CHAPTER 3. AFFECTED ENVIRONMENT

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3.1 Introduction

This chapter presents the existing environment, including the cultural, physical, biological, social, and economic resources, values, and uses, which would be affected by the Proposed Action and alternatives. The affected area consists of the Alton Coal Tract (hereafter generally referred to as the tract) and the reasonably foreseeable coal haul transportation route, as identified in the Interdisciplinary Team Analysis Record Checklist (Appendix G) and presented in Chapters 1 and 2 of this impact statement. This chapter provides the baseline for comparison of impacts and consequences described in Chapter 4. Management issues identified by the BLM, public scoping, and interdisciplinary analysis of the area have guided the material presented herein.

3.1.1 General Setting

The tract is located in Kane County, Utah approximately 0.10 mile south of the town of Alton and 2.9 miles east of U.S. Route 89 (US-89). The tract occurs at approximately 6,900 feet above sea level in the semiarid foothills of the Colorado Plateau Semidesert Province (Woods et al. 2001) of south-central Utah. The tract is located in the Alton Amphitheater between the Paunsaugunt Plateau to the northeast, Long Valley (Virgin River) to the west, and approximately 5.0 miles north and northwest of the Grand Staircase-Escalante National Monument. Mean annual precipitation in the town of Alton was approximately 16 inches from 1928 to 2006, and mean annual temperature for this same time period was 60.2 degrees Fahrenheit (F) (2006). The Colorado Plateau province receives most of its precipitation in the form of snow during the winter months; summers are generally hot and dry with a mid- to late-summer monsoon period when frequent thunderstorms occur (2006). The tract is characterized by a series of low-rising hills and benches cut by the north–south running Kanab Creek and by long diagonal washes that flow from the surrounding mountain ranges. Vegetation in the tract is typical of the Great Basin and includes large open areas of bunchgrass, perennial grasses, and sagebrush interspersed with dense stands of juniper and pinyon pine. Tall fir trees are apparent on the more rugged mountains to the northwest of the tract. Generally, the vegetation cover is continuous across most of the tract, broken by two-track dirt roads and fence lines. A map of the tract in relation to surrounding towns, highways, existing and potential fee coal areas, and other area landmarks is presented in Map 1.1.

Under the Proposed Action, the tract includes approximately 3,576 acres of land. All coal resources located within the tract are federally (BLM) owned and managed. Approximately 2,280 surface acres of the tract are under BLM management, and the remaining 1,296 surface acres are under private ownership. Under Alternative C, the tract includes approximately 3,173 acres of land. As under the Proposed Action, all coal resources under this tract configuration are federally (BLM) owned and managed; although, surface ownership is split between the BLM (2,280 acres) and private owners (893 acres). Coal reserves are known to occur beneath approximately 2,152 and 1,856 acres of the tract under the Proposed Action and Alternative C, respectively.

The entirety of the reasonably foreseeable coal haul transportation route (hereafter referred to simply as the coal haul transportation route) also occurs in southern Utah, more specifically in Kane, Garfield, and Iron counties near Alton, Hatch, Panguitch, and Cedar City. The total length of the route is approximately 110 miles (see Map 2.4). Existing vehicle traffic consists of local residents; tourists to Bryce Canyon National Park, Dixie National Forest, and BLM-administered lands; and commercial truck traffic. Transportation infrastructure associated with the tract and the coal haul transportation route includes numerous unimproved, dirt access roads and two-track trails, KFO Route 116, US-89, SR-20, I-15, and SR-56. The Union Pacific Railroad 21-mile branch to the Salt Lake City-Los Angeles line is located west of Cedar City, Utah and is the nearest railroad facility to the tract.

3.1.2 Supplemental Authorities and Other Resources, Values, and Uses Brought Forward for Analysis

Decisions related to the tract could affect supplemental authorities as listed in BLM's NEPA Handbook H-1790-1 (2008e) in addition to other resources, values, and uses identified during public and agency scoping. Table 3.1 lists the supplemental authorities and other resources, values, and uses brought forward for analysis. Some supplemental authorities and other resources, values, and uses identified during public and agency scoping were not brought forward for detailed analysis. These are also listed in Table 3.1, including a brief explanation for their omission from the EIS analysis.

Table 3.1. Supplemental Authorities and other Resources, Values, and Uses Considered for the Alton Coal Environmental Impact Statement

Analysis Element (supplemental authority)*	Brought Forward for Analysis	Explanation/Rationale
Aesthetic resources (soundscape, visual resources, and nighttime lighting)	Yes	Potentially affected
Air resources (air quality) (42 United States Code [USC] 7401 et seq.)	Yes	Potentially affected
Cultural resources (Native American religious concerns) (16 USC 470; 42 USC 1996)	Yes	Potentially affected
Fire management	Yes	Potentially affected
Geology and minerals	Yes	Potentially affected
Hazardous materials and hazardous and solid waste (43 USC 6901 et seq.; 43 USC 9615)	Yes	Potentially affected
Land use and access	Yes	Potentially affected
Livestock grazing (rangelands)	Yes	Potentially affected
Paleontology	Yes	Potentially affected
Prime and unique farmlands (30 USC 1201 et seq.	No	Not present
Recreation	Yes	Potentially affected
Socioeconomics (social and economic conditions, public health and safety, environmental justice) (EO 12898)	Yes	Potentially affected
Soils	Yes	Potentially affected
Transportation	Yes	Potentially affected
Vegetation and special status plant species (invasive and noxious weeds; forests; threatened, endangered, and candidate species; State of Utah and BLM Utah sensitive species)	Yes	Potentially affected
Water Resources (surface-water quality and quantity, groundwater quality and quantity, wetlands/riparian areas, floodplains, AVFs) (EO 11990)	Yes	Potentially affected
Wildlife and special status animal species (threatened, endangered, and candidate species; State of Utah and BLM Utah sensitive species; migratory birds, fish habitat) (50 CFR 600; 67 *Federal Register* 2376, January 17, 2002)	Yes	Potentially affected
Wilderness areas, WSAs, and non-WSAs with wilderness characteristics (43 USC 1701 et seq.; 16 USC 1131 et seq.)	No	Not present

Table 3.1. Supplemental Authorities and other Resources, Values, and Uses Considered for the Alton Coal Environmental Impact Statement

Analysis Element (supplemental authority)*	Brought Forward for Analysis	Explanation/Rationale
Wild and scenic rivers (16 USC 1271)	No	Not present
Areas of critical environmental concern (43 USC 1701 et seq.)	No	Not present
Native American Trust Resources	No	Not present

* Items (those brought forward for analysis) as listed under the heading "Analysis Element" correspond to section headings in Chapters 3 and 4 of this EIS. These may be the same as the supplemental authorities listed in (BLM 2008e) but not in all cases. Where headings have been changed or combined, the corresponding supplemental authori ies and/or the component sections are listed in parentheses. Potential impacts to specially designated areas (such as Bryce Canyon National Park, Cedar Breaks National Monument, and Grand Staircase-Escalante National Monument) are considered under the resource areas of concern for these areas—aesthetic resources, air resources, and recreation.

An analysis area has been identified for each analysis element to analyze potential impacts on the resource. Although analysis areas may differ between resources, the analysis area is generally defined as the outermost boundary of an area that encompasses potential direct and indirect impacts that may result from the No Action Alternative, the Proposed Action, and Alternative C. The analysis area for each resource brought forward for analysis is defined and described in the sections specifically addressing that resource.

3.1.3 Notes on Data Sources and Tract Acreage

Data and information used to describe the affected environment were gleaned from a variety of sources including internet sources, peer reviewed literature, government agency documents, current and historic permitting documents, and documents reporting the results of studies and data collection efforts completed for the EIS in specific. Key government agency documents from which data and information were extracted include larger scale planning documents, particularly the *Kanab Field Office Proposed Resource Management Plan and Final Environmental Impact Statement* (2008a) and the KFO RMP (2008b), previous EISs completed for the area (DOI 1980a, c), and smaller reports published by State of Utah and federal agencies (i.e., reports providing data and descriptions of particular resources). Documents included in the Coal Hollow PAP and reports completed by S. Petersen (2006, ACD 2008; Appendix 3), E. Petersen (Petersen Hydrologic 2007), and P. Collins (ACD 2008: Appendix 3) were also used for applicable data and information given the proximity of this mine to the tract. A variety of data and information was also gathered from a PAP submitted by Utah International Incorporated (UII) to DOGM in July 1987. In this PAP, UII proposed to mine an area including the Alton Coal Tract. Finally, seven "on the ground" studies have been completed for the affected area (tract and transportation route) in support of analyses specific to this EIS:

- a traffic study on the coal haul transportation route (Fehr and Peers 2008) (Appendix H);
- a reconnaissance-level vegetation community and habitat type study (SWCA 2007a: Appendix F) (Appendix F);
- a reconnaissance-level potential AVF study (Petersen Hydrologic 2008) (Appendix E); and
- a reconnaissance-level potential, jurisdictional wetland study (Collins 2008b: Appendix F);
- a detailed survey for sandloving penstemon (Collins 2008a: Appendix F);
- a night sky darkness impact study (Dark Sky Partners 2009; Appendix I); and
- an air resources dispersion modeling impact study (MESI 2010; Appendix K)

The NOI published in the *Federal Register* (Volume 71, Number 228, Tuesday, November 28, 2006) noting the BLM's intent to prepare an EIS for the tract indicates a tract acreage of "3,581.27 acres more or less." In this analysis, a tract acreage of approximately 3,576 acres is used rather than the approximately 3,581.27 acres listed in the NOI. As explained in Table 1.1 and 2.1 in Chapters 1 and 2, respectively, the tract acreage was refined and determined for analysis using a variety of sources for boundary data, such as hardcopy maps provided by ACD, the USGS 7.5-minute topographic map for the area, and a BLM shapefile of coal ownership. As a result of combining these relatively disparate sources of spatial data, and given that data sources are not survey accurate, approximately 5.0 acres of error was detected (hence a tract acreage of 3,576 acres rather than 3,581). Furthermore, the ownership lines from the map provided by ACD do not align well in all locales with the BLM boundary.

3.2 Aesthetics Resources

Aesthetic resources are elements of the human environment that are perceived and enjoyed by people surrounding the Alton Coal Tract and along the coal haul transportation route. The area of analysis for aesthetic resources possesses aesthetic qualities that are characterized by a visually diverse, rural landscape with few signs of modern development. Aesthetic resources are commonly considered visual resources, or things that are potentially seen with the naked eye. Because of the nature of the proposed action, aesthetic resources also include things that can be heard. The existing aesthetic resource conditions described in this EIS consist of the soundscape (natural sounds), visual resources (landscape), and the night sky (darkness).

3.2.1 Soundscape

The soundscape of an area is made up of both natural and human-created sounds. Sound occurs as a result of vibrations radiating through air, water, or solid objects. For the purposes of this section, noise is regarded as unwanted or nuisance sound. Exposure to prolonged, high levels of noise can result in temporary or permanent hearing loss or tinnitus (a ringing or roaring in the ears), and can also present safety issues. Although noise is known to have an effect on wildlife health and behavior, this section considers sound and noise levels as they relate to the human environment. For further information on wildlife and wildlife habitat within the area of analysis, refer to Section 3.17 Wildlife and Special Status Species. Humans experience sound based on frequency and amplitude. Frequency is defined as the number of pressure variations per second in the air. It is expressed in hertz (Hz). Humans can generally hear sound in the 20- to 20,000-Hz range. Amplitude is the volume of a sound and is expressed in decibels (dB). The threshold of human hearing is 0 dB. Decibels are measured on a logarithmic scale. A change in sound level of 10 dB is perceived by the average person as doubling (or halving) the level of loudness. Because the human ear perceives sounds differently at low frequencies than at high frequencies, measured sound levels may be adjusted to correspond to human hearing. The A-weighted decibel (dBa) is the adjusted unit of sound used to describe the human response to noise from industrial and transportation sources, including mining activities. Sound levels and characteristic impressions of common noise sources and environments are presented in Table 3.2.

Table 3.2. Common Sound Levels

Noise Source	Sound Level* (dBa)	Characteristic Impression	Relative Loudness[†]
Jet takeoff (50 feet)	140	Threshold of pain	64 times as loud
Rock concert near stage, jet takeoff (200 feet)	120	Uncomfortably loud	16 times as loud
Jet takeoff (2,000 feet)	100	Very loud	4 times as loud
Heavy diesel truck or motorcycle (25 feet)	90	–	2 times as loud
Garbage disposal (2 feet)	80	Moderately loud	Reference loudness
Vacuum cleaner (10 feet)	70	–	1/2 as loud
Light auto traffic (25 feet)	50	Quiet	1/8th as loud
Living room, bird calls	40	–	1/16th as loud
Library	30	Very quiet	–
Acoustic test chamber	10	–	–

Source: EPA 1974.
*For comparison purposes, the threshold of hearing is 0 (zero) dB.
[†] Relative loudness is the human judgment of different sound levels.

Although dBa indicates the level of noise at a single specific point in time, noise levels within a soundscape vary continuously and include sounds from a variety of sources. This variation can be accounted for using the equivalent continuous noise level (Leq). The Leq is the dBa average over time. Because of the greater sensitivity to noise levels at night, 10 dBa are added to any nighttime sounds before calculating a 24-hour average.

The soundscape is the area of analysis for noise because it could be affected by changes in noise or vibration levels occurring in the tract. Because noise and vibration from blasting activities may extend several miles or more, and noise from heavy machinery and coal haul trucks would extend a few hundred feet or less, the analysis area will vary under different aspects of mining operations. The area of analysis consists of the town of Alton; ranches adjacent to the tract, to Dixie National Forest, and to Bryce Canyon National Park; and the coal haul transportation route. Noise impacts would only occur where there are sensitive noise receptors to hear it.

Sensitive noise receptors are human-occupied locations and uses within a soundscape that are subject to stress, annoyance, and interference from noise. They consist of residential areas, hospitals, libraries, recreation areas, churches, and parks. The proposed tract is rural and sparsely populated. Sensitive noise receptors in the area of analysis are backcountry recreation opportunities on the Dixie National Forest, Bryce Canyon National Park, and BLM-KFO lands; the rural, residential area of Alton; and family ranches southeast of the tract. Receptors within Bryce Canyon National Park are 13.5 or more miles away from the proposed tract. Receptors on Dixie National Forest are 1.0–4.0 miles away from the tract. Residents of Alton and nearby ranches exist within 0.1 mile from the tract (the northwest portion of the tract, or Block NW) and within 2.0 miles of the location of centralized facilities. Sensitive noise receptors along the coal haul transportation route include schools, churches, hotels, parks, rental cabins, trails, residences, and recreation areas. These receptors occur in various locations within 40 feet of the coal haul transportation route.

3.2.1.1 AMBIENT AND EXISTING NOISE LEVELS

On September 15 and 16, existing, outdoor sound levels were measured at seven points in and near the town of Alton: three points in Alton, one point in Hatch, and three points in Panguitch. Measurements were recorded for each location on environmental noise data sheets (SWCA 2008). Locations were selected to be representative of sensitive noise receptors and existing noise levels within the area of analysis. The elements of sound along the entire coal haul transportation route, from the tract to the Iron Springs loadout, vary from day to night, and vary across seasons. Typical noise sources include motorized vehicle traffic, ranch machinery, aircraft traffic overhead, and wind.

In the town of Alton, sound levels were measured at three separate locations adjacent to surface streets in the town (Map 3.1). Five-minute to 15-minute measurements were used to determine an average. Average daytime levels ranged from 41 dBA Leq at the southern end of Alton to 55 dBA Leq within the town at the corner of 100 West and 100 North.

In the town of Hatch, the sound level was measured at one location, 50 feet from the centerline of US-89, on the northeast side of a church (see Map 3.1). The average daytime level was recorded at 64 dBA Leq over a period of 15 minutes.

In the town of Panguitch, the sound level was measured at three separate locations (see Map 3.1). The first was 40 feet from the centerline of Main Street. The sound level at this site was recorded for 24 hours from a sound meter placed 10 feet above ground level on a utility pole. The 24-hour average was 67 dBA Leq. The two remaining measurements were taken for 15 minutes from locations adjacent to surface streets within the town. Average daytime levels at both locations were 64 dBA Leq.

3.2.1.2 ENVIRONMENTAL PROTECTION AGENCY NOISE STANDARDS

The Noise Control Act of 1972 recognizes that uncontrolled noise can lead to impacts to the health and welfare of the nation's population. The act further declares that it is the policy of the United States to promote an environment free from noise that jeopardizes the health or welfare of the nation's population (EPA 1974). In 1974 the EPA released a document identifying a 24-hour exposure level of 70 Ldn (day-night sound level) as the level of environmental noise to prevent measurable hearing loss over a lifetime (EPA 1974). The same document identified levels of 55 dB outdoors and 45 dB indoors to prevent annoyance.

The Quiet Communities Act of 1978 promotes the development of state and local noise control programs. There is no state or local noise control program in the area of analysis; therefore, standards established by the EPA and the Mining Safety and Health Administration (MSHA) will be applied.

3.2.1.3 MINING SAFETY AND HEALTH ADMINISTRATION NOISE AND AIRBLAST STANDARDS

Hearing loss has been a health risk faced by many mine workers. In 1999 MSHA published new health standards for occupational noise exposure. These standards apply to all surface and underground metal, nonmetal, and coal mines. The purpose of these mandatory standards is to prevent occupational, noise-induced hearing loss among miners. The standards establish several circumstances where mine operators must take action (30 CFR 62.130). They are as follows:

- If miners are exposed to 85 dBa or more over an 8-hour period, they are required to enroll in a hearing protection program.
- If miners are exposed to 90 dBa or more over an 8-hour period, they must use feasible engineering and administrative controls to reduce noise levels.

- If miners are exposed to 105 dBA or more over an 8-hour period, they must ensure that they use both ear plug and earmuff-type hearing protectors.
- Miners must not be exposed to sound levels exceeding 115 dBa at any time.

3.2.2 Visual Resources

Visual resources (the landscape) consist of landform (topography and soils), vegetation, bodies of waters (lakes, streams, and rivers), and human-made structures (roads, buildings, and modifications of the land, vegetation, and water). These elements of the landscape can be described in terms of their form, line, color, and texture. Normally, the more variety of elements in a landscape, the more interesting or scenic the landscape becomes, if the elements exist in harmony with each other. The BLM manages landscapes for varying levels of protection and modification, giving consideration to other resources values and uses and the scenic quality of the landscape.

