graham's beardtongue.

Fire/Fuels Management

Impacts to fire and fuel management from implementation of Alternative C would be lower than those described under the Proposed Action due to the smaller surface disturbance under Alternative C. Restricting major development actions to non-Federal lands would reduce potential fire hazards to BLM-administered public lands and would allow continued conformance with existing fuels management objectives.

Implementation of recommended mitigation measures (**See below**) which include equipping vehicles with spark arrestors, and providing fire extinguishers and extinguisher training to workers would reduce impacts from Alternative C.

Recommended Mitigation Measures

To effectively mitigate impacts of Alternative C on vegetation including special status species, the following mitigation measures are recommended:

General Vegetation

- Removal and disturbance of vegetation would be kept to a minimum through construction site management (e.g., using previously disturbed areas and existing easements where feasible, and limiting well pad size, etc.).
- Sufficient topsoil or other suitable materials to facilitate revegetation would be segregated from subsoils during all construction operations requiring excavation and would be returned to the surface upon completion of operations. Soils compacted during construction would be ripped and tilled as necessary prior to reseeding. Cut and fill sections on all roads and along pipelines would be revegetated with seed mixtures approved by the appropriate SMA.
- On Federal lands, the operator would work with the BLM to monitor the success of interim and final vegetation reclamation. The operator would monitor sites that have been reclaimed two years prior, as agreed upon by the BLM. The two-year gap would allow seeded areas to become established with vegetation and provide vegetation two full growing seasons for a

better measure of success. If the BLM determines that reclamation has not been successful, the operator would reseed the location.

Graham's Beardtongue

- Measures that would specifically serve to protect Graham's beardtongue include adherence to U.S. Fish and Wildlife Service (USFWS) and BLM jointly developed draft conservation measures for the species, which are provided in **Appendix E**. In brief, these conservation measures include pre-construction surveys in potential habitat, avoidance of known plants, using spatial buffers between surface activities and known populations of plants, limiting off-road travel, and monitoring the effectiveness of these measures.

Fire Management

- All equipment, including welding trucks, would be equipped with fire extinguishers to minimize the possibility of fires during construction and operation.
- All vehicles would be equipped with spark-arrestors.
- All workers at the project site would be trained in fire prevention and fire control. Brush and dry wood would be removed from work areas.

4.2.5 Threatened and Endangered Plant Species

Direct and indirect impacts to threatened and endangered plant species are discussed in the following sections.

4.2.5.1 Alternative A – Proposed Action

The LCPA contains habitat for three Federally-listed plant species: shrubby reed-mustard, clay reed-mustard, and Uinta Basin hookless cactus. A discussion of each of these plant species associated with the LCPA follows. More detailed information is included in the BA written for this project, which is available upon request from the BLM Vernal FO.

<u>Shrubby Reed-Mustard</u>

As previously discussed, shrubby reed-mustard suitable and occupied habitats have been identified within the LCPA (B&A 2006a; B&A 2006d; B&A 2007). In addition, potential habitat is found throughout the LCPA and it is likely that undocumented populations are scattered throughout this habitat. Under the Proposed Action, surface-disturbing activities could potentially occur in suitable and occupied habitats for the shrubby reed-mustard and could result in individual plants being destroyed or damaged by project-related equipment or vehicles.

Increased roadway infrastructure and vehicle traffic in the LCPA could lead to indirect impacts to the shrubby reed-mustard. These indirect impacts could include loss and fragmentation of potential, suitable, and/or occupied habitats, spread of invasive weed species, an increase in fugitive dust, potential changes in erosion and water regime, loss of pollinator species, and loss of genetic integrity through potential loss of seed bank.

Roadside areas have been shown to have lower soil nutrient levels, reduced species richness, and a predominance of invasive species (Auerbach et al. 1997, Forman and Alexander 1998). The

zone of impact from road construction is generally many times wider than the road surface itself (Forman and Alexander 1998, Forman 2000). Weed species may compete with individual shrubby reed-mustard plants, potentially resulting in loss of individuals and degradation of suitable habitat. Changes in the water regime and sedimentation could impact suitable and/or occupied shrubby reed-mustard habitats by changing soil nutrients and water availability. Fragmentation of pollinator habitat has shown to reduce the viability of pollinator populations and reproductive success (Murren 2002). Additional studies have suggested that pollination may be reduced because of reduced pollinator activity in disturbed and fragmented habitat (Moody-Weis and Heywood 2001, Donaldson et al. 2002). Fugitive dust from areas cleared of vegetation (such as roadways) may affect photosynthesis, respiration, transpiration, and allow the penetration of phytotoxic gaseous pollutants (Farmer 1993). Specific actions set out under the Proposed Action that would reduce some indirect impacts to the shrubby reed-mustard include treatment and control of noxious and invasive plant species, erosion control measures, and general dust abatement.

However, residual impacts including the effects of dust on plants, loss/modification of potential, suitable, and/or occupied habitats, and loss of genetic integrity through potential reduction of the seed bank would remain under the Proposed Action. As such, the Proposed Action ***"may affect, is likely to adversely affect"*** the shrubby reed-mustard and its habitat.

Clay Reed-Mustard

Areas of clay reed-mustard have been identified in the LCPA (BLM 2002a). In addition, B&A (2007) identified areas of suitable habitat within the BPU of the LCPA. Given the presence of suitable habitat within the LCPA, it is possible that populations could be scattered throughout the LCPA. Under the Proposed Action, surface-disturbing activities would not likely occur in suitable or occupied habitats for the clay reed-mustard given the steep topography in which the species occurs. As such, it is unlikely that there would be direct disturbance to this species.

Increased roadway infrastructure and vehicle traffic in the LCPA could lead to indirect impacts to the clay reed-mustard. These indirect impacts include loss and fragmentation of potential or suitable habitat, spread of invasive weed species, potential changes in erosion and water regime, loss of pollinator species and genetic integrity, and an increase in fugitive dust.

Roadside areas have been shown to have lower soil nutrient levels, reduced species richness, and a predominance of invasive species (Auerbach et al. 1997, Forman and Alexander 1998). The zone of impact from road construction is generally many times wider than the road surface itself (Forman and Alexander 1998, Forman 2000). Weed species may compete with individual clay reed-mustard plants, potentially resulting in loss of individuals and degradation of suitable habitat. Changes in the water regime and sedimentation could impact suitable clay reed-mustard habitat by changing soil nutrients and water availability. Fragmentation of pollinator habitat has shown to reduce the viability of pollinator populations and reproductive success (Murren 2002). Additional studies have suggested that pollination may be reduced because of reduced pollinator activity in disturbed and fragmented habitat (Moody-Weis and Heywood 2001, Donaldson et al. 2002). Fugitive dust from areas cleared of vegetation (such as roadways) may affect photosynthesis, respiration, transpiration, and allow the penetration of phytotoxic gaseous pollutants (Farmer 1993). Specific actions set out under the Proposed Action that would reduce indirect impacts to the clay reed-mustard include treatment and control of noxious and invasive plant species, erosion control measures, and general dust abatement.

However, residual impacts including the effects of dust on plants, loss/modification of potential and/or suitable habitat, and loss of genetic integrity through potential reduction of the seed bank would remain under the Proposed Action. As such, the Proposed Action ***"may affect, is likely to adversely affect"*** the clay reed-mustard and its habitat.

Uinta Basin Hookless Cactus

A small area of Uinta Basin hookless cactus habitat was identified within the LCPA by the BLM (BLM 2002a). However, during two years of habitat evaluations, no suitable or occupied habitats for the species were identified in the LCPA (B&A 2006a; B&A 2007). If any habitat and/or plants exist in areas not previously surveyed, surface-disturbing activities under the Proposed Action could potentially result in direct disturbance to the species. Individual plants could be destroyed or damaged by project-related equipment or vehicles.

Increased roadway infrastructure and vehicle traffic in the LCPA could lead to indirect impacts to the Uinta Basin hookless cactus. These indirect impacts include potential increase in illegal collection, loss and fragmentation of potential habitat, spread of invasive weed species, potential changes in erosion and water regime, loss of pollinator species and genetic integrity, and an increase in fugitive dust.

Based on improved access to and within the LCPA, construction of new and upgrades to existing roads under the Proposed Action could potentially increase illegal collection of Uinta Basin hookless cactus. Illegal collection of the Uinta Basin hookless cactus, which is highly prized for its flowers, has been responsible for the loss of about 200 to 300 individuals in Colorado (USFWS 1990a).

In addition, increased human presence and motorized traffic within the LCPA could potentially increase indirect impacts to the Uinta Basin hookless cactus related to weed infestation, changes in water regime, increased sedimentation, loss of pollinators, and fugitive dust. Roadside areas have been shown to have lower soil nutrient levels, reduced species richness, and a predominance of invasive species (Auerbach et al. 1997, Forman and Alexander 1998). The zone of impact from road construction is generally many times wider than the road surface itself (Forman and Alexander 1998, Forman 2000). Weed species may compete with individual Uinta Basin hookless cactus, potentially resulting in loss of individuals and/or degradation of habitat. Changes in the water regime and sedimentation could impact Uinta Basin hookless cactus habitat by changing soil nutrients and water availability. Fragmentation of pollinator habitat has shown to reduce the viability of pollinator populations and reproductive success (Murren 2002). Additional studies have suggested that pollination may be reduced because of reduced pollinator activity in disturbed and fragmented habitat (Moody-Weis and Heywood 2001, Donaldson et al. 2002). Fugitive dust from areas cleared of vegetation such as roadways may affect photosynthesis, respiration, transpiration and allow the penetration of phytotoxic gaseous pollutants (Farmer 1993). Specific actions set out under the Proposed Action that would reduce indirect impacts to the Uinta Basin hookless cactus include treatment and control of noxious and invasive plant species, and erosion control measures.

However, residual impacts including the effects of dust on plants, loss/modification of potential habitat, loss of genetic integrity through potential reduction of the seed bank, and increased potential for illegal collection would remain under the Proposed Action. As such, the Proposed Action ***"may affect, is likely to adversely affect"*** the Uinta Basin hookless cactus and its habitat.

4.2.5.2 Alternative B – Conservation Alternative

As AEPMs (discussed in **Section 2.5.1**) would be implemented under Alternative B, direct impacts to threatened and endangered plant species would be avoided, and indirect impacts would be substantially lower than under the Proposed Action. These AEPMs include added invasive species controls and monitoring, enhanced dust abatement, species-specific conservation measures, and establishment of a shrubby reed-mustard seed bank. The conservation measures (**Appendix E)** for the three aforementioned special status plant species contain the following: pre-construction surveys in potential habitat, avoidance of known plants, using buffers between surface activities and known populations of plants, limiting off-road travel, and monitoring the effectiveness of these measures, all of which would serve to avoid or greatly reduce indirect impacts on the shrubby reed-mustard, clay reed-mustard, and Uinta Basin hookless cactus.

Adherence to the AEPMs, which include species-specific conservation measures (**Appendix E**), would effectively mitigate impacts to the clay reed-mustard and Uinta Basin hookless cactus. As such, Alternative B ***"may affect, is not likely to adversely affect"*** the clay-reed mustard and/or Uinta Basin hookless cactus, and/or their respective habitats.

However, based on the small number of known populations, limited extent of suitable habitat, and potential impacts to populations and habitat, Alternative B, even with adherence to AEPMs and creation of a seed bank, "***may affect, is likely to adversely affect***" the shrubby reed-mustard

4.2.5.3 Alternative C – No Action

Surface disturbance under Alternative C would be 74% less than surface disturbance under the Proposed Action. The scale and magnitude of potential impacts to threatened and endangered plant species would be correspondingly reduced. Under the No Action Alternative, surface-disturbing activities could potentially occur in suitable and/or occupied habitats for the shrubby reed-mustard, or habitats for the Uinta Basin hookless cactus. This could result in individual plants being destroyed or damaged by project related equipment or vehicles.

Indirect impacts to the threatened and endangered plant species including the effects of dust on plants, loss and fragmentation of habitats, and increased potential for illegal collection would remain under Alternative C. Based on these potential impacts, Alternative C ***"may affect, is likely to adversely affect"*** the shrubby reed-mustard, clay reed-mustard, and/or the Uinta Basin hookless cactus, and/or their respective habitats within the LCPA.

Assuming that implementation of recommended mitigation measures includes adherence to conservation measures **(Appendix E**), activities "***may affect, are not likely to adversely affect***" the clay reed-mustard and/or the Uinta Basin hookless cactus, and/or their respective habitats. However, based on the small number of known populations, limited extent of suitable habitat, and potential impacts to populations and habitat, activities under Alternative C (even with adherence to recommended mitigation measures) "***may affect, are likely to adversely affect***" the shrubby reed-mustard and its habitat.

<u>Mitigation Measures</u>

To effectively mitigate impacts of Alternative C to threatened and endangered plant species, the mitigation measures outlined in **Appendix E**, which include provisions for adherence to USFWS conservation measures, dust abatement, and monitoring would be implemented. Also

recommended is a measure for establishing a shrubby reed-mustard seed bank. These recommended mitigation measures are described below in detail.

Shrubby Reed-Mustard

- Measures that would specifically serve to protect the shrubby reed-mustard include adherence to USFWS and BLM jointly developed conservation measures for the species, which are provided in **Appendix E.** The most salient of these measures would include, as feasible, avoidance of surface disturbance within areas that fall within 300 feet of known plants. Where no other option exists and surface disturbance is necessary within 300 feet of known plants, the operators would:
    - Implement enhanced dust abatement techniques during construction activities that occur within 300 feet of known plants. Enhanced dust abatement would specifically entail watering (or the use of other dust suppressants approved by the appropriate SMA and USFWS) on disturbed surfaces every two hours (or as determined necessary by the appropriate SMA and USFWS for other dust suppressants) during active surface-disturbing activities. Exceptions (i.e., when dust suppression would not be necessary) would include periods within 12 hours of a precipitation event or if there is snow cover on the ground where construction activities are occurring.
    - Implement a long-term adaptive monitoring plan that would attempt to document population trends of the plants, and how these populations/plants are affected by construction, drilling, completion, and production activities, including monitoring of invasive and noxious weed infestations. The monitoring plan would include a study that would identify a representative sample of sites on Federal lands within the LCPA where surface-disturbing activities occur within 300 feet of known plants, as well as a control site where no surface disturbing activities have occurred within 300 feet of known plants. Qualified biologists would monitor these sites on an annual basis for at least three years after surface-disturbing activities during the flowering period to document density of shrubby reed-mustard, general status of the individuals/population, species composition and density of noxious and invasive weeds, and whether additional monitoring is needed. After the first three years of monitoring, the BLM and USFWS would jointly determine on a site-specific basis if additional monitoring is needed. Data collected from these monitoring efforts would be provided to both the BLM and USFWS in an annual formal report. The reports would also include any corrective actions needed to remedy perceived impacts on the shrubby reed-mustard individuals/populations. For example, if the study indicates that noxious and invasive weed infestations are occurring or increasing, the BLM and USFWS would collaborate on the most effective way for the operator to eliminate weeds without affecting the shrubby reed-mustard. Furthermore, if the monitoring efforts indicate that development within 300 feet of known plants appears to be adversely affecting the species, the BLM would re-initiate Section 7 consultation with the USFWS. Specific details of the monitoring plan (e.g., number of survey locations, type of survey technique used, timing of survey, etc.) would be determined by the USFWS and BLM in coordination with the operator.
- In addition to adherence to the conservation measures, the operator would fund the collection of shrubby reed-mustard seed in order to partially mitigate potential seed bank loss that could occur as a result of surface disturbance within suitable or occupied habitat for the species.

Seeds collected would be used to aid in final reclamation efforts of the LCPA. Specifically, the operator would fund a seed bank collection to be conducted by Red Butte Garden (RBG) in Salt Lake City, Utah. Field work for the collection would require approximately 3 - 4 visits to the LCPA by qualified specialists at RBG to 1) assess the population, 2) determine flowering period/optimal time for seed collection, and 3) conduct the seed collection(s). RBG's current USFWS permit allows for them to collect up to 1,000 seeds of a listed species (but less than 10 percent of total seed). If, during coordination with the USFWS, it is determined that additional seeds are needed for this effort, RBG would need an additional permit or an amendment to their existing permit from the USFWS. Specific details of the seed collection effort would be determined by the USFWS and BLM in coordination with RBG and the operator.

- In shrubby reed-mustard occupied habitat any spills, regardless of volume, would be reported to the BLM and USFWS.

Clay Reed-Mustard

- Measures that would specifically serve to protect the clay reed-mustard include adherence to USFWS and BLM jointly developed conservation measures for the species, which are provided in **Appendix E**. The most salient of these measures would include, as feasible, avoidance of surface disturbance within areas that fall within 300 feet of known plants. Where no other option exists and surface disturbance is necessary within 300 feet of known plants, the operators would:
    - Implement enhanced dust abatement techniques during construction activities that occur within 300 feet of known plants. Enhanced dust abatement would specifically entail watering (or the use of other dust suppressants approved by the appropriate SMA and USFWS) on disturbed surfaces every two hours (or as determined necessary by the appropriate SMA and USFWS for other dust suppressants) during active surface-disturbing activities. Exceptions (i.e., when dust suppression would not be necessary) would include periods within 12 hours of a precipitation event or if there is snow cover on the ground where construction activities are occurring.
    - Implement a long-term adaptive monitoring plan that would attempt to document population trends of the plants, and how these populations/plants are affected by construction, drilling, completion, and production activities, including monitoring of noxious and invasive weed infestations. The monitoring plan would include a study that would identify a representative sample of sites on Federal lands within the LCPA where surface-disturbing activities occur within 300 feet of known plants, as well as a control site where no surface-disturbing activities have occurred within 300 feet of known plants. Qualified biologists would monitor these sites on an annual basis for at least three years after surface-disturbing activities during the flowering period to document density of clay reed-mustard, general status of the individuals/population, and species composition and density of noxious and invasive weeds, and whether additional monitoring is needed. After the first three years of monitoring, the BLM and USFWS would jointly determine on a site-specific basis if additional monitoring is needed. Data collected from these monitoring efforts would be provided to

both the BLM and USFWS in an annual formal report. The reports would also include any corrective actions needed to remedy perceived impacts on the clay reed-mustard individuals/populations. For example, if the study indicates that noxious weed infestations are occurring or increasing, the BLM and USFWS would collaborate on the most effective way for the operator to eliminate weeds without affecting the clay reed-mustard. Furthermore, if the monitoring efforts indicate that development within 300 feet of known plants appears to be adversely affecting the species, the BLM would re-initiate Section 7 consultation with the USFWS. Specific details of the monitoring plan (e.g., number of survey locations, type of survey technique used, timing of survey, etc.) would be determined by the USFWS and BLM in coordination with the operator.

- Where surface disturbance is proposed within occupied clay reed-mustard habitat, enhanced erosion control and revegetation measures would be employed. For example, specific erosion control measures would be developed on a site-specific basis that would account for occupied clay reed-mustard habitat, and would avoid or minimize sedimentation or runoff into the occupied habitat. Erosion control efforts would be monitored by the operator and necessary modifications would be made to control erosion.

- In clay reed-mustard occupied habitat (if any occur within the LCPA) any spills, regardless of volume, would be reported to the BLM and USFWS.

Uinta Basin Hookless Cactus

- Measures that would specifically serve to protect the Uinta Basin hookless cactus include adherence to USFWS and BLM jointly developed conservation measures for the species, which are provided in **Appendix E**. The most salient of these measures includes the requirement to avoid surface disturbance within 100 feet of known plants, which would eliminate direct impacts on the species.

4.2.6 Wetlands/Riparian Zones

Direct and indirect impacts to wetlands and riparian habitats are discussed in the following sections.

4.2.6.1 Alternative A – Proposed Action

As discussed in **Chapter 3**, the LCPA contains approximately 1.5 miles of wetland/riparian habitat mainly along Willow Creek. However, these areas are sporadic, small, and occur near existing roads and infrastructure. Under the Proposed Action, new well pads or other infrastructure are proposed in the vicinity of eight of the ten riparian areas. Prior to construction in the vicinity of these areas, site-specific assessments would be conducted to determine if any surface disturbing activities would occur in riparian areas, if so, new well pads and roads would be relocated to avoid these areas to comply with Section 404 of the Clean Water Act and the Book Cliffs RMP. Therefore direct impacts to riparian zones would not occur.

Indirect impacts to riparian zones and wetlands could result from increased sediment loading to these areas, a potential increase in noxious weeds, and a potential for spills and leaks from construction equipment. Successful interim and final reclamation would contribute to minimizing soil erosion and sediment loading. In addition, noxious weed infestations on disturbed surfaces would be controlled, therefore reducing indirect impacts to riparian zones.

4.2.6.2 Alternative B – Conservation Alternative

Impacts to wetlands/riparian zones from implementation of Alternative B would be similar as those identified and assessed above for the Proposed Action. However, application of additional environmental protection measures (**Section 2.5.1**) that reduce soil erosion, minimize possible contaminants from entering these zones, and include additional noxious weed control measures, would further minimize potential impacts from those identified and assessed above for the Proposed Action.

4.2.6.3 Alternative C – No Action

Impacts to wetlands/riparian zones from implementation of Alternative C, the No Action Alternative, would be similar to those identified and assessed for the Proposed Action, but would be reduced in extent and magnitude as surface disturbance under this Alternative would be lower. Surface disturbance would be limited to about 486 acres. Under Alternative C, new well pads or other infrastructure are proposed in the vicinity of five of the ten riparian zones within the LCPA. As under the Proposed Action, specific measures set out under the alternative would avoid direct impacts and reduce indirect impacts to riparian zones or wetlands located within the LCPA or downstream from the LCPA.

Implementation of recommended mitigation measures (**See below**) which include revegetation monitoring to ensure vegetation establishment and reduction of soil erosion, added weed control efforts, and BMPs that reduce the potential for spills and leaks would further reduce indirect impacts from Alternative C.

<u>Mitigation Measures</u>

To effectively mitigate impacts of Alternative C to wetlands/riparian zones, the following mitigation measures are recommended:

- The operator would reseed disturbed surfaces, thus reducing the potential for soil erosion. The success of interim and final vegetation reclamation would be monitored after sites have been reclaimed for two years. If the appropriate SMA determines the reclamation has not been successful, the operator would reseed the location (see **Section 2.5.1** for full description).
- Mitigation measures recommended to reduce introduction and spread of invasive, non-native species, including powerwashing equipment and monitoring weed species, would also benefit wetland/riparian vegetation communities within the LCPA.
- The use of structural BMPs (e.g., retention basins, berms, vegetated filter strips, etc) in the vicinity of these resources would effectively protect them from leaks and spills from construction equipment.

4.2.7 Invasive and Noxious Species

Direct and indirect impacts to invasive and noxious weed species are discussed in the following sections.

4.2.7.1 Alternative A – Proposed Action

Roads provide a potential conduit for the spread of exotic plants into natural areas, particularly in arid and semiarid landscapes of the American West (Gelbard and Belnap 2003). Clearing of vegetation and soils, addition of fill, and grading of roads and well pads would create areas of deep, bare soil that would be susceptible to exotic seed establishment (Trombulak and Frissell 2000). As such, these actions would lead to the transport and establishment of weeds throughout the LCPA. Overall, the Proposed Action could increase establishment of invasive and noxious weeds, such as Russian thistle, halogeton, and cheatgrass. Weed species would compete with native vegetation and could reduce the diversity of the vegetation communities. Specific negative effects of noxious and invasive weeds can include: 1) reduction in the overall visual character of an area; 2) competition with, or elimination of, native plants; 3) reduction or fragmentation of wildlife habitats; and 4) increased soil erosion (Gelbard and Belnap 2003).

Under the Proposed Action, noxious weed infestations on disturbed surfaces would be controlled by spraying or mechanical removal, in accordance with agreement with the appropriate SMA. Per their Proposed Action, XTO would complete interim and final reclamation/revegetation actions on all project-related disturbed areas.

4.2.7.2 Alternative B – Conservation Alternative

The potential for introduction and/or increasing the occurrence of invasive and noxious species in the LCPA from implementation of Alternative B would be similar to that outlined for the Proposed Action. However, Alternative B outlines additional actions (see **Section 2.5.1**) that would further reduce or limit the introduction of invasive and noxious species. Commitment to conducting pre-disturbance, baseline weed surveys would add to the BLM's understanding of the extent and magnitude of this concern, and could result in changes in management objectives to better control these unwanted species.

4.2.7.3 Alternative C – No Action

The potential for introduction and/or increased occurrence of invasive and noxious species in the LCPA from implementation of the No Action Alternative would be similar to those identified and assessed for the Proposed Action, but would be reduced in extent and magnitude as surface disturbance would be limited to about 486 acres.

If recommended mitigation measures, which include power-washing vehicles/equipment and conducting a baseline weed survey are implemented, the above-described potential impacts would be further reduced.

<u>Mitigation Measures</u>

To reduce potential impacts from invasive and noxious weeds under Alternative A, the following mitigation measures are recommended:

- All construction equipment and vehicles coming into the LCPA from outside the Uinta Basin would be power-washed prior to entering the LCPA.

- The operator would complete a baseline survey of noxious and invasive weeds along proposed roadways, pipeline routes, well sites, and other facilities within the LCPA. These surveys, which could be completed on a site-by-site basis during the APD process, would form the basis for subsequent monitoring and control actions by the operator in the LCPA.

4.2.8 Fish and Wildlife, Including Special Status Species (Other than USFWS Listed Species)

4.2.8.1 Alternative A – Proposed Action

General Wildlife

The surface disturbance of about 1,882 acres of potential wildlife habitat associated with the construction of wells, roads, pipelines, related facilities, and infrastructure could reduce habitat availability within the LCPA for a variety of common wildlife species. This reduction in habitat is expected to have a minor impact on general wildlife species due to the following:

- Many of the species discussed are habitat generalists, meaning they are not tightly restricted to specific habitat types; and
- Many of the wildlife populations in the LCPA have likely adapted to existing gas exploration and production activities.