The visual analysis area consists of lands where potential alteration of the landscape from the proposed tract may be discerned. It consists of areas within and adjacent to the tract, the Grand View and Paunsaugunt Trails on the Dixie National Forest, and the town of Alton (Map 3.2). Because viewpoints from Bryce Canyon National Park occur outside the viewshed of the tract, it is not considered part of the area of analysis. Additionally, because no landscape change along the coal haul transportation route is proposed, it is not considered part of the visual analysis area.

3.2.2.1 CHARACTERISTIC LANDSCAPE

The tract lies in the Alton Amphitheater south of the town of Alton in Kane County, Utah, between the Paunsaugunt Plateau to the northeast, Long Valley (Virgin River) to the west, and the Gray Cliffs of the western edge of the Grand Staircase-Escalante National Monument to the south. The tract is characterized by a series of low-rising hills and benches cut by the north–south running Kanab Creek, and by long diagonal washes that flow from the surrounding mountain ranges. Vegetation in the tract is typical of the Great Basin and includes large, open areas of bunchgrass; perennial grass, forbs, and shrubs; and gray-green sagebrush interspersed with dense stands of darker green juniper and pinyon pine (see Section 4.15 for a full description of vegetation resources in the tract). Tall fir trees are apparent on the more rugged mountains to the northwest. Vegetation cover is continuous across most of the tract, broken by two-track dirt roads and fence lines.

The landscape of the tract has been partially modified by human development and activities. Dirt roads, dispersed ranches, agricultural fields, barbed wire fence lines, and large blocks of vegetation treatments have resulted in changes to the landscape of the tract. The graded dirt road (KFO Route 116) is a reddish tan band that traverses north–south along the length of the tract. Several ranches and homes surrounded by large cottonwood trees are located east of KFO Route 116 outside the southeastern edge of the tract. Green fields and meadows occur south of Alton and in the low-lying areas between the tract and the foothills of the Paunsaugunt Plateau. Barbed wire fences lined with tall, decadent sagebrush and rabbitbrush dissect the tract in various directions. Up to 700 acres, or 20% of the tract, has undergone mechanical vegetation treatments. Large, geometric vegetation treatment areas where trees and shrubs have been mechanically knocked over occur throughout the tract, leaving down, grayish white trunks and limbs interspersed with minimal grasses and shrubs. The geometric lines of the agricultural fields and vegetation treatments are large, and they are not readily apparent from locations within the tract. However, they are visible from the elevated viewpoints along the Dixie National Forest trails on the Paunsaugunt Plateau.

Although the tract has been modified by the activities described above, the setting is natural and remains largely undeveloped with few visible buildings and structures. Tree-covered mountains and white-, tan-, and red-colored cliffs border the tract to the north and east. In the background, east of the tract, the bright, colorful, and jagged cliffs of the Paunsaugunt Plateau on the Dixie National Forest increase the sense of a natural and undeveloped landscape.

3.2.2.2 VISUAL RESOURCE MANAGEMENT OBJECTIVES

Through the land-use planning process, BLM sets objectives for the management of landscape preservation and change. All lands are placed into one of four classes that identify the degree of acceptable landscape change or alteration, giving consideration to the scenic value of the landscape and other resource values and uses of the land. Class I objectives are established in areas where no landscape change is desired. Class IV objectives are set for landscapes where the BLM manages for uses that will result in substantial landscape changes (e.g., mining, energy development, wind farms). Classes II and III allow for varying degrees of landscape preservation and change in between Classes I and IV.

The VRM class objectives for the tract were established in the KFO RMP (2008b). Lands in the tract have been allocated to VRM Class IV management objectives (Map 3.3). The 1,296 acres of private land in the tract is not managed under any VRM class objectives. The objective of Class IV is to provide for management activities that require major modifications to the existing character of the landscape. These activities may dominate the view and may be the major focus of viewer attention.

3.2.3 Nighttime Lighting and the Extent of Skyglow

A natural lightscape is defined by the NPS Air Resources Division as “a place or environment characterized by the natural rhythm of sun and moon cycles, clean air, and of dark nights that are unperturbed by artificial lights” (NPS 2008d). Dark night skies are a part of the everyday experience of residents of Alton as well as part of the experience and expectation of visitors seeking recreation opportunities at NPS-managed lands. Bryce Canyon National Park has long been considered a leader in the protection and interpretation of dark skies. Park management also emphasizes the preservation of dark skies and astronomy through an extensive interpretive program, hosting dozens of astronomy educational programs throughout the year, including an annual astronomy festival held in late June.

The area of analysis for skyglow includes the tract’s surrounding lands that could be affected by changes in artificial lighting occurring from the Proposed Action and alternatives. Because lighting can disperse through the atmosphere and may extend further than 12 miles, the analysis area consists of the town of Alton, Dixie National Forest, Bryce Canyon National Park, Cedar Breaks National Monument, and Zion National Park. Because mine-related traffic would occur along existing roads associated with the coal haul transportation route and would be intermittent and in motion, no attempt was made to model lighting produced, and the coal haul transportation route is not considered in the area of analysis for skyglow.

There are several methods available for measuring skyglow and for measuring the brightness of night skies. Amateur astronomers use limiting magnitude to measure the brightness of the night sky. Limiting magnitude describes the faintest stars that can be seen with the unaided eye. Amateur astronomers compare the night sky to a star chart with known magnitudes. Limiting magnitude is then determined by the faintest star from the chart that is visible to the naked eye. Site-specific data on the darkness of the night skies over the tract were not available; therefore, the brightness of the night sky is based on the known limiting magnitude and night sky observations from Bryce Canyon National Park and Cedar Breaks National Monument. The night skies from viewpoints in Bryce Canyon National Park (e.g., Rainbow and Yovimpa points) have a limiting magnitude rating of 7.4. They are judged by NPS employees to be as dark as world class astronomical research locations (NPS 2008a). These dark night skies are the result of good air quality, low humidity, high elevation, and minimal sources of light pollution and skyglow.

Night sky conditions have been recorded by the NPS from both Yovimpa Point in Bryce Canyon National Park and from Brian Head Peak near Cedar Breaks National Monument (Personal Communication, Moore 2008). Night sky conditions are also recorded from both the east entrance and Lava Point within Zion National Park. Due to its proximity to St. George, Utah and Las Vegas, Nevada, night skies are brighter at Zion National Park than at Bryce Canyon National Park and Cedar Breaks National Monument. Additionally, most of Zion National Park is at a lower elevation and occurs within steep-walled canyons, minimizing the amount of potential light pollution that would be visible from the tract. Any perceived change in night sky conditions at Zion National Park would be less when compared with existing conditions.

Yovimpa Point is located near the southern end of Bryce Canyon National Park and is approximately 13 miles from the tract. From Yovimpa Point, there are apparent increases in night sky brightness resulting from natural air glow and from artificial light sources from 11 towns and cities surrounding the park, including Alton, Utah as well as Fredonia and Page, Arizona. In the area of sky opposite the tract, there is no apparent increase in skyglow from artificial light sources observed from Yovimpa Point. The greatest source of skyglow observed from Yovimpa Point comes from Cedar City, Utah approximately 48 miles the northwest of the tract (Dark Sky Partners 2009: Appendix I).

Brian Head Peak is located approximately 1.0 mile north of Cedar Breaks National Monument and 26.5 miles northwest of the tract. It has greater night sky brightness than that visible from Yovimpa Point. The night sky brightness comes primarily from the artificial light sources of Cedar City and St. George, Utah. The zenith of the night sky above Brian Head Peak appears approximately 6% brighter than under natural conditions, with brightness increasing closer to the horizon toward Cedar City and St. George. In addition, there are up to seven other cities and towns generating visible light domes surrounding Brian Head Peak (Dark Sky Partners 2009).

Amateur astronomers can qualitatively rank the brightness of the night sky using the Bortle Dark-Sky Scale, a numeric nine-level measure of the night sky brightness of a specific location (Table 3.3) (Bortle 2001). Under optimal conditions, Bryce Canyon National Park is assumed to have a Bortle Dark-Sky rating Class 3, equaling that of a typical, rural sky. Because there are few sources of artificial light between the park and the tract, it is further assumed that the tract is a Bortle Dark-Sky rating Class 3.

Light pollution is defined as the illumination of the night sky caused by artificial light sources (Bortle 2001). Effects of light pollution consist of a decrease in the visibility of stars and other natural night sky features, as well as disruption to natural lightscapes. Light pollution is caused by artificial light sources that are directed upward or sideways. Light then scatters throughout the atmosphere resulting in skyglow. Other factors that influence skyglow consist of humidity, snow cover, cloud cover, and increased PM in the air. Another form of light pollution is the glare that results from direct lighting.

Artificial light sources in the area of analysis include residential, commercial, and some street lighting from the Tropic, Hatch, Alton, as well as campgrounds and other developed facilities within Bryce Canyon National Park and Dixie National Forest. Because there are so few sources of light pollution, the night skies in the area of analysis are some of the darkest skies in the continental United States (NPS 2008a).

3.2.3.1 LIGHTSCAPE MANAGEMENT OBJECTIVES

The BLM does not set management objectives for night skies and lightscapes through the land-use planning process. The NPS will preserve, to the greatest extent possible, the natural lightscapes of parks. The NPS also works with park visitors, neighbors, and other agencies to prevent and minimize the intrusion of artificial lights on the night skies of national parks (NPS 2008d). Natural skyglow does occur, and can result from such things as moonlight, the Milky Way, low clouds, and airglow. Airglow is the emission of light from the Earth's upper atmosphere. NPS's policy is to consider the best 20% of night sky conditions, as recorded during night sky monitoring, when evaluating action alternatives.

Table 3.3. Bortle Dark-Sky Scale

Class	Title	Naked Eye Limiting Magnitude	Description
1	Excellent dark sky site	7.6–8.0	Zodiacal light, gegenschein, zodiacal band visible; M33 direct vision naked-eye object; Scorpius and Sagittarius regions of the Milky Way cast obvious shadows on the ground; airglow is readily visible; Jupiter and Venus affect dark adaptation; surroundings basically invisible.
2	Typical truly dark site	7.1–7.5	Airglow weakly visible near horizon; M33 easily seen with naked eye; highly structured summer Mi ky Way; distinctly yellowish zodiacal light bright enough to cast shadows at dusk and dawn; clouds only visible as dark holes; surroundings still only barely visible silhouetted against the sky; many Messier globular clusters still distinct naked-eye objects.
3	Rural sky	6.6–7.0	Some light pollution evident at the horizon; clouds illuminated near horizon, dark overhead; Milky Way still appears complex; M15, M4, M5, M22 distinct naked-eye objects; M33 easily visible with averted vision; zodiacal light striking in spring and autumn, color still visible; nearer surroundings vaguely visible.
4	Rural/ suburban transition	6.1–6.5	Light pollution domes visible in various directions over the horizon; zodiacal light is still visible, but not even halfway extending to the zenith at dusk or dawn; Milky Way above the horizon still impressive, but lacks most of the finer details; M33 a difficult averted vision object, only visible when higher than 55°; clouds illuminated in the directions of the light sources, but still dark overhead; surroundings clearly vis ble, even at a distance.
5	Suburban sky	5.6–6.0	Only hints of zodiacal light are seen on the best nights in autumn and spring; Mi ky Way is very weak or invis ble near the horizon and looks washed out overhead; light sources visible in most, if not all, directions; clouds are noticeably brighter than the sky.
6	Bright suburban sky	5.1–5.5	Zodiacal light is invis ble; Milky Way only visible near the zenith; sky within 35° from the horizon glows grayish white; clouds anywhere in the sky appear fairly bright; surroundings easily vis ble; M33 is impossible to see without at least binoculars; M31 is modestly apparent to the unaided eye.
7	Suburban/ urban transition	5.0 at best	Entire sky has a grayish white hue; strong light sources evident in all directions; Milky Way invis ble; M31 and M44 may be glimpsed with the naked eye, but are very indistinct; clouds are brightly lit; even in moderate-sized telescopes the brightest Messier objects are only ghosts of their true selves.
8	City sky	4.5 at best	Sky glows white or orange (you can easily read without additional lighting); M31 and M44 are barely glimpsed by an experienced observer on good nights; even with telescope, only bright Messier objects can be detected; stars forming familiar constellation patterns may be weak or completely invisible.
9	Inner city sky	4.0 at best	Sky is brilliantly lit with many stars forming constellations invis ble and many weaker constellations invisible; aside from Pleiades, no Messier object is visible to the naked eye; only objects to provide fairly pleasant views are the Moon, the Planets, and a few of the brightest star clusters.

Source: Adapted from Bortle 2001.

3.3 Air Resources

The air quality of a given airshed or region is determined by the topography, meteorology, location of air pollutant sources, and type, quantity, and combination of air pollutants. The calculated or measured concentrations of various pollutants are compared to established standards to evaluate the impact of a given source on regional air quality.

The following sections address the local weather and climate, the air quality regulatory requirements, and the air quality of the air resources analysis area (i.e., the near-field and far-field modeling domains as depicted in Map 3.4).

3.3.1 Climate and Weather

Utah's weather and climate are governed by altitude, latitude, and major mountain chains. These three characteristics also affect the dispersion potential of air emissions. In general, the main chain of the Rocky Mountains provides a barrier from cold Arctic weather, whereas the Sierra Nevada and Cascade mountains often prevent low-level, Pacific-storm moisture from reaching Utah. The proximity of the tract to the Wasatch Range and Plateau strongly influences its weather. The prevailing winds of the Pahvant Range and the Tushar and Brian Head mountains are westerly, and storms moving into Utah from the west encounter the south-central mountains. This mountainous terrain causes the air to rise and cool (orographic lifting), which squeezes out moisture that would otherwise pass over the area. These mountain chains also act as barriers to air mass flow and are responsible for the aridity of areas east of the mountains, which are characterized by hot, dry summers and cold, dry winters.

Synoptic (large scale) flow dominates the airflow on the mesa all along the Wasatch Plateau. In the absence of strong prevailing winds, wind movement within the valleys, canyons, and gulches is extremely complex. The terrain features suggest that there is a daily exchange of downslope and upslope flows oriented along the valley axis, which are controlled by surface heating and cooling. Downslopes (i.e., drainage flows) last longer and occur during the evening, night, and early morning hours, whereas upslope flows occur mid-day, when temperatures are at their high. Significant diurnal drainage flows can be expected along the south-central mountains. Drainage flows (slope and valley winds) commonly occur with local topographical features and may be accompanied by temperature inversions.

Daily and annual air temperatures vary considerably throughout the area and can vary greatly depending on elevation, as evidenced by monitoring data. Temperature recorded near the tract has annual, mean daily highs and lows ranging from 60.0°F to 31.1°F, respectively. July is the hottest month, with mean daily highs and lows ranging from 82.2°F to 50.0°F, respectively (Western Regional Climate Center 2010). At a higher elevation nearby, the recorded annual, mean daily temperature at Bryce Canyon National Park is 40.6°F and the annual normal highs and lows range from 54.6°F to 26.6°F. July is the hottest month with a mean daily temperature of 62.5°F, with mean daily highs and lows ranging from 78.3°F to 46.6°F (National Oceanic and Atmospheric Administration [NOAA] 2004).

Average annual precipitation in the area is 16.6 inches (Western Regional Climate Center 2010). This value compares well with the Bryce Canyon National Park data, which show average annual precipitation of 16.4 inches (NOAA 2004).

Complete weather data at the tract are not available. Data recorded at the Cedar City Station, located at the airport in Cedar City, Utah approximately 43 miles northwest of the tract, are considered representative of the tract's location (Personal Communication, UDAQ 2008). These data comprise the only complete weather dataset available for air dispersion modeling near the tract and the coal haul transportation route. Cedar City is warmer than Alton and has an annual, mean daily temperature of 50.5°F, with annual, normal highs and lows ranging from 64.4°F to 36.5°F. July is the hottest month with a mean daily temperature of 73.6°F, with mean daily highs and lows ranging from 89.4°F to 57.8°F (NOAA 2004).

Wind data collected from Cedar City indicate that prevailing winds are from the south-southwest. A representative windrose is shown in Figure 3.1. A distinct bimodal trend is not apparent at this location.

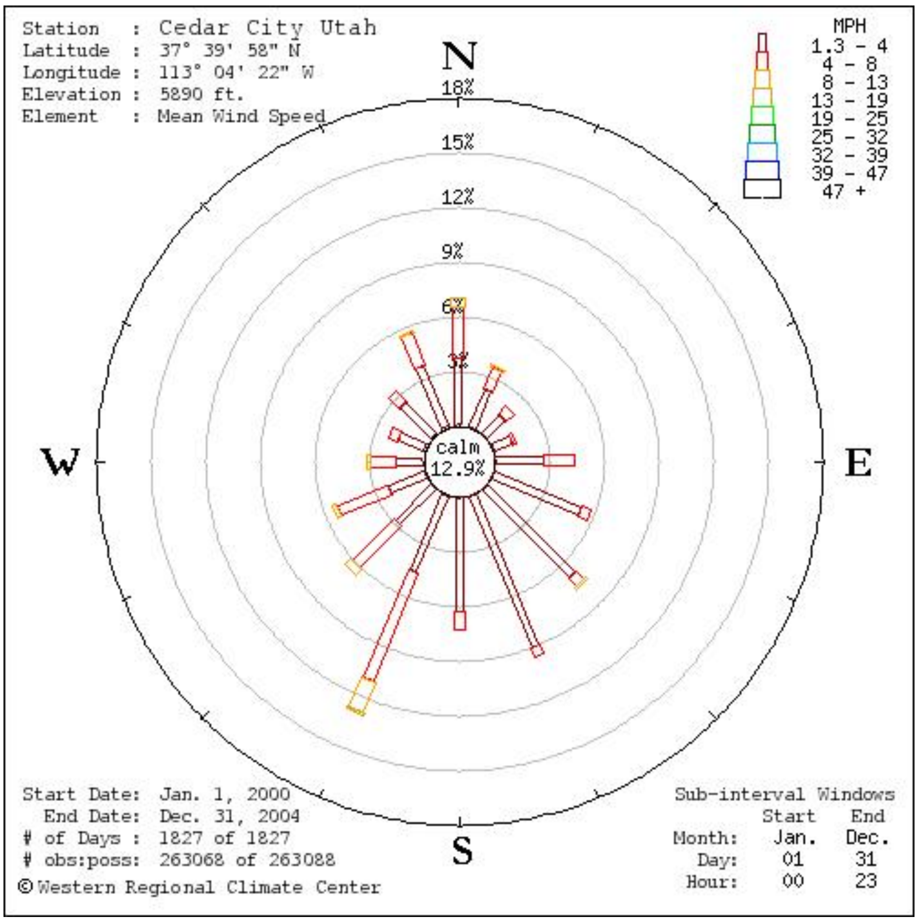

Figure 3.1. Windrose generated from Cedar City weather data (Community Environmental Monitoring Program 2011).