The severity of the direct and indirect impacts to general wildlife species under the Proposed Action would depend on the 1) availability of habitats within and outside the LCPA, 2) sensitivity of the species to human activity, 3) seasonal and daily timing of construction and development activities, and 4) site-specific topography and vegetation (e.g., construction sites that are visually obscured may impact adjacent wildlife less than where construction activities are in full view).

Big Game

The Book Cliffs RMP only identifies crucial pronghorn antelope habitat with the LCPA. As no other BLM-designated habitats occur in the LCPA, assessments of impacts to other habitats are compared to UDWR-identified crucial habitat. The use of UDWR-identified habitats is for the purpose of comparison between and among the alternatives relative to impacts to big game species habitat.

Species-specific habitat losses for BLM-designated and UDWR-designated big game ranges associated with the Proposed Action are listed in **Table 4-13**.

Table 4-13. Surface Disturbances to Big Game Habitats Under the Proposed Action.

Big Game Species	Habitat Type	Acres in LCPA	Acres of Disturbance in LCPA	Percent of Habitat Disturbed in LCPA
Pronghorn	BLM Crucial Winter	2,655	182	6.9
	UDWR Crucial Year-Long Fawning	6,316	276	4.4
	UDWR Substantial Year-Long	22,910	1,198	5.2
Mule Deer	UDWR Crucial Winter	645	27	4.2
	UDWR Substantial Winter	12,934	595	4.6
Elk	UDWR Substantial Winter	25,460	1,387	5.4

Pronghorn Antelope

Surface-disturbing activities associated with the Proposed Action would result in the surface disturbance of about 276 acres of UDWR-designated crucial value year-long habitat (fawning habitat), 1,198 acres of UDWR-designated substantial value year-long habitat, and approximately 182 acres of BLM-designated crucial value winter habitat for pronghorn antelope. Habitat loss and fragmentation associated with these disturbances could result in reduced habitat use by pronghorn within and near disturbed areas, increased animal densities in adjoining habitats, and increased stress from intra- and inter-specific competition.

Visual and noise disturbance from human activity could also reduce relative habitat value for pronghorn, especially during periods of heavy snow cover and cold temperatures. Pronghorn are likely to experience physiological stress during winter, particularly gestating females because they require higher energy levels for survival and successful reproduction. The increased presence of vehicles, equipment, and people within the LCPA, combined with the potential for insufficient winter forage, could exacerbate natural levels of winter stress among pronghorn that occupy the LCPA, therefore resulting in increased energy expenditures during severe winter periods. Disturbances in crucial range could also prevent access (e.g., travel corridors blocked by human activity) to sufficient amounts of forage necessary for winter survival. The ability of pronghorn to survive the winter and a female's ability to produce viable offspring depends on fat reserves. Increased stress could cause fat reserves to be used more quickly and could reduce the survival of female pronghorn and their fetus. Where wintering pronghorn are able to vacate areas surrounding construction operations, they could move to adjacent habitats where competition for resources may increase.

As the Book Cliffs (Herd Unit #10) pronghorn herd unit is currently below UDWR-designated population objectives, the above-mentioned impacts could reduce the population's ability to meet its management objective. However, as surface disturbance associated with the Proposed Action would be localized and would be minimal in relation to the extent of similar habitats across the region, impacts associated with the Proposed Action are not likely to alter current population levels. The LCPA occurs within an area where natural gas exploration and production has been on-going for decades. As such, pronghorn occupying the LCPA may have adapted to the visual and noise impacts associated with oil and gas development. Although the Proposed Action may impact individuals, it is not anticipated to negatively impact the Book Cliffs (Herd Unit #10) pronghorn herd unit.

Mule Deer

Surface-disturbing activities associated with the Proposed Action would result in the surface disturbance of approximately 27 acres of UDWR-designated crucial value winter range and about 595 acres of UDWR-designated substantial value habitat for mule deer. Habitat loss and fragmentation resulting from these disturbances could result in reduced habitat use by mule deer within and near disturbed areas, increased animal densities in adjoining habitats, and increased stress from intra- and inter-specific competition.

Disturbance from human activity would also reduce relative habitat values for deer (Nicholson et al 1997), especially during periods of heavy snow cover and cold temperatures. Mule deer typically experience severe physiological stress during the winter; particularly gestating females because they require higher energy levels for survival and successful reproduction (Karpowitz 1984). The increased presence of vehicles, equipment, and people within the LCPA, combined with the potential for insufficient forage due to surface disturbance, could result in increased energy expenditures by mule deer during severe winter periods (Karpowitz 1984). Disturbances

in crucial value year-long range could also prevent access (e.g., travel corridors blocked by human activity) to sufficient amounts of forage necessary for winter survival. In addition to direct loss and habitat fragmentation associated with the Proposed Action, disturbances from drilling activities and increased traffic could temporarily displace mule deer from habitats (including winter range) in areas of human activity. Wintering mule deer have been reported to vacate areas surrounding well pads during periods of concentrated human activity during construction operations (Reeve 1996). When displaced, individual mule deer would move to other adjacent habitats where competition for resources may increase.

New roads and increased traffic on new and existing roads would also pose potential problems for mule deer. The development of new roads, in combination with existing roads, would facilitate access for other development projects, recreational uses, hunting, and OHV use. Studies have reported that roads generally reduce the overall habitat value for mule deer for distances from 300 feet to 0.5 miles from the road, depending on the type of traffic and adjacent habitat types (Rost and Bailey 1979). These studies suggest that functional habitat loss for mule deer could occur from anywhere between 300 feet to 0.5 mile from the edge of new roads. Increased vehicular traffic on new and existing access roads would increase potential for vehicle collisions with mule deer. In addition, increased access to the LCPA could increase the potential for poaching and general harassment of mule deer.

As the Book Cliffs (Herd Unit #10) mule deer herd unit is currently below UDWR-designated population objectives, the above-mentioned impacts could potentially deter big game populations from meeting its management objective. However, as surface disturbance associated with the Proposed Action would be localized impacts associated with the Proposed Action are not likely to alter current population levels. The LCPA occurs within an area where natural gas exploration and production has been on-going for decades, and mule deer occupying the LCPA may have adapted to the visual and noise impacts associated with this development. Although the Proposed Action may affect individuals, it is not anticipated to negatively impact the Book Cliffs (Herd Unit #10) mule deer herd unit.

Rocky Mountain Elk

Surface-disturbing activities associated with the Proposed Action would result in the surface disturbance of about 1,387 acres of UDWR-designated elk substantial value winter habitat. Habitat loss resulting from this disturbance could result in reduced habitat use by elk within and near disturbed areas, increased animal densities in adjoining habitats, and increased stress from intra- and inter-specific competition.

Disturbance from human activity could also reduce relative habitat values for elk as described above for the mule deer. As the Book Cliffs (Herd Unit #10) elk herd unit is currently below UDWR-designated population objectives, the above-mentioned impacts could deter big game populations from meeting its management objective. However, as surface disturbance associated with the Proposed Action would be localized and would be minimal in relation to the extent of similar habitats across the region, impacts associated with the Proposed Action are not likely to alter current population levels. The LCPA occurs within an area where natural gas exploration and production has been on-going for decades, and elk occupying the LCPA may have adapted to the visual and noise impacts associated with this development. Although the Proposed Action may affect individuals, it is not anticipated to negatively impact the Book Cliffs (Herd Unit #10) elk herd unit.

Migratory Birds

Impacts to migratory birds in the LCPA under the Proposed Action would be similar for all migratory bird species, but would vary depending on loss of habitat types and species' sensitivities to disturbance. For the purposes of impact analyses in this EA, impacts to migratory birds within the LCPA are discussed together; however, proposed surface disturbance estimates for vegetative communities under the Proposed Action, which provide habitats for migratory birds, are summarized in **Section 4.2.4.1**.

Implementation of the Proposed Action and its associated impacts would be dependent upon seasonal timing of construction, drilling, and completion activities. If these activities were to be conducted in the late fall, many of the migratory species would have left the LCPA for southern wintering grounds. Surface disturbance, visual, and noise impacts during this time would not impact most individual birds or nesting locations. However, if construction, drilling, and completion activities were to occur during the spring or summer months, the Proposed Action could result in temporary displacement from nesting habitats or deter nesting establishment. Fragmentation of habitat and associated edge avoidance by migratory birds has been documented as leading to lower levels in productivity (Renfrew et al. 2005). Associated noise and increased human presence could cause displacement from forging and nesting habitats. If displaced birds move to less suitable habitats, an increase in competition, deteriorated physical condition, and a decrease in reproductive success could occur. Increased roads and vehicle traffic levels could also lead to the increased potential for collisions between migratory birds and vehicles. Impacts to individual migratory birds could also include increased mortality levels resulting from contact with petroleum-based products in reserve pits. In addition, as the Proposed Action does not include provisions for installation of screening on the openings of heater-treaters or fired vessels to prevent entry by migratory birds, asphyxiation in heater-treaters or fired vessels could occur.

Raptors

Implementation of the Proposed Action could affect nesting and breeding raptors that utilize the LCPA. Direct and indirect impacts to raptors may include temporary displacement from suitable habitats during the breeding season due to increased noise levels and visual disturbances on the landscape and a reduction in habitat for prey species due to direct habitat loss.

Surface disturbing activities or areas with concentrated human activity in close proximity (e.g., ½-mile) of an active raptor nest could lead to temporary displacement from nesting sites, avoidance of affected areas, and deterrence from establishing other nesting sites. Displacement could lead to nest failure or nest abandonment, thereby affecting the breeding pair and their annual productivity. Steidl and Anthony (2000) suggest that the greatest energetic costs from disturbance occur in nestlings, potentially decreasing overall reproductive success. Displacement could also lead to increased use of adjacent habitats, which could lead to increased inter- and intra-specific competition for resources. However, as increased noise levels and visual disturbances associated with construction, drilling, and completion activities would be localized and short-term as compared to the LOP, displacement to adjacent habitats would likely be temporary in nature and would not likely alter the productivity of current raptor populations within the LCPA. In addition, although human activity has been shown to adversely impact breeding raptors, some evidence of raptor habituation to human-induced disturbances has also been documented (Andersen et al. 1989; Steidl and Anthony 2000; Rodriguez-Estrella et al. 1998).

In addition, surface disturbances associated with the Proposed Action would result in the direct loss of approximately 1,882 acres of habitat for raptor prey species such as mammals, songbirds,

and reptiles. Rodriguez-Estrella et al. (1998) identified the loss or fragmentation of prey species habitat as a contributor to raptor population declines. The reduction in prey habitat in the LCPA would be compounded by prey base losses that are already occurring in the Uinta Basin due to the ongoing drought. Under the Proposed Action, interim and final reclamation efforts could somewhat restore prey habitat losses for raptor species. However, as the Proposed Action does not include provisions for notification of UDWR to remove carrion from LCPA roadways, shoulders, and ROWs, the potential for vehicle collisions with carrion-feeding raptors would increase in the LCPA as a result of increased traffic levels.

Fish

Direct and indirect impacts to fish and fish habitats in the Green River would result from implementation of the Proposed Action due to water depletion, increased erosion, and increased sediment deposition to the Green River. The total water use for construction, drilling, and general dust abatement for the first 7 years of the project would be approximately 1,700 acre-feet of water (or 243 acre-feet per year). For the remaining 18 years of the project, water use for general dust abatement would be approximately 846 acre-feet (or 47 acre-feet per year). The average water use per year over the entire 25 year life of the project would be approximately 101 acre-feet per year. Assuming that the water used would be withdrawn either directly or indirectly from the Green River and would therefore deplete flow in the Green River, the Proposed Action would deplete the average annual flow in the Green River by a maximum of about 0.003 percent. This could lead to a direct habitat loss and/or degradation of habitat for aquatic species in the Green River. However, as water depletion would be negligible in relation to the flow of the Green River, impacts associated with habitat loss would be expected to be minimal.

Fish habitats could also be affected by increased erosion and sediment deposition yielded into waterways through drainages or surface water runoff via wells, pipelines, or roads. Similarly, if any pipeline or wellhead spills were to occur during a storm event, condensate could potentially reach waterways, and subsequently to the Green River system. Erosion leading to sediment loading into streams has been identified as resulting in lower fish species density (Ross et al. 2001, Gorman and Karr 1978). Additionally, increased levels in disturbances such as sediment deposition and spills, can lead to a reduction in invertebrate species richness and thereby a reduction in prey available to many fish species (Robinson and Marshall 1986). As such, increased erosion and sediment deposition to the Green River from activities within the LCPA could potentially lower fish species density and decrease invertebrate prey species for fish. However, based on the high dilution and turbidity of the Green River, increased erosion and sediment deposition to the Green River associated with the Proposed Action would likely have negligible effects on fish species density and availability of prey species.

Special Status Species Other Than FWS Listed Species

Roundtail Chub, Bluehead Sucker, and Flannelmouth Sucker

Direct impacts to the roundtail chub, bluehead sucker, and flannelmouth sucker are not likely to occur under the Proposed Action, as Hill Creek and Willow Creek do not contain sufficient flow to maintain fish habitats. However, indirect impacts to these species and their habitats could potentially occur downstream of the LCPA in the Green River. Implementation of the Proposed Action could degrade habitats for these fish in the Green River by increasing erosion, sediment yield, and the potential for exposure to hazardous substances in the case of an accidental spill. As previously discussed, the Proposed Action would increase sediment loading to the Green River by 1,637 tons per year, an increase of about 0.02 percent from current levels. Turbidity and salinity

could be expected to increase by similar amounts. However, these impacts would be reduced by certain actions set out under the Proposed Action: implementation of a SPCC plan and a SWPPP plan.

Sage Sparrow

Implementation of the Proposed Action would result in the direct loss of approximately 570 acres of potential sage sparrow habitat (i.e., black sagebrush and Wyoming big sagebrush) within the LCPA. This vegetation removal could result in temporary displacement of sage sparrows to adjacent, less suitable habitats and increased general distress, based on the sage sparrow's close association with sagebrush habitats. In addition, fragmentation of sagebrush stands could increase the potential for brown-headed cowbird (*Molothrus ater*) parasitism of sage sparrow nests (Parrish et al. 2002).

Bald Eagle

Wintering bald eagles concentrate at established roosting sites for the purpose of feeding and sheltering in close proximity to sufficient food sources. Increased human presence, traffic, and associated noise level during the winter (early November to late March) could deter bald eagles from feeding or taking shelter in the LCPA. Disruptive activities in the flight path between important roosting and foraging areas may also interfere with feeding. As no bald eagle roosting sites are located within the LCPA and the closest documented roosting site is located approximately 5 miles west of the LCPA along the Green River, surface-disturbing activities under the Proposed Action would not likely deter wintering bald eagles from utilizing or selecting roosting sites along the Green River. However, these activities could affect bald eagles foraging within the LCPA.

Roadside carrion is one of the bald eagle's primary winter food sources. As the Proposed Action does not include provisions for the UDWR to remove carrion from LCPA roadways, shoulders, and ROWs, the potential for vehicle collisions with carrion-feeding bald eagles could increase in the LCPA as a result of increased traffic levels.

Indirect effects on bald eagles could include the loss of approximately 1,882 acres of prey habitat (e.g., prairie dogs, rabbits, mice, small birds) associated with vegetation removal from project development. The loss of some prey species may limit foraging opportunities for individual eagles. Additionally, the construction of approximately 77 miles of road could increase the potential for bald eagle collisions with project traffic.

Golden Eagle

Implementation of the Proposed Action could impact both breeding and wintering golden eagles, depending on the location of surface-disturbing activities and surface facilities relative to occupied territories, nest sites, or wintering areas. Surface-disturbing activities within proximity of an active golden eagle nest could potentially disturb breeding and nesting activities. Such disturbance could result in temporary displacement of eagles or avoidance of nesting sites caused by increased human activity, traffic, and traffic levels. Since golden eagles often alternate between nest sites between years, any surface facilities where ongoing traffic or human presence occurs could prevent inactive nests from being used in the future. During the winter, golden eagles roost in areas where bald eagles congregate, and sometimes roost with ferruginous hawks, red-tailed hawks, and rough-legged hawks (Wheeler 2003). However, as no bald eagle roosting sites are located within the LCPA and the closest documented roosting site is located approximately 5 miles west of the LCPA along the Green River, surface-disturbing activities

under the Proposed Action would not likely deter wintering golden eagles from selecting roosting sites along the Green River. However, these activities could affect golden eagles foraging within the LCPA.

Like the bald eagle, roadside carrion is one of the golden eagle's primary winter food sources. As the Proposed Action does not include provisions for the UDWR to remove carrion from LCPA roadways, shoulders, and ROWs, the potential for vehicle collisions with carrion-feeding golden eagles could increase in the LCPA as a result of increased traffic levels.

Vegetation loss associated with the Proposed Action would result in the loss of about 1,882 acres of prey species habitat (e.g., ground squirrels, prairie dogs, and rabbits). The loss of some prey species may limit foraging opportunities for individual eagles. In addition, golden eagles may avoid hunting grounds near to where construction activities are taking place.

Ferruginous Hawk

Implementation of the Proposed Action could result in both direct and indirect impacts to the ferruginous hawk. Potential impacts to the ferruginous hawk could include: temporary displacement caused by increased human activity, traffic, and noise levels, and loss and fragmentation of prey species habitat.

The species is particularly susceptible to human-caused disturbances during courtship and incubation periods. Ferruginous hawks will abandon nests if disturbed prior to the eggs hatching (Wheeler 2003). Breeding and nesting activities in the LCPA could potentially be disturbed by construction, drilling, or completion activities. As the Proposed Action does not include provisions for seasonal and spatial buffers around active nesting sites, such disturbance could result in temporary displacement from nesting sites and reduced nesting success.

Indirect effects on ferruginous hawks would include the loss of and fragmentation of approximately 1,882 acres of prey species habitat (e.g., ground squirrels, prairie dogs, jackrabbits, rabbits, small rodents, and birds) associated with vegetation removal from project development. The loss of some prey species may limit foraging opportunities for individual ferruginous hawks.

Short-eared Owl

Implementation of the Proposed Action could result in both direct and indirect impacts to the short-eared owl. Potential impacts to the short-eared owl could include temporary displacement from nesting habitats caused by increased human activity, traffic, and noise levels, and/or loss and fragmentation of prey species habitat.

Construction of well pads, roads, and ROWs in the LCPA could reduce the availability of nesting habitat in areas of suitable vegetative cover (i.e., big sagebrush and greasewood stands near Hill Creek and Willow Creek) and could cause temporary displacement from nesting sites. Reproductive success of short-eared owls is often low in areas where activities make nests vulnerable to predation by crows, hawks, foxes, or fires (Johnsgard 1988). As such, clearing vegetation may increase vulnerability of nests to predation if nests are located adjacent to these areas. In addition, increased noise levels and visual disturbances in the landscape could result in temporary displacement from nesting sites. As the Proposed Action does not include provisions for seasonal or spatial buffers around active nesting sites, such displacement could reduce nesting success.

Indirect effects on short-eared owls would include the loss and fragmentation of prey species habitat (e.g., rodents) associated with vegetation removal from project development. The loss of some prey species or reduced prey densities may limit foraging opportunities for individual short-eared owls.

Western Burrowing Owl

The primary impact to burrowing owls under the Proposed Action would be the loss and increased fragmentation of nesting habitat within the LCPA. Loss and fragmentation of nesting habitat due to surface disturbing activities or avoidance of areas with concentrated human activity could lead to nest abandonment, thereby affecting the breeding pair and their productivity. Impacts related to direct loss and fragmentation of habitat caused by the clearing of vegetation would likely continue through the life of the project, particularly if prairie dog towns are located near heavily trafficked roads or near areas with intense human activity.

Construction, drilling, and completion activities would also result in visual disturbance on the landscape, noise from equipment use, and increased vehicle traffic, all of which could cause burrowing owls to avoid or be displaced from disturbed areas. Such behaviors could lead to an increased use of less suitable adjacent habitats, which could then lead to increased inter-specific and intra-specific competition for resources in these areas.

Indirect effects on western burrowing owls would include loss and fragmentation of prey species habitat (e.g., insects, ground squirrels, young prairie dogs, and cottontails) associated with vegetation removal from project development. The loss of some prey species or reduced prey densities may limit foraging opportunities for individual burrowing owls.

Based on the limited distribution of white-tailed prairie dog colonies throughout the LCPA, implementation of the Proposed Action would likely have negligible impacts on burrowing owls within the LCPA. However, as the Proposed Action does not include provisions for seasonal and spatial buffers around active nesting sites, the impacts discussed above could occur.

Swainson's Hawk

Implementation of the Proposed Action could result in both direct and indirect impacts to the Swainson's hawk. Potential impacts to the Swainson's hawk could include the following: temporary displacement caused by increased human activity, traffic, and noise levels, and indirect loss and fragmentation of prey species habitat.

Although these birds are generally acclimated to humans in certain areas, they are susceptible to human-caused disturbances in remote locations (Wheeler 2003). Breeding and nesting activities in the LCPA could potentially be disturbed by construction, drilling, or completion activities. Such disturbance could result in temporary displacement from nesting sites and reduced nesting success, as the Proposed Action does not include provisions for seasonal and spatial buffers around active nesting sites.

Indirect effects to Swainson's hawks could include the loss and fragmentation of approximately 1,882 acres of prey species habitat (e.g., ground squirrels and other rodents, rabbits, insects, small birds, and reptiles) associated with vegetation removal from project development. The loss of some prey species may limit foraging opportunities for individual Swainson's hawks.

Greater Sage-grouse

Surface disturbance associated with the Proposed Action would result in the direct loss of approximately 570 acres of sagebrush habitat (i.e., black sagebrush and Wyoming big sagebrush). Although sagebrush habitat exists throughout much of the LCPA, not all sagebrush habitats in the LCPA are utilized by sage-grouse. Sage-grouse are a sagebrush obligate species that rely almost exclusively on contiguous sagebrush ecosystems for leks (strutting grounds), nesting sites, feedings sites, brooding sites, protection, and wintering grounds.

Under the Proposed Action, surface-disturbing activities in crucial value sage-grouse brooding habitat would occur primarily in the LCU and BPU portions of the LCPA; some surface-disturbing activities would also occur in crucial value winter sage-grouse habitat on the eastern boundary of the LCU. As such, sage-grouse could be impacted by the direct loss and fragmentation of crucial brooding habitat (approximately 1,455 acres) and crucial winter habitat (approximately 15 acres). Other potential impacts to sage-grouse include increased predation by raptors and displacement or abandonment of brooding habitats due to increased noise associated with traffic and construction, drilling, and completion activities. As the Proposed Action does not include provisions to prevent predation by raptors, sage-grouse could be preyed upon by raptors using facility equipment for perching.

Direct impacts to breeding activity are not anticipated, as no leks have been documented within the LCPA. However, should leks be established within visual or audio range of the LCPA, direct impacts could include disturbance of courtship or nesting activities, if construction activities occur within 2 miles of active leks between March 15 and June 15. As the Proposed Action does not include provisions for seasonal and spatial buffers around leks or daily timing restrictions around leks during the breeding season, disruption of breeding sage-grouse could occur if leks become established within the LCPA.

White-tailed Prairie Dog

Potential direct, adverse impacts to WTPDs associated with oil and gas development include the following: habitat loss due to clearing and crushing of vegetation; fragmentation of available habitat due to pad construction, road development, and well operation; temporary displacement of individual prairie dogs; increased potential for vehicle collisions with prairie dogs; alteration of surface water drainages; and degraded habitat values due to increased soil compaction (USFWS 1990b). Indirect effects to WTPDs include increased shooting pressure by OHV users caused by improved access into remote areas (Seglund et al. 2004).

Prairie dogs are often found on or near roadways, and so colonies are easily fragmented by road development. When colonies are fragmented by roads, which would reduce dispersal ability, prairie dog densities increase, thus increasing the potential for plague outbreak (Rayor 1985, Cully and Williams 2001). Habitat quality for these species can also be degraded by the introduction of noxious and invasive weeds. Weed invasions may lead to a decrease in the amount of native perennial species and bare ground, thereby degrading habitat for prairie dogs by decreasing visibility, forage quality, and burrow development.

As some established prairie dog towns and potential habitat for new prairie dog towns (e.g., low growing shrublands) occur in the LCPA, implementation of the Proposed Action could result in the above-mentioned adverse impacts to WTPDs. This would likely have the greatest effect on WTPD colonies when females and pups are most vulnerable (April – July 15) (Seglund 2004). As the Proposed Action does not include provisions to avoid known colonies or prohibit firearms within the LCPA, prairie dog towns could be affected by the Proposed Action. However, as the

LCPA is likely to contain only small, scattered colonies given the marginal habitat present, impacts to the species would likely be minimal.

Townsend's Big-eared Bat and Big Free-tailed Bat

Implementation of the Proposed Action could alter habitat for the Townsend's big-eared bat and big free-tailed bat. As traffic within the LCPA increases during construction, drilling, and completion activities, roosting and nesting sites could be impacted and potentially abandoned. However, as habitat for these species is widespread throughout the State, the Proposed Action could affect individuals bats through displacement, habitat loss or degradation, but would not likely result in a trend towards Federal listing.

4.2.8.2 Alternative B – Conservation Alternative

Under Alternative B, impacts to fish and wildlife species and their habitats within the LCPA (or downstream of the LCPA as in the case of fish) would be similar in nature and magnitude to those described above under the Proposed Action (**Section 4.2.8.1**). However, application of additional environmental protection measures (**Section 2.5.1**) could substantially reduce or minimize several potential adverse impacts to big game, raptors, migratory birds, sensitive fish, sage-grouse, and WTPDs. These AEPMs are organized by wildlife type, but many could have indirect mitigation effects on all species within the LCPA.

4.2.8.3 Alternative C – No Action

Under Alternative C, impacts to fish and wildlife species and their habitats within the LCPA (or downstream of the LCPA as in the case of fish) would be similar in nature to those described above under the Proposed Action (**Section 4.2.8.1**). However, the magnitude of habitat loss and the resulting impacts to these species would be lower under Alternative C, as less development would occur within the LCPA. Implementation of Alternative C would result in a loss of approximately 486 acres of prey/foraging habitat. If implemented, recommended mitigation measures outlined below could substantially reduce or minimize potential adverse impacts to fish and wildlife species.