3.3.2 Regulatory Requirements

3.3.2.1 NATIONAL AMBIENT AIR QUALITY STANDARDS

EPA established NAAQS for six pollutants known as "criteria" pollutants. They are CO, NO_2, ozone (O_3), lead (Pb), SO_2, and PM. PM is defined as fine particulates with a nominal aerodynamic diameter of 10 micrometers or less (PM_{10}), and fine particulates with a nominal aerodynamic diameter of 2.5 micrometers or less ($PM_{2.5}$). The primary standards for the criteria pollutants are health-based standards. They are set at levels to protect the health of the most sensitive individuals in the population: the very young, the very old, and those with respiratory problems or other ailments. The EPA also established secondary standards for the criteria pollutants. These are the quality of life standards that are the same as the primary standards or less stringent than the primary standards. All of the standards are expressed as concentration and duration of exposure, and most address both short-term and long-term exposure. NAAQS for the criteria pollutants are presented in Table 3.4 (40 CFR 50.1–50.17).

Table 3.4. Environmental Protection Agency National Ambient Air Quality Standards, Significant Impact Levels, and Recorded Concentrations

Pollutant	Standard Value[a, f]	Significant Impact Levels[f]	Recorded Concentration[c]	Location[c]
CO				
8-hour average	9 ppm (10 mg/m^3)[b]	500 $\mu g/m^3$	1 ppm (1,150 $\mu g/m^3$) (estimate)	Kane County
1-hour average	35 ppm (40 mg/m^3)[b]	2,000 $\mu g/m^3$	1 ppm (1,150 $\mu g/m^3$) (estimate)	
NO_2				
Annual arithmetic mean	0.053 ppm (100 $\mu g/m^3$)[b]	1 $\mu g/m^3$	17 $\mu g/m^3$ (estimate)	Kane County
1-hour average	0.1 ppm (188 $\mu g/m^3$)[b]		n/a	
O_3				
1-hour average	0.12 ppm (235 $\mu g/m^3$)[b, g]	n/a	n/a[g]	Canyonlands National Park[d]
8-hour average	0.075 ppm (effective 5/27/2008)		0.072 ppm	
Pb				
Quarterly average	1.5 $\mu g/m^3$	n/a	0.08 $\mu g/m^3$	Magna, Salt Lake County[i]
PM_{10}				
Annual arithmetic mean	Revoked[e]	n/a	23 $\mu g/m^3$	UDAQ
24-hour average	150 $\mu g/m^3$ 5 $\mu g/m^3$		72 $\mu g/m^3$	
$PM_{2.5}$				
Annual arithmetic mean	15 $\mu g/m^3$	n/a[h]	2.8 $\mu g/m^3$ [j]	Bryce Canyon [j]
24-hour average	35 $\mu g/m^3$ [e]	n/a[h]	9.5 $\mu g/m^3$ [j]	
SO_2				
Annual arithmetic mean	0.03 ppm (80 $\mu g/m^3$)[b]	1 $\mu g/m^3$	5 $\mu g/m^3$ (estimate)	Kane County[c]
24-hour average	0.14 ppm (365 µg/m3)[b]	5 $\mu g/m^3$	10 $\mu g/m^3$ (estimate)	
1-hour average	75 ppb		n/a	
3-hour average (secondary standard)	0.5 ppm (1,300 $\mu g/m^3$)[b]	25 $\mu g/m^3$	20 $\mu g/m^3$ (estimate)	

[a] CO=primary standard; NO_2, O_3, Pb, and PM=primary and secondary standards; SO_2 = annual arithmetic mean.
Mean and 24-hour average are primary standards, 3-hour average is a secondary standard.
ppm=parts per million; ppb=parts per billion.

[b] Parenthetical value is an approximate equivalent concentration in micrograms per cubic meter.

[c] Data from UDAQ, Personal Communication, 2008; UDAQ 2010. PM_{10} value is from the UDAQ state permitting for the Coal Hollow Mine.

[d] Data from NPS 2008b. The recorded value is based on the 4th high.

[e] Effective December 17, 2006.

[f] The 1-hour NO_2 NAAQS became effective April 12, 2010. The final 1-hour SO_2 NAAQS was signed June 2, 2010.

[g] Data from 40 CFR 50.1–50.17. Applies only in limited areas; as of June 15, 2005, EPA revoked the 1-hour ozone standard in all areas except the fourteen 8-hour ozone nonattainment Early Action Compact areas. The tract is not in an Early Action Compact area.

[h] Data from *Federal Register* 2007. The EPA proposed hree options for developing significant impact levels for $PM_{2.5}$. The rule has not been promulgated.

[i] Data from EPA 2005.

[j] Data from NPS 2008c. $PM_{2.5}$ background is from the Bryce Canyon National Park IMPROVE Site. The most recent 3-year average design values are from 2008.

When a designated air quality area or airshed within a state exceeds a NAAQS, that area may be designated as a "nonattainment" area. Areas with levels of a criteria pollutant below the health-based standard are designated as "attainment areas." It is possible for a geographic area to be an attainment area for one criteria pollutant, but a nonattainment area for another. To determine whether an area meets the NAAQS, air-monitoring networks have been established and are used to measure ambient air quality. Monitoring sites, by design, are located in areas where high concentrations within a region are expected to occur. The Utah air quality map shows the monitoring station locations within the State of Utah (Map 3.5).

3.3.2.2 CLASS I AREAS AND CLASS II AREAS

Clean air designations were established under the federal Clean Air Act (CAA) Title I, Part C, Prevention of Significant Deterioration (PSD) of Air Quality. Generally, the Class I air quality and land-use classification is the designation for clean, pristine airsheds and would permit little or no development, and the Class II designation is applied to all other clean airsheds (in attainment of the NAAQS) where development is permitted under state authority. Class I areas include national parks larger than 6,000 acres, national wilderness areas larger than 5,000 acres, and international parks and national memorial parks larger than 5,000 acres. Except for fires and wind erosion, the only potential for adverse air quality impacts in Class I areas is from anthropogenic pollutants transported into these areas by large-scale winds, local winds, or both. Areas in the United States that have ambient air quality concentrations greater than those specified in the NAAQS are designated as nonattainment areas; the remainder of the country is designated Class II.

3.3.2.3 PREVENTION OF SIGNIFICANT DETERIORATION

In addition to the NAAQS discussed above, the EPA promulgated PSD regulations to further protect and enhance air quality. The PSD regulations use an incremental approach and are intended to help maintain good air quality in areas that attain the national standards and to provide special protections for national parks. These increments establish the maximum increase in pollutant concentration allowed above a baseline level. Complete consumption of an increment would impose a restriction to growth for the affected area. It does not necessarily indicate an adverse health impact. PSD permits are required for major, new stationary sources of emissions that emit 250 tons (100 tons for some specific sources) or more per year of an air pollutant. Increment consumption for major sources is tracked by the State of Utah as permits are issued. The maximum allowable PSD increments over baseline are in Table 3.5.

Table 3.5. Prevention of Significant Deterioration of Air Quality Increments: Maximum Allowable Increase (μg/m^3)

Pollutant	Averaging Time	Class I	Class II
PM_{10}	24 hour	8	30
$PM_{2.5}$	Annual	n/a[a]	n/a[a]
	24 hour	n/a[a]	n/a[a]
SO_2	Annual	2	20
	24 hour	5	91
	3 hour	25	512
NO_2	Annual	2.5	25

Table 3.6 presents the PSD baseline dates triggered for the entire State of Utah.

Table 3.6. Prevention of Significant Deterioration Baseline Dates for the State of Utah

	SO_2	PM_{10}	NO_2
Major sources	August 17, 1979	August 17, 1979	April 21, 1988
Minor sources	April 1, 1990	April 1, 1990	April 21, 1988

3.3.2.4 AIR QUALITY-RELATED VALUES

Federal land managers identified air quality-related values (AQRV) to be protected in federal areas such as national parks and national forest Class I areas. AQRVs are scenic, cultural, physical, biological, ecological, or recreational resources that may be affected by a change in air quality, as defined by the federal land manager. Specific AQRVs of concern are dependent on a number of variables, including the evolving state of the science, project-specific pollutants, site-specific management concerns, and the existing condition of the AQRVs. Refer to the Existing Air Quality section for a discussion of specific AQRVs: visibility, acid rain, flora, and fauna.

3.3.2.5 GLOBAL CLIMATE CHANGE

Scientific investigation and discussion continue to address the rise in global mean temperatures, the possible causes of this rise, and whether a warming trend will continue. GHGs have been identified as a possible contributor to the rise in global mean temperatures. Ongoing scientific research has identified the potential impacts of anthropogenic (from human activities) GHG emissions and changes in biologic carbon sequestration on the global climate. Through complex interactions on a regional and global scale, these changes are thought to cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat radiated by the earth back into space, much as glass traps heat over a greenhouse.

GHGs absorb infrared radiation and trap its heat in the atmosphere. Many gases exhibit GHG properties; some occur naturally, such as carbon dioxide (CO_2), CH_4, water vapor, ozone, and nitrous oxide (N_2O). Others are synthetic, such as chlorofluorocarbons, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Some of the naturally occurring GHGs are also produced by anthropogenic activities. The study of global climate change is complex because there are many factors that may contribute to changes in the earth's temperature, including the emission of GHGs, as well as the earth's ability to remove these gases from the atmosphere through mechanisms such as photosynthesis and ocean uptake. Analysis of climatic change comprises several factors, including GHG emissions, land-use management practices, and the albedo effect (i.e., the cycle of increased temperature resulting from the increased absorption of normally reflected light).

The predominant GHGs emitted in the United States are CO_2, CH_4, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. In the United States, anthropogenic GHG emissions come primarily from burning fossil fuels. Energy-related CO_2 emissions from the combustion of petroleum, coal, and natural gas accounted for 81% of total United States anthropogenic GHG emissions in 2008. "Although the industrial sector is the largest consumer of energy (including direct fuel use and purchased electricity), the transportation sector emits more CO_2 because of its near-complete dependence on petroleum fuels" (DOE/EIA 2010).

Anthropogenic CH_4 emissions from landfills, coal mines, oil and natural gas operations, and agriculture account for 11% of United States emissions. Nitrous oxide emitted through fertilizers, burning fossil fuels, and from industrial and waste management processes accounts for 4% of total emissions. Several human-made gases account for 3% of the total (DOE/EIA 2010).

GHG inventories are usually reported in terms of "CO_2 equivalents" to account for the relative global warming potential (GWP), or a given pollutant's ability to trap heat. For example, CH_4 has a GWP of 21, meaning it is 21 times more effective at trapping heat than CO_2. Nitrous oxide has a GWP of 310, meaning it is 310 times more effective at trapping heat than CO_2. Hydrofluorocarbons range from 140 to 11,700 GWP, whereas perfluorinated compounds range from 6,500 to 9,200 GWP.

There are many regional sources that may contribute to global climate change, including those sources presented in Table 3.7. It is likely that all of the sources discussed above for the United States would be found near the tract or within the State of Utah.

3.3.3 Existing Air Quality

3.3.3.1 BACKGROUND AIR QUALITY AND REGIONAL SOURCES

Existing air quality near the tract is expected to be typical of undeveloped regions in the western United States. Limited data collected in typical undeveloped areas indicate that ambient pollutant levels are usually near or below measurable limits. Locations vulnerable to decreasing air quality include areas adjacent to surface-disturbing activities, such as energy and mineral development projects, farm tilling, and local population centers affected by residential emissions.

Data from the 2010 UDAQ statewide emissions inventory report for Kane County and Utah are shown in Table 3.7. The report summarizes criteria pollutant levels in tons per year by source type. The data illustrate that emissions in Kane County are a small percentage of statewide totals.

The greatest sources of NO_x and PM_{10} in Kane County are onroad mobile sources (automobiles and trucks traveling on established roads) and area sources (small mobile and stationary sources such as gas stations or woodburning).

Local sources of air pollution include automobiles, trains, generators, and woodburning stoves and fireplaces (in the winter). These sources typically generate CO, NO_2 and other NO_x, VOCs, and PM_{10}. Additionally, ozone, a highly reactive form of oxygen, typically forms when NO_x and VOC emissions from these sources react with sunlight on hot, still days. With the removal of leaded gasoline in the marketplace, and the absence of industries such as nonferrous smelters and battery plants, airborne-lead pollution is not an issue of concern in the area. In fact, lead is currently monitored only in Salt Lake County, Utah (EPA 2005).

The tract is classified as attainment for all criteria pollutants. No state monitoring stations exist near the tract. Background air quality levels are derived from several sources, as identified in the footnotes of Table 3.4. Concentrations are also presented in Figure 3.2.

Table 3.7. 2008 Summary of Emissions by Source (tons per year) for Kane County and Utah

Location	Source	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC
Kane County	Area source	1,509.07	40.96	749.32	273.39	23.53	474.97
	Nonroad MOBILE	2,115.78	83.81	23.25	21.53	3.17	720.69
	Onroad MOBILE	3,185.58	500.94	458.26	59.16	1.46	270.27
	Point source	0.00	0.00	0.00	0.00	0.00	0.00
	Biogenics	9,133.20	0.00	0.00	0.00	0.00	47,897.91
	Wildfires	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**15,943.63**	**625.71**	**1,230.83**	**354.08**	**28.16**	**49,363.84**
Utah Total	Area source	45,711.40	8,008.52	46,766.83	12,914.13	1,036.83	45,339.83
	Nonroad MOBILE	152,516.84	23,451.76	1,828.75	1,714.86	1,179.24	24,254.28
	Onroad MOBILE	463,537.10	61,634.05	37,136.78	3,111.18	247.15	31,672.98
	Point source	21,100.69	84,755.71	11,696.12	4,023.05	28,550.43	8,805.91
	Biogenics	136,583.55	0.00	0.00	0.00	0.00	754,396.36
	Wildfires	7,258.96	206.66	878.31	790.48	0.00	1,239.96
	Total	**826,708.55**	**178,056.72**	**98,306.79**	**22,553.70**	**31,013.65**	**865,709.32**
Kane County Percentage of Utah		1.9%	0.4%	1.3%	1.6%	0.1%	5.7%

Source: UDAQ 2010.

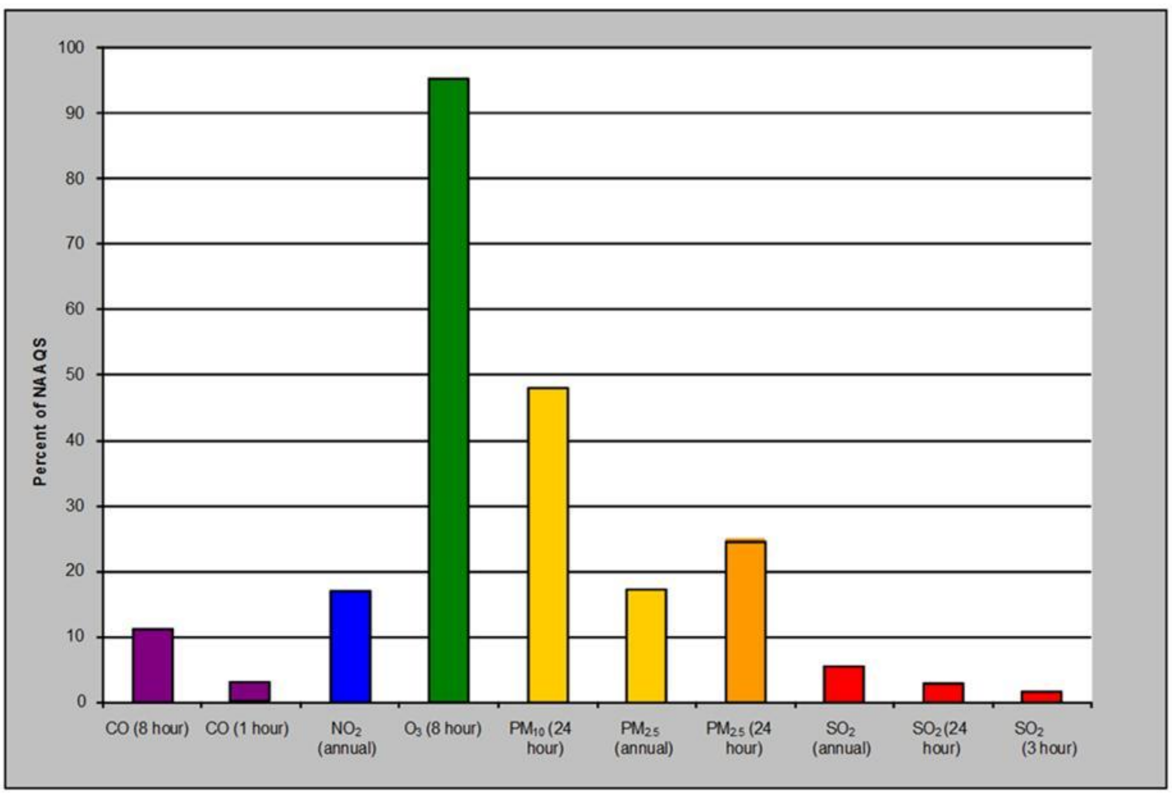

Figure 3.2. Background concentrations of criteria pollutants.

The location of the tract is designated as a Class II area for the criteria pollutants. There are several Class I and sensitive Class II parks near the tract, including Bryce Canyon, Zion, Capital Reef, and Grand Canyon national parks (all Class I), and Grand Staircase-Escalante National Monument (Class II). The closest Class I area is Bryce Canyon National Park, which is approximately 16.1 km (10 miles) from the tract. There are many regional sources that may impact the Class I areas near the tract. Table 3.8 lists point source emissions sources within 50 km (31 miles) of the Class I areas with emissions greater than PSD thresholds (emissions greater than 250 tons per year of an air pollutant), as they existed during a 1996 study with available updates noted in the table. PSD sources have the potential for significant impact, and more restrictive permitting requirements are generally imposed. No additional PSD sources were found as part of this air quality analysis. The largest contributors to air pollutant emissions in the region are power plants and generating stations (Western Regional Air Partnership 1996).

Table 3.8. Sources Near the National Park Class I Areas: Bryce, Zion, Capitol Reef, Grand Canyon (Western Regional Air Partnership 1996 except as noted)

Facility (Class I area in parentheses)	**Emissions (tons per year)**				
	VOC	**NO_x**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Carbon Power Plant Helper, Utah (Capitol Reef)[1]	18	3,380	6,765	221	38.8
Chemical Lime Co. Nelson Lime Plant, Arizona (Grand Canyon)	16.9	719	122.2	355.7	188.5
El Paso Natural Gas Co. Environmental AF, Arizona (Grand Canyon)	975.6	2,556.4	0.5	0	0
El Paso Natural Gas Company Flagstaff Co, Arizona (Grand Canyon)	28.9	1,068.2	0.2	0	0
El Paso Natural Gas Company Hackberry Co, Arizona (Grand Canyon)[2]	14.2	461.0	0.3	10.7	0
El Paso Natural Gas Company Williams Com, Arizona (Grand Canyon)	19.6	1,508.4	0.6	0	0
Hunter Power Plant, Castle Dale, Utah (Capitol Reef)[1]	130	19,869	7,029	1,226	583.2
Huntington Power Plant, Huntington, Utah (Capitol Reef)[1]	82	11,198	13,714	1,067	341.8
Intermountain Generation Station (Delta, Utah) (Capitol Reef)	0.4	19,688.3	3,758.8	100.5	19.0
Moab Compressor Station, Moab, Utah (Capitol Reef)	17.1	470.4	0	2.3	2.3
Navajo Power Plant, Page, Arizona (Bryce, Zion, Capitol Reef, Grand Canyon)[3]	196.4	34,744	3,843	1,560.7	708.1
Phoenix Cement Portland Cement Plant, Arizona (Grand Canyon)	0	2,628.3	196.5	179	94.9
Reid Gardner, Nevada (Bryce, Zion, Grand Canyon)	49.8	14,288.3	3,547.1	874.1	874.1
Transwestern Pipeline Company, Arizona (Grand Canyon)	59.1	1,319.9	1.1	2	1.4

[1] Data from USFS 2009. VOC, NO_x, SO_2, and PM_{10} emissions updated.
[2] Data from EPA 2009. OC, NO_x, SO_2, and PM_{10} emissions updated.
[3] Data from Sourcewatch 2009. O_x and SO_2 emissions updated with 2006 emissions data.

The Coal Hollow Mine has not yet received a state construction permit. The proposed emissions are presented in Table 3.9. Based on the potential emissions, the facility would not be a major emissions source under the PSD or Title V programs. This mine would not be in operation during the operation of the tract.

Table 3.9. Coal Hollow Mine Potential to Emit

Emissions (tons per year)					
VOC	**NO_x**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	**CO**
5.5	26.1	31.5	75.65	10.5	9.1

3.3.3.2 VISIBILITY

Visibility is the degree to which the atmosphere is transparent to visible light. It is an important air quality value, particularly in scenic and recreational areas. Scenic vistas in most United States parklands can be diminished by haze, which reduces contrast, dilutes colors, and reduces the distinctness or visibility of distant landscape features. Visibility degradation in national park lands and forests is a consequence of broader, regional-scale visibility impairment from visibility-reducing particles and their precursors often carried long distances to these remote locations.

Sulfates, organic matter, elemental carbon (soot), nitrogen compounds, soil dust, and their interaction with water cause most anthropogenic visibility impairment. The causes and severity of visibility impairment vary over time and from one place to another, depending on weather conditions, sunlight, and the size and proximity of emission sources.

Visibility protection requirements are included in EPA PSD regulations, which require protection of AQRVs for Class I areas. These AQRV impacts are subjective and intended to be used as guidelines for assessing potential project impacts and not as definitive regulatory thresholds. A change in contrast of not more than 10% at sensitive view areas is considered acceptable, as described in the existing FLAG guidance. Impacts greater than 10% are noted, and further investigation may be initiated. Unlike NAAQS standards and PSD increments, however, an exceedance of the 10% threshold does not, by itself, cause a project to be halted. As discussed in the previous section, the Bryce Canyon, Zion, Capital Reef, and Grand Canyon national parks (all Class I) and the Grand Staircase-Escalante National Monument (Class II) are near tract.

The State of Utah has addressed both visibility and regional haze in the Class I areas in two state implementation plans. The *Utah State Implementation Plan Section XVII Visibility Protection* report (UT 1993) addresses visibility protection of Utah's natural features and uses a two-phased approach. The first phase implements a visibility monitoring strategy and considers direct plume impacts on visibility from proposed new sources. The second phase addresses the development of a long-term plan to show progress toward national visibility protection goals. This document is still in force but has not been revised since 1993.

More current information is available in the recently revised *Utah State Implementation Plan Section XX Regional Haze* (UT 2008). This document contains measures addressing regional haze visibility impairment to ensure that the state makes reasonable progress toward national goals. The state has implemented long-term strategies to reduce regional haze resulting from various air pollution sources. For most Class I Areas in the region, stationary source NO_x and PM emissions are not considered a major contributor to visibility impairment on the average 20% best and 20% worst days; although, on some of the worst days, nitrates and PM are the main components of visibility impairment. Pollutant projections affecting regional haze, as identified in the state implementation plan, include the following:

- 33% decrease in Utah sources and 53% decrease in SO_2 emissions for the nine states in the Grand Canyon Visibility Transport Commission (GCVTC) between 1996 and 2018
- 36% decrease in Utah sources and 57% decrease in NO_x emissions for the nine states in GCVTC between 1996 and 2018
- 38% decrease in Utah sources and 31% decrease in $PM_{2\ 5}$ emissions for the nine states in GCVTC between 1996 and 2018
- Visibility improvement for the 20% best and worst days for each of the Class I areas (Bryce Canyon, Zion, Capitol Reef, and the Grand Canyon) between 1996 and 2018

The State of Utah's reductions in SO_2 are primarily due to that state's long-term strategy for stationary sources of SO_2. Reductions in NO_x and $PM_{2.5}$ have resulted from the implementation of new federal engine standards and fuel standards; although, stationary source NO_x emissions are projected to increase by 4% between 1996 and 2018. Although stationary source PM emissions are projected to increase, they likely cause less than 2% of the regional visibility impairment.

3.3.3.3 ACID DEPOSITION

Air pollution is produced when acid chemicals are incorporated into rain, snow, fog, or mist. This pollution is generally referred to as acid rain or acid deposition. Atmospheric deposition of air pollutants can increase the acidity of soils and water resources. The acid in the rain comes from sulfur oxides (SO_x), NO_x, products of burning coal and other fuels, and from certain industrial processes. Title IV of the Clean Air Act set a goal of reducing annual SO_2 emissions by 10 million tons below 1980 levels. To achieve these reductions, the law requires a two-phase tightening of the restrictions placed on fossil fuel-fired power plants.

Measurements of atmospheric deposition are currently being taken in Class I areas of Grand Canyon and Bryce Canyon national parks by the National Acid Deposition Program. The *2005 Annual Performance Report: Air Quality in National Parks* (NPS 2005) indicates the rates of atmospheric deposition of nitrogen and sulfur in rain are relatively low in Bryce Canyon National Park, but are elevated above natural conditions. Trends analysis shows that nitrogen deposition has no statistical trend and that sulfur deposition has slightly decreased between 1995 and 2004. The Grand Canyon trends analysis shows a degrading trend for both nitrogen and sulfate for the same period.

Kane County does not have significant sources of acid rain; however, there are significant, nearby regional power plants that are listed in Table 3.8. Regional acid rain sources in Utah include the Carbon Power Plant (Phase II acid rain source that has been issued a Phase I acid rain permit by the EPA for early NO_x reduction), the Hunter Power Plant (Phase II acid rain source), the Huntington Power Plant (Phase II acid rain source), and the Intermountain Generation Station (Group I, Phase II acid rain source) (UDAQ 2009). The acid rain provisions for these facilities refer to coal-fired utility units that are subject to an acid rain emission limitation or reduction requirement for SO_2 under the Clean Air Act. Although there are significant acid rain sources in the region, the tract would not considered a significant acid rain source.

3.3.3.4 FLORA AND FAUNA

Pollutant emissions from larger point sources may impact flora and fauna at the Class I areas; however, the sensitivity of ecosystem response to increased pollutant emissions from these particular sources is not well documented. Because emissions from the tract would be a small percentage of the existing regional sources, an in-depth review of these regional sources was not performed.

3.3.3.5 GENERAL CONFORMITY

To eliminate or reduce the severity and number of NAAQS violations in nonattainment areas and to achieve expeditious attainment of the NAAQS, the EPA promulgated the Conformity Rule (40 CFR 6, 51, 93). The Conformity Rule applies to federal actions and environmental analyses, in nonattainment areas, completed after March 15, 1994. This rule contains a variety of substantive and procedural requirements to show conformance with both the NAAQS and state implementation plans. The nonattainment/maintenance areas in Utah (UT 2010) are as follows:

- $PM_{2.5}$: part of Utah County; part of Cache County in Utah, and Franklin County in Idaho; and Salt Lake, Davis, and parts of Weber, Box Elder, and Tooele counties are nonattainment.
- PM_{10}: Salt Lake and Utah counties and Ogden (Weber County) are nonattainment. Redesignations are pending for all three locations.

- SO_2: Salt Lake and Tooele counties (above 5,600 feet) are nonattainment. Redesignation is pending for Salt Lake County.
- CO: Ogden City (maintenance area redesignated in 2001); Salt Lake City (maintenance area redesignated in 1999); and Provo and Orem in Utah County (maintenance area redesignated 2006).
- Ozone: Davis and Salt Lake counties (maintenance areas redesignated 1997).

The tract is located in Kane County. This county is in attainment of the NAAQS for all criteria pollutants, as defined under the EPA.

3.3.3.6 GREENHOUSE GASES

Climate change analyses comprise several factors, including GHGs (which include CH_4 and CO_2), land-use management practices, and the albedo effect (reflectivity of the surface, by vegetation or water). The tools necessary to quantify incremental climatic impacts of specific activities associated with those factors are presently unavailable (i.e., existing climate prediction models are not at a scale sufficient to estimate potential impacts of climate change within the analysis area). Research on how GHG emissions influence global climate change and associated effects has focused on the overall impact of emissions from aggregate regional or global sources. GHG emissions from single sources are small relative to aggregate emissions, and GHGs, once emitted from a given source, become well mixed in the global atmosphere and have a long atmospheric lifetime. The climate change research community has not yet developed specific tools for evaluating or quantifying end-point impacts attributable to the emissions of GHGs from a single source. Also, scientific literature that addresses the climate effects of individual, facility-level GHG emissions has not been identified. The current tools for simulating climate change generally focus on global and regional-scale modeling. Global and regional-scale models lack the capability to represent important small-scale processes. As a result, confidence in regional- and sub-regional-scale projections is lower than at the global scale. There is thus limited scientific capability in assessing, detecting, or measuring the relationship between emissions of GHGs from a specific single source and any localized impacts. As a consequence, impact assessment of effects of specific anthropogenic activities cannot be performed. Additionally, specific levels of significance have not yet been established. Therefore, climate change analysis for the purpose of this document is limited to accounting for and disclosing the factors that contribute to climate change. Qualitative and/or quantitative evaluations of potential contributing factors within the planning area are included where appropriate and practicable.

3.4 Cultural Resources

Investigations to identify and evaluate cultural resources in the Alton Coal Tract were conducted in 2005 and 2008 by Montgomery Archaeological Consultants, Inc. on behalf of ACD (Stavish 2007, 2008a), and supplemental work was conducted by the BLM-KFO in 2007 (Zweifel 2007). This documentation satisfied the identification phase of Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and implementing regulations at 36 CFR 800. The cultural resources identified during these investigations consist of prehistoric and historic archaeological sites. A detailed cultural resource management plan (CRMP) will be developed for archaeological resources in the tract. The CRMP will outline the testing and mitigation that would be implemented in the event that either the Proposed Action or Alternative C is adopted (Personal Communication, Stavish 2008c).

Additional cultural resources that may be affected by mine-related actions include the Panguitch Historic District, which is listed on the NRHP, and Utah Heritage Highway 89 (also known as US-89) with its associated Mormon Pioneer Heritage Area.

3.4.1 Regional Overview

The tract lies in the Grand Staircase section of the Colorado Plateau Semidesert Province (Stokes 1986). An overview of the region's geology and soils, particularly with regard to the impact of surficial and bedrock units on the distribution of cultural resources in the area, is presented as Appendix C of the Montgomery Archaeological Consultants, Inc. 2005 inventory report (Lamm 2005 in Stavish 2007). The two most prominent geologic units in the region are alluvium and Tropic Shale. The 2005 report describes the possible natural impacts to cultural resources distributed on the alluvium. These include the localized slope failure or collapse of arroyo walls, the piping of finer grained sediments, the entrenching of drainages, and the potential for buried sites. Potential impacts to cultural resources distributed across the Tropic Shale include localized slope failure, surficial creep and slope wash on steeper slopes, and erosion of weathered bedrock on steep to gentle slopes. Moreover, the vertical erosion of in-situ sediments on the Tropic Shale may also distort the integrity of buried cultural resources.

3.4.1.1 CURRENT LAND USES AND IMPACTS

Current land uses in the Alton Amphitheatre and Sink Valley include farming, ranching, and mining. Over 20% of the land in the tract consists of agricultural lands, whereas cattle and other livestock graze on private farmlands and on BLM-managed pasturelands. Historic coal mining has also been conducted in the area, and three historic archaeological resources have been recorded: the Smirl Mine (42Ka4017), the Jacob A. Sorenson Mine (42Ka4019), and the Alton Mine (42Ka4091). The remnants of these mines have since been reclaimed by ongoing activities, and no evidence of their existence was documented during the 2005 cultural resource inventory (Stavish 2007).

3.4.2 Known Cultural Resources

3.4.2.1 CULTURAL-HISTORICAL OVERVIEW

A detailed review of the region's culture history and associated references is provided in Stavish (2007, 2008b). Nonetheless, it is useful to recap that human occupation of the region is represented by the Paleoindian, Archaic, Formative, Protohistoric, and Historic cultural periods, possibly beginning as early as 11,500 years before present (BP) or earlier. Recorded sites in the tract likely date from the Early Archaic (beginning ca. 7800 BP) through Historic periods, and also include evidence for Middle and Late Archaic, Anasazi, Fremont, Numic (or Southern Paiute) activities and occupations.

3.4.2.2 ARCHAEOLOGICAL SITES IDENTIFIED IN THE TRACT

Details of the previously conducted cultural resource surveys in the tract, all of which have been inventoried as part of the development of the CRMP, are provided in Stavish (2008b). A total of 132 archaeological sites has been identified in the tract; Table 3.10 provides a list of these sites (from Stavish 2007; Zweifel 2007; Stavish 2008a).

Table 3.10. Recorded Archaeological Sites in the Tract

Site Number	Type	NRHP Eligibility	Land Status	Description
42KA1267	Multicomponent	Eligible	BLM	Numic lithic scatter and historic trash dump
42KA1313	Prehistoric	Eligible	BLM	Archaic, Anasazi Pueblo II, Numic temporary camp
42KA1314	Prehistoric	Eligible	BLM	Southern Paiute temporary camp, lithics, ground stone, ceramics
42KA2038	Prehistoric	Eligible	BLM	Southern Paiute
42KA2039	Prehistoric	Eligible	BLM	Late Archaic, Numic
42KA2040	Prehistoric	Eligible	Private	Southern Paiute lithic and pottery scatter
42KA2041	Prehistoric	Eligible	BLM, Coal Hollow	Anasazi, Southern Paiute
42KA2043	Prehistoric	Eligible	BLM, Coal Hollow	Numic lithic scatter
42KA2044	Prehistoric	Eligible	BLM, Coal Hollow	Archaic temporary camp
42KA2045	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA2047	Prehistoric	Eligible	BLM	Lithic scatter
42KA2048	Prehistoric	Eligible	BLM	Lithic scatter
42KA2049	Prehistoric	Eligible	BLM	Early Archaic lithic scatter
42KA2050	Multicomponent	Eligible	BLM	Archaic lithic scatter and historic herder camp
42KA2051	Prehistoric	Eligible	BLM, Private	Lithic scatter
42KA2052	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA2055	Prehistoric	Eligible	BLM	Archaic, Fremont, Southern Paiute
42KA2056	Prehistoric	Eligible	BLM	Fremont, Numic temporary camp
42KA2057	Prehistoric	Eligible	BLM	Anasazi, Southern Paiute
42KA2058	Multicomponent	Eligible	BLM	Late Archaic Lithic and Historic trash dump
42KA2059	Prehistoric	Eligible	BLM	Lithic scatter
42KA2065	Prehistoric	Eligible	BLM	Archaic, Anasazi, Fremont, Southern Paiute
42KA2066	Prehistoric	Eligible	BLM	Lithic scatter
42KA3097	Prehistoric	Eligible	Other fee coal, private	Archaic, Anasazi, Southern Paiute lithic scatter
42KA3115	Prehistoric	Eligible	Private	Temporary camp. Lithic scatter
42KA3168	Prehistoric	Eligible	BLM	Anasazi artifact scatter
42KA3169	Prehistoric	Eligible	BLM	Anasazi, Paiute, Lithic and ceramic scatter with hearths
42KA3170	Prehistoric	Eligible	BLM	Anasazi lithic scatter
42KA3171	Prehistoric	Eligible	BLM	Anasazi temporary camp. Lithic scatter
42KA3172	Prehistoric	Eligible	BLM, Coal Hollow	Southern Paiute temporary camp. Lithic scatter, ceramics