<u>Recommended Mitigation Measures</u>

If the following recommended mitigation measures are implemented with Alternative C, direct and indirect impacts to wildlife species could be reduced. These recommended mitigation measures are organized by wildlife type, but many could have indirect mitigation effects on all species within the LCPA. Project personnel of the operator and their contractors would be educated on and subject to the following requirements within the LCPA:

General

- As feasible, production facilities would be located outside of the 100-year floodplains of the LCPA drainages. Where well pads are proposed near LCPA drainages, shallow groundwater, or floodplains (i.e., where no option exists to locate surface facilities outside of these areas), closed-loop drilling systems, leak detection devices, or self-contained mud systems would be installed.

Big Game

- To mitigate the loss of wildlife within the LCPA, the operator would fund an acre for acre mitigation project that would be designed to improve wildlife habitat. As feasible, the location of the habitat restoration work would be identified within or adjacent to the LCPA. On Federal lands, the details of this mitigation plan would be determined by the BLM and Utah Division of Wildlife Resources (UDWR).

Raptors

- Prior to any construction, raptor surveys would be conducted to determine the potential presence of raptor nests and other important habitats. Surveys would be conducted between February 1st and August 31st, within 0.5 mile of proposed construction sites for the presence of raptor nests. When surveys are required of the operator, the consultant hired must be found acceptable to the appropriate SMA prior to the field survey being conducted. If occupied raptor nests are found, temporary construction activities would not occur within the species-specific buffer radius during the nesting season, as specified in **Table 2-3** (Romin and Muck 2002).
- No permanent infrastructure would be placed within 0.5 mile of raptor nests; however, permanent facilities could be placed within 0.25 mile of a raptor nest if project facilities are obscured from line of sight of the nest and noise levels are minimized.
- The operator and their contractors would contact the UDWR to remove carrion from the roadways, shoulders, and ROWs. This could minimize potential impacts to carrion-feeding raptors from vehicle collisions.
- Where feasible, well pads, access roads, pipelines, and other facilities or infrastructure would be located so as to conceal them from raptor nests by considering topographical or vegetative screening features.

Migratory Birds

- Screening would be placed on stacks and on other openings of heater-treaters or fired vessels to prevent entry by migratory birds.

Special Status Wildlife Species

- Prior to any project-related surface disturbance, all locations proposed for surface disturbance would be evaluated by a wildlife biologist approved by the appropriate SMA to determine if any special status wildlife species are present. If present, the operator would consult with the appropriate SMA prior to initiating any surface-disturbing activities, and would implement appropriate avoidance or mitigation measures. Site-specific species clearances would be performed at the time of the onsite review.

Special Status Raptor Species

- Prior to any construction, raptor surveys would be conducted to determine the potential presence of special status raptor nests and other important habitats. Surveys would be conducted between November 1st and August 31st, within 0.5 of proposed construction sites for the presence of raptor nests. When surveys are required of the lessee/operator, the consultant hired must be found acceptable to the appropriate SMA prior to the field survey being conducted. If occupied raptor nests are found, temporary construction activities would

not occur within the species-specific buffer radius during the nesting season, as specified in **Table 2-3** (Romin and Muck 2002).

- No permanent infrastructure would be placed within 0.5 mile of special status raptor nests; however, permanent facilities could be placed within 0.25 mile of a special status raptor nest if project facilities are obscured from line of sight of the nest and noise levels are minimized.
- The operator and their contractors would contact the UDWR to remove carrion from the roadways, shoulders, and ROWs. This could minimize potential impacts to carrion-feeding raptors from vehicle collisions.
- Where feasible, well pads, access roads, pipelines, and other facilities or infrastructure would be located so as to conceal them from raptor nests by considering topographical or vegetative screening features.
- As feasible, the placement of wells, roads, or pads on or through active prairie dog colonies would be avoided.

Greater Sage-grouse

- In the event that a sage-grouse lek is discovered or becomes established in the LCPA, prior to any construction between March 15th and June 15th, all sagebrush habitats within a two-mile radius of proposed construction sites would be surveyed for the presence of active sage-grouse leks. If active sage-grouse leks are located, surface-disturbing activities would be avoided within 0.6 mile (1 km) of active sage-grouse leks during the breeding season (March 15 – June 15) from one hour before sunrise to three hours after sunrise (UDWR 2002). This measure would not apply to workover rigs or maintenance and operation of producing wells.
- Roads, fences, poles, and utility lines would not be placed within 1,300 feet (400 meters) of a sage-grouse lek to prevent predation by raptor species (UDWR 2002).

White-tailed Prairie Dogs

- As feasible, the placement of wells, roads, or pads on or through active prairie dog colonies would be avoided.

4.2.9 Endangered Fish Species

4.2.9.1 Alternative A – Proposed Action

<u>Endangered Colorado River Fish</u>

For the purposes of this EA, impacts to the Colorado River fish are analyzed collectively, as these species are all affected by activities that deplete and/or degrade the flow of downstream waters to the Upper Colorado River Basin, including portions of the Green River that contain designated critical habitat. Implementation of development activities in the LCPA could affect Colorado River fish downstream in the Green River by: 1) depleting water from the Upper Colorado River Basin; 2) increasing erosion and sediment deposition to Hill Creek, Willow Creek, and area drainages; and 3) potentially exposing fish to contaminants from accidental spills/leaks of pipelines, equipment, and production facilities.

The total water use for construction, drilling, and general dust abatement for the first 7 years of the project would be approximately 1,700 acre-feet of water (or 243 acre-feet per year). For the remaining 18 years of the project, water use for general dust abatement would be approximately 846 acre-feet (or 47 acre-feet per year). The average water use per year over the entire 25 year life of the project would be approximately 101 acre-feet per year. This water depletion would result in a reduction of water flow in the Upper Colorado River basin. As such, assuming that the water used would be withdrawn either directly or indirectly from the Green River and would therefore deplete flow in the Green River, the Proposed Action would deplete the average annual flow in the Green River by a maximum of about 0.003 percent. This could lead to a direct habitat loss and/or degradation of habitat (including designated critical habitat of the Colorado River fish) for aquatic species in the Green River.

The USFWS has determined that water depletions reduce flow throughout the Upper Colorado River Basin, leading to habitat losses that jeopardize the continued existence of the endangered Colorado River fish and modify or adversely affect their critical habitat. In addition, the USFWS has determined that new water depletions greater than 100 acre-feet can be offset by the water project proponent's one-time contribution to the Recovery Program. Payments are based on the project's average annual depletion and the rate is adjusted annually for inflation[1]. As such, based on the anticipated average annual water depletion to the Upper Colorado River Basin described above, Section 7 consultation with the USFWS and payment of a water depletion fee would be required to evaluate and offset impacts from water depletion to the Colorado River fish and their critical habitats in the Green River.

In addition, increased erosion and sediment deposition to Hill Creek, Willow Creek, and area drainages due to development activities in the LCPA could result in habitat degradation for Colorado River fish in the Green River. Specifically, degradation of critical habitat for the Colorado pikeminnow and razorback sucker could occur approximately 11.5 miles downstream of the LCPA in the Green River (i.e., at Willow Creek's confluence with the Green River). Soil loss calculations indicate that an estimated 5,458 tons per year of additional erosion could be expected to occur in the LCPA as a result of the Proposed Action; however, this erosion estimate is subject to considerable uncertainty. With the proper application and maintenance of erosion control measures (i.e., non-structural controls and structural controls as part of the SWPPP), the actual amount of sediment that could potentially be transported to Hill Creek, Willow Creek, and the Green River would be much less than the erosion estimate listed above. For the purposes of estimating the amount of increased sediment delivery, it is assumed that erosion controls would be 70 percent effective. As such, 30 percent of the increased erosion calculated (or 1,637 tons per year) would be expected to eventually be delivered to Hill Creek, Willow Creek, and the Green River. If it is assumed that all sediment from the construction of pipelines and project facilities would eventually be transported to the Green River, the average annual sediment loading to the Green River would increase by about 0.02 percent.

Habitat degradation, including degradation of critical habitat for the Colorado River fish, could also result if a spill or leak from a pipeline or production facility were to occur. As proposed under Alternative A, 25 well pads would be constructed within the 100-year floodplains of Hill and Willow Creeks. If a spill or leak were to enter Hill Creek, Willow Creek, or an ephemeral drainage (such as during a storm event), contaminants would eventually enter the Green River where they would likely accumulate in backwater/depressional areas that have reduced dilution and less flushing capacity (Woodward et al. 1985). This could reduce habitat values (i.e., water

[1] The FY08 (October 1, 2007 – September 30, 2008) depletion fee is $17.79 per acre-foot.

quality and the biological environment) for Colorado River fish that utilize these sites for cover and food sources. However, it should be noted that impacts to critical habitat for the Colorado pikeminnow and razorback sucker due to potential chemical exposure would be reduced as the operator would implement and adhere to SPCC plans (refer to **Section 2.4.5).**

Based on the estimated water depletion to the Upper Colorado River Basin and the increased potential for erosion, sedimentation, and contamination to Hill Creek and Willow Creek within the LCPA, the Proposed Action "***may affect, is likely to adversely affect***" the endangered Colorado River fish and "***may affect, is likely to adversely affect***" designated critical habitat for the Colorado pikeminnow and razorback sucker in the Green River.

4.2.9.2 Alternative B – Conservation Alternative

Endangered Colorado River Fish Species

Under Alternative B, impacts to the endangered Colorado River fish and their designated critical habitats would be similar in nature to those described above under the Proposed Action (**Section 4.2.9.1**). Water use for this alternative would be slightly higher, as enhanced dust abatement would be implemented in certain areas of the LCPA. The average yearly water use over the 25 year life of the project is estimated to be 103 acre-feet per year. Application of additional environmental protection measures (**Section 2.5.1**) for water resources and soil resources could further reduce adverse impacts to Colorado River fish from possible spills of condensate materials and could further reduce habitat loss/degradation caused by erosion and sediment loading to Hill Creek and Willow Creek. As compared to the Proposed Action, these additional environmental protection measures would not result in an appreciable reduction or minimization of impacts to these fishes or their critical habitats. As such, Alternative B "***may affect, is likely to adversely affect*"** the Colorado River fish and "***may affect, is likely to adversely affect***" designated critical habitat for the Colorado pikeminnow and razorback sucker at Willow Creek's confluence with the Green River.

4.2.9.3 Alternative C – No Action

Endangered Colorado River Fish Species

Under Alternative C, impacts to the endangered Colorado River fish and their designated critical habitats would be similar in nature to those described above under the Proposed Action (**Section 4.2.9.1**). However, these impacts would be less under Alternative C, as less development would occur within the LCPA. As proposed under Alternative C, 6 well pads would be constructed within the 100-year floodplains of Hill and Willow Creeks. Anticipated water needs for the 81 wells under Alternative C would result in water depletion (on average 17 acre-feet per year of water would be used for the 25 year life of the project.) to the Upper Colorado River Basin. As proposed, Alternative C "***may affect, is likely to adversely affect***" the Colorado River fish and "***may affect, is likely to adversely affect***" designated critical habitat for the Colorado pikeminnow and razorback sucker at Willow Creek's confluence with the Green River.

Recommended Mitigation Measures

Colorado River Endangered and BLM Sensitive Fish Species

As appropriate (i.e., if water is pumped directly from the Green River or Willow Creek,), the following measures would be applied to reduce or eliminate direct impacts to habitat for the Colorado River fish species downstream of the LCPA in the Green River.

- To avoid entrainment, water should be pumped from an off-channel location (i.e., one that does not connect to the river during high spring flows). An infiltration gallery constructed in a BLM and USFWS approved location is best.
- If the pump head is located in the river channel where larval fish are known to occur, the following measures apply:
    - the pump would not be situated in a low-flow or no-flow area as these habitats tend to concentrate larval fishes;
    - the amount of pumping would be limited, to the greatest extent possible, during that period of the year when larval fish may be present (see above); and
    - the amount of pumping would be limited, to the greatest extent possible, during the pre-dawn hours as larval drift studies indicate that this is a period of greatest daily activity.
- All pump intakes would be screened with ¼-inch mesh material.
- Any fish impinged on the intake screen would be reported to the USFWS (801-975-3330) and the UDWR.
- Where directed by the appropriate SMA, the operator would construct erosion control devices (e.g., riprap, bales, and heavy vegetation) at culvert outlets. All construction activities would be performed to retain natural water flows.
- On a site-specific basis, berms would be constructed on the side(s) of well pads potentially affected by surface water runoff to minimize the possibility of contaminants entering the floodplains for Hill and Willow Creeks.
- Closed-loop drilling would be utilized for any wells within the 100-year floodplains for Hill and Willow Creeks.
- Production facilities (e.g., well pads, tanks, pipelines, roads, etc.,) would be located outside of the active channels of Willow and Hill Creeks within the LCPA on a site-specific basis.
- Appropriate erosion control and revegetation measures would be employed. In areas with unstable soils where seeding alone may not adequately control erosion, grading would be used to minimize slopes and water bars would be installed on disturbed slopes. Erosion control efforts would be monitored by the operator and necessary modifications would be made to control erosion.

4.2.10 Livestock Grazing

4.2.10.1 Alternative A – Proposed Action

The Proposed Action would result in the removal of about 1,882 acres of vegetation in BLM grazing allotments in the LCPA. **Table 4-14** provides a breakdown of estimated loss of livestock AUMs by grazing allotment. As can be seen, the percentage loss ranges from 0-8.7 percent

Table 4-14. Estimated Livestock AUMs Affected by the Proposed Action

Allotment Name	Usable[1] BLM Acres w/in LCPA	BLM AUMs w/in LCPA	Loss of Usable[1] BLM Acres w/in LCPA	Loss of BLM AUMs w/in LCPA	% of BLM AUMs Affected by Proposed Action
Big Pack Mountain	8,847	688	769	60	8.7
Brewer	58	3	0	0	0
Hatchbroome Bartholomew	979	78	46	4	4.7
Lower Showalter	10	1	0	0	0
Oil Shale	3,347	254	105	8	3.1
Sand Wash	2,057	323	130	20	6.3
Thorne-Ute-Broome	1,288	86	15	1	1.2
Wild Horse Bench	348	79	13	3	3.7

Source: BLM 2007, Rangeland Administration System.
[1] Usable land is defined as land that has a slope of 40% or less.

The Proposed Action does not incorporate BMPs that would support continued livestock management/administration of these allotments. There is no assurance for the continued integrity and functionality of existing livestock facilities (e.g., fences, cattleguards, corrals, watering facilities within the LCPA). As such, there would be residual impacts to continued livestock use and administration, increasing possible trespass situations and uneven livestock utilization of assigned grazing allotments/pastures.

4.2.10.2 Alternative B – Conservation Alternative

The amount of surface disturbance under Alternative B would be equivalent to that outlined under the Proposed Action; however, additional environmental protection measures (**Section 2.5.1**) that include avoidance of livestock facilities and repair or replacement of such facilities if avoidance is not possible, would effectively mitigate impacts to existing livestock facilities (e.g., fences, cattleguards, corrals, watering facilities within the LCPA).

4.2.10.3 Alternative C – No Action

Direct and indirect impacts to livestock grazing activities under the No Action alternative would be similar in nature to the Proposed Action. As surface disturbance would be limited to approximately 486 acres, the scale of potential impacts to livestock grazing activities would be similarly reduced. Assuming an average carrying capacity of 11 acres/AUM, a total of about nine livestock AUMs would be affected by implementation of Alternative C. As the majority of development would occur on non-BLM lands, it is reasonable to expect that these estimated 9 livestock AUMs would correspond to non-BLM lands within the livestock allotments.

Implementation of recommended mitigation measures (**See below**) which include avoidance of livestock facilities and repair or replacement of such facilities if avoidance is not possible, would reduce impacts to existing livestock facilities within the LCPA.

<u>Mitigation Measures</u>

To effectively mitigate impacts of Alternative C on livestock resources, the following mitigation measures are recommended:

- No roads, pipelines, well pads, or other gas facilities would be placed within 200-meters (660-foot) of livestock reservoirs, rain gauges, corrals, springs, and guzzlers. If there is no means to avoid these existing range facilities, these facilities would be replaced, as needed.
- The operator would repair or replace to appropriate SMA standards any fences, cattleguards, gates, drift fences, and natural barriers that are damaged as a result of development.

4.2.11 Cultural Resources

4.2.11.1 Alternative A – Proposed Action

Under the Proposed Action, direct impacts to cultural resources could potentially include destruction of or damage to cultural resources as a result of surface and/or subsurface disturbance during site preparation, construction, operation, or reclamation of well locations, supporting facilities, pipelines, and access roads.

The Proposed Action would result in surface disturbance of about 1,882 acres. Adherence to existing policies and regulations implementing the NHPA as set out in **Section 2.4.5.2** of this EA, which require that Class III cultural resource inventories and consultation with SHPO occur prior to any surface-disturbing activities, would effectively eliminate direct impacts to cultural resources on the surface through mitigation and avoidance. Furthermore, as described in **Section 2.4.5.2**, if any historic or archaeological resources are found during operations, all work that could further disturb such materials would be suspended at the site and the appropriate AO would be immediately contacted to decide a course of action. This measure would effectively eliminate or reduce to negligible levels, potential impacts to sub-surface cultural resources.

Cultural resources are also subject to potential indirect impacts that can result from increased vehicular and pedestrian traffic associated with development. The Proposed Action could result in increased human presence in the LCPA during well field development and operation. In addition, proposed and upgraded well field roads could provide increased motorized access for the general public to areas that may contain cultural resources. Increased traffic into the LCPA could potentially lead to vandalism, surface artifact collection, and excavation of cultural resources. Increased off-road travel (which can occur as an indirect result of increased road access) could potentially lead to the damage, destruction, or removal of scientific information, the loss of research potential, loss of interpretation possibilities, and changes in the character or setting of a cultural site.

4.2.11.2 Alternative B - Conservation Alternative

Impacts to cultural resources under Alternative B would be similar in nature to those under the Proposed Action. However, to further reduce both the initial and long-term potential impacts to cultural resources from development and activities associated with development, the operator would adhere to an AEPM under the Conservation Alternative. XTO and its contractors would inform their employees about Federal regulations intended to protect cultural resources. All personnel would be informed that collecting artifacts, including arrowheads, is a violation of Federal law. Such a requirement would not completely mitigate the potential for intentional or unintentional vandalism and/or theft of cultural resources within the LCPA, as increased access to areas previously less accessible to the general public could potentially lead to some level of resource damage and/or theft by the general public.

4.2.11.3 Alternative C – No Action

Under the No Action alternative, direct and indirect impacts would be similar in nature to the Proposed Action, but would be at a reduced scale as substantially fewer roads would be constructed. This would provide less access to the LCPA and thus a reduced potential for vandalism, theft, or damage to cultural resources. In addition, direct and indirect impacts to cultural resources could be reduced if recommended mitigation measures listed below are implemented.

Recommended Mitigation Measures

To effectively mitigate impacts of Alternative C on cultural resources, the following mitigation measures are recommended:

- The operator and their contractors would inform their employees about Federal regulations intended to protect archaeological and cultural resources.

4.2.12 Native American Religious Concerns

4.2.12.1 Alternative A – Proposed Action

Impacts to Native American religious concerns under the Proposed Alternative would be similar in nature to those discussed under **Section 4.2.11.1**, Cultural Resources. As discussed in **Table 6-1,** consultation with affected Tribes would occur prior to any surface-disturbing activities. The consultation process would identify sites of religious significance, and would result in impact minimization and avoidance measures that would reduce or eliminate direct and indirect impacts to sites of Native American cultural and/or religious significance.

4.2.12.2 Alternative B – Conservation Alternative

Impacts to Native American religious concerns under the Conservation Alternative would be similar in nature to those discussed under **Section 4.2.11.2**, Cultural Resources. As discussed in **Table 6-1**, consultation with affected Tribes would occur prior to any surface-disturbing activities. The consultation process would identify sites of religious significance, and would result in impact minimization and avoidance measures that would reduce or eliminate direct and indirect impacts to sites of Native American cultural and/or religious significance. Furthermore, in order to further reduce both the initial and long-term potential impacts to Native American religious resources from development and activities associated with development, the operator would adhere to an AEPM under the Conservation alternative. XTO and its contractors would inform their employees about Federal regulations intended to protect Native American religious resources. All personnel would be informed that collecting artifacts, including arrowheads, is a violation of Federal law. Such a requirement would not completely mitigate the potential for intentional or unintentional vandalism and/or theft of Native American religious resources within the LCPA, as increased access to areas previously less accessible to the general public could potentially lead to some level of resource damage and/or theft by the general public.

4.2.12.3 Alternative C – No Action

Impacts to Native American religious concerns under Alternative C would be similar in nature to those discussed under **Section 4.2.11.3,** Cultural Resources. As discussed in **Table 6-1**, consultation with affected Tribes would occur prior to any surface-disturbing activities. The

consultation process would identify sites of religious significance, and would result in impact minimization and avoidance measures that would reduce or eliminate direct and indirect impacts to sites of Native American cultural and/or religious significance. In addition, direct and indirect impacts to Native American religious resources could be reduced if recommended mitigation measures listed below are implemented.

Recommended Mitigation Measures

To effectively mitigate impacts of Alternative C on Native American religious concerns, the following mitigation measures are recommended:

- The operator and their contractors would inform their employees about Federal regulations intended to protect archaeological and cultural resources.

4.2.13 Paleontology

4.2.13.1 Alternative A – Proposed Action

Portions of the LCPA have the potential to produce fossils. Potential impacts to paleontological resources include the loss of scientifically important fossils due to surface disturbance such as well pad, road, and pipeline excavation and grading. The magnitude of the potential losses cannot be quantified. Alternatively, construction of well pads, access roads, and pipeline corridors may uncover scientifically important fossils.

The Uinta and Green River formations are Class 1 paleontological areas that have the potential to contain fossils. If Class 1, 2, or 3 fossils are found, sampling, salvage, rerouting, relocation, and monitoring would occur as directed by the appropriate SMA.

4.2.13.2 Alternative B – Conservation Alternative

Potential impacts to paleontological resources in the LCPA from Alternative B are the same as those for the Proposed Action. There are no additional mitigation measures for protection of paleontological resources proposed for Alternative B.

Paleontological surveys would be conducted prior to any surface-disturbing activities and monitoring completed during any excavations within areas known to have high potential for significant paleontological resources. If Class 1, 2, or 3 fossils are found, sampling, salvage, rerouting, relocation, and monitoring would occur as directed by the appropriate SMA.

4.2.13.3 Alternative C – No Action Alternative

Under the No Action Alternative the amount of land disturbed would be about one-fourth of the amount for the Proposed Action. Therefore, the potential for destruction of fossils or discovery of new species would be smaller by a similar amount.

Mitigation Measures

To effectively mitigate impacts of Alternative C on paleontological resources, the following mitigation measures are recommended:

- Paleontological surveys would be conducted prior to any surface-disturbing activities and monitoring completed during any excavations within areas known to have high potential for significant paleontological resources.

4.2.14 Socioeconomics

4.2.14.1 Alternative A – Proposed Action

Implementation of the Proposed Action would create additional employment opportunities in the Uinta Basin during the 7-year construction phase and over the production lifetime of the wells (approximately 25 years). Opportunities for direct employment (e.g. positions hired for construction, production, and decommissioning) and indirect employment (e.g., jobs available in service industries) would increase as a result of project operations.

The primary influx of employment opportunities would occur during the construction phase of the project. During full field development, about 265 employees would be needed over a 5-8 year period for construction, drilling, and completion of wells in the LCPA. When feasible, local sub-contractors and workers would be hired for the proposed well field development. Equal employment opportunities would be available to members of the Tribe, as well as to residents of Uintah County.

Once the wells are in production, a level of sustained permanent employment would be required for operation and maintenance of the wells and pipelines, as well as gradual reclamation of inactive wells and access roads. Only a small number of workers would be required to perform these functions. When feasible, local subcontractors and workers would be hired for operation and maintenance.

It can be assumed that there would be a minor population of "non-local" construction workers that would work in conjunction with local workers within the LCPA. The non-local population initially would consist of construction and later production employees. The majority of non-local settlement would likely occur in the nearby population centers of Vernal, Roosevelt, and Ft. Duchesne. In many cases, construction workers would utilize motel accommodations or stay in recreational vehicles rather than long-term rental housing, such as apartments or houses. Non-local populations contribute to the local economy of these cities through the purchase of motel rooms, housing, or other accommodations, as well as meals, groceries, gasoline, and various other goods and services.

The average salaries in the State of Utah for natural resources and mining employees (including the oil and gas) are higher than any other non-agricultural employment sector in the State. In 2004, oil and gas employees earned about $4,606 per month, which is about 44 percent higher than the Uintah County average ($2,592 per month), and about 54 percent higher than the Ute Tribe average ($2,132 per month) (Utah Department of Workforce Services 2004; U.S. Census Bureau 2006; GOPB 2006).

Because local workers are expected to be used for the majority of project activity, it can be assumed that the Proposed Action would result in a negligible to minor increased demand for local services (e.g. housing, law enforcement, fire protection, medical and social services, or public schools). It is possible that local emergency service departments within Uintah County may be asked to provide assistance in the unlikely event of a serious accident in the LCPA.

However, employee training programs and compliance with applicable OSHA regulations would reduce the risk of serious accidents.

Federal mineral royalties are collected by the Mineral Management Service, U.S. Department of the Interior for oil and gas produced on Federal leases. Federal royalties are collected at a fixed rate of 12.5 percent and are split evenly between the Federal government and the State of origin. Utah's share of the royalties is distributed in the following manner: 40 percent to the Utah Department of Transportation (UDOT), which is then distributed to the Uintah County Special Service Districts; 32.5 percent to the Permanent Community Impact Fund (PCIF); and the remainder to various State Departments. PCIF funds are used to make needed improvements to facilities and services that are traditionally provided by the government. Uintah County and the municipalities affected by the Proposed Action (e.g. Duchesne, Roosevelt, and Vernal) would be eligible for these funds.

Within the LCPA, the majority of the proposed wells would be located on Federally-owned minerals. Over a 30-year period, which is the estimated life of a well in the Uinta Basin, XTO estimates that each well located in the LCPA would produce about 100 thousand cubic feet (mcf) of gas per day. According to the Energy Information Administration, the average price of natural gas over this same time period will be about $5.23 per mcf (Energy Information Administration 2006). Based upon these production numbers, **Table 4-15** provides an estimate of the Federal mineral royalties that would be collected over the life of the project, and how the royalties would likely be distributed.

Table 4-15. Estimated Federal Mineral Royalty Distribution

Total Federal Mineral Royalty	Total State Share	UDOT	PCIF	Other State Departments
$307,102,331	$153,551,166	$61,420,466	$49,904,129	$42,226,571

On State and private lands, specific royalty payments are determined by confidential lease agreements. Standard royalty payments are 12.5 percent to 18 percent of the production value. For the purposes of this analysis, a minimum royalty rate of 12.5 percent is used. Both the State of Utah and private land owners are entitled to the entire mineral royalty. Under the Proposed Action approximately 56 wells would be located on State minerals and approximately 20 wells would be located on private minerals. Mineral royalties collected on State of Utah lands are likely to yield about $40,087,950 (**Table 4-16**). Mineral royalties on private land are likely to yield about $14,317,125 (**Table 4-16**).

In Utah, severance tax is collected by the Utah State Tax Commission. The State is entitled to severance tax from all oil and gas products produced, sold, or transported from Federal, State, or private lands. Currently State-levied severance tax is collected at a split rate. For example, the first $1.50 per mcf of gas is taxed at a rate of 3 percent; any additional revenue is taxed at a rate of 5 percent. Based upon XTO's expected production, over the life of the project, about $128,013,712 would be paid to the Utah General Tax Fund (**Table 4-16**).

A conservation tax is collected by the Utah State Tax commission at a rate of 0.002 percent of the value of oil and gas produced, sold, or transported from Federal, State, or private lands within Utah. The conservation tax from gas receipts in the LCPA would be about $5,784,119 (UDOGM 2006).

Sales and property tax revenue are used by local cities and counties to fund important local services and facilities. Sales taxes are paid by oil and gas operations when purchase of equipment, materials, supplies, and basic goods and services are made in the local area.

Property taxes are based upon the value added to the property leased for gas operations. Property values increase through the construction of wells, pipelines, and associated facilities. Consequently, property tax would increase though the construction phase of the project until the field was fully developed and would decrease as facilities located in the LCPA are dismantled and reclaimed.

Under the Proposed Action, approximately 20 wells and well pads would possibly be developed on the Hill Creek Extension of the Uintah and Ouray Indian Reservation. In the Hill Creek Extension, all mineral rights are held in split estate, meaning the Tribe owns the surface, but they are not entitled to the minerals beneath the surface. Minerals located in the Hill Creek Extension are Federally-owned and are administered by the BLM.

In addition to the 20 proposed wells on Tribal surface, five wells are proposed on Tribal-allotted lands. Tribal allotments are owned by an individual or a collective group of Tribal members. In the HCU, the Tribal allottee(s) own surface and mineral rights. Tribal-allotted mineral rights are similar to private mineral rights, in that the allottee(s) receive mineral royalties through confidential lease agreements, and the allottee(s) are entitled to the entire royalty payment. Standard royalty payments are between 12.5 and 18 percent of the production value. For the purposes of this analysis, a minimum royalty rate of 12.5 percent was used. Tribal allottee(s) would receive about $3,579,281 in royalty payments (**Table 4-16**).

Although the Ute Tribe is not entitled to any mineral royalties, as a surface owner they are allowed to negotiate the access and use of the Reservation. As a form of compensation for anticipated disturbances caused by oil and gas operations, the Tribe and XTO have entered into a Surface Use and Access Agreement. Surface Use and Access Agreement (#97-288), signed by the Tribe's governing body in 1997, approved ROW access and the construction and use of wells, pipelines, and access roads for a 20-40 year period. In return for disturbance and damage that result from project activities, the Tribe would be compensated with an overriding royalty payment of 3.18 percent to 5 percent. In addition, the Tribe would receive approximately $1,000 per well pad in damages fees for well pads constructed on Tribal lands. The total Ute Surface Use Agreement payment would be approximately $3,642,276 (**Table 4-16**).

Table 4-16. Summary of Royalties and Tax Revenues[1]

Type of Royalty or Tax	Total Revenue
Federal Mineral Royalties	$307,102,331
State Mineral Royalties	$40,087,950
State Severance Tax	$128,013,712
State Conservation Tax	$5,784,119
Private Mineral Royalties	$14,317,125
Indian Allotted Mineral Royalties	$3,579,281
Ute Surface Use Agreement Payment	$3,642,276
County Property and Sales Taxes	Unknown

[1]All revenues are calculated on 30 year production life with a minimum production rate of 100 mcf per well/day.

4.2.14.2 Alternative B – Conservation Alternative

Impacts to socioeconomics of the Uinta Basin from implementation of Alternative B would be unchanged from those identified and assessed above for the Proposed Action.

4.2.14.3 Alternative C – No Action

Under the No Action Alternative, socioeconomic impacts would be substantially reduced as development would be limited to approximately 81 wells on State and private lands. This decreased level of development would result in correspondingly reduced numbers of temporary and permanent job opportunities, as well as substantially reduced revenues to the Federal, State and county treasuries.

Mitigation Measures

There are no recommended mitigation measures for socioeconomic resources.

5.0 CUMULATIVE IMPACTS ANALYSIS

Cumulative impacts result from the incremental impacts of an action when added to past, present, and reasonably foreseeable future actions, regardless of who takes the action. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time. This chapter discusses cumulative impacts as the incremental effect to specific resources or issues that would occur from Alternatives A-C, in conjunction with other cumulative actions.

5.1 PAST, PRESENT AND REASONABLY FORESEEABLE DEVELOPMENT

In support of the cumulative impact discussion, this chapter provides discussion on past and present oil and gas activities in the Uinta Basin, both of which serve as introductions to the outlook for reasonably foreseeable development (RFD) in the LCPA and the greater Uinta Basin. The cumulative impact and RFD analysis is based upon the level of activities and actions identified in the Vernal FO Draft RMP (BLM 2005b). Within the Vernal FO Draft RMP, projected oil and gas activity would be the most significant activity expected in the Vernal FO area. Other significant activities would be livestock grazing and recreational projects. The Cumulative Impact Analysis Area (CIAA) for most resources is Vernal FO Planning Area which encompasses approximately 5.5 millions acres in Duchesne, Dagget, Uintah and Grand Counties. For some resources, the CIAA is specifically defined.

5.1.1 Oil and Gas

The Uinta Basin is a significant source of natural gas and oil, and it is currently one of the most active oil and gas producing areas in the onshore U.S. In September 2004, the Utah BLM's quarterly oil and gas lease sale broke the record of most acreage, revenues, and bidders for any lease sale. The focus of the bidding seemed to be both on known producing areas in the Uinta Basin and in frontier areas in the central portion of the State. In the case of the Uinta Basin, past exploration has been in shallow areas up to 8,000 feet. Companies are just now beginning to tap the huge gas reserves that are 10,000-20,000 feet deep due to new technology and economics.

Oil and gas development is at an all-time high in the basin, with more rigs operating, and more applications for APDs being processed than ever before. For example, over half of the total oil and gas wells drilled in Utah between 1911 and November of 2000 were drilled within the Uinta Basin. APDs and ROW applications processed by the BLM Vernal FO have illustrated a significant upward trend, estimated to be approximately 15 percent annually. In support of the Vernal FO Draft RMP, a mineral potential report was prepared (BLM 2002b). In that report it was estimated that a total of about 6,530 wells could be drilled in the Uinta Basin by various oil and gas operators over a 15-year period (BLM 2002b).

Exploratory drilling is currently proposed in the western and southwestern portions of the Uinta Basin, including BLM, Tribal and National Forest lands. Production of exploratory wells typically lags discovery by many years. These exploratory wells are typically characterized by larger, deeper, more remote locations requiring greater per-well expenditures, potential delays in infrastructure access and therefore, greater financial risk.

Future oil and gas development in the Uinta Basin would depend upon the feasibility of exploration, as determined by the underlying geology and further infill development projects

within the Basin. Future development would be dependent upon the geologic feasibility of each prospect, the cost to develop the resources, and engineering technological advancements. Development of Tribal lands would continue and perhaps increase as exploratory wells are drilled in the Hill Creek Extension. Drilling in the Ashley National Forest would likely increase as a result of new leasing and management strategies implemented by the Forest Service. However, the level of development on Tribal and National Forest System lands is unknown.

The cumulative scenario for this EA is based on the number of existing wells in the Vernal FO Planning Area, as well as the estimated total number of wells anticipated to be drilled over the coming 15-20 years in this same area. As of October 2007, approximately 8,926 wells had been drilled in the Vernal FO Planning Area. Of these wells, 77% (6,889 wells) are currently active (i.e., producing; shut-in; drilled commenced; drilling suspended), leaving 23% (2,037 wells) that have been plugged, abandoned, and reclaimed (UDOGM 2007). Under the Vernal FO Draft RMP Preferred Alternative, an estimated 6,530 additional oil and gas wells are anticipated in the Vernal FO Planning Area. To estimate surface disturbance regarding past and future oil and gas development in the Vernal FO Planning Area, the following assumptions have been applied:

- Surface disturbance for a well pad: 2.4 acres;
- Surface disturbance for an access road, assuming 0.2 mile/well: 0.73 acres/well;
- Surface disturbance for pipelines and flowlines: 0.47 acres/well.

Based on these assumptions, surface disturbance associated with past, present and reasonably foreseeable oil and gas development would be 48,309 acres, or 0.9% of the 5.5 million acre Vernal FO Planning Area. The details are shown in **Table 5-1.**

Table 5-1. Surface Disturbance Associated with Past, Present, and Reasonably Foreseeable Oil and Gas Development in the Vernal Field Office Planning Area CIAA

Existing Active Wells[1]	RFD Wells[2]	Cumulative Wells[3]	Well Pads (acres)[4]	Access Roads (acres)[4]	Pipelines (acres)[4]	Cumulative Surface Disturbance (acres) in the CIAA[5,6]	% of Total Acreage within CIAA
6,889	6,530	13,419	32,206	9,796	6,307	48,309	0.9%

[1] Source for well count: UDOGM 2007.
[2] Source for well count: Mineral Potential Report, BLM 2002b.
[3] Sum of Existing Active Wells and RFD Wells.
[4] Calculated using assumptions discussed above.
[5] Calculated by adding well pad, access road, and pipeline acreages together
[6] Well pad disturbance is overestimated because it assumes one well per pad. In some cases, two or more wells may be drilled from a single well pad (i.e., directional drilling may be utilized).

Table 5-2 shows the cumulative surface disturbance within the Vernal FO Planning Area (from **Table 5-1**) in relation to surface disturbance associated with the Proposed Action and alternatives.

Table 5-2. Surface Disturbance Associated with Project Alternatives Relative to Cumulative Surface Disturbance in the Vernal Field Office Planning Area CIAA.

Alternative	Surface Disturbance from Project Alternatives (acres)	Cumulative Surface Disturbance (acres) in the CIAA	Surface Disturbance from Project Alternatives as a % of Cumulative Surface Disturbance
A/B	1,882	48,309	3.9%
C	486	48,309	1.0%

5.1.2 Livestock Grazing

Livestock grazing is currently a permitted use of public lands within the Vernal FO Planning Area. Although some minor changes may be expected over the next few years, it is reasonable to expect that livestock grazing would continue. Allocated AUMs would remain essentially unchanged; however, based on use trends over the past seven years actual use may decline based on individual grazing permittee's operations and market conditions. The Vernal FO currently administers grazing on 147 allotments. The 147 allotments within the Vernal FO boundary designated for livestock grazing encompass approximately 2,268,120 acres (1,696,416 acres of BLM land; 571,704 acres of private, State, and Tribal lands). Within the grazing allotments managed by the Vernal FO, 153,370 AUMs are allocated for livestock.

5.1.3 Recreation

Reasonable foreseeable recreation decisions potentially affecting cumulative impacts in the Vernal FO RMP area could include likely designation of Backcountry Byways, ACECs, WSRs, and Special Recreation Management Areas (SRMAs), as well as trail, campground, and cabin development. These designations and developments would have beneficial impacts on recreation, but would also affect the management of other resources in the Cumulative Impact Analysis Area (CIAA).

5.2 RESOURCE-SPECIFIC CUMULATIVE IMPACTS

This section discloses the impacts expected when the Proposed Action is added to the past, present and reasonably foreseeable actions.

5.2.1 Air Quality

A comprehensive air quality analysis, the Air Quality Assessment Report for the Vernal and Glenwood Springs RMPs (BLM 2005a), was conducted in conjunction with the Draft EIS and RMP for the Vernal FO (BLM 2005b). This analysis addressed the impacts to air quality in the Uinta Basin and surrounding areas of special concern, considering both existing and RFD sources. Results from this analysis indicate that existing air quality in the region is generally good, and based on Reasonable Development Scenario of more than 6,000 wells in the next 20 years and other cumulative sources, would not significantly increase.

In particular, the cumulative well development of more than 6,000 wells in the Uinta Basin is not expected to affect attainment of NAAQS standards or regional PSD increments. Existing and RFD stationary sources, including the 510 wells proposed for the Proposed Action and

Alternative B or the 81 wells proposed for Alternative C, the LCPA Project, were found to have no significant impact and would be in compliance with all applicable Federal and State of Utah air quality standards. A cumulative effects analysis on visibility impairment within nearby Class I and selected Class II areas found that potential changes in visibility and acid deposition were well within acceptable guidelines.

In general, the increase in emissions associated with the Proposed Action would be localized, in some cases temporary (construction, drilling, and completion phases), and on a limited scale in comparison with regional emissions.

5.2.2 Water Resources

The CIAA for water resources, including erosion/sedimentation, water depletion and floodplains, is the BLM Vernal FO Planning Area. In the CIAA, construction of oil and gas facilities would likely have the greatest potential impact on water resources due to increased erosion and sedimentation rates. In addition to oil and gas development, recreational activities (OHV use and the development of facilities including campgrounds), mining activities (Gilsonite, sand, gravel, and potentially oil shale), county and private road construction, agricultural activities (livestock grazing), and prescribed burns also increase natural erosion rates and contribute sediment to the rivers in the CIAA.

5.2.2.1 Erosion and Sedimentation

Surface disturbance associated with past, present and reasonable foreseeable oil and gas development (i.e., 13,419 wells = 48,308 acres) in the CIAA would increase background erosion rates from 53,847 tons per year to approximately 193,940 tons per year. It is assumed that sedimentation control devices employed for the reasonably foreseeable projects would be about 70 percent effective, the sediment delivery from these projects would be about 58,182 tons per year. It is assumed that this increased sediment would eventually be delivered to the Green River. Additional increases in sediment delivery could also be expected from expanded recreational use, mining activities, livestock grazing, prescribed burns, and construction or improvement of county and private roads.

Table 5-3 shows the estimated increased erosion and sediment yield associated with each alternative of the LCPA. The Proposed Action and alternatives would result in a slight increase in erosion rates and sediment yield. Rapid and successful reclamation/re-vegetation of temporarily disturbed areas and installation of sediment control devices are particularly important in minimizing water quality impacts and assuring maintenance of long-term stream health. Design features of the Proposed Action and alternatives, including berms, sediment control structures, and proper grading of well pads and access roads, would minimize the erosion of sediment from the proposed project facilities. In addition, mitigation measures would minimize the additional sedimentation and the chance for contamination of surface water and groundwater. As such, the increased erosion and sedimentation, combined with increases associated with other oil and gas development, recreational activities including OHV use, livestock grazing, and mining, would have minimal cumulative negative impacts on aquatic habitat within affected drainages.

Table 5-3. Estimated Increased Erosion and Sediment Yield Associated with Each Alternative of the LCPA[1]

	Surface Disturbance (acres)	Increase in Erosion (tons/year)	Increase in Sediment Loading (tons/year)[2]	% of Total Sediment Loading Estimated for Existing and RFD in the CIAA
Alternative A/B	1,882	5,458	1,637	2.8 %
Alternative C	486	1,410	423	0.7 %

[1]Acreage calculations were made using assumptions in **Section 5.1.1**.
[2]Assumes that sedimentation control devices employed for the project would be about 70 percent effective.

5.2.2.2 Stream Flow Regimes

Assuming an average of approximately 0.75 acre-feet of water would be required to drill an oil or gas well, and assuming all water would come from the Upper Colorado River Basin, RFD in the CIAA would deplete flow in the Upper Colorado River Basin by 4,898 acre-feet. Project-related water consumption would deplete the flow in the Green River by about 0.002-0.006 percent, depending on the alternative selected. This depletion would incrementally add to the depletion from other past, present, and reasonably foreseeable oil and gas activities, and diversions of water for agricultural and industrial uses, including mining activities. The cumulative depletion of the Green River flows from all of these sources would still be less than 1 percent of the projected 1,175,000 acre-feet per year that will be annually depleted in Utah from the Upper Colorado River Basin by 2020 (USDI-BOR 2003). Therefore, no diversions or alterations of flow regimes of the White River are expected to occur as a result of the Proposed Action or alternatives.

The Proposed Action or alternatives, combined with other oil and gas development and increased recreational activities, would slightly increase the chance that accidental spills of fuels, lubricants, and other petroleum products would occur and contaminate surface water within the CIAA. Spills of fuels or produced fluids from well pads, pipelines, and compressor stations also have the potential to contaminate the shallow alluvial groundwater along LCPA drainages and the Green River.

5.2.2.3 Floodplains

There are approximately 59 well pads (212 acres of disturbance) located within floodplains of the CIAA, with an additional 60 well pads (216 acres of disturbance) that are reasonably foreseeable within the floodplains of the CIAA. The Proposed Action and Alternative B would add approximately 25 well pads (90 acres of disturbance), and Alternative C would add approximately 6 well pads (450 acres of disturbance) to the existing and RFD acreage within the floodplains of the CIAA. The Proposed Action and alternatives could result in a slight increase in erosion rates and sediment yield to floodplains in the CIAA (**Table 5-3**). The increased erosion, combined with increases associated with other oil and gas development, recreational activities including OHV use, and livestock grazing, could have cumulative negative impacts on floodplain ecological functioning within the CIAA.

5.2.3 Soils

The CIAA for soil resources is the BLM Vernal FO Planning Area. The Proposed Action and Alternative B would contribute approximately 3.9 percent, and Alternative C would contribute approximately 1.0 percent to cumulative surface disturbances in the CIAA.

Any land-disturbing activity that removes native vegetation and topsoil can result in an increase in erosion rates and sediment yield. Authorized actions that could result in increased erosion and sediment yield within the CIAA include oil and gas development, livestock grazing, recreation, county and private road construction, and mining activities (gilsonite, sand, gravel, and potentially oil shale). Of these potential soil-disturbing activities, existing and proposed roads are the features of highest concern. Unlike surface and buried pipelines, active roadways and well pads are not reclaimed until the end of the life of the project, thus sediment yield from roads could continue at rates two to three times above background rates for that period.

Compaction due to construction activities at well pads, along access roads, and in other disturbed areas would result in a small increase in surface runoff from the area. This slightly increased runoff could in turn cause increased sheet, rill, and gully erosion. The construction and operation of each well would incrementally increase the chance that leaks or spills of saline water, hydro-fracturing chemicals, fuels, and lubricants would occur within the CIAA. Spills of this nature could increase the loss of soil productivity within the area.

As shown in **Table 5-4,** road development and surface disturbance associated with the Proposed Action and alternatives when compared to past, present, and reasonably foreseeable actions would have minimal impacts (approximately 2.9% and 0.6% of CIAA) on soil resources across the CIAA. Design features including berms, sediment control structures, and proper grading of well pads and access roads, would reduce the impacts of the Proposed Action and alternatives on soil resources by minimizing soil erosion and compaction, and by reducing the potential for soil contamination.

Table 5-4. Road Development Associated with the Proposed Action and Alternatives

	Road Development by Alternative(miles)	Past, Present and RFD Road Development (miles)[1]	% of Road Development for Past, Present, and RFD in the CIAA
Alternative A/B	77	2,684	2.9 %
Alternative C	15	2,684	0.6 %

[1]Acreage calculations were made using assumptions in **Section 5.1.1**.

5.2.4 Vegetation, Including Sensitive Plant Species (Other than FWS Listed Species) and Fire/Fuels Management

The CIAA for vegetation is the BLM Vernal FO Planning Area. Existing and RFD activities in the CIAA have or would disturb approximately 48,308 acres of vegetation. In addition, existing and reasonably foreseeable forage use by livestock grazing, wild horses, and wildlife, additional recreational use of habitats, mining activities, and prescribed burns would also potentially disturb existing vegetation throughout the CIAA. Specific negative effects associated with the proposed development in the CIAA could include 1) reduction in the overall visual character of an area; 2) reduction or fragmentation of wildlife habitats; 3) increased soil erosion; and 4) increased potential for weed invasion.

As shown in **Tables 5-2** and **5-4** above, road development and surface disturbance associated with the Proposed Action and alternatives when compared to past, present, and reasonably foreseeable actions would have minimal impacts on vegetation across the CIAA. Yet in the context of cumulative impact analyses, each acre of vegetation disturbance adds to a cumulative impact by increasing erosion, incrementally adding to overall native vegetation loss, and potentially increasing invasion of noxious weeds. However, based upon the minimal amount of

road development and surface disturbance associated with the alternatives when compared to RFD in the CIAA, the cumulative impacts of each alternative would result in minimal cumulative impacts to vegetation resources.

BLM Sensitive Plants

The CIAA for BLM Sensitive plant species is the BLM Vernal FO Planning Area. However, as the habitats have not been fully mapped and the population estimates are unknown, disturbances in the CIAA cannot be quantified.

Potential habitat for the Graham's beardtongue has been identified within and near the LCPA. The Proposed Action and alternatives could result in the direct loss of individual plants in the LCPA, if any were to occur, which would incrementally contribute to cumulative impacts affecting habitats and populations of this species. Past, present, and reasonably foreseeable oil and gas projects would contribute to incremental loss and fragmentation of habitat within the LCPA and surrounding areas for this plant species. These activities could also have indirect effects resulting from increased sedimentation and weed invasion, which could cumulatively decrease the plant's recovery potentials. In addition to impacts from oil and gas developments, past, present, and reasonably foreseeable forage use by livestock grazing, wild horses, wildlife, and additional recreational use of habitats would also potentially disturb existing vegetation in and near the LCPA. These reductions of habitat could be compounded by other losses resulting from non-human induced conditions such as prolonged drought conditions.

Lands involving special status plant species habitats within the CIAA have generally been leased with terms and conditions to protect the species and its habitat. Adherence to conservation measures/practices to moderate development in these areas, affording protective distances from proposed development to plants and/or their occupied habitats, and minimization of disturbance in suitable habitats could collectively reduce cumulative impacts to the Graham's beardtongue. However, these protective conditions are not applied under the Proposed Action, but would be implemented under the Conservation Alternative and are recommended under the No Action Alternative.

Under the Proposed Action, protective measures would not be implemented, and therefore activities under the Proposed Action may adversely impact Graham's beardtongue, and would therefore contribute to cumulative impacts on this species and its habitat.

Under Alternative B, AEPMs, which include species-specific conservation measures, would be implemented. As such, Alternative B activities would not likely adversely impact the Graham's beardtongue, and therefore would have negligible cumulative impacts on this species and its habitat.

Assuming recommended mitigation measures that include adherence to conservation measures are implemented, Alternative C activities would not likely adversely impact the Graham's beardtongue, and therefore would have negligible cumulative impacts on this species and its habitat.

5.2.5 Threatened and Endangered Plant Species

The CIAA for threatened and endangered plant species is the BLM Vernal FO Planning Area. However, as habitats have not been fully mapped and population estimates are unknown, disturbances in the CIAA cannot be quantified.

Habitat for three Federally-listed plant species (shrubby reed-mustard, clay reed-mustard, and Uinta Basin hookless cactus) has been identified or potentially occurs within and near the LCPA. The Proposed Action and alternatives could impact plants and their habitats which would incrementally contribute to cumulative impacts affecting populations of and habitats for these special status plant species. Existing and reasonably foreseeable oil and gas projects have and would continue to contribute to incremental loss and fragmentation of special status plant habitats within the LCPA and surrounding areas for these plant species. These activities could also have indirect impacts on the threatened and endangered plants caused by sedimentation and weed invasion, which could cumulatively decrease the plants' recovery potentials. In addition, forage use by livestock grazing, wild horses, wildlife, and additional recreational use of habitats would also potentially disturb threatened and endangered plant habitats in and near the LCPA. These reductions of habitat could be compounded by other losses resulting from non-human induced conditions such as prolonged drought conditions.

Lands involving threatened and endangered plant species habitats within the CIAA have generally been leased with terms and conditions to protect these species and their habitats. Adherence to conservation measures/practices to moderate development in these areas and afford protective distances from proposed development to plants and/or their occupied habitats, and minimization of disturbance in suitable habitats could collectively reduce cumulative impacts to threatened and endangered plants. However, these protective conditions are not applied to all alternatives in this EA, and as such, the Proposed Action and alternatives result in different determinations.

Under the Proposed Action, protective measures would not be implemented, and therefore activities under the Proposed Action "***may affect, are likely to adversely affect***" the shrubby reed-mustard, clay reed-mustard, and Uinta Basin hookless cactus, and would therefore contribute to cumulative impacts on these species and their habitats.