Table 3.10. Recorded Archaeological Sites in the Tract

Site Number	Type	NRHP Eligibility	Land Status	Description
42KA3174	Prehistoric	Eligible	BLM	Temporary camp. Lithic scatter, ground stone
42KA3175	Prehistoric	Eligible	BLM	Southern Paiute temporary camp. Lithic scatter, ground stone
42KA6072	Prehistoric	Not Elig ble	Private	Lithic scatter
42KA6073	Prehistoric	Eligible	Private	Lithic scatter
42KA6074	Prehistoric	Eligible	Private	Lithic scatter
42KA6075	Prehistoric	Eligible	Private	Lithic scatter
42KA6076	Prehistoric	Eligible	Private	Lithic scatter
42KA6077	Prehistoric	Not Elig ble	Private	Lithic scatter
42KA6078	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6079	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6080	Prehistoric	Eligible	BLM, other fee coal	Archaic, Numic temporary camp
42KA6081	Prehistoric	Eligible	BLM, private	Lithic scatter
42KA6082	Historic	Not Elig ble	Private	Corral
42KA6083	Prehistoric	Eligible	BLM	Lithic scatter
42KA6084	Prehistoric	Eligible	BLM	Southern Paiute
42KA6085	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6086	Historic	Not Elig ble	BLM, private	Bridge
42KA6087	Prehistoric	Eligible	BLM	Lithic scatter
42KA6088	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6089	Prehistoric	Eligible	BLM	Temporary camp
42KA6090	Prehistoric	Eligible	BLM	Temporary camp
42KA6091	Prehistoric	Eligible	BLM	Early Archaic temporary camp
42KA6092	Prehistoric	Eligible	BLM	Lithic scatter
42KA6093	Prehistoric	Eligible	Private	Lithic scatter
42KA6094	Prehistoric	Eligible	BLM	Early Archaic lithic scatter
42KA6095	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6096	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6097	Prehistoric	Eligible	BLM	Lithic scatter
42KA6098	Prehistoric	Eligible	BLM	Temporary camp
42KA6099	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6100	Prehistoric	Not Elig ble	BLM	Archaic lithic scatter
42KA6101	Prehistoric	Eligible	BLM	Lithic scatter
42KA6102	Prehistoric	Eligible	BLM	Lithic scatter
42KA6103	Prehistoric	Eligible	BLM	Lithic scatter
42KA6104	Prehistoric	Eligible	Coal Hollow, private	Archaic lithic scatter
42KA6109	Prehistoric	Eligible	BLM, Coal Hollow	Lithic scatter

Table 3.10. Recorded Archaeological Sites in the Tract

Site Number	Type	NRHP Eligibility	Land Status	Description
42KA6110	Prehistoric	Eligible	BLM	Lithic scatter
42KA6111	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6112	Prehistoric	Eligible	BLM	Lithic scatter
42KA6113	Multicomponent	Eligible	BLM	Lithic scatter, Historic trash dump
42KA6114	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6115	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6116	Prehistoric	Eligible	BLM	Lithic scatter
42KA6117	Prehistoric	Eligible	BLM	Fremont lithic scatter
42KA6118	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6119	Prehistoric	Eligible	BLM	Lithic scatter
42KA6120	Prehistoric	Eligible	BLM	Lithic scatter
42KA6121	Prehistoric	Eligible	BLM	Lithic scatter
42KA6122	Prehistoric	Eligible	BLM	Lithic scatter
42KA6123	Prehistoric	Eligible	BLM	Lithic scatter
42KA6125	Prehistoric	Eligible	BLM	Lithic scatter
42KA6126	Prehistoric	Eligible	BLM, Coal Hollow	Anasazi, Southern Paiute temporary camp
42KA6127	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6128	Prehistoric	Eligible	BLM	Lithic scatter
42KA6129	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6130	Prehistoric	Eligible	BLM	Lithic scatter
42KA6131	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6132	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6133	Prehistoric	Eligible	BLM	Lithic scatter
42KA6134	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6135	Multicomponent	Eligible	BLM	Southern Paiute, Historic trash scatter
42KA6136	Prehistoric	Eligible	BLM	Lithic scatter
42KA6137	Prehistoric	Eligible	BLM	Lithic scatter
42KA6138	Prehistoric	Eligible	BLM	Late Archaic, Southern Paiute
42KA6139	Prehistoric	Eligible	BLM	Temporary camp
42KA6307	Prehistoric	Eligible	Private	Lithic scatter
42KA6351	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6352	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6353	Prehistoric	Eligible	BLM	Lithic scatter
42KA6354	Prehistoric	Not Elig ble	BLM	Lithic scatter
42KA6357	Prehistoric	Eligible	BLM	Archaic, Southern Paiute temporary camp
42KA6360	Prehistoric	Eligible	BLM	Archaic, Late Prehistoric lithic scatter
42KA6361	Prehistoric	Eligible	BLM	Archaic lithic scatter

Table 3.10. Recorded Archaeological Sites in the Tract

Site Number	Type	NRHP Eligibility	Land Status	Description
42KA6477	Prehistoric	Eligible	Private	Lithic scatter
42KA6478	Prehistoric	Not Elig ble	Private	Lithic scatter
42KA6479	Prehistoric	Eligible	Private	Lithic scatter
42KA6480	Prehistoric	Eligible	Private	Archaic lithic scatter
42KA6481	Prehistoric	Eligible	Private	Lithic scatter
42KA6482	Prehistoric	Eligible	Private	Lithic scatter
42KA6483	Historic	Not Elig ble	Private	Camp
42KA6484	Historic	Not Elig ble	Private	Dugout and corral and trash scatter
42KA6485	Prehistoric	Eligible	Private	Anasazi artifact scatter
42KA6486	Prehistoric	Eligible	Private	Anasazi, Fremont
42KA6487	Historic	Not Elig ble	Private	Trash scatter
42KA6488	Prehistoric	Eligible	Private	Lithic scatter
42KA6489	Historic	Not Elig ble	Private	Enclosure
42KA6490	Prehistoric	Eligible	Private	Lithic scatter
42KA6491	Prehistoric	Eligible	Private	Lithic scatter
42KA6492	Prehistoric	Eligible	Private	Anasazi artifact scatter
42KA6493	Prehistoric	Eligible	BLM, private	Anasazi, Protohistoric artifact scatter
42KA6494	Multicomponent	Eligible	Private	Middle Archaic, Anasazi, Protohistoric, Euro-American
42KA6495	Prehistoric	Eligible	Private	Virgin Anasazi Pueblo II rockshelter and artifact scatter
42KA6496	Prehistoric	Eligible	Private	Lithic scatter
42KA6497	Prehistoric	Eligible	Private	Archaic, protohistoric lithic scatter
42KA6498	Prehistoric	Eligible	Private	Lithic scatter
42KA6499	Multicomponent	Eligible	Private	Middle Archaic, Euro-American
42KA6500	Prehistoric	Eligible	Private	Anasazi artifact scatter
42KA6501	Prehistoric	Eligible	Private	Lithic scatter
42KA6502	Prehistoric	Eligible	Private	Lithic scatter
42KA6503	Prehistoric	Not Elig ble	Private	Lithic scatter
42KA6504	Prehistoric	Not Elig ble	Private	Lithic scatter
42KA6505	Prehistoric	Eligible	Coal Hollow, private	Late Archaic, Anasazi artifact scatter

Most archaeological sites (95%) identified in the tract are prehistoric, or contain prehistoric components and consist of lithic scatters from stone tool production, use, and maintenance. Table 3.11 provides a summary of the general cultural association of these sites (historic, prehistoric, or both, i.e., multicomponent) and their NRHP-eligibility assessment. Most recorded sites (81%) are eligible for the NRHP and are considered significant resources in terms of their potential to yield important historic or prehistoric information.

Table 3.11. Summary of Archaeological Site Types in the Tract

Cultural Association	Eligible	Not Eligible	Total
Historic	0	6	6
Multicomponent	7	0	7
Prehistoric	100	19	119
Total	**107**	**25**	**132**

Many of the recorded prehistoric and multicomponent sites contain components that can be associated with individual cultural periods or phases. Table 3.12 presents the numbers of such cultural components (i.e., occupations that date to an individual period or phase) that have been identified at sites recorded in the tract; because more than one component can be present at a site, the total number of components listed here is greater than the total number of sites in Tables 3.10 and 3.11 above.

Table 3.12. Identified Prehistoric Components at Archaeological Sites Recorded in the Tract

	Archaic	Anasazi	Fremont	Numic	Unknown	Total
Eligible	30	18	5	26	53	132
Not elig ble	1	0	0	0	18	19
Total	**31**	**18**	**5**	**26**	**71**	**151**

3.4.2.3 CULTURAL RESOURCES ALONG THE COAL HAUL TRANSPORTATION ROUTE

In addition to impacts to archaeological sites in the tract, impacts to cultural resources along the coal haul transportation route under the Proposed Action (see Map 2.4) must also be analyzed. Such resources include the Panguitch Historic District, which is listed on the NRHP, and the Utah Heritage Highway 89/Mormon Pioneer Heritage Area.

The Panguitch Historic District is roughly bordered by 500 North, 400 East, 500 South, and 300 West. The portion of the coal haul transportation route through Panguitch that follows Center Street from 400 East to Main Street and then follows Main Street to 500 North would be in the historic district (Map 3.6). The district is significant for its association with the early settlement of Panguitch, originally an isolated pioneer outpost, and with the subsequent economic development of the area, which has focused on ranching and tourism (NPS 2006). It is also significant for its intact concentration of historic buildings, many of which are made from a characteristic, locally manufactured red brick.

The Utah Heritage Highway 89 and Mormon Pioneer Heritage Area were established by the National Heritage Areas Act of 2006 (S. 203 [109th] 2006). The portion of this area through which the coal haul transportation route would pass would consist of the town of Alton, the roads that connect Alton to US-89, and the US-89 corridor to its junction with SR-20, including the communities of Hatch and Panguitch. The heritage area was established in recognition of the role that Mormon settlement played in the Euro-American colonization of the west and, among other things, in opening up "vast amounts of natural resources, including coal, uranium, silver, gold, and copper" (S. 203 [109th] 2006). As a legislatively established heritage area, the board of directors of the Utah Heritage Highway 89 Alliance is authorized to receive federal funds for purposes such as conserving, interpreting, and developing the historical, cultural, natural, and recreational resources in the heritage area, and expanding, fostering, and developing heritage businesses and products relating to the cultural heritage of the heritage area.

3.4.3 Native American Consultation

Initial consultation regarding the tract has taken place with the Kaibab Paiute, Southern Paiute, Hopi, Ute, Zuni, and Navajo tribes (Personal Communication, Zweifel 2008). Cultural and religious concerns could arise among the tribes should archaeological resources be identified in the tract. If resources are identified, consultation with tribes would occur. The tribes would review the CRMP as part of the consultation process. Based on their review of the CRMP, additional input to the structure and process of the CRMP may result. Other considerations such as possible effects to TCPs would also be incorporated into the CRMP, as necessary. TCPs can include, but are not limited to, natural landscape features, natural resource harvesting and processing areas, trails, and archaeological sites.

3.5 Fire Management

The *Southern Utah Support Area Fire Management Plan* acts as the primary strategic document for fire management on and adjacent to the Alton Coal Tract. The overlying goal of the fire management plan is to describe specific actions authorized on the public lands to protect life and ensure public safety, to target resource goals and objectives, to reduce fuel loads, and to achieve and maintain healthy, functioning ecosystems (BLM 2005a). Protection of human life, including the lives of firefighters committed to an incident, is the mandated priority for all fire management activities.

In the fire management plan, land management areas are established. These areas are called fire management units (FMUs) and are defined by objectives, topographic features, access, protected values, political boundaries, fuel types, or major fire regimes. These units have dominant management objectives and have preselected fire management strategies assigned to accomplish these objectives. The tract is located entirely in the Glendale Bench FMU (Map 3.7). The Glendale Bench FMU encompasses 118,618 acres, 67,423 of which are under BLM management. Approximately 2,280 acres of the FMU on the tract is on public lands.

3.5.1 Area Overview and Fire History

The tract occurs in the semiarid foothills of the Colorado Plateau Semidesert Province (Woods et al. 2001). Precipitation in the FMU averages approximately 14–18 inches of water per year, as modeled by the Parameter-elevation Regressions on Independent Slopes Model (PRISM) from 1961 to1990 (2004b). Most of this precipitation is in the form of snow during the winter months. Summers are generally hot and dry with a mid- to late-summer monsoon period when frequent thunderstorms occur (2006).

The weather and fuel structure in the tract provide an opportunity for ignition from frequent summer storms. Lightning accounts for at least 78% of fire starts in the BLM-KFO area. Careless smoking, vehicle exhaust, escaped agricultural burning, and unattended campfires account for most human-caused fires in the Glendale Bench FMU. Sparking from vehicles or construction equipment is also responsible for starting some fires (2004b). Naturally occurring fires are widely distributed in terms of frequency and severity.

Sensitive resources in the FMU that could be affected by wildfire include greater sage-grouse lekking and brood-rearing habitat, deer and elk crucial summer ranges, the upper Kanab Creek watershed, and archeological resources. Unplanned wildfire may also affect communication sites, private residences, range improvements, special status species habitat, power lines, dispersed recreation opportunities, and ROWs (2005a).

3.5.2 Wildland Urban Interface

Wildland fires pose the greatest threat to community residents, property, and firefighters when they occur in, or spread into, the WUI. WUIs are commonly defined as geographic areas where human habitation and developments intermix with wildland or vegetative fire (2007a). The Southwest Utah Regional Wildfire Protection Plan (RWPP) does not consider the town of Alton as a state-identified community at risk of wildfire. However, the RWPP does identify WUI areas immediately west of Alton, along the length of US-89, as well as the Spencer Bench, Spencer Cliff Estates, and Stout Canyon area. The RWPP risk assessment identifies a high wildfire risk in these areas (FCAOG 2007b), which include portions of the coal haul transportation route.

3.5.3 Fire Management Objectives and Planning Efforts

3.5.3.1 FIRE REGIME CONDITION CLASS

FRCC is an interagency, standardized tool for determining the degree of departure of an area or landscape from its historic to its present conditions (i.e., fire frequency in the area), including the effects of fire suppression and invasive species invasion. Assessing FRCC can help guide management objectives and set priorities for treatments. FRCC was assigned to classify vegetation on public lands in the state through review of cover types identified by Utah GAP Analysis (Edwards et al. 1995) and elevation ranges (2008b). FRCCs are defined as follows:

- **FRCC 1:** Fire regimes are within a historical range and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within a historical range. Where appropriate, these areas can be maintained within the historical fire regime by treatments such as fire use.
- **FRCC 2:** Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components (soil, vegetation structure, species composition, alteration of nutrient cycles, hydrologic regimes) is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased), which results in moderate changes to one or more of the following: fire size, intensity, and severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range. Where appropriate, these areas may need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire regime.
- **FRCC 3:** Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. This results in dramatic changes to one or more of the following: fire size, intensity, and severity, and landscape patterns. Vegetation attributes have been significantly altered from their historical range. Where appropriate, these areas may need high levels of restoration treatments, such as hand or mechanical treatments, before fire can be used to restore the historical fire regime.

The dominant vegetation communities in the tract area are pinyon-juniper woodland, sagebrush/grassland, and treated sagebrush/grassland (Table 3.13). Annual and perennial grasses (pastureland), mountain brush, meadow wetlands, riparian, and rabbitbrush vegetation communities are also found in the tract. Acreages of vegetation and FRCC are presented in Table 3.13 and in Map 3.8.

Table 3.13. Acreages of Vegetation and Fire Regime Conditions Class in the Fire Management Unit/Tract

Vegetation Community	Acreage	Percentage of the Tract*	FRCC
Pinyon-juniper woodland	1,430.0	40.2%	3
Sagebrush/grassland	860.2	24.1%	3
Sagebrush/grassland (treated)	749.1	20.9%	3
Annual and perennial grasses (pastureland)	324.1	9.1%	3
Mountain brush	62.8	1.8%	3
Meadow	62.8	1.8%%	3
Riparian	55.3	1.5%	3
Rabbitbrush	10.7	0.3%	3
Total	**3,555.0**	**99.4%**	

*Unvegetated areas consist of 4.1 acres of open water and 17.4 acres of roads, or approximately 0.6% of the 3,576.6-acre tract.

3.5.3.2 DESIRED WILDLAND FIRE CONDITION

Desired wildland fire condition (hereafter referred to as the desired condition) is the description of the desired condition of a vegetative community as it relates to its susceptibility from severe fire effects (e.g., the loss of key ecosystem components such as soil, vegetation structure, species; or the alteration of key ecosystem processes such as nutrient cycles and hydrologic regimes).

The general desired condition is to have ecosystems that are at a low risk of losing ecosystem components following a wildland fire and that function within their historical range. A healthy ecosystem at low risk of losing key ecosystem components following a wildland fire would be considered at optimum desired condition.

In terms of desired condition outside the WUI, the trend is to move to a lower FRCC using the least intrusive method possible. In other words, the desired condition would involve moving lands in FRCC 3 to FRCC 2 and lands in FRCC 2 to FRCC 1. When feasible, this would occur through fire and nonfire treatments where wildland fire use is the preferred method of treatment. Inside the WUI, the general desired condition is less potential for values to be threatened by wildland fire, usually through modification of fuels. Therefore, because all of the lands in the tract fall in FRCC 3, the trend would be to move them to FRCC 2.

Fire management actions authorized for wildland fire activities, prescribed fire and nonfire fuel treatments, and emergency stabilization and restoration are based on desired condition. The Utah land-use plan amendment for fire and fuels management addresses specific fire management objectives for each major vegetation community, and is designed to progress toward desired condition of public lands.

3.5.3.3 PLANNED FIRE MANAGEMENT PROJECTS ON AND ADJACENT TO THE TRACT

The Glendale Bench FMU, which contains the tract in its entirety, has a resource objective emphasis. Fire management actions would include full fire suppression in some target vegetation communities, nonfire fuel treatments, and prescribed fire. Using acreage limitations prescribed by the FMU, appropriate management response is used to accomplish vegetation conversion using natural fire ignitions. The prescribed appropriate management response for the Glendale Bench FMU includes achieving the objectives in pinyon-juniper woodland, and sagebrush/grassland areas described below.

In the Glendale Bench FMU, large acreages of pinyon-juniper woodland and sagebrush/grassland are targeted for improvements using fire management. However, the FMU also contains areas where suppression is critical to protect communities, private property, and sensitive natural resources. Treatments would convert pinyon-juniper woodland to sagebrush/grassland communities. Sagebrush treatment would create a diversity of age classes in the sagebrush vegetation community. Resource objectives would be met by improving habitat for deer, sage-grouse, and other species, including special status species. Planned treatment acres in this FMU are as follows:

- Pinyon-juniper: Convert 15,000 acres to sagebrush grassland over the course of 10 years (plan released in 2004) using natural fire, prescribed fire, and mechanical treatment.
- Juniper: Convert 5,000 acres to sagebrush grassland over the course of 10 years (plan released in 2004) using natural fire, prescribed fire, and mechanical treatment.
- Sagebrush: Using mechanical methods, create a mosaic of age classes in the sagebrush and sagebrush perennial grassland vegetation communities on approximately 2,000 acres over the course of 10 years (plan released in 2004).