Under Alternative B, AEPMs, which include species-specific conservation measures, would be implemented. As such, Alternative B activities "***may affect, are not likely to adversely affect***" the clay reed-mustard and/or the Uinta Basin hookless cactus, and therefore would have a negligible cumulative impact on these species and their habitats. However, based on potential impacts to suitable and occupied habitats, activities under Alternative B (even with adherence to AEPMs) "***may affect, are likely to adversely affect***" the shrubby reed-mustard, and would therefore contribute to cumulative impacts on this species and its habitat.

Assuming recommended mitigation measures that include adherence to conservation measures are implemented, Alternative C activities "***may affect, are not likely to adversely affect***" the clay reed-mustard and/or the Uinta Basin hookless cactus and therefore would have a negligible cumulative impact on these species and their habitats. However, based on potential impacts to suitable and occupied habitats, activities under Alternative C (even with adherence to recommended mitigation measures) "***may affect, are likely to adversely affect***" the shrubby reed-mustard, and would therefore contribute to cumulative impacts on this species and its habitat.

5.2.6 Wetlands/Riparian Zones

The CIAA for wetlands and riparian zones is the BLM Vernal FO Planning Area, however riparian/wetland maps in the CIAA have not been finalized by the BLM to the point where acreage calculations of existing riparian/wetland areas and impacts to those areas can be quantified. As such, cumulative impacts to this resource will not be analyzed quantitatively. In the CIAA, wetlands and riparian zones would most likely be impacted by oil and gas

development, recreational activities (OHV use and the development of facilities including campgrounds), county and private road construction, and agricultural activities (livestock grazing).

Wetlands and riparian habitats in the LCPA occur sporadically along Willow Creek. Under the Proposed Action and alternatives, the conceptual placement of well pads, roads and other infrastructure does show some disturbance in the wetland/riparian zones in the LCPA. However, as these surface disturbing activities would be re-routed out and away from wetlands/riparian zones during the on-site visits, these direct disturbances would not occur. In addition, design features of the Proposed Action and alternatives, including berms, sediment control structures, and proper grading of well pads and access roads, would minimize impacts to wetlands and riparian zones. As such, impacts of the Proposed Action and alternatives, combined with other oil and gas development, recreational activities including OHV use, livestock grazing, and mining, would have minimal cumulative impacts on wetlands and riparian zones throughout the CIAA.

5.2.7 Invasive and Noxious Species

The CIAA for invasive and noxious weeds is the BLM Vernal FO Planning Area. Invasive and noxious weed species are a major concern in the Uinta Basin. Weed Management Areas have been established involving interagency planning and coordination and treatment to search and destroy stands of invasive and noxious species. As previously stated, past, present, and reasonably foreseeable oil and gas projects in the CIAA would potentially include the construction of approximately 2,684 miles of road, and disturbance of approximately 48,309 acres of vegetation. In addition, to vegetation lost from oil and gas developments, past, present and reasonably foreseeable forage use by livestock grazing, wild horses, and wildlife, additional recreational use of habitats mining activities, and prescribed burns would also potentially increase noxious and invasive weeds throughout the CIAA. Specific negative effects of invasive plants and noxious weeds associated with proposed development in the CIAA could include 1) reduction in the overall visual character of the area; 2) competition with, or elimination of native plants; 3) reduction or fragmentation of wildlife habitats; and 4) increased soil erosion.

Tables 5-2 and **5-4** show the amount of road development and overall surface disturbance associated with each alternative in the LCPA. Based upon the minimal amount of road development and surface disturbance associated with the alternatives when compared to RFD in the CIAA, along with the applicant-committed measures that would be implemented under each alternative to aggressively treat infestations, and to maximize interim and final reclamation, the cumulative impacts of each alternative would result in minimal cumulative impacts to invasive and noxious weeds.

5.2.8 Fish and Wildlife, Including Special Status Species (Other than FWS Listed Species)

The CIAA for wildlife is the BLM Vernal FO Planning Area. Past and present actions in the CIAA have caused direct habitat loss and/or degradation of habitat, contributed to habitat fragmentation, displaced individual wildlife species, likely increased collisions between wildlife and vehicles, and potentially contributed to the poaching and general harassment of wildlife. As shown in **Table 5-1**, surface disturbances from past development, estimated reasonably foreseeable development of oil and gas activities in the CIAA, including development proposed under Alternatives A, B and C, are approximately 48,309 acres. Recreation and livestock grazing within the CIAA also contribute to cumulative impacts to wildlife; however, their incremental

contributions have not been quantified and therefore, are not estimated within the scope of this EA. This cumulative impact analysis assumes that future surface disturbances in the CIAA would primarily result from oil and gas development, although livestock grazing, recreation and development of dedicated recreation facilities, and growth of Uinta Basin communities would also remove habitat and thus would also reduce habitat values for wildlife species, including special status wildlife species.

While surface disturbance does somewhat correspond to associated wildlife habitat loss, accurate calculations of cumulative wildlife habitat loss are not determinable because impacts are species-specific and are dependent upon the following: 1) the status and condition of the population(s) or individual animals being affected; 2) seasonal timing of the disturbance; 3) value and quality of the LCPA as well as adjacent habitats within the CIAA; 4) physical parameters of the affected and nearby habitats (e.g., the extent of topographical relieve and vegetative cover); and 5) the type of surface disturbance. However, surface disturbance calculations are considered a useful indicator of habitat loss because as habitats are removed to support oil and gas development, mining, and other development activities, wildlife carrying capacities of an area would be reduced.

As shown in **Table 5-2**, total proposed surface disturbances associated with the Proposed Action and alternatives, when compared to the total surface disturbance in the CIAA caused by past, present, and RFD, would likely have minimal impacts on wildlife and their habitats across the CIAA. Yet in the context of cumulative impact analyses, each acre of vegetative disturbance in the LCPA would be additive to other losses of habitat, foraging areas, breeding areas, ground cover, and increased habitat fragmentation within the CIAA. Additional development activities could temporarily displace wildlife or preclude wildlife species from using areas of more intense human activity. Other impacts could result in an increased disruption of migratory routes and use of seasonal ranges, increased general distress, deteriorated physical condition, and decreased reproductive success and nutritional condition due to increased energy expenditure.

Based upon the minimal amount of surface disturbance in the CIAA associated with the Proposed Action and alternatives, the direct and indirect cumulative impacts of each alternative could affect individual species, but would not likely result in a loss of viability of wildlife populations within the CIAA.

Special Status Wildlife Species

The CIAA for special status wildlife species is the Vernal FO Planning Area. It should be noted that this analysis assumes cumulative impacts to special status wildlife species would be similar in nature to those discussed above for wildlife; however, given their ongoing habitat losses, sensitivity to disturbances, and declining population numbers, special status wildlife species would be expected to be more sensitive to impacts related to development within the CIAA than other, more common wildlife species.

Given such sensitivities, historic, current, and future land uses have reduced and will likely continue to reduce the quality and quantity of habitats in the CIAA for special status wildlife species. However, by conducting field surveys for special status wildlife species prior to construction and implementing seasonal and spatial buffers (or avoidance), as directed by the appropriate AO, these impacts could be reduced. Based upon the minimal amount of surface disturbance associated with the Proposed Action and alternatives relative to the CIAA, the direct and indirect cumulative impacts of each alternative could affect individual species, but would not likely result in a loss of viability of sensitive wildlife populations within the CIAA.

5.2.9 Endangered Fish Species

Unlike the special status species mentioned above, water depletions associated with the Proposed Action and alternatives, in combination with depletions from other activities in the CIAA, would reduce the ability of the Upper Colorado River Basin to create and maintain the physical habitat and biological environment for the four endangered Colorado River fishes. As such, these water depletions, along with past, present, and reasonably foreseeable depletions to the Upper Colorado River Basin "***may affect, are likely to adversely affect***" the Colorado River fishes and "***may affect, are likely to adversely affect***" their USFWS-designated critical habitats.

5.2.10 Livestock Grazing

The CIAA for livestock grazing is the combined area of all eight grazing allotments, portions of which fall within the LCPA. Cumulative impacts from oil and gas development to livestock grazing would include the loss of AUMs during the life of the disturbance. Recreation activities also contribute to cumulative impacts, but the incremental contribution is impossible to quantify.

Table 5-5 displays the past, present and reasonably foreseeable oil and gas development in the livestock grazing CIAA.

Table 5-5. AUMs Lost from Existing and Reasonable Foreseeable Oil and Gas Developments in the Livestock Grazing CIAA

Alternative	Allotment Name	Total AUMs in CIAA	AUMs Lost from Project Alternative	Past and Present AUMs[1] Lost	RFD AUMs[1] Lost	Total Reasonably Foreseeable AUMs[2] Lost in CIAA	% of Total AUMs in CIAA
A/B	Big Pack Mountain	1,242	60	12	19	**91**	7.4
	Brewer	200	0	2	3	**5**	2.5
	Hatchbroome Bartholomew	138	4	1	2	**7**	5.4
	Lower Showalter	1,426	0	14	22	**36**	2.5
	Oil Shale	1,137	8	11	17	**37**	3.2
	Sand Wash	5,876	20	58	90	**168**	2.9
	Thorne-Ute-Broome	292	1	3	4	**8**	2.9
	Wild Horse Bench	2,462	3	24	38	**65**	2.6
	TOTAL for CIAA	**12,773**	**96**	**127**	**195**	**418**	**3.3**
C	Big Pack Mountain	1,242	5	12	19	**36**	2.9
	Brewer	200	0	2	3	**5**	2.5
	Hatchbroome Bartholomew	138	0	1	2	**3**	2.5
	Lower Showalter	1,426	0	14	22	**36**	2.5
	Oil Shale	1,137	1	11	17	**30**	2.6
	Sand Wash	5,876	2	58	90	**150**	2.6
	Thorne-Ute-Broome	292	2	3	4	**7**	2.5
	Wild Horse Bench	2,462	0	24	38	**62**	2.5
	TOTAL for CIAA	**12,773**	**8**	**127**	**195**	**330**	**2.6**

[1] Wells for this calculation were assumed to be equally distributed in the CIAA. Source for existing and RFD well data is UDOGM 2007 (Aug 2007)

[2] The Reasonable Foreseeable AUMs were calculated by adding the following columns: Past and Present AUMs lost, RFD AUMs lost, and Total AUMs lost from Project Alternative.

In addition to loss of AUMs, the development of roads has both adverse and beneficial impacts on livestock grazing activities. Roads would beneficially provide additional access to portions of the grazing allotments that currently do not have access. Livestock is known to use roads as easy access to grazing areas, thus improving livestock distribution to some areas that have been previously inaccessible or under-utilized by livestock. Conversely, increased roads within the LCPA would contribute to difficulties in controlling livestock as more natural barriers to livestock movement are removed, and livestock are more likely to use roads as travel routes. Furthermore, increased road and pipeline ROWs could contribute to changes in water flow, thereby reducing flows to livestock ponds. These past, present, and future construction activities, and other visual and noise impacts in the LCPA could cause livestock to move to adjacent undisturbed areas, thereby leading to additional livestock impacts on vegetation in those locations. Vegetative recovery, via revegetation efforts, may become increasingly more difficult as grazing animals compete for resources that may become less available due to continued prolonged drought conditions. Successful vegetation manipulation treatments and interim and final reclamation may result in beneficial effects and reduce adverse effects to livestock resources.

5.2.11 Cultural Resources

As potential impacts to cultural resources across a geographic landscape are not additive, the CIAA for cultural resources is the LCPA. Cumulative impacts to cultural resources are defined as any damage to, or destruction of, cultural resources which result from the incremental impact of the action when added to other past, present, and RFD actions (40 CFR 1508.7). The magnitude of the impacts may be greater or lesser depending on 1) the cultural resource site densities present in the areas of project-related activity; 2) the significance of the cultural resources present; and 3) the final magnitude and scope of RFD actions over the next 20 years. Cumulative impacts to the cultural resources in the CIAA would primarily result from activities associated with surface and subsurface disturbances such as oil and gas development projects, increased visitation to the LCPA, recreational/OHV use, and fire management. Impacts may also result from non-surface-disturbing activities that create atmospheric, visual, and/or auditory effects. These types of impacts cumulatively affect not only the historic setting, feeling, and viewshed of cultural properties, but also their eligibility potential for nomination to the NRHP.

Table 5-6 shows past, present and reasonably foreseeable disturbances within the CIAA for cultural resources, although direct impacts to these resources would be avoided. As shown in **Table 5-6**, total disturbances from the project alternatives would account for approximately 65.8 and 33.2 percent of the cumulative surface disturbance in the CIAA, depending on the alternative

Table 5-6. Cumulative Oil and Gas Development Surface Disturbances in the CIAA for Cultural Resources, including the Proposed Action and Alternatives.

Alternative	Total # of Existing and RFD Wells[1]	Total Surface Disturbance (acres)[2,3]	Surface Disturbance by Alternative (acres)	Cumulative Surface Disturbance in CIAA	Surface Disturbance by Alternative as a % of Cumulative Surface Disturbance in CIAA
A/B	272	979	1,882	2,861	65.8%
C	272	979	486	1,465	33.2%

[1] Source for well count: UDOGM 2007.
[2] Calculated using the assumptions from the mineral potential report on the total number of existing and RFD wells.
[3] Well pad disturbance is overestimated because it assumes one well per pad. In some cases, two or more wells may be drilled from a single well pad (i.e., directional drilling may be utilized).

As cultural resource surveys would occur prior to any surface-disturbing activities in the LCPA, and as all significant cultural resources would be avoided or appropriately mitigated, direct cumulative impacts to these resources are expected to be minimal. The greater cumulative threat to cultural resources would be indirect impacts. When considered alongside other past, present, and RFD actions, the impacts of the Proposed Action may cumulatively impact unknown cultural resources in the LCPA by introducing atmospheric, visual, and auditory intrusions, increasing visitation and pedestrian traffic during well field development and operation, increasing vandalism, OHV and other motorized vehicle use, erosion, and other unknown impacts to unidentified TCPs and cultural landscapes, all of which could contribute to an alteration of the overall historic setting and feeling of the CIAA for cultural resources. Generally speaking, project-related activities could incrementally and cumulatively add to the loss of important cultural resources across the CIAA for cultural resources. These types of impacts present significant consequences for the breadth, completeness, and interpretive value of the archaeological record. Beneficial cumulative impacts would also likely occur as undocumented cultural resources could be discovered and preserved.

Many potential cumulative impacts to cultural resources would be reduced or eliminated through the implementation of Federal regulatory laws, actions, and guidelines designed to protect cultural resources. However, it is anticipated that such measures would not likely prevent all indirect cumulative impacts from occurring, and in the context of cumulative impact analyses, any impact on cultural resources would incrementally add to overall cumulative impacts. In addition, under some project alternatives, measures would be incorporated (under Alternative B) or recommended measures could be implemented/adhered to (under Alternative C) that would reduce, minimize, or avoid project-specific and cumulative impacts to cultural resources. Assuming these measures are adhered to, cumulative impacts under Alternatives B and C would incrementally affect cultural resources less than under the Proposed Action.

5.2.12 Native American Religious Concerns

As potential impacts to Native American religious resources across a geographic landscape are not additive, the CIAA for this resource is the LCPA. Cumulative impacts to Native American religious concerns would be similar to those described under the cultural resources section above (**Section 5.2.11**). As discussed in **Table 6-1,** consultation with affected Indian Tribes would occur prior to any surface-disturbing activities. The consultation process would identify sites of religious significance, and would result in impact minimization and avoidance measures that would reduce or eliminate direct and indirect impacts to sites of Native American cultural and/or religious significance.

As shown in **Table 5-6**, total disturbances from the project alternatives would account for approximately 65.8 and 33.2 percent of the cumulative surface disturbances in the CIAA, depending on the alternative. Direct and indirect impacts from the Proposed Action and alternatives would incrementally contribute to those occurring from other existing and RFD activities.

5.2.13 Paleontological Resources

As potential impacts to paleontological resources across a geographic landscape are not additive, the CIAA for paleontological resources is defined as the existing LCPA. Cumulative impacts to paleontological resources would primarily result from activities associated with surface and subsurface disturbance such as oil and gas development projects, recreational use/OHV travel, and fire management. These activities could have cumulative effects on paleontological

resources in the CIAA. Surface-disturbing activities could affect paleontological resources by damaging or destroying fossils. Adverse effects include physical damage to or destruction of fossils, as well as increased vandalism and theft that result from improved access to fossil localities.

Based on the projected development in the CIAA, the existing and reasonably foreseeable surface disturbance and paleontological resource disturbance from oil and gas activities would consist of up to 979 acres (**Table 5-6**). The additional 510 wells proposed under the Proposed Action and Alternative A, 82 wells proposed under Alternative C, and associated infrastructure would add approximately 1,882 and 486 acres to this number, respectively. As shown in **Table 5-6**, total disturbances from the Proposed Action and alternatives would account for approximately 65.8 and 33.2 percent of the cumulative surface disturbance in the CIAA, depending on alternative . Livestock grazing, recreation use and other authorized uses of public lands will generate their own surface disturbances affecting paleontological resources, however these effects are difficult to quantify. However, as all identified paleontological resources would be avoided or impacts mitigated, cumulative impacts associated with the Alternatives A, B, and C would be reduced or eliminated. Public education and where necessary, law enforcement actions would reduce unauthorized fossil collecting.

Surface-disturbing activities could also have a beneficial effect on paleontological resources by drawing the attention of a qualified paleontologist to areas that are not currently being researched, resulting in the collection of specimens and data that would not otherwise be recovered.

5.2.14 Socioeconomic

During the latter half of the 20th century, minerals development has replaced agriculture as the Uinta Basin's most significant private industry. As energy-related development has grown and traditional farming and ranching activities have decreased, the standard of living in the Vernal FO planning area has increased. Availability of housing, capacity of schools, and availability of medical care have been driven by cycles in the petroleum industry. As the national demand for energy grew, counties in the Basin have grown in population and economic vitality. As the oil and gas and public land industries grew, retail trade, private services and government services also grew.

Assuming the average Federal royalty rate of 12.5% on a producing well is $98,000 per year (current dollars); the approximately 6,500 reasonably foreseeable wells in the CIAA could generate about $80 million dollars in mineral lease royalties, which would then be distributed to State and local governmental entities as set out by established regulations and procedures.

Overall, the addition of XTO's LCPA project would incrementally add to beneficial cumulative socioeconomic impacts to the CIAA from oil and gas development by contributing to income taxes, royalties, and other fees/revenues collected by the State of Utah, County and Tribal governments. Among the largest natural gas counties in Utah, Uintah County's mineral extraction industries make a major contribution to the economic well being of the State and the Tribe.

Other actions related to recreation and rangeland management may have smaller socioeconomic effects in relation to oil and gas activities. Decisions within County, the BLM, the National Forest and Tribe land management plans could result in economic benefits within the CIAA to the extent that they promote tourism and recreation.

6.0 CONSULTATION AND COORDINATION

6.1 INTRODUCTION

The issue identification section of Chapter 1 identifies those issues analyzed in detail in Chapter 4. **Appendix B** provides the rationale for issues that were considered but not analyzed further. The issues were identified through the public and agency involvement process described in **Sections 6.2** and **6.3** below.

6.2 PERSONS, GROUPS, AND AGENCIES CONSULTED

Table 6-1. List of all Persons, Agencies and Organizations Consulted for Purposes of this EA

Name	Purpose & Authorities for Consultation or Coordination	Findings & Conclusions
Bekee Megown, U.S. Fish & Wildlife Service	Information on Consultation, under Section 7 of the Endangered Species Act (16 USC 1531)	Provided information on listed, proposed for listing and candidate species. Also provided comment under NEPA, MBTA, Bald and Golden Eagle Protection Act and the Fish & Wildlife Coordination Act. A copy of this EA has been submitted to the USFWS for review.
Utah State Historic Preservation Office (SHPO)	Consultation for undertakings, as required by the National Historic Preservation Act (NHPA) (16 USC 470)	Consultation with the SHPO has been initiated. Section 106 consultation will be completed following site-specific cultural clearances. A copy of this EA has been submitted to the SHPO for review.
Tribes with historic ties to the Uinta Basin	Consultation as required by the American Indian Religious Freedom Act of 1978 (42 USC 1531) and NHPA (16 USC 1531)	The BLM will consult with applicable Tribes regarding the identification of sacred sites or traditional cultural properties within the LCPA.
Superintendent, U&O Indian Reservation, BIA	Coordination as required by Onshore Order #1 (revised 3/07/07) involving Indian surface and Federal minerals.	
Susan Bachini Nall U.S. Army Corps of Engineers	Information and coordination on requiring a permit from the Corps under authority of Section 404 of the Clean Water Act (33 USC 1251)	
Tom Orth, Utah Department of Environmental Quality, Division of Air Quality	Information and coordination on air quality	Data and analysis on air quality obtained from this source has been incorporated into Chapters 3 and 4
Utah Division of Wildlife Resources	Information and coordination on wildlife species and their habitats associated with the LCPA.	Data and analysis regarding big game species incorporated into Chapters 3 and 4.

Name	Purpose & Authorities for Consultation or Coordination	Findings & Conclusions
Darlene Burns, Uintah County	Consult with County Road Department as agency with expertise on roads within the LCPA	Data on County roads incorporated into Chapters 2, 3 and 4.

6.3 SUMMARY OF PUBLIC PARTICIPATION

During preparation of the EA, the public was notified of the Proposed Action by posting on the Utah Internet Homepage on October 17, 2006. A 30-day public comment period is being provided for this document. The comment period will be begin on February 19, 2008 and end on March 19, 2008. Any comments submitted during the 30-day public comment period for this document will receive a formal response in the Final EA.

6.4 LIST OF PREPARERS

This EA was prepared by a third-party contractor, Buys & Associates, Inc., of Littleton, Colorado, and was reviewed by the BLM Vernal FO staff members listed below and accepted by the BLM Vernal FO Authorized Officer.

Table 6-2. List of Preparers

BLM		
Name	**Title**	**Responsible for the Following Section(s) of this Document**
Stephanie Howard	Environmental Coordinator	NEPA Compliance, Project Management
Amy Torres	Wildlife Biologist	Wildlife, T&E and Special Status Animal Species
Stan Olmstead	Natural Resource Specialist	Water Resources, Floodplains
Blaine Phillips	Archaeologist	Cultural Resources, Native American Religious Concerns
John Mayers	Geologist	Paleontology, Ground Water
Marc Stavropoulos	Supervisory. Rangeland Management Specialist	Rangeland Management
Del Clark	Rangeland Management Specialist	Wild Horses
Dylan Tucker	Rangeland Management Specialist	Soils
Charlie Sharp	Natural Resource Specialist	T&E and Special Status Plant Species, Vegetation, Noxious Weeds
Kim Bartel	Recreation Planner	Recreation, Visual Resources
Steve Strong	Natural Resource Specialist	Forestry, Woodlands, Fuels Management
Peter Sokolosky	Geologist	Geology, Minerals
Tim Faircloth	Assistant Field Manager, Renewable Resources	Wildlife, T&E Animal Species
Robert Specht	Branch Chief, Surface Compliance	Vegetation, T&E Plant Species
Karl Wright	Natural Resource Specialist	Water Resources, T&E Plant Species
Dixie Sadlier	Wildlife Biologist	Wildlife, T&E Wildlife Species
Kyle Smith	GIS, Cartographer	GIS, Data maps

Non-BLM Preparers		
Name	**Title**	**Responsible for the Following Section(s) of this Document**
Dawn Martin	NEPA Project Manager Buys & Associates	Project Manager, Technical Editing
Tanja Butler-Melone	GIS Manager, Environmental Planner Buys & Associates	Recreation, Visual Resources, Audio (Noise)
Jean Sinclear	NEPA Specialist Buys & Associates	Vegetation, T&E and Special Status Species (Plants), Noxious Weeds, Fire/Fuels Management
Tyler Ashcroft	Environmental Planner Buys & Associates	Transportation, Land Use, Socioeconomics
Shina duVall	Archaeologist, Buys & Associates	Cultural Resources, Paleontology, Native American Religious Concerns
Karin McShea Melissa Bridendall	Biologists, Buys & Associates	Wildlife, Vegetation, Soils, Rangeland, T&E and Special Status Species (Animals), Technical Editing
Nicole Elliott	GIS Specialist, Buys & Associates	GIS, Cartography
Jon Torizzo	Air Quality Scientist, Buys & Associates	Air Quality
Dave Nicholson	Senior Geologist, Buys & Associates	Water Resources, Paleontology
Kristin Muirhead	Hydrogeologist, Buys & Associates	Geology, Soils
Alden Hamblin	Paleontologist, A.H. Hamblin Paleontological Consulting	Paleontology
Angela Whitfield	Archaeologist, Montgomery Archaeological Consultants	Cultural Resources

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7.0 REFERENCES AND ACRONYMS

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7.2 LIST OF ACRONYMS USED IN THIS EA

- A -	
ANC	acid neutralization capacity
APD	Application for Permit to Drill
AO	Authorized Officer
AQRV	Air Quality Related Value
AUM	Animal Unit Month
- B -	
bbl	Barrel
Bcf	Billion cubic feet
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BPU	Big Pack Unit
BOP	Blowout preventer
- C -	
$CaCO_3$	calcium carbonate
CEHE	Critical Elements of the Human Environment
CFR	Code of Federal Regulations
cfs	cubic feet per second
CO	carbon monoxide
COA	Condition of Approval
- D -	
DR	Decision Record
- E -	
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
- F -	
FLPMA	Federal Land Policy and Management Act
FO	Field Office
FONSI	Finding of No Significant Impact
- G -	
GIS	Geographic Information System
- H -	
HAP	Hazardous Air Pollutants
HCU	Hill Creek Unit

hp	Horsepower
- I -	
IDT	interdisciplinary team
- K -	
km	kilometers
- L -	
LCU	Little Canyon Unit
LCPA	Little Canyon Project Area
- M -	
MBTA	Migratory Bird Treaty Act
Mcf	Thousand Cubic Feet
MMcf	Million Cubic Feet
mcl	maximum contaminant levels
mg/L	milligrams per liter
MSDS	Materials Safety Data Sheet
- N -	
NAAQS	National and Utah Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NI	Not impacted
NO_2	nitrogen dioxide
NP	Not present
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
- O -	
OHV	Off-highway vehicle
OSHA	Occupational Safety and Health Act
- P -	
PILT	payments in lieu of taxes
PM	Particulate Matter
PSD	Prevention of Significant Deterioration
psi	Pounds per square inch
- R -	
RCRA	Resource Conservation and recovery Act of 1976
REL	Reference Exposure Levels
RfC	reference concentrations
RFD	Reasonable Foreseeable Development
RMP	Resource Management Plan
ROW	right-of-way

- S -	
SAR	Sodium Adsorption Ratio
SARA	Superfund Amendments and Reauthorization Act
SITLA	School and Institutional Trust Lands Administration
SMA	Surface Management Agency
SO_2	sulfur dioxide
SPCC	Spill Prevention, Control and Countermeasure
- T -	
TDS	Total Dissolved Solids
TLV	Threshold Limit Values
TSL	Toxic Screening Level
- U -	
UDEQ	Utah Department of Environmental Quality
USDA	United States Department of Agriculture
UDOGM	Utah Division of Oil, Gas and Mining
UDWR	Utah Division of Wildlife Resources
USFWS	U.S. Fish and Wildlife Service
USDI	U.S. Department of the Interior
USFS	U.S. Forest Service
- V -	
VOC	Volatile Organic Compounds
- X -	
XTO	XTO Energy, Inc.

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APPENDICES

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APPENDIX A
MAPS AND FIGURES

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APPENDIX B
INTERDISCIPLINARY TEAM ANALYSIS

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INTERDISCIPLINARY TEAM ANALYSIS RECORD CHECKLIST

Project Title: HCU-LCU-BPU Natural Gas Development EA

NEPA Log Number: UT-080-05-249

File/Serial Number:

Project Leader: Stephanie Howard

DETERMINATION OF STAFF: (Choose one of the following abbreviated options for the left column)

NP = not present in the area impacted by the proposed or alternative actions
NI = present, but not affected to a degree that detailed analysis is required
PI = present with potential for significant impact analyzed in detail in the EA; or identified in a DNA as requiring further analysis
NC = (DNAs only) actions and impacts not changed from those disclosed in the existing NEPA documents cited in Section C of the DNA form.

Det ermi-nation	Resource	Rationale for Determination*	Signature	Date
		CRITICAL ELEMENTS		
PI	Air Quality	Proposed compressors would potentially impact air quality. Also fugitive dust.	Stephanie Howard	3/20/06
NP	Areas of Critical Environmental Concern	No ACECs are present in the area. Book Cliffs RMP.	Stephanie Howard	3/20/06
NP	Potential Areas of Critical Environmental Concern	No potential ACECs are present. Draft Vernal RMP 2005	Stephanie Howard	1/30/07
PI	Cultural Resources	Known and potential significant sites are present in the area.	Blaine Phillips	3/20/06
NI	Environmental Justice	According to the EPA Region VIII, State of Utah, Environmental Justice Map, the region has been categorized as a minority population area of 10-20% and a poverty population area of 10-20%. No minority or economically disadvantaged communities or populations are present which could be affected by the Proposed Action or alternatives. (http://www.epa.gov/enviro/ej, 8/25/05)	Stephanie Howard	3/20/06
NP	Farmlands (Prime or Unique)	No prime or unique farmlands are present in the field office.	Stephanie Howard	3/20/06
PI	Floodplains	Wells on terraces could have potential for erosional failures. Several roads and pipelines are in floodplains.	Stan Olmstead	3/20/06
PI	Invasive, Non-native Species	Potential for invasive and noxious weeds to occur or increase in density.	Delbert Clark	3/20/06
PI	Native American Religious Concerns	Cemetery, burials, and culturally sensitive materials in and near the Project Area.	Blaine Phillips	3/20/06
PI	Threatened, Endangered or Candidate Plant Species	Confirmed presence of Schoenocrambe suffrutescens Sclerocactus wetlandicus, and Schoenocrambe argillacea, most populations occurring between Hill Creek and Willow Creek within Green River Formation and along Green River-Uinta Formation interface (large SCSU population in Big Pack Unit). Potential habitat for Penstemon scariosus var. albifluvis.	Charlie Sharp Clayton Newberry	3/20/06 6/25/07
PI	Threatened, Endangered or Candidate Animal Species	Adjacent to potential habitat for T&E fish. Bald eagle foraging habitat. No black footed ferrets. Mexican spotted owl habitat was downgraded from "good" to	Amy Torres	6/25/07

Det ermi-nation	Resource	Rationale for Determination*	Signature	Date
		"poor" so there will be no impacts to MSO.		
NI	Wastes (hazardous or solid)	*Hazardous Waste:* No chemicals subject to reporting under SARA Title III in an amount equal to or greater than 10,000 pounds will be used, produced, stored, transported, or disposed of annually in association with the drilling, testing, or completing of this well. Furthermore, no extremely hazardous substances, as defined in 40 CFR 355, in threshold planning quantities, will be used, produced, stored, transported, or disposed of in association with the drilling, testing, or completing of this well" *Solid Wastes:* Trash would be confined in a covered container and hauled to an approved landfill. Burning of waste or oil would not be done. Human waste would be contained and be disposed of at an approved sewage treatment facility.	Stephanie Howard	3/20/06
Surface: PI Ground: NI	Water Quality (surface/ground)	*Surface*: Increased erosion of salts and sediments to Hill Creek, Willow Creek, and other onsite drainages will occur due to road and pipeline crossings. Potential exists for spills of hydrocarbons and other chemicals as well as increased sediments in the surface drainages and downstream Green River which will be considered through the Section 7 consultation. *Ground*: The operator has certified compliance with all Onshore Oil and Gas Orders. "Onshore Oil and Gas Order No. 2 Drilling Operations" will assure that the project will not adversely affect groundwater quality. Due to the state-of-the-art drilling and well completion techniques, the possibility of adverse degradation of groundwater quality or prospectively valuable mineral deposits by the Proposed Action will be negligible. Well completion must be accomplished in compliance with "Onshore Oil and Gas Order No. 2, Drilling Operations", These guidelines specify the following:…*proposed casing and cementing programs shall be conducted as approved to protect and/or isolate all usable water zones, potentially productive zones, and any prospectively valuable deposits of minerals. Any isolating medium other than cement shall receive approval prior to use.*	Surface: Stan Olmstead Sue Nall Ground: John Mayers	3/20/06 2/22/07 3/20/06
PI	Wetlands/Riparian Zones	Wetland and riparian areas identified along Willow Creek and Hill Creek.	Stan Olmstead Sue Nall	3/20/06 2/22/07
NP	Wild and Scenic Rivers	No wild or scenic rivers are present.	Stephanie Howard	3/20/06
NP	Eligible Wild and Scenic Rivers	No eligible wild or scenic rivers are present. Draft Vernal RMP, 2005.	Stephanie Howard	1/30/07
NP	Wilderness	No wilderness areas or wilderness study areas are present.	Stephanie Howard	3/20/06
OTHER RESOURCES / CONCERNS**				
PI	Rangeland Health Standards and Guidelines	Utah Rangeland Health Standard #1 requires that "upland soils exhibit permeability and infiltration rates that sustain or improve site productivity, considering the soil type, climate and landform". Increased soil erosion and soil compaction could potentially result in a failure to achieve Rangeland Health Standard #1. Could cause the allotment to not meet Utah Rangeland Health standards #3 (due to	Dylan Tucker	3-15-06

Det ermi-nation	Resource	Rationale for Determination*	Signature	Date
		increased invasive species due to disturbance which decreases the desired species)		
PI	Livestock Grazing	A corral, water well and reservoir are present in the Project Area. Also cattleguard maintenance, increased traffic, increased trespass of cattle on sheep allotments due to additional roads (breach of topographic boundaries) will need to be addressed.	Delbert Clark	3/20/06
NP	Woodland / Forestry	No woodlands are present.	Steve Strong	3/20/06
NP (ss) PI (veg)	Vegetation including Special Status Plant Species other than FWS candidate or listed species	Loss of general vegetation due to surface disturbance for the long term. Also potential impacts to Penstemon grahamii.	Charlie Sharp Clayton Newberry	3/20/06 6/25/07
PI	Fish and Wildlife Including Special Status Species other than FWS candidate or listed species e.g., Migratory birds.	Potential golden eagle, burrowing owl, sage grouse, white tail prairie dog, antelope, elk and deer habitat.	Amy Torres	3/20/06
PI	Soils	Construction of proposed wells, pipelines, roads, and associated facilities would result in the removal of or disturbance to Project Area vegetation and soils. Disturbance of soils could potentially lead to increased soil compaction, soil erosion, sediment yield, and salinity being delivered into the Colorado River Basin (through Hill Creek, Willow Creek, and Green River. Disturbance of soils could potentially result in increased sedimentation to livestock ponds. Construction of roads and pipeline could also divert water away from stock ponds.	Dylan Tucker	3-15-06
PI	Recreation	Limited recreation occurs primarily from elk and deer hunters using trucks, SUV's and ATV's. Total road and off-road traffic for the purposes of recreation are approx. 400 annually. However, the creation of new roads could positively impact recreation opportunities by attracting non-commercial traffic for recreation purposes through improved access to hunting areas, by expanding opportunities for OHV use, etc. However, improved access to the area could also result in higher densities or commercial traffic, recreational vehicles, and hunters, which would adversely impact hunting opportunities in the area.	Joshua Fisher	06/19/07
NI	Visual Resources	VRM Class III and IV. The upper slopes of Big Pack Mt. are managed as VRM IV; the lower as VRM III. The rationale for the VRM classes is based on viewers traveling the Willow Creek road from ½ mile away. Because well locations cannot be constructed on slopes in excess of 40%, only distant, and less surface disturbed locations would be constructed. Therefore, casual observers would not see any locations that would dominate their attention.	Kim A Bartel	1-26-07
NI	Geology / Mineral Resources/Energy Production	Sandstones of the lower Uinta Formation outcrops on the top of Big Pack Mountain Green River Formation lies at its base. Mineral materials in the form of dimension stone occurs between Big Pack Mtn and Willow Creek, however, there are no sales or permits for its removal within the Project Area. A statement of adverse energy impact (in accordance with EO 13212) is not needed as the project is directed at oil and gas development.	P. Sokolosky	2/10/2006
PI	Paleontology	High probability for vertebrate fossils in the area. Lower wagonhound member of the Uinta formation and evacuation creek member of the green river formation.	John Mayers	3/20/06
NI	Lands / Access	The proposed area is located within the Book Cliffs Resource Management Plan area, which allows for oil and gas development with associated road and pipeline right-	Shauna Derbyshire	3/20/06

Det ermi-nation	Resource	Rationale for Determination*	Signature	Date
		of-ways. Private, Federal and Tribal managed lands are within the Project Area. Current land uses, within the area identified in the Proposed Action and adjacent lands, consist of existing oil and gas development, gilsonite mining, wildlife habitat, recreational use, and sheep and cattle ranching. No existing land uses would be changed or modified by the implementation of the Proposed Action; therefore, there would be no adverse affect.		
PI	Fuels / Fire Management	Southern portion of area has pinion juniper and sage vegetation types.	Steve Strong	3/20/06
PI – positive	Socioeconomics	The Proposed Action would have positive effects on the socioeconomics of local cities and towns surrounding the Project Area. Project area work crews would likely increase local revenue through expenditures on lodging, meals, and supplies. In the last 50 years, Uintah County has shifted from an agrarian economy to an oil and gas economy with services to support oil and gas (retail trade, private services, and government services). A single well would have a total drilling and completion cost of about $600,000 according to IPAMs. A single well would employ about 34 employees over the life of the well (30 initial, 4 long term). Long term employment is about 15% of total employment for well development, and would be a more significant contributor to the community due to the fact that it would be more likely to draw employees from the local community than the initial employment, which would draw employees from both local and regional bases. Therefore there is a positive impact to socioeconomics expected.	Stephanie Howard	3/20/06
PI	Waters of the U.S. (USACE)	Hill Creek, Willow Creek, many unnamed ephemeral drainages, and associated wetlands occur within the Project Area. There is the potential to impact surface waters from road and buried pipeline crossings. Water resources should be mapped and avoided. Unavoidable impacts will require a Corps permit and may require compensatory mitigation.	Sue Nall	2/22/07
NP	Wild Horses and Burros	No herd management areas are present.	Delbert Clark	3/20/06
NP	Wilderness characteristics	No wilderness characteristics are present in the Project Area.	Kim Bartel	3/20/06

FINAL REVIEW:

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Reviewer Title	Signature	Date	Comments
NEPA/Environmental Coordinator			
Authorized Officer			

APPENDIX C
TRANSPORTATION PLAN

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TRANSPORTATION PLAN FOR
XTO'S MASTER DEVELOPMENT PLAN
INVOLVING THE
LITTLE CANYON PROJECT AREA

INTRODUCTION AND PURPOSE

XTO (the Operator) proposes a development plan for their existing leases in their Hill Creek Unit (HCU), Little Canyon Unit (LCU), and Big Pack Unit (BPU), collectively called the Little Canyon Project Area (LCPA.). The Project Area is located approximately 32 miles south of Vernal, Utah, is comprised of about 33,240 acres in Uintah County, Utah. The purpose of this Transportation Plan is to assist the Bureau of Land Management (BLM), Vernal FO and Uintah County in transportation planning for future road development in the LCPA.

SCOPE

This Transportation Plan contains information regarding:

- Access to the Project Area
- Existing roads within the Project Area
- Existing traffic conditions on roads that provide access to and within the Project Area
- Proposed modifications to the current transportation system
- Estimated traffic increases as a result of the Proposed Action
- Road construction standards and maintenance agreements
- Disposition of access roads after well abandonment
- Applicant-committed environmental protection measures.

ACCESS

There are a limited number of roads that provide access to the Project Area. Utah State Highway 88 turns into Seep Ridge Road in the town of Ouray, north of the Project Area. Highway 88/Seep Ridge Road is the primary access road to the Project Area. Seep Ridge Road is a two-lane paved road located on the Uintah and Ouray Indian Reservation. Seep Ridge Road connects with Willow Creek Road, also known as Turkey Track Road. Willow Creek Road is an unpaved Class "B" road claimed and maintained by Uintah County.

EXISTING ROAD NETWORK

The existing transportation system within the Project Area consists of approximately 66 miles of unpaved access roads that service existing oil and gas operations. Of the existing network, 23.7 miles are classified as Class "B" and 10.4 miles are classified as Class "D" roads (Uintah County 2005). Class B roads maintained by Uintah County; Class D roads are unmaintained. In addition to these roads, there are 3.18 miles of roads on the Uintah and Ouray Indian Reservation, maintained by the Bureau of Indian Affairs (BIA), and 28.9 miles of road that is part of the BLM road system.

EXISTING TRAFFIC

Use of transportation corridors is monitored by the Utah Department of Transportation (UDOT 2004). Traffic volume data is expressed as Average Annual Daily Traffic (AADT). The AADT on the roads accessing the Project Area are listed in Table D-1 below.

Table D-1. AADT report for Primary Roads Providing Access to the Project Area

Route	AADT
Highway 88 (at the town of Ouray)	1140 vehicles
Highway 88 (at the intersection of US 40/191)	995 vehicles
Seep Ridge Road	569 vehicles

Source: Uintah County Roads Department
UDOT 2004 *Traffic on Utah Highways*

PROPOSED ROAD NETWORK MODIFICATIONS AND MAINTENANCE

Under the Proposed Action about 77 miles of new roads co-located with buried pipelines would be constructed, and 32 miles of proposed pipelines buried next to existing roads. The construction, drilling, and completion phase of the gas development project is projected to take about seven years.

The Operator would reclaim all disturbed areas not needed for production activities, where feasible. Portions of access road ROWs not needed in the functioning of the road would be reclaimed to the specifications set forth by the appropriate Surface Management Agency (SMA). The Proposed Action is expected to have a life of about 20-30 years.

Roads constructed on Federal land will comply with BLM standards set forth in *Surface Operating Standards for Oil and Gas Exploration and Development (*Fourth edition, 2007*),* also known as the "Gold Book."

Constructed roads will be maintained as resource or local roads. The appropriate SMA will determine the appropriate maintenance standard for each road constructed by the Operator.

A brief definition of each type of road follows.

- Resource Roads: Resource roads are single lane roads that carry a low volume of traffic at a low speed to individual well locations. Resource roads are generally reclaimed upon well abandonment.
- Local Roads: Local roads are designed as single or two-lane roads. The design of these roads is based upon compatibility with the local landscape. The purpose of local roads is to provide access to a number of well locations. These roads generally connect with roads that already exist in the public road system. These roads may be reclaimed after field abandonment.

A Task Force consisting of the Companies, Uintah County Public Lands/Road Department and the BLM is currently being organized. The purpose of the Task Force is to establish responsibilities for maintenance of roads. Uintah County is spearheading the effort to coordinate road maintenance activities and responsibilities.

All roads required for the project would be maintained as necessary to provide all weather access. Maintenance on local roads is anticipated to occur at least twice per year; resource road maintenance is required at least annually. The Operators would be responsible for the maintenance of their ROWs and Uintah County Class D Roads. Uintah County would be responsible for the maintenance of all Class B roads. When roads become impassable, the appropriate SMA or Uintah County may deny access until the roads are repaired and the potential for resource damage is alleviated.

Currently there are no maintenance standards for Class D roads; however, Uintah County encourages operators to follow the BLM's Gold Book guidelines on Uintah County Roads.

DISPOSITION OF ACCESS ROADS AFTER WELL ABANDONMENT

At the end of the productive life of each well the resource road will be reclaimed in accordance with the requirements of the appropriate SMA. Reclamation of the road would generally involve re-contouring the surface to the approximate natural contours, re-establishing soil conditions, and reseeding with seed mixtures approved by the appropriate SMA. Reclamation procedures would continue until the appropriate SMA determines that the reclamation is successful.

ESTIMATED TRAFFIC VOLUMES

Vehicles would be used to transport equipment and personnel to the Project Area for construction of well pads, access roads, drilling, and completion of wells. During the construction phase the Operators plan to construct 510 wells on 362 well pads. Assuming construction on the project lasts for seven years, as the Proposed Action indicates; an average of 73 wells will be drilled annually on 52 well pads. Vehicle traffic would be the highest during the development stage of the project. Traffic associated with the development would be about 51 roundtrips per day. During each year of the production phase, and for the remainder of the project's life, it is assumed that there would be about 25 round trips per-day associated with routine operations (BLM 2006). Table D-2 provides an estimate of traffic associated with the Proposed Action. It is important to note that these traffic estimates are tentative projections of traffic that would be generated by the Proposed Action. Actual traffic volumes would vary depending on the level of drilling activity and status of the project at a particular time.

As previously mentioned, there is limited access to the Project Area. Peak traffic is expected to occur in the morning and afternoon hours at the time of shift changes for construction crews. Table D-3 shows the estimated changes in traffic on the major access roads as a result of the proposed project. The direct travel routes and origins for project related activities are unknown; traffic estimates in Table D-3 are based upon the assumption that all project related traffic will use each road servicing the Project Area on a daily basis. As a result, estimates presented here are likely inflated.

Table D-2. Estimated Annual Traffic from the Proposed Action

Vehicle Type	Purpose	# Round trips/day	Annual Round Trips
Construction Phase			
Construction Vehicles (for 52 well pads*)			924
Semi inbound	Haul equipment in	3	
Semi outbound	Haul equipment out	3	

Vehicle Type	Purpose	# Round trips/day	Annual Round Trips
Construction Phase			
Pick-up	Worker transport	1	
Development Phase			
Drilling Vehicles (for 73 wells*)			13,262
Semi inbound	Haul equipment in	4.5	
Semi outbound	Haul equipment out	4.5	
Pick-up	Worker/others transport	3	
Larger trucks	Other equipment/fuel/water	2	
Completion Vehicles (for 73 wells*)			4,547
Pick-up	Worker/others transport	3	
Rig truck	Haul in, haul out	1	
Sand truck	Stays on site	1	
Pump truck	Stays on site	1	
Frac truck	Stays on site	1	
Fuel truck	Deliver every 3 days	1	
Water truck	Deliver every 2 days	1	
Wireline truck	Stays on site	1	
Production truck	Stays on site	1	
Annual Round Trips (Development)			18,733
Production Phase			
Annual Round Trips (Operations)			9,125
Average Daily Round Trips (Development and Full-Field Operations)			76
Average Daily Round Trips after Development			25

* Assuming construction on the project lasts for seven years, as the Proposed Action indicates; an average of 73 wells will be drilled annually on 52 well pads.
Source: BLM 2006, modified from Greater Deadman Bench EIS.

Table D-3. Estimated Traffic Increases on Roads Servicing the Project Area at Peak Development

Route	Existing AADT	Proposed AADT[1]	Percent Increase	AADT after Development	Increase
Highway 88 (Ouray)	1140	76	7%	25	2%
Highway 88 (US 40/191)	995	76	8%	25	2.5%
Seep Ridge Road	569	76	13%	25	6%

Source: Uintah County. 2005. GIS Database.
UDOT 2004, *Traffic on Utah Highways*
BLM 2006, Modified from Greater Deadman Bench EIS
[1]Estimates in table D-3 are based upon the assumption that all project related traffic will use each road servicing the Project Area on a daily basis.

APPLICANT-COMMITTED MEASURES

- Best Management Practices identified in the "Gold Book" would be implemented on road ROWs authorized by the BLM.
- Road construction in the 100-year floodplain would be avoided, where possible.
- All employees would adhere to all traffic laws and regulations, including speed limits.
- To the extent possible, limit use of roads (e.g. western portion of the Big Pack Mountain loop Road) by truck and heavy equipment when ruts created by tires are greater than 4 inches.
- As part of normal operational winter maintenance, roads would be plowed the minimum amount necessary to allow safe navigation. Plows would provide breaks in the snow piled berms to allow free movement of wildlife across all roads.
- Speed limits would be reduced, as necessary, to minimize the risk of traffic accidents, dust generation, and noise.
- The BLM, the Companies, and BIA (on Tribal land), would make an on-site inspection of each proposed well pad, access road, and pipeline alignment within the Project Area, so that site-specific recommendations and mitigation measures can be developed.
- Where possible, implement minor routing variation during access road layout to avoid slopes greater than 8 percent. The Companies would utilize slope-stabilizing structures in areas of steep or unstable slopes, and obtain approval from the appropriate SMA prior to construction.
- Install runoff and erosion control measures, such as drainage dips, ditch relief culverts, rock aprons, low water crossings, and culverts. Discharges within waters (such as culverts) will require a Section 404 permit.
- Install culverts for ephemeral drainage crossings. Design all drainage-crossing structures to carry a 100-year discharge event, or as otherwise directed by the appropriate SMA. Consider low water crossings for suitable sites.
- Implement a re-vegetation program, as specified by the surface management agency as soon as feasible, to stabilize the soil and prevent erosion.
- Upon completion of construction activities, restore topography to pre-existing contours at the well sites, and along access roads and pipelines ROWs.

- Construct cattle guards and fences, where necessary, to minimize the potential of project vehicle collisions with livestock.
- The operator and their contractors would contact the UDWR to remove carrion from the roadways, shoulders, and ROWs. This could minimize potential impacts to carrion-feeding raptor species from vehicle collisions.
- Work crews would be encouraged to carpool to the Project Area to minimize traffic.

REFERENCES

Bureau of Land Management. 2006. Modified from Greater Deadman Bench EIS.

Bureau of Land Management and U.S. Forest Service. 2007. *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development.* Fourth Edition.

Utah Department of Transportation (UDOT). 2004. *Traffic on Utah Highways.* Accessed at www.udot.utah.gov/download.php.tid=1338/2004TrafficOnUtahHighways.pdf.

Uintah County. 2005. GIS Database.

APPENDIX D
RECLAMATION PLAN

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Reclamation Plan for Little Canyon Project Area Natural Gas Development Plan[1]

This Reclamation Plan outlines measures to be taken to reclaim areas that would be disturbed by the implementation of the development proposed by XTO in the Hill Creek, Little Canyon, and Big Pack Units, referred to as the Little Canyon Project Area (LCPA). The objectives of this reclamation plan are to re-establish vegetation, reduce dust and erosion, compliment the visual resources of the surrounding area, and generally minimize impacts to the environment.

The "Gold Book" calls for a reclamation plan that includes both interim and final reclamation (BLM and USFS 2007). Interim reclamation refers to measures applied to stabilize disturbed areas and to control runoff and erosion during time periods when application of final reclamation measures is not feasible or practicable. Interim reclamation would be implemented within 90 days after drilling of each well is complete on all disturbed areas that are not needed for production activities (this includes unused portions of road and pipeline ROWs, well pads, compressor stations, and any other disturbed areas). Final reclamation refers to measures that would be applied after well abandonment and at the end of the project. The lifespan of individual producing wells may vary; however, the typical lifespan of a well is estimated to be 20 to 30 years. For the purposes of this BA, the lifespan was assumed to be 25 years.

The reclamation plan follows the progression of proposed activities, which would occur in three main phases: 1) construction, drilling, and completion; 2) production and maintenance; and 3) decommissioning and reclamation. Reclamation activities that would occur during or following each of the three phases are discussed below.

Phase I: Construction, Drilling, and Completion

<u>Surface Disturbance:</u>

- All surface disturbance would be kept to a minimum (i.e. existing roads would be utilized where possible, well pads would be constructed to minimize the size of the pad, while allowing for safe construction, drilling, and completion activities).

<u>Fugitive Dust Control:</u>

- XTO would use water or other approved dust suppressants approved by the appropriate SMA and USFWS at construction sites and along roads, as necessary, to abate fugitive dust.