Fire management strategies in the area would use full fire suppression to protect human communities and private property in the FMU. When possible, fire suppression strategies would be developed in accordance with sage-grouse habitat guidelines so that less than 20% of sage-grouse habitat is disturbed in a single year. Ponderosa pine (*Pinus ponderosa*) vigor and reproduction would be improved by reducing competition by pinyon and juniper trees by using prescribed fire, nonfire fuels treatments, or both.

3.6 Geology and Minerals

3.6.1 Regional Overview and Assessment Area

The Alton Coal Tract is part of the Alton Coal Field, which is located between the Kaiparowits Coal Field to the east and the Kolob Coal Field to the west. The tract is located east of Long Valley and southwest of the Paunsaugunt Plateau. The geology, geologic history, stratigraphy, and structure of the tract have been described by Doelling and Graham (1972a) and Tilton (2001) and are summarized in this section, along with geologic hazards, mineral resources potentially present in or near the tract, and underground coal fires.

3.6.2 Local Geology

3.6.2.1 TOPOGRAPHY AND PHYSIOGRAPHY

The tract is characterized by bench and slope topography. Topographic relief in the region is approximately 3,000 feet, with elevations ranging from approximately 9,300 feet on top of the Paunsaugunt Plateau to approximately 6,500 feet in the Kanab Creek valley bottoms.

The tract is located southwest of the Paunsaugunt Plateau in the Alton Amphitheater, which is typified by broad, gently rolling hills and valleys and landforms with isolated bedrock outcrops. The western portion of the tract is transected by Kanab Creek, which runs north to south. The tract also includes the Robinson Creek drainage, which runs east to west.

In 1983 OSM reported that there are potential AVFs located in the Alton Coal Field. Further, a reconnaissance-level survey was conducted on the tract in spring 2008 and confirms the presence of potential AVFs in portions of the tract (Petersen Hydrologic 2008). See Section 3.16 for more information regarding AVFs.

3.6.2.2 STRATIGRAPHY

The geologic stratigraphy of the region in and near the tract consists of Jurassic, Cretaceous, and Quaternary age deposits of (from oldest to most recent) Navajo Sandstone, Carmel Formation, Dakota Formation, Tropic Shale, Straight Cliffs Formation, Wahweap and Kaiparowits formations, Claron Formation, and Quaternary deposits (see Figure 3.3 for a stratigraphic cross section of the area). The stratigraphy in and immediately adjacent to the tract includes the Dakota Formation, the Tropic Shale, the Straight Cliffs Formation, and various Quaternary deposits. In the Dakota Formation, two regionally important coal zones are present. These include the Smirl Coal Zone, which is located near the upper formational contact with the Tropic Shale, and the Bald Knoll Coal Zone, which is located approximately 200 feet below the Smirl Coal Zone near the base of the Dakota Formation (see Figure 3.3). The Bald Knoll Coal Zone is not of interest in this analysis because it would not be mined and, therefore, it is not further discussed.

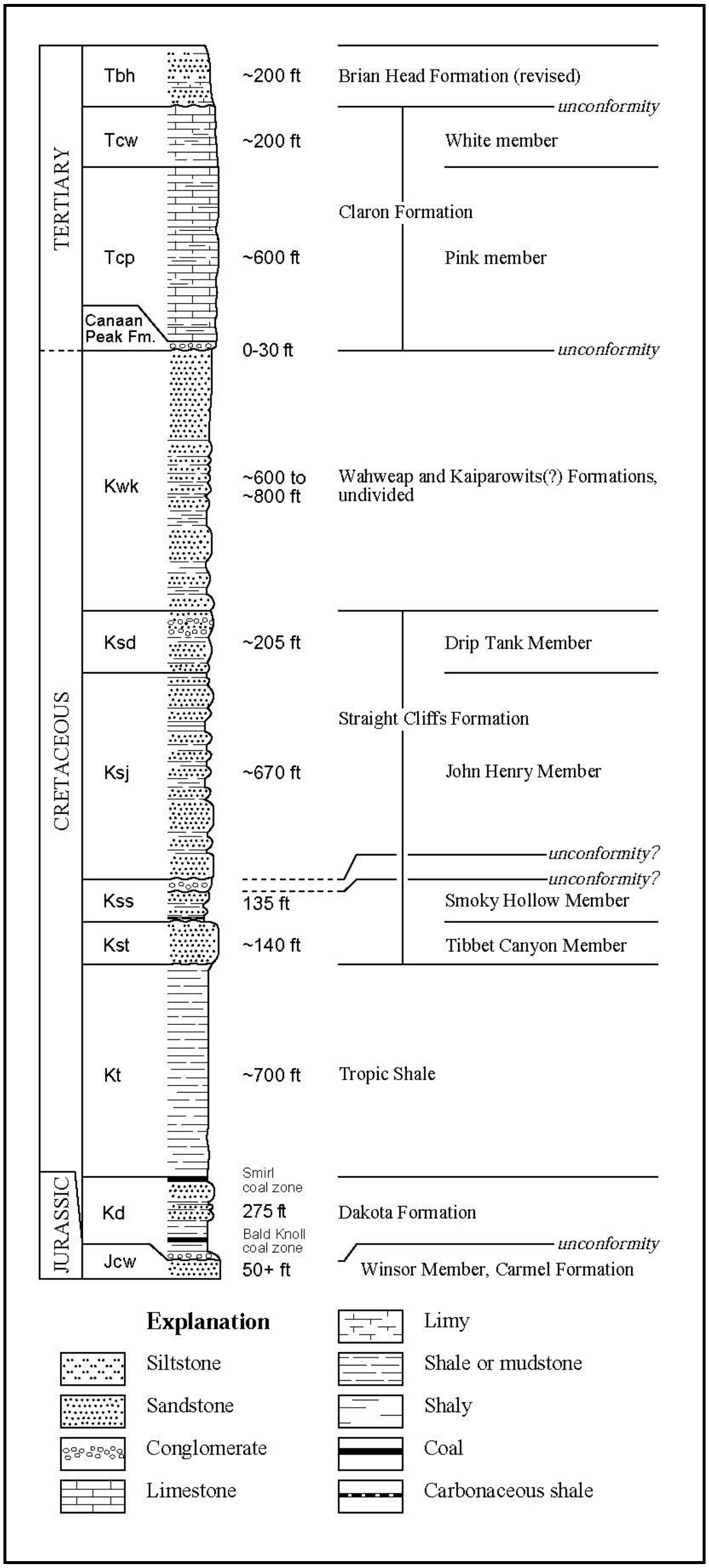

Figure 3.3a. Stratigraphic cross section of the stratigraphy in western Kane County (Part 1 of 2) (Tilton 2001)

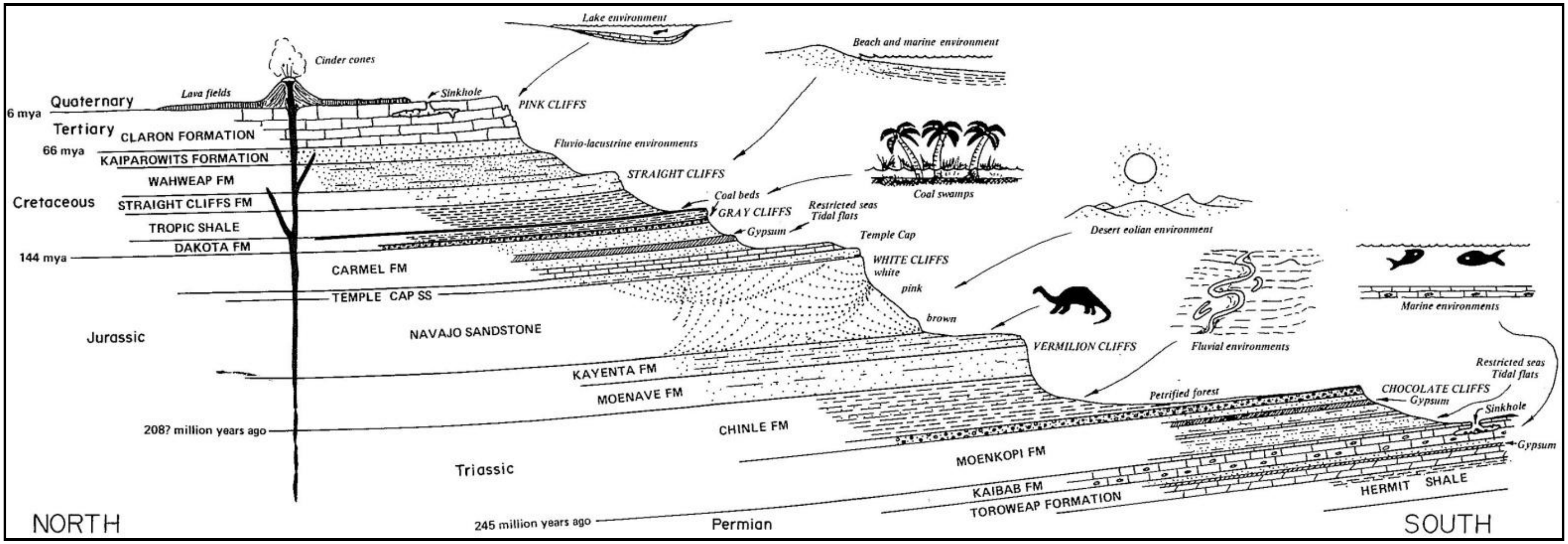

Figure 3.3b. Stratigraphic cross section of the stratigraphy in western Kane County (Part 2 of 2). (Doelling et al. 1989)

The degree of exposure of these formations depends primarily on the amount of weathering and erosion that has resulted in changes to the physical geology of the area over geologic time. The results of these geologic processes for the area are shown in Map 3.9. The Dakota Formation and Tropic Shale dominate the geology of the tract.

In areas where it has not been weathered or eroded, the Dakota Formation has a maximum thickness of approximately 275 feet. The Dakota Formation consists of alternating mudstone and sandstone layers with associated coal, bentonite, and conglomerate. The physical character and makeup of the Dakota Formation suggests marine and nonmarine depositions, including shallow subtidal, shoreface, distal coastal plain, and stream channel components. The Dakota Formation is a poor source of producible water because of its intricate interlayering, lensing, and interfingering of permeable and impermeable beds.

In areas where it has not been weathered or eroded, the Tropic Shale marine unit has a maximum thickness of approximately 700 feet. Marine fauna are locally visible, including ammonites and oysters. See Section 3.10 for more information on fossil resources in the area. In the tract, the Tropic Shale has mostly weathered and eroded to where the thickness ranges from zero to tens of feet. The Tropic Shale consists predominantly of gray and carbonaceous silty shale and claystone with a few marine sandstone beds located mostly in its upper layer. The Tropic Shale typically weathers at the surface to a clayey soil that forms gentle slopes. The Tropic Shale acts as an impermeable layer that does not yield significant water or transmit significant water to the Dakota Formation (ACD 2008). Springs form in areas where the sandstone of the Straight Cliffs Formation or pediment gravel overlay the Tropic Shale (1987).

The Straight Cliffs Formation has four members. Immediately adjacent and north-northeast of the tract, these members have eroded. The Straight Cliffs Formation has been downdropped on the east side of the Bald Knoll Fault, creating the steep hillsides that border the east and northeast tract boundaries. The members consist primarily of sandstone and mudstone—with sandstone composing approximately 75% of the total composition—and erode to form cliffs and steep slopes above the Tropic Shale.

There are many delineated units of the Quaternary system. The units that are exposed in the tract consist of alluvium and landslide deposits. Alluvium fills the Kanab Creek, Robinson Creek, and other minor drainages. The alluvium, therefore, transects the entire north to south tract boundaries and expands to varying widths from the east to west tract boundaries. The alluvium ranges from 0 to 50 feet thick, but is up to 140 feet thick along the eastern margins of Sink Valley outside the tract (DOI 1980a).

The landslide unit is located along the northeastern perimeter of the tract. It is characterized by unconsolidated knolls with deposits of mud and sand, and large blocks of sandstone. This unit is formed primarily from gravity-transported slide debris of the Straight Cliffs Formation and is less than or equal to 100 feet thick. AVFs are discussed in the water resources section.

The pediment gravel deposits are typically located on gentle hills formed on the Tropic Shale. The gravels are poorly sorted and composed of cobbles and pebbles from the Canaan Peak and Claron formations.

3.6.3 Geologic Hazards

3.6.3.1 FAULTS

There are two major fault zones near the tract: the Sevier fault zone located 1–2 miles west of the tract and the Paunsaugunt fault zone located approximately 15 miles east of the tract. Both of these fault zones generally trend to the northeast and are considered normal faults with the downdropped block on the west.

Displacements along the Sevier fault zone are approximately 1,000–2,000 feet, and along the Paunsaugunt fault zone, displacements are 100–800 feet (Doelling et al. 1989).

Three smaller, generally north–south trending local faults occur between the Sevier and Paunsaugunt fault zones: Sink Valley Fault, Bald Knoll Fault, and Sand Pass Fault. The Sink Valley Fault runs parallel and along the southeastern boundary of the tract with displacements on the order of tens of feet. The Bald Knoll Fault is located 1.5–2.0 miles east of the tract, and the Sand Pass Fault is located 2.0–3.0 miles west of the tract, each with less than 650 feet of displacement.

Seismic activity reports from two University of Utah seismograph stations in the region (Kanab and East Kanab) show that the region has not experienced significant, recent seismic activity. In the last few years there have been clusters of earthquake activity with magnitudes up to approximately 3.6 on the Richter Scale (Arabasz et al. 2006; University of Utah 2008).

The region surrounding the tract is located on the edge of the intermountain seismic belt (Personal Communication, Pechmann 2008). According to the USGS National Seismic Hazard Maps (USGS 2008), the region has a 2% probability of exceeding a peak horizontal acceleration of between 20% and 30% due to gravity. This is not a negligible or a high level of seismic hazard compared to other areas in Utah (such as the Wasatch Front), but it is above the 10% of gravity that is often assumed to be the threshold for damage to weak construction, such as unreinforced masonry buildings (Personal Communication, Pechmann 2008). The coal mining process often induces seismic events due to subsidence and forces due to the removal of coal and overburden. However, the National Seismic Hazard Maps do not include mining-induced seismicity in their hazard ratings.

3.6.3.2 ACID-FORMING AND TOXIC-FORMING MATERIALS

Typical acid-forming materials in western coal mine environments consist of inorganic sulfide minerals, including pyrite and marcasite. Exposure to air and water may oxidize sulfur-bound compounds, causing the release of hydrogen (H+) ions in water, thus decreasing pH (creating acidic conditions). UII and ACD conducted geochemical analysis in the area in 1987 (1987) and 2007–2008 (2008), respectively. The results from both surveys indicate that the acidic-forming potential is low for the tract because 1) the concentration of sulfur species is low, 2) the concentration of naturally neutralizing calcium carbonate is high, and 3) most of the sulfur species present are organic based, and therefore do not typically contribute to forming acidic conditions. USGS reports low levels of Mercury, Thorium, and Uranium within Alton coals, but reports these levels to be of low concern.

Selenium was not detected in any of the samples from the adjacent Coal Hollow Mine permit area, and concentrations of water-extractable boron were low (i.e., less than 3 mg/kg in all samples analyzed). Based on the geochemical analyses referenced above, acid-forming and toxic-forming materials that could result in the contamination of surface-water or groundwater supplies in the tract are generally not present (Petersen Hydrologic 2007).

Acid-forming and toxic-forming materials are not expected to represent a geologic or mineral hazard under the Proposed Action and will not be carried forward for detailed analysis in Chapter 4.

3.6.3.3 RADON

Radiation, as found in radon gas, comes from the natural (radioactive) breakdown of uranium in soil, rock, and water. ACD (2008) conducted a radon survey and showed no hazardous concentrations of radon in the adjacent Coal Hollow Mine permit area. Furthermore, Doelling et. al. (1989: Plate 5) showed that the tract area did not have areas of “above background radiation” or uranium deposits.

The drill hole analysis completed by Applied Geotechnical Engineering Consultants (2007) for the adjacent Coal Hollow Mine indicates that there is no significant radon gas is present in the Smirl Coal Zone in that location (Applied Geotechnical Engineering Consultants Inc 2007). Assuming that the Smirl Coal Zone within the Alton Coal Tract is similar to this zone within the Coal Hollow Mine area, no geologic hazard from radon is anticipated to occur under the Proposed Action because no unusual concentrations would be intercepted or released by mining activities on the tract. In addition, the surface mine would be naturally ventilated ("open air") during the mining process and any underground mining would also be ventilated according to DOGM and MSHA regulations and procedures. Therefore, Radon will not be carried forward for detailed analysis in Chapter 4.

3.6.3.4 LANDSLIDE

Quaternary landslide deposits composed of mud, sand, and blocks of sandstone are present in and adjacent to the tract (see Map 3.9). One area of landslide deposits is present east of the tract below the Straight Cliffs Formation. The thickness of the landslide deposits locally ranges from a few feet to more than 100 feet. The landslide deposits generally sustain more plant growth (usually oaks) than the surrounding undisturbed land because of the deposits ability to hold water (Tilton 2001).

3.6.4 Mineral Resources

3.6.4.1 LEASABLE MINERALS

3.6.4.1.1 Coal

The tract is located in the Alton Coal Field. The tract contains approximately 46 million tons of recoverable coal in the Dakota Formation. The coal that would be mined is present as a single coal seam approximately 15 feet thick, referred to as the Smirl Coal Zone. Overburden above the Smirl Coal Zone ranges from 20 to 300 feet thick with an average thickness of 100 feet. It is composed primarily of Tropic Shale and Quaternary deposits (both described above).

The average quality of the coal in the Smirl Coal Zone is summarized in Table 3.14. The inherent moisture content of the coal is approximately 13%. Higher percentages of moisture lower the heating efficiency of coal. Ash content of coal is the noncombustible residue left after coal is burnt. The percentage of ash in the original weight for coal in the tract is approximately 10%. The fixed carbon percentage for the coal is approximately 50%, which is nonvolatile carbon minus ash. The volatile matter in coal refers to the components of coal, other than moisture, that are liberated at high temperatures in the absence of air. The fixed carbon content of the coal is the carbon found in the material that is left after volatile materials are driven off. These compounds include long-chain and aromatic hydrocarbons. The percentage of volatile matter of this coal is approximately 39%. The sulfur content of the coal is approximately 1.13%, which is lower than the average of 2%–3% for this type of coal (high-volatile subbituminous B). The lower the sulfur content is in coal, the less sulfur is emitted into the air during the burning of coal, and hence, the less sulfuric acid is formed. The coal in the Smirl Coal Zone has a heat content approximately 20 million British thermal units (BTU) per ton (10,019 BTUs per pound).