<u>Topsoil and Surface Preparations</u>:

- At all construction sites, topsoil would be stockpiled separately from other soil materials and maintained for future use in rehabilitating the location. In most cases, drilling activities would be completed in approximately 20 days; therefore it is unlikely that lengthy topsoil stockpiling would be necessary.
- After well completion, salvaged topsoil would be evenly re-spread over disturbed surfaces not actively used during the production phase. Topsoil would be spread as thinly as possible in order to preserve soil microorganisms.

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[1] This plan is a general reclamation plan developed for the LCPA. It does not include extra measures within occupied special status species habitat.

Reserve Pit Reclamation:

- After well completion, reserve pits would be refilled. Prior to filling, reserve pits would be dry and free of oil and other liquid or solid wastes. The liner would be pushed back into the pit and buried with previously excavated soil.

Interim Revegetation:

- After well completion, all disturbed areas not needed for the operation of the well would be reseeded. The interim seed mixture to be used would consist mainly of grass species and would be determined by the appropriate SMA's authorized officer during the ADP process. **Table 1** below provides an example interim seed mixture with suggested application rates.
- Private, State, and Tribal lands would be seeded with a similar seed mixture, unless the landowner requests a different seed mixture.
- Late fall is typically a good time of year to seed; however, timing of seeding would be adjusted depending upon weather, soil moisture conditions, and the plant species being used.
- Depending on topography and/or timing, seeding would be accomplished either by drill seeding or broadcasting. If the broadcast method is used, the seed rates established for drill seeding would be doubled.

Table 1. Interim Reclamation Seed Mixture for the LCPA

Common Name	**Scientific Name**	**Rate** [1,2]
GRASSES		
Crested wheatgrass	*Agropyron cristatum* 'Hycrest'[3]	4.0 lbs/acre
Bottlebrush Squirreltail	*Elymus elymoides*	4.0 lbs/acre
Needle and Thread grass	*Stipa comata*	4.0 lbs/acre
FORBS		
Globemallow	*Sphaeralcea parvifolia*	0.5 lbs/acre
Pure Live Seed Total		**12.5 lbs/acre**

[1] Rate numbers are in Pure Live Seed (PLS).
[2] Seed rates are specific to the drill seeding method. If broadcasting is used to disperse the seed, the seed rates above would be doubled.
[3] Either Hycrest variety would be used, or a more drought tolerant variety.

Phase II: Production and Maintenance

Access:

- If necessary for safe access and operation during production, gravel or similar reinforcing material would be used on access routes and necessary portions of well pads (such as in clay soils) to stabilize these areas.

Noxious and Invasive Weeds:

- XTO would control noxious and invasive weeds along access roads, pipeline routes, well sites, or other applicable facilities by spraying or mechanical removal. A list of noxious weeds may be obtained from the BLM or the appropriate County Extension Office. On BLM-administered land, it is required that a Pesticide Use Proposal be submitted and approved prior to the application of herbicides, pesticides, or possibly hazardous chemicals.

Fugitive Dust Control:

- XTO would use water or other approved dust suppressants as approved by the appropriate SMA and USFWS at construction sites and along roads, as necessary, to abate fugitive dust.

Phase III: Decommissioning and Reclamation

Plugging the Well:

- Prior to well abandonment, the operator shall submit and receive approval for the Sundry Notices and Reports on Wells (Form 3160-5) from the appropriate SMA's Authorized Officer.

Topsoil and Final Surface Preparation:

- After well plugging, all disturbed areas would be recontoured back to the original contour or a contour that blends with the surrounding landform (roads must also be reclaimed unless the appropriate SMA or surface owner requests that they be left unreclaimed).
- To achieve final reclamation of an area previously reclaimed using interim reclamation methods, all topsoil and vegetation must be restripped from areas that were not previously reshaped.
- The SMA's Authorized Officer would determine if any gravel or similar materials used to reinforce an area are to be removed or buried in place during final reclamation.
- Salvaged topsoil would be respread evenly over the surfaces to be revegetated.
- The soil surface would be prepared to provide a seedbed for re-establishment of desirable vegetation. Site preparation may include gouging, scarifying, dozer track-walking, mulching, or fertilizing. The appropriate seedbed preparations would be determined by the SMA's Authorized Officer at the time of final reclamation.

Final Revegetation:

- All disturbed and recontoured areas would be reseeded. The final seed mixture to be used would be similar to the vegetation of the surrounding areas and may consist of grasses, forbs, or shrubs. **Table 2** below provides an example final seed mixture with suggested application rates. Final determination of the appropriate seed mixture would be developed by the SMA's Authorized Officer on a site-specific basis at the time of field review of the facility.
- Private, State, and Tribal lands would be seeded with a similar seed mixture, unless the landowner requests a different seed mixture.
- Late fall is typically a good time of year to seed; however, timing of seeding would be adjusted depending upon weather, soil moisture conditions, and the plant species being used.

- Depending on topography or timing, seeding would be accomplished either by drill seeding or broadcasting. If the broadcast method is used, seed rates established for drill seeding would be doubled.
- Reclamation would be deemed successful when 70 percent of vegetative cover in a comparative or adjacent area has been re-established in the revegetated area.

Table 2. Final Reclamation Seed Mixture for the LCPA

Common Name	Scientific Name	Rate [1,2]
GRASSES		
Bottlebrush squirreltail	*Elymus elymoides*	1.5 lbs/acre
Galleta grass	*Hilaria jamesii*	1.5 lbs/acre
Indian rice grass	*Achnatherum hymenoides*	1.5 lbs/acre
Western wheatgrass	*Pascopyrum smithii*	1.5 lbs/acre
Needle and threadgrass	*Stipa comata*	1.5 lbs/acre
FORBS		
Yellow beeplant	*Cleome lutea*	0.3 lbs/acre
Prostrate kochia	*Kochia prostrate*	0.3 lbs/acre
Globemallow	*Sphaeralcea parvifolia*	0.3 lbs/acre
SHRUBS		
Fourwing saltbush	*Atriplex canescens*	2 lbs/acre
Shadscale	*Atriplex confertifolia*	1.5 lbs/acre
Pure Live Seed Total		**11.9 lbs/acre**

[1]Rate numbers are in Pure Live Seed (PLS).
[2] Seed rates are specific to the drill seeding method. If broadcasting is used to disperse the seed, the seed rates above would be doubled.

References Cited

Bureau of Land Management and U.S. Forest Service. 2007. Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development. Fourth Edition.

APPENDIX E
SPECIAL STATUS PLANT SPECIES CONSERVATION MEASURES

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Graham's Beardtongue (*Penstemon grahamii*)

In order to minimize effects to the Graham's beardtongue, the Bureau of Land Management (BLM) in coordination with the USFWS developed the following avoidance and minimization measures. Integration of and adherence to these measures will help ensure the activities carried out during oil and gas development (including but not limited to drilling, production, and maintenance) are in compliance with the ESA. The following avoidance and minimization measures should be included in the Plan of Development:

1. Pre-project habitat assessments will be completed across 100 percent of the project disturbance area within potential habitat[1] prior to any ground disturbing activities to determine if suitable Graham's beardtongue habitat is present.

2. Within suitable habitat[2], site inventories will be done to determine occupancy. Inventories:

    a. Must be conducted by qualified individual(s),
    b. Will be conducted in suitable and occupied[3] habitat for all areas proposed for surface disturbance prior to initiation of project activities and within the same growing season, at a time when the plant can be detected (April 15th to May 20th, unless extended by the BLM),
    c. Will occur within 300' from the centerline of the proposed ROW for surface pipelines or roads; and within 300' from the perimeter of disturbance for the proposed well pad including the well pad,
    d. Will include, but not be limited to, plant species lists and habitat characteristics, and
    e. Will be valid until April 15th the following year.

3. Design project infrastructure to minimize impacts within suitable habitat[2]:

    a. Reduce well pad size to the minimum needed, without compromising safety,
    b. Limit new access routes created by the project,
    c. Roads and utilities should share common ROWs where possible,
    d. Reduce the width of ROWs and minimize the depth of excavation needed for the road bed; where feasible, use the natural ground surface for the road within habitat,
    e. Place signing to limit off-road travel in sensitive areas, and
    f. Stay on designated routes and other cleared/approved areas.

4. Within occupied habitat[3], project infrastructure will be designed to avoid direct disturbance and minimize indirect impacts to populations and to individual plants:

    a. Follow the above (#3) recommendations for project design within suitable habitats,
    b. Construction of roads will occur such that the edge of the ROW is at least 100' from any plant,
    c. Where occurring within delineated area (see map), roads will be graveled; the operator is encouraged to apply water for dust abatement to such areas from April 15 to May 30 (flowering period); dust abatement applications will be comprised of water only,

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[1] Potential habitat is defined as areas which satisfy the broad criteria of the species habitat description; usually determined by preliminary, in-house assessment.

[2] Suitable habitat is defined as *areas* which contain or exhibit the specific components or constituents necessary for plant persistence; determined by field inspection and/or surveys; may or may not contain Graham's beardtongue. Habitat descriptions can be found in the Federal Register 71(12):3158-3196.

[3] Occupied habitat is defined as areas currently or historically known to support Graham's beardtongue; synonymous with "known habitat."

d. The edge of the well pad should be located at least 300' away from plants,
e. Surface pipelines will be laid such that a 50 foot buffer exists between the edge of the ROW and the plants, use stabilizing and anchoring techniques when the pipeline crosses the habitat (exposed raw shale knolls and slopes derived from the Parachute Creek and Evacuation Creek members of the geologic Green River Formation) to ensure the pipelines don't move towards the population,
f. Construction activities will not occur from mid-April through May within delineated area (see map),
g. Before and during construction, areas for avoidance should be visually identifiable in the field, e.g., flagging, temporary fencing, rebar, etc.,
h. Where technically and economically feasible, use directional drilling or multiple wells from the same pad,
i. Designs will avoid concentrating water flows or sediments into occupied habitat,
j. Place produced oil, water, or condensate tanks in centralized locations, away from occupied habitat, and
k. Minimize the disturbed area of producing well locations through interim and final reclamation. Reclaim well pads following drilling to the smallest area possible.

5. Occupied Graham's beardtongue habitats within 50' of the edge of the surface pipelines' ROWs, 300' of the edge of the roads' ROWs, and 300' from the edge of the well pad shall be monitored for a period of three years after ground disturbing activities. Monitoring will include annual plant surveys to determine plant and habitat impacts relative to project facilities. Annual reports shall be provided to the BLM and the USFWS. To ensure desired results are being achieved, minimization measures will be evaluated and may be changed after a thorough review of the monitoring results and annual reports during annual meetings between the BLM and the USFWS.

6. Reinitiation of section 7 consultation with the USFWS will be sought immediately if any loss of plants or occupied habitat for the Graham's beardtongue occurs as a result of project activities.

Additional measures may also be employed to avoid or minimize effects to the species. These additional measures will be developed and implemented in consultation with the USFWS to ensure continued compliance with the ESA.

Shrubby Reed-mustard *Schoenocrambe (=Glaucocarpum) suffrutescens*

In order to minimize effects to the Federally endangered shrubby reed-mustard, the BLM in coordination with the USFWS developed the following avoidance and minimization measures. Integration of and adherence to these measures will help ensure the activities carried out during oil and gas development (including but not limited to drilling, production, and maintenance) are in compliance with the ESA. The following avoidance and minimization measures should be included in the Plan of Development:

1. Pre-project habitat assessments will be completed across 100 percent of the project disturbance area within potential habitat[1] prior to any ground disturbing activities to determine if suitable shrubby reed-mustard habitat is present.

2. Within suitable habitat[2], site inventories will be done to determine occupancy. Inventories:

    a. Must be conducted by qualified individual(s) and according to BLM and Service accepted survey protocols,
    b. Will be conducted in suitable and occupied[3] habitat for all areas proposed for surface disturbance prior to initiation of project activities and within the same growing season, at a time when the plant can be detected (April 15th to August 1st, unless extended by the BLM),
    c. Will occur within 300' from the centerline of the proposed right-of-way for surface pipelines or roads; and within 300' from the perimeter of disturbance for the proposed well pad including the well pad,
    d. Will include, but not be limited to, plant species lists and habitat characteristics, and
    e. Will be valid until April 15th the following year.

3. Design project infrastructure to minimize impacts within suitable habitat[2]:

    a. Reduce well pad size to the minimum needed, without compromising safety,
    b. Limit new access routes created by the project,
    c. Roads and utilities should share common right-of-ways where possible,
    d. Reduce the width of right-of-ways and minimize the depth of excavation needed for the road bed; where feasible, use the natural ground surface for the road within habitat,
    e. Place signing to limit off-road travel in sensitive areas, and
    f. Stay on designated routes and other cleared/approved areas.

4. Within occupied habitat[3], project infrastructure will be designed to avoid direct disturbance and minimize indirect impacts to populations and to individual plants:

---

[1] *Potential habitat* is defined as areas which satisfy the broad criteria of the species habitat description; usually determined by preliminary, in-house assessment.

[2] *Suitable habitat* is defined as areas which contain or exhibit the specific components or constituents necessary for plant persistence; determined by field inspection and/or surveys; may or may not contain shrubby reed-mustard; habitat descriptions can be found in the Federal Register 52(193):37416-37420 and in the USFWS's 1994 Utah Reed-Mustards Recovery Plan (http://www.fws.gov/endangered/wildlife.html).

[3] *Occupied habitat* is defined as areas currently or historically known to support shrubby reed-mustard; synonymous with "known habitat."

a. Follow the above (#3) recommendations for project design within suitable habitats,
b. Construction of roads will occur such that the edge of the right of way is at least 300' from any plant,
c. Roads will be graveled within occupied habitat; the operator is encouraged to apply water for dust abatement to such areas from April 15th to May 30th (flowering period); dust abatement applications will be comprised of water only,
d. The edge of the well pad should be located at least 300' away from plants,
e. Surface pipelines will be laid such that a 300 foot buffer exists between the edge of the right of way and the plants, use stabilizing and anchoring techniques when the pipeline crosses the white shale strata to ensure the pipelines don't move towards the population,
f. Construction activities will not occur from April 15th through May 30th within occupied habitat,
g. Before and during construction, areas for avoidance should be visually identifiable in the field, e.g., flagging, temporary fencing, rebar, etc.,
h. Where technically and economically feasible, use directional drilling or multiple wells from the same pad,
i. Designs will avoid concentrating water flows or sediments into occupied habitat,
j. Place produced oil, water, or condensate tanks in centralized locations, away from occupied habitat, and
k. Minimize the disturbed area of producing well locations through interim and final reclamation. Reclaim well pads following drilling to the smallest area possible.

5. Occupied shrubby reed-mustard habitats within 300' of the edge of the surface pipeline right of ways, 300' of the edge of the road right of ways, and 300' from the edge of well pads shall be monitored for a period of three years after ground disturbing activities. Monitoring will include annual plant surveys to determine plant and habitat impacts relative to project facilities. Annual reports shall be provided to the BLM and the USFWS. To ensure desired results are being achieved, minimization measures will be evaluated and may be changed after a thorough review of the monitoring results and annual reports during annual meetings between the BLM and the Service.

6. Reinitiation of section 7 consultation with the Service will be sought immediately if any loss of plants or occupied habitat for the shrubby reed-mustard is anticipated as a result of project activities.

Additional site-specific measures may also be employed to avoid or minimize effects to the species. These additional measures will be developed and implemented in consultation with the U.S. Fish and Wildlife Service to ensure continued compliance with the ESA.

Clay reed-mustard (*Schoenocrambe argillacea*)

In order to minimize effects to the Federally threatened clay reed-mustard, the BLM in coordination with the USFWS developed the following avoidance and minimization measures. Integration of and adherence to these measures will help ensure the activities carried out during oil and gas development (including but not limited to drilling, production, and maintenance) are in compliance with the ESA. The following avoidance and minimization measures should be included in the Plan of Development:

1. Pre-project habitat assessments will be completed across 100 percent of the project disturbance area within potential habitat[1] prior to any ground disturbing activities to determine if suitable clay reed-mustard habitat is present.
2. Site inventories will be conducted within suitable habitat[2] to determine occupancy. Where standard surveys are technically infeasible and otherwise hazardous due to topography, slope, etc., suitable habitat will be assessed and mapped for avoidance (hereafter, "avoidance areas"); in such cases, in general, 300' buffers will be maintained between surface disturbance and avoidance areas. However, site specific distances will need to be approved by USFWS and BLM when disturbance will occur upslope of habitat. Where conditions allow, inventories:
    a. Must be conducted by qualified individual(s) and according to BLM and USFWS accepted survey protocols,
    b. Will be conducted in suitable and occupied habitat for all areas proposed for surface disturbance prior to initiation of project activities and within the same growing season, at a time when the plant can be detected (usually May 1st to June 5th, in the Uintah Basin; however, surveyors should verify that the plant is flowering by contacting a BLM or USFWS botanist or demonstrating that the nearest known population is in flower),
    c. Will occur within 300' from the edge of the right-of-way for surface pipelines or roads; and within 300' from the perimeter of disturbance for the proposed well pad including the well pad,
    d. Will include, but not be limited to, plant species lists and habitat characteristics, and
    e. Will be valid until May 1st the following year.
3. Design project infrastructure to minimize impacts within suitable habitat[2]:
    a. Where standard surveys are technically infeasible, infrastructure and activities will avoid all suitable habitat (avoidance areas) and incorporate 300' buffers, in general; however, site specific distances will need to be approved by USFWS and BLM when disturbance will occur upslope of habitat,
    b. Reduce well pad size to the minimum needed, without compromising safety,
    c. Limit new access routes created by the project,
    d. Roads and utilities should share common right-of-ways where possible,
    e. Reduce the width of right-of-ways and minimize the depth of excavation needed for the road bed; where feasible, use the natural ground surface for the road within habitat,
    f. Place signing to limit off-road travel in sensitive areas, and
    g. Stay on designated routes and other cleared/approved areas.
4. Within occupied habitat[3], project infrastructure will be designed to avoid direct disturbance and minimize indirect impacts to populations and to individual plants:

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[1] *Potential habitat* is defined as areas which satisfy the broad criteria of the species habitat description; usually determined by preliminary, in-house assessment.

[2] *Suitable habitat* defined as areas which contain or exhibit the specific components or constituents necessary for plant persistence; determined by field inspection and/or surveys; may or may not contain clay reed-mustard; habitat descriptions can be found in Federal Register Notice and species recovery plan links at <http://www.fws.gov/endangered/wildlife.html>.

[3] *Occupied habitat* is defined as areas currently or historically known to support clay reed-mustard; synonymous with "known habitat."

a. Where standard surveys are technically infeasible, infrastructure and activities will avoid all suitable habitat (avoidance areas) and incorporate 300' buffers, , in general; however, site specific distances will need to be approved by USFWS and BLM when disturbance will occur upslope of habitat,
b. Follow the above recommendations (#3) for project design within suitable habitats,
c. To avoid water flow and/or sedimentation into occupied habitat and avoidance areas, silt fences, hay bales, and similar structures or practices will be incorporated into the project design; appropriate placement of fill is encouraged,
d. Construction of roads will occur such that the edge of the right of way is at least 300' from any plant and 300' from avoidance areas,
e. Roads will be graveled within occupied habitat; the operator is encouraged to apply water for dust abatement to such areas from May 1st to June 5th (flowering period); dust abatement applications will be comprised of water only,
f. The edge of the well pad should be located at least 300' away from plants and avoidance areas, in general; however, site specific distances will need to be approved by USFWS and BLM when disturbance will occur upslope of habitat,
g. Surface pipelines will be laid such that a 300' buffer exists between the edge of the right of way and plants and 300' between the edge of right of way and avoidance areas; use stabilizing and anchoring techniques when the pipeline crosses suitable habitat to ensure pipelines don't move towards the population ; site specific distances will need to be approved by USFWS and BLM when disturbance will occur upslope of habitat,
h. Construction activities will not occur from May 1st through June 5th within occupied habitat,
i. Before and during construction, areas for avoidance should be visually identifiable in the field, e.g., flagging, temporary fencing, rebar, etc.,
j. Where technically and economically feasible, use directional drilling or multiple wells from the same pad,
k. Place produced oil, water, or condensate tanks in centralized locations, away from occupied habitat, and
l. Minimize the disturbed area of producing well locations through interim and final reclamation. Reclaim well pads following drilling to the smallest area possible.

5. Occupied clay reed-mustard habitats within 300' of the edge of the surface pipelines' right of ways, 300' of the edge of the roads' right of ways, and 300' from the edge of the well pad shall be monitored for a period of three years after ground disturbing activities. Monitoring will include annual plant surveys to determine plant and habitat impacts relative to project facilities. Annual reports shall be provided to the BLM and the USFWS. To ensure desired results are being achieved, minimization measures will be evaluated and may be changed after a thorough review of the monitoring results and annual reports during annual meetings between the BLM and the USFWS.

6. Reinitiation of section 7 consultation with the Service will be sought immediately if any loss of plants or occupied habitat for the shrubby reed-mustard is anticipated as a result of project activities.

Additional site-specific measures may also be employed to avoid or minimize effects to the species. These additional measures will be developed and implemented in consultation with the U.S. Fish and Wildlife Service to ensure continued compliance with the ESA.

Uinta Basin Hookless Cactus (*Sclerocactus glaucus (= brevispinus* and *wetlandicus*)

In order to minimize effects to the Federally threatened Uinta Basin hookless cactus, the BLM in coordination with the USFWS, developed the following avoidance and minimization measures. Integration of and adherence to these measures will help ensure the activities carried out during oil and gas development (including but not limited to drilling, production, and maintenance) are in compliance with the ESA. The following avoidance and minimization measures should be included in the Plan of Development:

1. Pre-project habitat assessments will be completed across 100% of the project disturbance area within potential habitat[1] prior to any ground disturbing activities to determine if suitable Uinta Basin hookless cactus habitat is present.
2. Within suitable habitat[2], site inventories will be done to determine occupancy. Inventories:
    a. Must be conducted by qualified individual(s) and according to BLM and USFWS accepted survey protocols,
    b. Will be conducted in suitable and occupied[3] habitat for all areas proposed for surface disturbance prior to initiation of project activities and within the same growing season, at a time when the plant can be detected, and during appropriate flowering periods:
        i. *Sclerocactus brevispinus* surveys should be conducted March 15th to June 30th, unless extended by the BLM
        ii. *Sclerocactus wetlandicus* surveys can be done any time of the year, provided there is no snow cover,
    c. Will occur within 115' from the centerline of the proposed right-of-way for surface pipelines or roads; and within 100' from the perimeter of disturbance for the proposed well pad including the well pad,
    d. Will include, but not be limited to, plant species lists and habitat characteristics, and
    e. Will be valid until March 15th the following year for *Sclerocactus brevispinus* and one year from the survey date for *Sclerocactus wetlandicus*.
3. Design project infrastructure to minimize impacts within suitable habitat[2]:
    a. Reduce well pad size to the minimum needed, without compromising safety,
    b. Limit new access routes created by the project,
    c. Roads and utilities should share common right-of-ways where possible,
    d. Reduce width of right-of-ways and minimize the depth of excavation needed for the road bed; where feasible, use the natural ground surface for the road within habitat,
    e. Place signing to limit off-road travel in sensitive areas,
    f. Stay on designated routes and other cleared/approved areas, and
    g. All disturbed areas will be re-vegetated with native species comprised of species indigenous to the area and non-native species that are not likely to invade other areas.
4. Within occupied habitat[3], project infrastructure will be designed to avoid direct disturbance and minimize indirect impacts to populations and to individual plants:
    a. Follow the above (#3) recommendations for project design within suitable habitats,
    b. Buffers of 100 feet minimum between the edge of the right of way (roads and surface pipelines) or surface disturbance (well pads) and plants and populations will be incorporated,

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[1] *Potential habitat* is defined as areas which satisfy the broad criteria of the species habitat description; usually determined by preliminary, in-house assessment.

[2] *Suitable habitat* is defined as areas which contain or exhibit the specific components or constituents necessary for plant persistence; determined by field inspection and/or surveys; may or may not contain Uinta Basin hookless cactus. Habitat descriptions can be found in the U.S. Fish and Wildlife Service's 1990 Recovery Plan and Federal Register Notices for the Uinta Basin hookless cactus (http://www.fws.gov/endangered/wildlife.html).

[3] *Occupied habitat* is defined as areas currently or historically known to support Uinta Basin hookless cactus; synonymous with "known habitat."

c. Surface pipelines will be laid such that a 100 foot buffer exists between the edge of the right of way and the plants, use stabilizing and anchoring techniques when the pipeline crosses the habitat to ensure the pipelines don't move towards the population,
d. Before and during construction, areas for avoidance should be visually identifiable in the field, e.g., flagging, temporary fencing, rebar, etc.,
e. Where technically and economically feasible, use directional drilling or multiple wells from the same pad,
f. Designs will avoid concentrating water flows or sediments into occupied habitat,
g. Place produced oil, water, or condensate tanks in centralized locations, away from occupied habitat, and
h. Minimize the disturbed area of producing well locations through interim and final reclamation. Reclaim well pads following drilling to the smallest area possible.

5. Occupied Uinta Basin hookless cactus habitats within 100' of the edge of the surface pipelines' right-of-ways, 100' of the edge of the roads' right-of-ways, and 100' from the edge of the well pad shall be monitored for a period of three years after ground disturbing activities. Monitoring will include annual plant surveys to determine plant and habitat impacts relative to project facilities. Annual reports shall be provided to the BLM and the Service. To ensure desired results are being achieved, minimization measures will be evaluated and may be changed after a thorough review of the monitoring results and annual reports during annual meetings between the BLM and the Service.

6. Reinitiation of section 7 consultation with the Service will be sought immediately if any loss of plants or occupied habitat for the Uinta Basin hookless cactus is anticipated as a result of project activities.

Additional measures may also be employed to avoid or minimize effects to the species. These additional measures will be developed and implemented in consultation with the USFWS to ensure continued compliance with the ESA.

APPENDIX F
SOILS OF THE LCPA

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Map Unit	Soil Complex Name	Acreage in Project Area	Soil Unit Name	Percent of Complex (%)	Soil Type	Landforms	Depth to Bed-rock (inches)	Slope (%)	pH Range	Max. Salinity (mmhos/ cm)	Clay Con-tent (%)	Hydro. Group	Erosion K Factor
12	Badland-Rock Outcrop complex	6,625	Badland	50	Clay, silty clay	Erosion remnant, ridge, hill	0 to 2	1 to 75	7.9-11	20	40-60	D	.10
			Rock Outcrop	35	Bedrock	Cliff, erosion remnant, escarpment, ledge	0	1 to 100	NR	NR	NR	D	NR
34	Cadrina-Cadrina, Cool – Badland complex	3,953	Cadrina	40	Extremely channery loam	Hill	5 to 20	25 to 50	7.9–9	4	18-27	D	.05
			Cadrina, cool	25	Extremely channery loam	Hill	5 to 20	25 to 50	7.9–9	4	18-27	D	.05
			Badland	20	Clay, silty clay	Erosion remnant, hill, ridge	0 to 2	25 to 50	7.9–11	20	40-60	D	.10
35	Cadrina extremely flaggy loam	2,252	Cadrina	85	Extremely flaggy loam, extremely channery silt loam	Hill	5 to 20	4 to 25	7.9-9	4	18-27	D	.05
36	Cadrina extremely stony loam – Rock outcrop complex	250	Cadrina	65	Extremely stony loam	Hill	5 to 20	25 to 50	7.9-9	4	18-27	D	.05
			Rock Outcrop	20	Bedrock	Cliff, erosion remnant, escarpment, ledge	0	25 to 50	NR	NR	NR	D	NR
38	Cadrina-Casmos-Rock outcrop complex	1,286	Cadrina	40	Extremely stony loam	Hill	5 to 20	2 to 25	7.9-9	4	18-27	D	.05
			Casmos	30	Channery loam	Hill	5 to 20	2 to 40	7.9-9	4	18-27	D	.15

Map Unit	Soil Complex Name	Acreage in Project Area	Soil Unit Name	Percent of Complex (%)	Soil Type	Landforms	Depth to Bed-rock (inches)	Slope (%)	pH Range	Max. Salinity (mmhos/ cm)	Clay Con-tent (%)	Hydro. Group	Erosion K Factor
			Rock Outcrop	15	Bedrock	Cliff, erosion remnant, escarpment, ledge	0	2 to 25	NR	NR	NR	D	NR
42	Casmos-Dadrina-Badland complex	3,577	Casmos	35	Very channery loam	Hill	5 to 20	4 to 25	7.9-9	4	18-27	D	.15
			Cadrina	30	Extremely channery loam	Hill	5 to 20	4 to 25	7.9-9	4	18-27	D	.05
			Badland	20	Clay, silty clay	Erosion remnant, hill, ridge	0 to 2	4 to 25	7.9-11	20	40-60	D	.10
78	Gilston sandy loam	1659	Gilston	85	Sandy loam, gravelly sandy loam, gypsiferous loam	Drainage-way	NR	2 to 8	7.9-11	16	5-18	B	.15
113	Ioka gravelly sandy loam	660	Ioka	85	Gravelly loam, very gravelly sand, gravelly sandy loam	Alluvial flat	NR	0 to 3	8.5-9	4	0-20	A	.05
128	Leebench sandy loam	176	Leebench	85	Sandy loam, clay loam, very gravelly loam, very gravelly sandy loam	Alluvial fan remnant, strath terrace	NR	0 to 2	7.9-11	16	10-35	C	.10
152	Motto-Casmos	364	Motto	55	Very flaggy	Structural	10-20	2 to 25	7.9-11	8	16-35	D	.05

Map Unit	Soil Complex Name	Acreage in Project Area	Soil Unit Name	Percent of Complex (%)	Soil Type	Landforms	Depth to Bed-rock (inches)	Slope (%)	pH Range	Max. Salinity (mmhos/ cm)	Clay Con-tent (%)	Hydro. Group	Erosion K Factor
	complex				loam, clay loam, extremely channery clay loam	bench, hill							
			Casmos	30	Very channery loam, channery loam	Hill	5 to 20	4 to 25	7.9-9	4	18-27	D	.15
154	Motto-Rock outcrop complex	509	Motto	75	Very flaggy loam, clay loam, extremely channery clay loam	Structural bench, hill	10 to 20	2 to 25	7.9-11	8	16-35	D	.05
			Rock Outcrop	10	Bedrock	Cliff, erosion remnant, escarpment, ledge	0	2 to 25	NR	NR	NR	D	NR
179	Pherson-Hickerson complex	292	Pherson	45	Very gravelly loam, very gravelly sandy loam	Drainage-way	NR	2 to 8	7.9-9	4	5-23	B	.10
			Hickerson	40	Loam, silty clay loam, sandy clay loam	Flood plain, alluvial flat	NR	1 to 4	7.9-9	4	13-33	B	.20
242	Turzo loam	512	Turzo	85%	Loam, clay loam, silty clay loam	Alluvial flat	NR	0 to 4	8.5-11	16	18-35	B	.37
243	Turzo-Umbo	329	Turzo	65	Clay loam,	Alluvial flat	NR	0 to 2	7.9-9	2	18-35	B	.37

Map Unit	Soil Complex Name	Acreage in Project Area	Soil Unit Name	Percent of Complex (%)	Soil Type	Landforms	Depth to Bed-rock (inches)	Slope (%)	pH Range	Max. Salinity (mmhos/ cm)	Clay Con-tent (%)	Hydro. Group	Erosion K Factor
	complex				loam								
			Umbo	20	Clay loam	Alluvial flat	NR	0 to 2	7.9-9	8	27-35	B	.24
256	Walknolls extremely channery sandy loam	435	Walknolls	85%	Extremely channery sandy loam	Hill	8 to 20	4 to 25	7.9-9	2	8-18	D	.05
266	Walknolls-Uendal association	5,918	Walknolls	55%	Very channery sandy loam	Hill	8 to 20	2 to 25	7.9-9	2	8-18	D	.10
			Uendal	30%	Gravelly sandy loam, sandy loam	Hill	20 to 40	4 to 8	7.9-9	2	8-15	C	.15

APPENDIX G
SUMMARY OF POTENTIAL OCCURRENCES OF SPECIAL STATUS WILDLIFE AND PLANT SPECIES

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SUMMARY OF POTENTIAL OCCURRENCES OF SPECIAL STATUS WILDLIFE AND PLANT SPECIES FOR XTO'S LITTLE CANYON DEVELOPMENT PROJECT

SPECIES	STATUS[1]	HABITAT	POTENTIAL for OCCURRENCE IN the LCPA	ELIMINATED FROM DETAILED ANALYSIS
Mammals				
Black-footed ferret *Mustela nigripes*	Endangered	Semi-arid grasslands and mountain basins. It is found primarily in association with active prairie dog colonies that contain suitable burrow densities and colonies that are of sufficient size.	None: The distribution of this species is limited to a nonessential experimental population reintroduced into Coyote Basin, Uintah County starting in 1999.	**Yes**
Canada lynx *Lynx canadensis*	Threatened	Primarily occurs in Douglas-fir, spruce-fir, and subalpine forests at elevations above 7,800 feet amsl. The lynx uses large woody debris, such as downed logs and windfalls.	None: If extant in Utah, this species most likely occurs in montane forests in the Uinta Mountains.	**Yes**
White-tailed prairie dog *Cynomys leucurus*	Species of Concern	Inhabits grasslands, plateaus, plains and desert shrub habitats. White-tailed prairie dogs form colonies or "towns" and spend much of their time in underground burrows and hibernating during the winter.	Moderate: Although no prairie dog colonies have been identified within the LCPA, it is likely that sporadic populations exist.	**No**
Spotted bat *Euderma maculatum*	Species of Concern	Inhabits desert scrub, sagebrush-rabbitbrush, piñon-juniper woodland, and ponderosa pine and montane forest habitats. The species also uses lowland riparian and montane grassland habitats. Suitable cliff habitat typically appears to be necessary for roosts/hibernacula. Spotted bats typically do not migrate and use hibernacula that maintain a constant temperature above freezing from September through May.	Low: Roosting most likely occurs in crevices of cliff habitats. Known distribution of species is south and outside of the LCPA	**Yes**

SPECIES	STATUS[1]	HABITAT	POTENTIAL for OCCURRENCE IN the LCPA	ELIMINATED FROM DETAILED ANALYSIS
Townsend's big-eared bat *Corynorhinus townsendii*	Species of Concern	Inhabits a wide range of habitats from semi-desert shrublands and pinyon-juniper woodlands to open montane forests. Roosting occurs in mines and caves, in abandoned buildings, on rock cliffs, and occasionally in tree cavities. Foraging occurs well after dark over water, along margins of vegetation, and over sagebrush.	Low: The species may potentially occur in the southeast portion of the LCPA, where juniper trees are present	**No**
Big free-tailed Bat (*Nyctinomops macrotis*)	Species of Concern	Rare summer resident of Utah, primarily in southern half of the State. Species prefers rocky and woodland habitats. Roosting occurs in caves, mines, old building, and rock crevices.	Low: Roosting habitat does not occur in the LCPA and the species is not expected to be present.	**No**
Fringed Myotis *Myotis thysanodes*	Species of Concern	Inhabits caves, mines and other structures in desert and woodland areas.	Low: This species could potentially occur in the southeastern portion of the LCPA in the juniper habitat.	**Yes**
Birds				
Bald eagle *Haliaeetus leucocephalus*	BLM Sensitive	In Utah, breeding occurrences are limited to only nine locations. Winter habitat typically includes areas of open water, adequate food sources, and sufficient diurnal perches and night roosts.	Moderate to High: Bald eagles utilize game species winter ranges that provide carrion. Bald eagles are known to roost along the Green River to the West of the LCPA.	**No**
Mexican spotted owl *Strix occidentalis lucida*	Threatened	Found primarily in canyons with mixed conifer forests, pine-oak woodlands and riparian areas. This species nests on platforms and large cavities in trees, on ledges, and in caves. Breeding and nesting season: approximately March through August.	None: "Poor" habitat has been identified by the USFWS in the southeast corner of the LCPA in areas with junipers. Therefore, this species will not be impacted by project activities.	**Yes**

SPECIES	STATUS[1]	HABITAT	POTENTIAL for OCCURRENCE IN the LCPA	ELIMINATED FROM DETAILED ANALYSIS
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	Candidate	Riparian obligate and usually occurs in large tracts of cottonwood/willow habitats. However, this species also has been documented in lowland deciduous woodlands, alder thickets, deserted farmlands, and orchards. Breeding season: late June through July.	None: Suitable habitat does not occur in the LCPA. No Western yellow-billed cuckoo nests have been identified within the LCPA.	**Yes**
Golden eagle *Aquilla chrysaetos*	BGEPA	Found in mountainous areas, canyons, shrub-land, and grassland, and in shrub-steppe habitats in winter.	Moderate to high: Nesting and foraging habitat is found throughout the area. One golden eagle nest has been reported within the LCPA.	**No**
Ferruginous hawk *Buteo Regalis*	Species of Concern	Resides mainly in lowland open desert terrain characterized by barren cliffs and bluffs, piñon-juniper woodlands, sagebrush-rabbit brush, and cold desert shrub. Nesting habitat includes promontory points and rocky outcrops.	Moderate to High: This species is known to occur in the West Desert and the Uinta Basin as a summer resident and a common migrant. Although no ferruginous hawk nests have been identified, there is potential nesting habitat throughout the LCPA.	**No**
American white pelican *Pelecanus erythrorhynchos*	Species of Concern	Inhabits areas of open water including large rivers, lakes, ponds, and reservoirs with surrounding habitats ranging from barren to heavily vegetated sites. Typically nests on isolated islands in lakes or reservoirs; rarely nests on peninsulas.	None: In Utah, the species is known to nest on islands associated with Great Salt and Utah lakes. In northeastern Utah, the species occurs as a transient on larger water bodies.	**Yes**
Swainson's hawk *Buteo swainsoni*	Sensitive	Inhabits grasslands, deserts, agricultural areas, shrublands, and riparian forests. Breeding birds nest in trees in or near open areas. In Utah, the species also occurs in marshlands; rarely occurs in brushy areas or scrub desert.	Moderate: This species occurs in the Uinta Basin as an uncommon summer resident and common migrant. It requires trees of moderate height for nesting. No Swainson's hawk nests have been documented within the LCPA and habitat is marginal.	**No**

SPECIES	STATUS[1]	HABITAT	POTENTIAL for OCCURRENCE IN the LCPA	ELIMINATED FROM DETAILED ANALYSIS
Northern goshawk	CAS	Nests in higher elevations in mature conifer forests, aspen stands, and along valley cottonwood habitats. Winter habitat includes the lower elevation pinyon-juniper woodlands.	None: Suitable habitat does not occur in the LCPA. No Northern Goshawk nests have been identified within the LCPA.	**Yes**
Greater sage-grouse *Centrocercus urophasianus*	Species of Concern; PIF	Inhabits upland sagebrush habitat in rolling hills and benches. Breeding occurs on open leks (or strutting grounds) and nesting and brooding occurs in upland areas and meadows in proximity to water and generally within a 2-mile radius of the lek. During winter, sagebrush habitats at submontane elevations commonly are used.	Moderate: The species is widespread, but declining, with extant populations in Uintah and Daggett counties. Although no leks occur within the LCPA, there is designated sage grouse brooding habitat throughout.	**No**
Long-billed curlew *Numenius americanus*	Species of Concern	Inhabits shortgrass prairies, alpine meadows, riparian woodlands, and reservoir habitats. Breeding habitat includes upland areas of shortgrass prairie or grassy meadows with bare ground components, usually near water.	None: Widespread migrant in Utah. Breeding birds are fairly common but localized, primarily in central and northwestern Utah. Potential nesting has been reported in Uintah County, but has not been confirmed. Habitat does not occur in the LCPA.	**Yes**
Short-eared owl *Asio flammeus*	Species of Concern	Inhabits arid grasslands, agricultural areas, marshes, and occasionally open woodlands. In Utah, cold desert shrub and sagebrush-rabbit brush habitats also are utilized. Typically a ground nester.	Low: The species breeds in northern Utah and occurs as a migrant potentially throughout theState. It is known to occur in Uintah County, with occurrence probable in Duchesne County. Although no short-eared owl nests have been identified in the LCPA, there is potential habitat.	**No**

SPECIES	STATUS[1]	HABITAT	POTENTIAL for OCCURRENCE IN the LCPA	ELIMINATED FROM DETAILED ANALYSIS
Burrowing owl *Athene cunicularia*	Species of Concern	Inhabits desert, semi-desert shrubland, grasslands, and agricultural areas. Nesting habitat primarily consists of flat, dry, and relatively open terrain; short vegetation; and abandoned mammal burrows for nesting and shelter.	Low: Burrowing owls nest in desert/grassland habitats and are found in close association with prairie dog colonies in Northeastern Utah. Although no burrowing owl nests or prairie dog colonies have been identified, potential nesting habitat exists within the LCPA.	**No**
Lewis' woodpecker *Melanerpes lewis*	Species of Concern; PIF	Inhabits open habitats including pine forests, riparian areas, and piñon-juniper woodlands. Breeding habitat typically includes ponderosa pines and cottonwoods in stream bottoms and farm areas. The species inhabits agricultural lands and urban parks, montane and desert riparian woodlands, and submontane shrub habitats.	None: In Utah, the species is widespread. Breeding by this species has been observed in Ouray and Uintah counties, and along Pariette Wash. However, no potential habitat occurs in the LCPA.	**Yes**
Sage sparrow *Amphispiza belli*	PIF	Dry sagebrush/scrublands with sparse vegetation	Moderate: Portions of the LCPA have suitable habitat for sage sparrows.	**No**
Bobolink *Dolichonyx oryzivorus*	Species of Concern	Inhabits mesic and irrigated meadows, riparian woodlands, and subalpine marshes at lower elevations (2,800 to 5,500 feet amsl). Suitable breeding habitat for this ground nester includes tall grass, flooded meadows, prairies, and agricultural fields; forbs and perch sites also are required.	None: The species breeds in isolated areas of Utah, primarily in the northern half of the State. No breeding by this species has been documented within the LCPA.	**Yes**
Black swift *Cypseloides niger borealis*	Species of Concern	Require waterfalls, typically surrounded by mixed conifer or spruce-fir forests for nesting. Forage thousands of meters above the ground, but may forage over rivers and streams.	None: Suitable habitat for the black swift is not present in the LCPA.	**Yes**
Three-toed woodpecker	Species of Concern	Inhabits Engelmann spruce, sub-alpine fir, Douglas fir, ponderosa pine, tamarack, aspen and lodgepole pine forests at elevations above 8,000 feet.	None: The species inhabits coniferous forests above 8,000 feet. This habitat does not occur in the LCPA.	**Yes**

SPECIES	STATUS[1]	HABITAT	POTENTIAL for OCCURRENCE IN the LCPA	ELIMINATED FROM DETAILED ANALYSIS
Fish				
Humpback chub *Gila cypha*	Endangered	Endemic to the Colorado River system within deep, swift-running rivers, with canyon shaded environments.	Moderate: This species occurs in the Green River downstream of the LCPA.	**No**
Bonytail *Gila elegans*	Endangered	Endemic to the Colorado River system, restricted to the Green River. They use main channels of large rivers and favor swift currents.	Moderate: This species occurs in the Green River downstream of the LCPA	**No**
Colorado pikeminnow *Ptychocheilus lucius*	Endangered	Endemic to the Colorado River system. Uses large swift rivers.	Moderate: This species occurs in the Green River downstream of the LCPA.	**No**
Razorback sucker *Xyrauchen texanus*	Endangered	Endemic to large rivers of the Colorado River system.	Moderate: This species occurs in the Green River downstream of the LCPA.	**No**
Colorado River cutthroat trout *Oncorhynchus clarki pleuriticus*	CAS	Cool, clear water, high-elevation streams and lakes.	None: No potential habitat is found downstream of the LCPA.	**Yes**
Roundtail chub *Gila robusta*	CAS	Adults inhabit low to high flow areas in the Green River; young occur in shallow areas with minimal flow.	Moderate: This species occurs in the Green River downstream of the LCPA.	**No**
Bluehead sucker *Catostomus discobolus*	CAS	Occupies a wide range of aquatic habitats ranging from cold, clear mountain streams to warm, turbid rivers.	Moderate: This species occurs in the Green River downstream of the LCPA.	**No**
Flannelmouth sucker *Catostomus latipinnis*	CAS	Adults occur in riffles, runs, and pools in streams and large rivers, with the highest densities usually in pool habitat. Young live in slow to moderately swift waters near the shoreline areas.	Moderate: This species occurs in the Green River downstream of the LCPA.	**No**
Reptiles				
Cornsnake *Elaphe guttata*	Species of Concern	Typically inhabits areas near streams or in rocky or forest habitats.	Low: This species could potentially occur near Hill Creek or Willow Creek or in rocky areas within the LCPA	**Yes**

SPECIES	STATUS[1]	HABITAT	POTENTIAL for OCCURRENCE IN the LCPA	ELIMINATED FROM DETAILED ANALYSIS
Smooth greensnake *Opheodrys vernalis*	Species of Concern	Inhabits moist grassy areas and meadows where the snake is well camouflaged.	Low: The smooth greensnake could potentially occur near Hill Creek or Willow Creek in moist areas.	**Yes**
Plants				
Arabis vivariensis park rock cress	BLM Sensitive	Webber Sandstone- Sandstone and limestone outcrops in mixed desert shrub and pinyon-juniper communities. 5000-6000ft.	None: No potential habitat. The geological formation and soils associated with this species do not occur in the LCPA.	**Yes**
Astragalus equisolensis horseshoe milkvetch	Candidate	Duchesne River Formation soils in sagebrush, shadscale, horsebrush and mixed desert shrub communities, 4,790-5,185ft. The species is endemic to a single location in central Uintah County (UNHP-UDWR 2007).	None: No potential habitat. The LCPA is within the Uinta Formation. Exposures of the Brennan Basin member of the Duchesne River Formation occur as horizontal bands in the badlands erosion areas. The soils associated with this species do not occur in the LCPA.	**Yes**
Astragalus hamiltonii Hamilton milkvetch	BLM Sensitive	Lapoint and Dry Gulch members of the Duchesne River Formation, Mowry Shale, Dakota Sandstone and the Wasatch Formation soils in pinyon-juniper and desert shrub communities. 5240-5800ft	None: No potential habitat. The LCPA is within the Uinta Formation. Exposures of the Brennan Basin member of the Duchesne River Formation occur as horizontal bands in the badlands erosion areas. The soils associated with this species do not occur in the LCPA.	**Yes**
Cirsium ownbeyi Ownbey thistle	BLM Sensitive	East flank Uinta Mountains. In mesic sites within canyons in mixed sagebrush, juniper and riparian communities. 5500-6200ft.	None: No potential habitat. The LCPA is within the Uinta Formation. The geological formations and soils associated with this species do not occur in the LCPA.	**Yes**
Hymenoxys lapidicola Rock hymenoxis	BLM Sensitive	Sandy soils on ledges and soil filled crevices in the Weber Formation associated with Blue Mountain. (5700-8100 feet).	None: No potential habitat. The LCPA is within the Uinta Formation. The geological formation and soils associated with this species do not occur in the LCPA.	**Yes**

SPECIES	STATUS[1]	HABITAT	POTENTIAL for OCCURRENCE IN the LCPA	ELIMINATED FROM DETAILED ANALYSIS
Penstemon acaulis stemless penstemon	BLM Sensitive	Daggett County. Semi-barren substrates in the Browns Park Formation. Pinyon-juniper and sagebrush-grass communities. 5840-7285 ft.	None: No potential habitat. The LCPA is within the Uinta Formation. The geological formation and soils associated with this species do not occur in the LCPA.	**Yes**
Penstemon flowersii Flowers penstemon	BLM Sensitive	Clay badlands from Myton to Roosevelt and Randlett, in shadscale and desert communities. 5000-5400ft.	None: No potential habitat. The LCPA is within the Uinta Formation. The formations and soils associated with this species do not occur in the LCPA. This species is found within isolated geographic areas (Myton to Roosevelt and Randlett) outside of the LCPA. The closest known population occurs approximately 22 miles northwest of the LCPA.	**Yes**
Penstemon gibbensii Gibbens penstemon	BLM Sensitive	Brown's Park in Daggett County. Sandy and shaley (Green River Shales) bluffs and slopes with juniper, thistle, Eriogonum, Elymus, serviceberry, rabbit brush & Thermopsis spp. 5500-6400 ft.	None: No potential habitat. The LCPA is within the Uinta Formation. The White River shales and soils associated with this species do not occur in the LCPA.	**Yes**
Penstemon goodrichii Goodrich penstemon	BLM Sensitive	Lapoint-Tridell-Whiterocks area. Lapoint and Dry Gulch members of the Duchesne River Formation on blue gray to reddish bands of clay badlands. Elevations 5590 to 6215 ft.	None: No potential habitat. The formations and soils associated with this species do not occur in the LCPA. This species is found within isolated geographic areas (Lapoint-Tridell-Whiterocks area) approximately 25 north of the LCPA.	**Yes**
Penstemon grahamii Graham beardtongue	BLM Sensitive	East Duchesne and Uintah Counties. Evacuation Creek and Parachute Creek member of the Green River Shale. Shaley knolls in sparsely vegetated desert shrub and pinyon-juniper communities. 4600-6700 ft	High: Populations or potential habitat have been identified within the LCPA.	**No**

SPECIES	STATUS[1]	HABITAT	POTENTIAL for OCCURRENCE IN the LCPA	ELIMINATED FROM DETAILED ANALYSIS
Penstemon scariosus var. *albifluvis* White River penstemon	Candidate	Evacuation Creek and Parachute Creek member of the Green River Shale on sparsely vegetated shale slopes in mixed desert shrub and pinyon-juniper communities. 5000-6000ft	None: No potential habitat. The LCPA is within the Uinta Formation. The geological formations and soils associated with this species do not occur in the LCPA.	**Yes**
Schoencrambe argillacea Clay reed mustard	Threatened	Bookcliffs On the contact zone between the upper Uinta and Green River Shale in mixed desert shrub of Indian ricegrass and pygmy sagebrush.5000-5650 ft.	High: Populations or potential habitat have been identified within the LCPA.	**No**
Schoencrambe (=Glaucocarpum) suffrutescens Shrubby reed-mustard	Endangered	Evacuation Creek and lower Parachute Creek Members of the White River Formation on calcareous shales in pygmy sagebrush, mountain mahogany, juniper and mixed desert shrub communities. 5400-6000ft.	High: Populations or potential habitat have been identified within the LCPA.	**No**
Sclerocactus wetlandicus Uinta Basin hookless cactus	Threatened	Gravelly hills and terraces on Quaternary and tertiary bedrock soils in cold desert shrub communities. 4700-6000ft.	High: Populations or potential habitat have been identified within the LCPA.	**No**
Spiranthes diluvialis Ute ladies'-tresses	Threatened	Streams, bogs and open seepages in cottonwood, salt cedar, willow and pinyon-juniper communities on the south and east slope of the Uintah Range and it's tributaries, and the White River from Browns Park to Split mountain. Potentially in the Upper reaches of streams in the Book Cliffs. 4400-6810ft.	Low: The Ute ladies'-tresses has not been identified in the LCPA, and has not been identified in the greater Book Cliffs RMP planning area.	**Yes**

[1] Endangered = Federally listed as endangered.
Threatened = Federally listed as threatened.
Candidate = Federal candidate for listing as threatened or endangered.
Sensitive = State of Utah sensitive species.
Species of Concern = State Wildlife Species of Concern.
PIF = Partners in Flight species of concern.
BLM Sensitive = BLM designated sensitive species
BGEPA = Bald and Golden Eagle Protection Act
CAS = State Conservation Agreement Species

Source: Utah Division of Wildlife Resources (http://dwrcdc.nr.utah.gov/ucdc)
Utah Natural Heritage Program Biodiversity Tracking and Conservation System, Utah's State Listed Species by County (2006)