Table 3.14. Average Quality of the Coal in the Smirl Coal Zone

Thickness (feet)	Moisture (%)	Ash (%)	Fixed Carbon (%)	Volatile Matter (%)	Sulfur (%)	BTU/ton
15.3	13	10	50	39	1.13	~ 20 million (10,019 BTUs/pound)

Source: ACD 2004.

3.6.4.1.2 Oil and Gas

There is an oil and gas lease (UTU-079271) that includes the northeast area of the tract and extends to the area north and east of the tract (east of the Sink Valley Fault where the Straight Cliff Formation is exposed; see Map 3.9). In general, the BLM classifies this area as high potential for oil and gas development (2008b), and there are a handful of existing leases near the tract. Given the coal deposits (both the Smirl Coal Zone and the Bald Knoll Coal Zone) in the area, there is also a potential for the occurrence of coalbed CH_4; though there are no existing proposals to develop this resource.

3.6.4.2 SALABLE MINERALS

3.6.4.2.1 Burnt Shale

The geological map for the tract shows three gravel resource sites in Sections 13, 24, and 31, Township 30 South, Range 6 West (see Map 3.9). The BLM-KFO reports that these are authorized community pits that are open to the public for purchase of burnt shale aggregate. Most of these pits have been in operation since the late 1970s and are nearly depleted. Other known burnt shale resources exist west of the tract. Recent interest in the development of these resources has been shown.

3.6.4.2.2 Gravel

As mentioned in the stratigraphy section above, there are pediment gravels in the tract. These gravel deposits are derived mostly from the erosion of the Claron and Canaan Peak formations and consist of quartzite pebbles and cobbles. These deposits are considered to be salable by the BLM.

3.6.4.3 LOCATABLE MINERALS

3.6.4.3.1 Septarian Nodules

Septarian nodules are geode-like concretions containing angular cavities or cracks, or septaria. The nodules are often valued by collectors, and occur in the Tropic Shale near the tract. The nodules in the region are thought to be of high (gem) quality, and are considered a locatable resource.

According to the *Kanab Field Office Final Analysis of the Management Situation* (AMS) active mining for septarian nodules is occurring on leases in the Mount Carmel area southwest of the tract. Development potential is rated moderate in areas where Tropic Shale is present, as in the Alton tract (BLM 2005b). However, as no surveys or studies have been done on the tract for septarian nodules it is unknown how common these nodules are in the tract, or if they are present in sufficient density to be economically viable for development.

3.6.5 Underground Coal Fires

According to (Stracher 2007) spontaneous combustion is the most significant cause of fires in coal mines. An increase in the temperature of coal occurs when the coal is exposed to air. A reaction occurs between the coal and the air in a solid-gas process that involves the reaction of oxygen. Provided there is an adequate supply of oxygen, a process called *runaway ignition* can occur. Runaway ignition is when the heat raises the temperature of the coal, which changes the rate of oxidation. If unchecked, this process can grow exponentially and subsequently initiate a fire. If the generated heat is quickly dissipated, the risk of spontaneous combustion decreases.

Coals of lower BTU rank are more susceptible to spontaneous combustion than coals of higher rank. The coal in the Alton Coal Tract has an average of 10,019 BTUs per pound, which is lower than other coal fields in Utah (Jahanbani 1998). Even higher rank, eastern coals have ignited either by spontaneous combustion or other sources once exposed to atmospheric oxygen.

Coal ignitions due to spontaneous combustion in surface mines or surface coal stockpiles do occur but are readily accessible and manageable. Mine operators have financial and environmental incentives to quickly and effectively control any ignitions that may occur in surface mines or surface coal stockpiles. However, underground fires near surface coal mines have proven to be troublesome because the fires generally cannot be controlled or extinguished. This is a particular problem in the eastern United States where higher population density means towns and structures can be, and have been, directly affected because the towns are directly above the coal seams.

Underground coal fires can also be attributed to mine-related activities such as cutting and welding, electric work, use of explosives, smoking, or any activity that could provide ignition. Other activities that do not provide a spark but can increase the risk for spontaneous combustion include the movement of heavy machinery and vehicles that have the potential to create fractures in the coal seam, which leads to increased oxygen circulation. In addition, fires can be caused after abandonment of the mine when humans provide ignition of the coal through other means.

A historical review of the coal history prepared by Doelling and Graham (1972b) and site visits have not shown any indication of past coal mine fires near the tract. Also, past mining of the Smirl Coal Zone in the tract and surrounding areas has occurred at very shallow depths, with more exposure of the coal to atmospheric oxygen.

3.7 Hazardous Materials and Hazardous and Solid Waste

3.7.1 Existing Sources of Hazardous Materials and Hazardous and Solid Waste On and Adjacent to the Tract

Hazardous materials are defined as any material that may pose a hazard to human health or the environment, because of its quantity, concentration, or physical or chemical characteristics. Hazardous materials include flammable or combustible material, toxic material, corrosive material, oxidizers, aerosols, and compressed gases. Solid waste includes garbage; construction debris; commercial refuse; sludge from water supply or waste treatment plants, or air pollution control facilities; and other discarded materials. Hazardous materials discussed in this section include hazardous chemicals, hazardous substances, and hazardous wastes, and are defined below according to the EPA (2010).

- Hazardous chemical: An EPA designation for any hazardous material requiring a Material Safety Data Sheet (MSDS) under OSHA's Hazard Communication Standard. Such substances are capable of producing fires and explosions or adverse health effects like cancer and dermatitis.
- Hazardous substance: Any material that poses a threat to human health and/or the environment. Any substance designated by EPA to be reported if a designated quantity of the substance is spilled in the waters of the United States or is otherwise released into the environment. Typical hazardous substances are toxic, corrosive, ignitable, explosive, or chemically reactive.
- Hazardous waste: By-products of society that can pose a substantial or potential hazard to human health or the environment when improperly managed. Possesses at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity), or appears on special EPA lists.

Coal mining and subsequent transportation activities would necessitate the presence of hazardous materials at the Alton Coal Tract. Primarily, these materials would include fuels, lubricants, and solvents. See Section 2.3.2.7 for a list of hazardous materials anticipated for the tract. Potential sources of hazardous or solid waste on the tract would include hazardous substances, petroleum products, and/or solid waste associated with coal mining and transportation activities. Currently there are no hazardous materials or solid wastes present on the tract.

3.8 Land Use and Access

3.8.1 Land Status and Ownership

Primary land uses within and adjacent to the Alton Coal Tract include tourism, farming, livestock grazing, and dispersed recreation, including hunting. See Sections 3.9 Livestock Grazing and 3.11 Recreation for details on these specific land uses. The *Kane County, Utah General Plan* describes the area as, “some of the most remote and rugged lands in the continental United States” (FCAOG 1998a). The plan has not allowed for significant development in the area. There are no commercial buildings, facilities, or private residences within the tract. However, the nearest residential community is the town of Alton, whose population is approximately 140 (Utah Department of Workforce Services [UDWS] 2010a). Alton is located immediately north of the northern tract boundary. There are no state lands within or immediately adjacent to the tract. The closest parcel of SITLA land is 1 mile northwest of the tract. Map 1.1 illustrates the location of the tract in relation to some of the private and federal land ownerships in the area.

Access to the tract is from US-89, approximately 2.9 miles west of the tract. This highway is the major thoroughfare for the area, serving as a route for tourist traffic to public lands, including Bryce Canyon National Park, Dixie National Forest, BLM-managed lands, and Grand Staircase-Escalante National Monument. For details regarding transportation along portions of US-89, refer to Section 3.14 Transportation and Appendix H.

3.8.1.1 PRIVATE LANDS AND EXISTING LAND USES ON AND ADJACENT TO THE TRACT

All coal reserves within the tract are federally owned, though surface ownership is mixed. Approximately 1,296 surface acres of the tract are in private ownership, including eight different private surface owners. Landowners have been notified of the tract and will be included throughout the EIS process. Private land uses in the tract and surrounding land include farming, livestock grazing, and dispersed recreation, including hunting. Land use specifically in Alton has traditionally been for homes, farming, and livestock grazing. There have not been any official classifications of land use or zoning ordinances to enforce the use of land; however, the land has been generally classified into four areas: residential, church, agriculture, and recreation (FCAOG 1981). Two-track roads also exist throughout the tract for recreational use and for private landowner access to private surface lands.

3.8.1.2 FEDERAL LANDS AND EXISTING LAND USES ON AND ADJACENT TO THE TRACT

The BLM-KFO consists of 2,847,200 acres, of which the BLM manages approximately 554,000 acres (approximately 20%). All coal reserves within the tract are federally owned. Approximately 2,280 surface acres of the tract are in federal (BLM) ownership, representing 0.4% of the total area managed by BLM-KFO. Dominant land uses in the tract include livestock grazing and recreation (primarily backcountry motorized travel and sightseeing, OHV use, and hunting).

3.8.2 Land-use Planning and Management

3.8.2.1 FEDERAL

Land-use planning for public lands in the area allocates the land to many uses, including mining, grazing, and recreation (BLM 2008b). No coal production has occurred in Kane or Garfield counties since 1971, and there are presently no coal leases in the boundaries of the BLM-KFO (BLM 2008b).

Dixie National Forest lands near the tract are managed for the following recreation activities: OHV touring, hunting, fishing, photography, picnicking, hiking, backpacking, camping, and viewing nature, wildlife, and geologic features. Currently the forest is being managed under the forest plan that was signed in 1986. Revisions to the forest plan are currently on hold.

As discussed in Chapter 1, some of the coal reserves in the tract are not currently considered recoverable because KFO Route 116 traverses the tract. Under SMCRA, the approval of surface-mining operations on lands within 100 feet of the outside line of the ROW for a public road requires a process resulting in a final decision by DOGM or the public road authority. In the event of a lease sale, Kane County and the BLM would temporarily relocate KFO Route 116 during the life of the mine. Once mining operations are complete, the temporary road location would be reclaimed, and the original route would be reconstructed according to requirements specified in R645-103-234–R645-103-234.400 for relocation of public roads.

3.8.2.2 LOCAL

The entire tract lies within the northwestern section of Kane County. Approximately 90% of Kane County lies in federal ownership (FCAOG 1998a). Historically, Kane County lands have been used for agriculture (predominantly farming and livestock grazing), and according to the *Kane County, Utah General Plan* (FCAOG 1998a), much of the land within and adjacent to the tract is currently zoned for agricultural use.

Garfield and Iron counties are adjacent to Kane County to the north and west, respectively. These counties include areas for tourism and recreation. It is anticipated that coal mined from the tract would be transported through these counties for delivery to market (see Section 2.5.4 Reasonably Foreseeable Coal Loadout Location and Transportation Route). Further, public travel is frequent through these counties, specifically to access federal lands near the tract (Bryce Canyon National Park, Dixie National Forest, BLM-administered lands, and Grand Staircase-Escalante National Monument). Both the Kane County and Garfield County general plans identify transportation infrastructure as an important investment due to their contribution to tourism travel in the area. The Garfield County plan indicates that the roads in the area are in fair condition partly due to insufficient funds to properly maintain and renovate them. For a detailed description of travel and transportation in the area please see Section 3.14 Transportation and Appendix H.

The town of Alton desires to remain a rural/agricultural area. To retain this, agricultural uses (i.e., animals, gardening, and farming) will be permitted on residential lots, with reasonable limitations provided. Future areas of growth will be planned to minimize impact on community resources and to be consistent with the best use of the land surrounding Alton (FCAOG 1981).

3.9 Livestock Grazing

3.9.1 Regional Overview

Grazing in the Alton Coal Tract is administered by the BLM in accordance with the *Standards for Rangeland Health and Guidelines for Grazing Management on BLM Lands in Utah* (BLM 1997). These standards and guidelines were instituted for all Utah rangelands and are based on ecological principles that underlie the sustainable production of rangeland resources. With regard to rangeland health, the following four conditions must be present on BLM-administered public lands:

- Watersheds are in, or making significant progress toward, properly functioning physical condition, including their upland, riparian–wetland, and aquatic components; soil and plant conditions support infiltration, soil moisture storage, and the release of water that are in balance with climate and landform and maintain or improve water quality, and timing and duration of flow.
- Ecological processes, including the hydrologic cycle nutrient cycle, and energy flow, are maintained, or there is significant progress toward their attainment, in order to support healthy biotic populations and communities.
- Water quality complies with State water quality standards and achieves, or is making significant progress toward achieving established BLM management objectives such as meeting wildlife needs.
- Habitats; are, or are making significant progress toward being, restored or maintained for federal threatened and endangered species, federal proposed, Category 1 and 2 federal candidate and other special status species. (BLM 2007)

Section 3 of the Taylor Grazing Act of 1934, as amended, authorizes livestock grazing on BLM-administered public lands.

3.9.2 Allotments on and Adjacent to the Tract

Seven grazing allotments encompass 2,143 acres of the tract (Table 3.15; Map 3.10); two occur completely within the tract and five occur partially within the tract. The Alton and Cove (Alton) allotments occur completely within the tract. The allotments that occur partially within the tract are the Isolated Tracts, Levanger Lakes, Robinson Creek, Syler Knoll, and Upper Sink Valley allotments. These allotments are used exclusively for cattle grazing; they are not used to graze horses or sheep (BLM 2008a).

Table 3.15. Grazing Allotment Acres and Animal Unit Months in the Alton Coal Tract

Allotment	Total Federal Acres	Acres Within the Tract*	Percentage of Allotment in the Tract†	Total AUMs Allocated to Livestock	Calculated AUMs in Tract‡
Alton	392	388.5	99%	5	5
Cove (Alton)	158	155.9	99%	10	10
Isolated Tracts	1,028	243.9	24%	65	15
Levanger Lakes	872	196.3	23%	33	7
Robinson Creek	524	208	40%	24	10
Syler Knoll	442	363.5	82%	6	5
Upper Sink Valley	4,806	586.7	12%	311	38
Total	**8,222**	**2,143**	**26%**	**454**	**118**

* Acres are approximations subject to up to 5 acres of error as a result of potential misalignment of datasets at different scales.
† Percentage of each allotment in the tract has been rounded to the nearest whole number.
‡ Calculated by multiplying the total AUMs allocated to livestock by the percentage of the allotment in the tract.

The carrying capacity of a livestock grazing allotment is defined in terms of AUMs. In general terms, an AUM is the amount of forage needed to sustain one cow and her calf for one month. In specific terms, an AUM is a standardized measurement of the amount of forage necessary to sustain one cow unit (or its equivalent) for one month (approximately 800 pounds of usable air-dried forage), or the amount of forage necessary to sustain one 1,000-pound animal for one month.

Table 3.15 shows the total acres and percentage for each allotment that occurs partially or completely within the tract. The table also includes the total AUMs that are allocated to livestock in each allotment, and the calculated number of AUMs within the tract. The number of AUMs in the tract was calculated by multiplying the total AUMs allocated to livestock within the allotment by the percentage of the allotment within the tract. Calculated AUMs in the tract may or may not be properly represented because the AUMs in these allotments are typically found in concentrated areas due to the pinyon-juniper invasion. As pinyon-junipers encroach into shrub-steppe vegetation communities and outcompete forbs, grasses, and shrubs for resources, fewer acres of high quality forage are available for livestock consumption within allotments. However, because the rate and extent of juniper encroachment across allotments over the life of the tract cannot be determined, it is conservatively assumed that AUMs (forage) are evenly distributed throughout the allotments.

3.10 Paleontology

The Alton Amphitheatre is located below the west rim of the Paunsaugunt Plateau, immediately east of the Sevier fault zone. In general, the geological column in this portion of the Colorado Plateau (Foster et al. 2001) is highly fossiliferous in the Upper Triassic (Chinle Formation), Lower and Middle Jurassic (Moenave, Kayenta, and Carmel formations), and Upper Cretaceous (Dakota, Tropic, Straight Cliffs, Wahweap, and Kaiparowits formations). The tract would be located primarily in the Tropic Shale (53.5%), Dakota Formation (20.3%) and Alluvium (21.2%); the remaining 5% would be located in landslide deposits or areas where no data are available. Uppermost Cretaceous and Paleogene units (Canaan Peak, Pine Hollow, Grand Castle and Claron formations) are only sparsely fossiliferous due to the high energy or highly destructive weathering conditions that pervaded for most of that time. The fossil record of these units, whether highly or sparsely fossiliferous, is highly significant, and several of the formations, including the Chinle, Moenave, Wahweap and Kaiparowits formations, are justifiably famous for their vertebrate fossil fauna. The geological column in the area records a succession of semiarid to arid terrestrial environments, with intertounging, shallow marine units in the early and middle Mesozoic, tropical, humid coastal plain conditions in the Late Cretaceous (Eaton 1991; Titus et al. 2005), and low elevation, intermontane basins during the latest Cretaceous and Paleogene. The fossil faunas and floras reflect this succession, and the tropical humid coastal plain deposits contain the highest fossil biomass. Recent work in the Kaiparowits Basin immediately to the east has demonstrated that the Alton Amphitheater contains one of the most complete Late Cretaceous (73–100 million years ago) terrestrial fossil records known in the world (Eaton et al. 1999). Surveys in the sparsely vegetated badlands of the central and southern Kaiparowits Plateau have uncovered the remains of dozens of new species of marine reptiles, dinosaurs, mammals, crocodylians, turtles, lizards, fish, and other taxa (Eaton et al. 1999; Nydam 1999; Gates 2004; Titus et al. 2005) making this resource world class. Paleontological resources in the Dakota and Tropic Shale formations are highly fossiliferous, consisting mainly of well known invertebrate fossils such as gastropods and cephalopods (Hamblin 2006). Located only 35 miles to the west, the greater Alton area holds potential for similar, significant Late Cretaceous fossil resources.

3.10.1 Paleontological Resources

The Alton Amphitheatre is underlain entirely by Late Cretaceous-age through Eocene-age sedimentary bedrock (Tilton 2001). In ascending order, these are the Dakota (target formation for coal mining), Tropic, Straight Cliffs, Wahweap, and Claron formations. A review of the Proposed Action in Chapter 2 shows that only the Dakota Sandstone and the Tropic Shale would be significantly impacted by the installation, operation, and maintenance of the mine. Both of these units have produced significant fossils in the immediate area near the town of Alton. The Dakota Formation yields an abundant and diverse lower and middle, Cenomanian terrestrial vertebrate fauna, of which only the mammals have been described (Eaton 1993, 1995). Many of the specimens reported in these papers were recovered from the Alton Amphitheatre or immediately nearby, and clearly support the resource potential of the Dakota Formation. Fish, turtles, crocodylians, squamates, and dinosaurs are also known to occur in the Dakota Formation. The Tropic Shale similarly yields a robust, highly significant vertebrate fauna (Gillette et al. 2001; Albright et al. 2002, 2007a, b). However, most of what is known about the formation has been gleaned from the Kaiparowits Plateau. Two partial plesiosaurs have been recovered near the town of Alton, one in the Ford Pasture area approximately 15 km southeast of Alton (A. Titus, unpublished data) and one in the Muddy Creek septarian mine approximately 20 km southwest of Alton (Gillette et al. 1999). A third isolated paddle bone, probably a humerus, was observed west of Trail Canyon (A. Titus, unpublished data); it was not collected. In addition to the marine fauna, the partial remains of an ornithischian dinosaur were collected from the Tropic Shale in the area of Muddy Creek, east and south of the tract.

Field inventories conducted in 2006 by the BLM found the Tropic Shale in the area around the southern margin of the tract to be highly fossiliferous (A. Titus, unpublished data). Unusual features were noted and consist of rare, articulated fish remains and the existence of limestone mounds that may represent cold CH_4 seeps active in the Cretaceous (sourced from the Smirl Coal Zone). Upper Cenomanian ammonites and other invertebrates of the *Euomphaloceras septemseriatum*, *Eumophaloceras costatum*, *Burroceras irregulare*, and *Neocardioceras juddi* ammonoid biozones are locally common and exceptionally well preserved in three dimensions inside of limestone concretions that weather out of the shale. The ammonoid taxa found in the Alton area are considered significant because three-dimensional, well preserved specimens are rarely found in stratigraphically younger, amminoid biozones of North America, such as the biozones present in the Alton area. In spite of the quality and abundance of fossil specimens that occur in the Tropic Shale in the Alton area, exposures of the formation are generally poor; soil and plant cover is extensive; and colluvium from the overlying Straight Cliffs and Grand Castle formations forms debris fans over much of the formation's areal extent. Therefore, the likelihood of discovering one of these limestone concretions before they have been damaged, altered or destroyed by natural processes is relatively low. Based on nearby areas where the Dakota Formation and the Tropic Shale are better exposed, the following resource occurrence patterns can be expected out of the Dakota Formation:

- The lower gravely member of the Dakota Formation is mostly barren of fossils except for reworked specimens of large, petrified conifer logs (probably sourced from the Morrison or Chinle formations) and Paleozoic invertebrate fossils in clasts derived from the Sevier Thrust Belt. These are not of any particular scientific significance and would not require mitigation, although local petrified wood collectors do value the wood as a hobby material.
- The middle member of the Dakota Formation contains common plant, invertebrate, and vertebrate fossils. The distribution of the vertebrate fossils, which are the most significant from a protection perspective, is random and uncommon in overbank pond mudstone and less random and more concentrated in the basal layers of sandstone channel deposits. Large sections of turtle shells, bivalve and gastropod concentrations, ganoid fish scales, and scattered crocodylian teeth and bones are the most obvious remains in such channel deposits. However, bulk sampling and careful study of the resulting concentrates show a much more diverse fauna that includes dinosaur, lizard, and mammalian remains.
- The upper member of the Dakota Formation is abundantly fossiliferous; however, the fauna is dominantly nearshore marine and aquatic in nature. The vertebrate fauna is dominated by isolated shark teeth and poorly preserved, boney fish remains. Plant fossils associated with the Smirl Coal Zone have been observed to be very well preserved in the Skutumpah Creek area, and potential for well preserved vertebrates and soft bodied invertebrates in the coal zone is high even though no Konservat-Lagerstatte-type preservation has been previously observed in the Alton area.

The Tropic Shale is not formally divided into members, but it can informally be divided into three zones (intervals) in the Alton area, a lower siderite dominated interval, a middle highly fossiliferous carbonate concretionary interval, and an upper, poorly fossiliferous concretionary interval. They are as follows:

- The lower interval is approximately 7–8 m thick and immediately overlies the Smirl Coal Zone. Although fossiliferous, this lower interval has not yielded anything but poorly preserved ammonites and bivalves of the *Vascoceras diartianum* Ammonoid Biozone. Large specimens of the heavily ribbed ammonite *Calycoceras naviculare* are not uncommon, but they are nearly all crushed.
- The middle interval is characterized by calcite concretions 0.3–0.5 m in diameter and contain an abundant and well preserved benthic and nektic fauna. Ammonites and other mollusks are the dominant fauna, but crustaceans, corals, annelids, shark teeth, bony fish remains, and marine reptile skeletons also occur. Ammonites of the *Euomphaloceras septemseriatum* biozone (next zone above that of *V. diartianum*) are widespread and well preserved over much of North America. Although this zone’s ammonites, including *Metoicoceras geslinianum*, *Sciponoceras gracile*, *Worthoceras vermiculum*, *Placenticeras cumminsi*, and *Eumophaloceras septemseriatum*, are common and very well preserved in the Alton area, they have no special scientific value outside of the local region. Hobby collectors do place great value on these fossils as objects of aesthetic beauty and wonder.

- The upper interval is characterized by three-dimensional ammonite fossils from the zones above the *E. septemseriatum* (middle) interval that are generally uncommon in North America, being well known from only a handful of places. Just south of the tract, on the east side of the Sink Valley, three-dimensional specimens of ammonites from the *Euomphaloceras costatum*, *Euomphaloceras* n. sp., *Burroceras irregulare*, and *Neocardioceras juddi* Ammonoid Biozones were collected in succession (Titus 2002). This is a very rare occurrence and is one of only three places in North America where this can be observed. It is thought that the presence of unusually high levels of coal-sourced CH_4 in the sediment during the fossilization process may have helped catalyze the excellent preservation of this succession (Titus 2002). Vertebrates are not particularly common in this interval. However, perfectly preserved three-dimensional fish fossils in this interval have been collected from the *Euomphaloceras costatum* zone in the Ford Pasture area of the BLM-KFO. The overlying Turonian sediments contain concretions, but these are generally poorly fossiliferous or contain poorly preserved fossils. To the east, this interval has the highest potential for marine reptiles. Unfortunately, there are not enough data to model their abundance in the Alton area even though their presence is certain given the finds at Muddy Creek and Ford Pasture. Higher levels in the Tropic Shale and Straight Cliffs Formation are fossiliferous but would not be impacted by activities outlined in the Proposed Action or alternatives and therefore are not reviewed.

Potential also exists for Late Pleistocene fossil resources in older alluvial and/or pluvial deposits; however, there are no good age constraints on alluvial fill in the Alton Sink and therefore no way to accurately assess potential. A similar setting near Skutumpah Creek, approximately 15 km to the southeast, yielded a partial proboscidean skeleton (cf. *Mammuthus columbi*) that was excavated by the Museum of Northern Arizona; therefore, it is likely that the floors on the alluvial fill are old enough to contain pre-Holocene vertebrate megafauna.

3.11 Recreation

Southwestern Utah offers a variety of recreation opportunities in varying terrain, including mountains, desert, forests, canyons, rivers, and lakes. Major recreation attractions are Bryce Canyon National Park, Dixie National Forest, and Grand Staircase-Escalante National Monument, and several scenic highways and backways. A number of developed and semideveloped campgrounds, day-use areas, back country roads, and trails exist for recreational use in the area. The analysis area for recreation (defined below) is managed by the BLM, NPS, USFS, UDWR, counties, and local municipalities.

The recreation resources analysis area for the Alton Coal Tract consists of the tract, linear features such as roads and OHV trails affected by mine-related activities, and all adjacent lands within a 5-mile radius of the tract (Map 3.11). A 5-mile radius (encompassing approximately 92,573 acres) was chosen on the assumption that recreational users affected by mining activities would move to lands that provide similar recreation opportunities that are immediately adjacent to the tract. Outside the 5-mile radius, additional recreation activities, areas, and opportunities were identified to describe the indirect and cumulative impacts of the alternatives. These areas were identified from BLM and USFS land-use plans, NPS general management plans, UDWR management areas, discussions with BLM, USFS, and UDWR resource specialists, and county and municipality plans.

3.11.1 Bureau of Land Management Recreation Opportunities, Management Objectives, and Experiences

BLM manages the tract and adjacent areas as part of an extensive recreation management area (ERMA) for undeveloped and dispersed recreation opportunities. ERMA objectives include providing for visitor health and safety, limiting user conflict, and protecting resource values, with no activity-level planning required. Therefore, actions within ERMAs would generally be implemented directly from land-use planning decisions. Dispersed camping is allowed throughout the recreation analysis area, which is managed as VRM Class IV, allowing for landscape modifications (see Section 3.2 Aesthetic Resources). OHV use is permitted on designated routes on BLM-managed lands within the analysis area. There are approximately 92 miles of routes available for OHV use within the recreation analysis area. Of the 92 miles, approximately 13 miles of routes are in the tract: 11 miles on BLM-managed land and 2 miles on private land. The BLM manages lands within the analysis area for the following recreation activities: OHV touring, hunting, fishing, photography, picnicking, hiking, backpacking, camping, competitive events, and viewing nature, wildlife, and geologic features. No other recreational trails or facilities are located on BLM-managed lands within the recreation analysis area.

BLM also manages the Grand Staircase-Escalante National Monument. The monument was established in 1996 and is located approximately 10 miles southeast of the analysis area. No portion of the monument is within the analysis area. However, it is expected that some recreation users, such as hunters, if displaced, would relocate their activities to similar ecological systems on the monument. Approximately 600,000 users visit Grand Staircase-Escalante National Monument each year. Areas within the monument adjacent to the analysis area are managed as an Outback Zone (BLM 1999) for undeveloped and self-reliant visitor experiences. Visitor facilities would be provided only for locations needed for resource protection. Most of the monument adjacent to the analysis area is managed as a VRM Class II and III.

Within the KFO, the BLM manages approximately 25,579 acres within the analysis area. In the KFO RMP all 25,579 acres within the analysis area are managed as an ERMA. Under the RMP, ERMAs provide for a range of undeveloped and dispersed recreation opportunities. Very little recreational use occurs on BLM-managed lands within the analysis area, with hunting being the predominant recreation activity. BLM does not have visitor use numbers for recreational activities occurring within the analysis area.

3.11.2 U.S. Forest Service Recreation Opportunities, Management Objectives, and Experiences

The Dixie National Forest has 17,397 acres in the recreation analysis area. The existing Dixie National Forest Land and Resource Management Plan (Dixie National Forest Plan) manages USFS lands within the analysis area as semiprimitive, nonmotorized zones and semiprimitive, motorized zones on the Recreation Opportunity Spectrum (ROS) (USFS 1986). Semiprimitive, nonmotorized zones are settings that have primitive roads or trails that are not open to motorized use. These zones are generally at least 2,500 acres in size and are between 0.5 and 3.0 miles from all roads, railroads, or trails with motorized use. Access to these zones is by nonmotorized trails, nonmotorized primitive roads, or cross-country. The analysis area contains a natural-appearing environment and has a high probability of solitude.

Semiprimitive, motorized zones are managed in a similar manner as the semiprimitive, nonmotorized zones. The only difference is that the semiprimitive motorized zone allows the use of motorized access on trails and roads within the area.

Dixie National Forest lands within the analysis area are managed for the following recreation activities: OHV touring, hunting, fishing, photography, picnicking, hiking, backpacking, camping, and viewing nature, wildlife, and geologic features.

There is limited motorized access to Dixie National Forest lands within the analysis area. Few roads access these locations and therefore, little recreation use occurs in these areas. Existing recreational facilities on nearby Dixie National Forest lands include the nonmotorized, 78-mile-long, Grand View trail that runs from the Thunder Mountain trailhead to the Sheep Creek trailhead. The Paunsaugunt OHV trail system also runs through Dixie National Forest lands near the analysis area. Dixie National Forest does not maintain visitor use information for lands near the analysis area.

Portions of the Dixie National Forest within the analysis area are managed under several management prescriptions (recreation, wood production and utilization, and livestock grazing) developed in the Dixie National Forest Plan. Management prescriptions are distinct from ROS zones in that they are intended to provide management guidelines for many different types of uses on the Dixie National Forest, and not just recreational use.

Approximately 12,070 acres of the analysis area is in the recreation management prescription. This management prescription provides guidelines for a broad range of outdoor recreation activities that meet recreational demands, and allows for a broad range of low-cost, dispersed recreation opportunities.

Approximately 4,470 acres of the analysis area are in the wood production and utilization management prescription. This management prescription is designed to manage for wood and fiber production. However, along forest roads, the USFS manages the area for a semiprimitive, motorized experience and a semiprimitive, nonmotorized experience in nonroaded areas within the zone.

Finally, approximately 855 acres of the analysis area are in the livestock grazing management prescription. This management prescription is designed to manage for intensive livestock grazing. The prescription also allows for dispersed recreation, with opportunities ranging from semiprimitive, nonmotorized to roaded natural on the ROS.

3.11.3 Bryce Canyon National Park Recreation Opportunities, Management Objectives, and Experiences

Bryce Canyon National Park is located approximately 13.5 miles east of the tract. The park is open year-round and over the past five years, annual park attendance has averaged roughly 1.5 million visitors. The NPS provides visitors with numerous opportunities to explore the landscape and experience a relaxing, peaceful encounter in the outstanding natural setting of Bryce Canyon National Park.

Although Bryce Canyon National Park is located outside the recreation analysis area, roads to the park may be affected by mine-related actions and some recreational settings may be affected by mine operations (see Section 3.2 Aesthetic Resources for more information on visual resources and nightscapes; see Section 3.3 Air Resources for more information on visibility).

Over 99% of the park is managed for recreational activities. The Bryce Canyon National Park General Management Plan (NPS 1987) provides approximately 37% (13,325 acres) of the park as the natural environmental subzone, where lands are managed for preservation of natural features and no development is allowed. Approximately 62% (22,325 acres) of the park is managed as the wilderness subzone, where lands are managed to retain eligibility for wilderness designation in accordance with criteria developed for wilderness designation under the Wilderness Act of 1964. The remainder of the park (185 acres) is managed for preservation of historic features and development of facilities for park management.

Recreation use in Bryce Canyon National Park includes hiking, backpacking, camping, cross-country skiing, photography, picnicking, and viewing nature, wildlife, and geologic features. Hunting is not allowed in Bryce Canyon National Park.

3.11.4 Utah Department of Wildlife Resources Recreation Opportunities, Management Objectives, and Experiences

The UDWR manages hunting and fishing in Utah. The tract is located in UDWR's PPMA. This management area (approximately 957,122 total acres in size) is open to all small-game hunting; hunting for mule deer and elk is managed through a permit system. The UDWR manages big game hunting in the PPMA as a trophy hunting area, with high buck-to-doe ratios for mule deer. Combined with limited hunting permits, the area is also popular for wildlife viewing of trophy mule deer, particularly because the area is between high visitation sites, such as Bryce Canyon National Park and Grand Staircase-Escalante National Monument.

For the 2007 hunting season, approximately 180 mule deer permits were issued for the PPMA. The UDWR allocated approximately 34 permits for archery only, 50 permits for muzzleloader only, and 96 permits for any weapon. In 2007 success rates for mule deer ranged from 68% for archery to 78% for muzzleloader and any weapon permits, with 100% of all permits being used.

Also in 2007, approximately 33 elk permits were issued for the management area, with nine permits allocated to archery only, five permits for muzzleloader only, and 19 permits for any weapon. The 2007 success rates for elk ranged from 17% for archery only to 45% for any weapon. The muzzleloader-only success rate was 20%. Approximately 97% of all 2007 tags were used in the PPMA.

There are no data on the number of hunters using the PPMA for hunting other species (predominantly small game), but UDWR believes most small-game hunters are from nearby communities (Personal Communication, Aoude 2008).

Finally, Upper Kanab Creek has a small rainbow trout fishery, but no fishing occurs on or near the tract (Personal Communication, Hadley 2008).

The tract falls within a cooperative wildlife management unit (CWMU). A CWMU is a hunting area consisting primarily of private lands. Its management involves cooperation with public agency land managers to manage healthy and diverse populations of big game animals. The CWMU is 55,000 acres and ranges in elevation from 5,500 feet to 9,000 feet. Public hunting is permitted from June through December (CWMU 2008). Within the Alton CWMU, 21 deer permits and four elk permits are issued each year. According to the CWMU contact, the tract does not fall within prime CWMU deer or elk habitat, and over the past 20 years, there have been no deer or elk kills in the proposed tract (Personal Communication, Heaton 2009).

3.11.5 Designated Highways Recreation Opportunities, Management Objectives, and Experiences

The National Scenic Byways Program was established under the Intermodal Surface Transportation Efficiency Act of 1991, and reauthorized in 1998 under the Transportation Equity Act for the 21st Century. Under the program, the U.S. Secretary of Transportation recognizes certain roads as National Scenic Byways or "All-American Roads" based on their archaeological, cultural, historic, natural, recreational, and scenic qualities. There are 126 such designated byways in 44 states. The Federal Highway Administration manages the National Scenic Byways system to maintain the defined qualities of a designated road segment as a scenic byway. Utah scenic byways are managed by the Utah Office of Tourism and are also managed to maintain the defined qualities of a designated road segment as a state scenic byway

Mine-related activities would result in the use of several transportation corridors that have been designated as scenic byways and that lead to recreation areas. US-89 is designated as a State of Utah scenic byway from the intersection with SR-12 south to the City of Kanab. It is also known as the Mount Carmel Scenic Byway and is designated as a National Heritage Highway. The road provides access to the Dixie National Forest and BLM-managed lands within the recreation analysis area.

SR-12 is another designated scenic byway. It has been designated as an All-American Road, a state scenic byway, and a national forest byway. The road accesses portions of Dixie National Forest, Bryce Canyon National Park, Grand Staircase-Escalante National Monument, and Kodachrome Basin State Park. The road is popular for sightseers and visitors to Bryce Canyon and Capitol Reef national parks. The East Fork of the Sevier Scenic Byway (SR-12) travels south from SR-12 through the Sevier River Valley with the Paunsaugunt Plateau west of the byway and the Pink Cliffs to the east. The byway follows the river the entire way, passing Tropic Reservoir about halfway. From US-89, 9 miles east of Kanab, the Johnson Canyon/Alton Amphitheatre Scenic Backway first passes through portions of the Grand Staircase-Escalante National Monument, including the vermillion cliffs, then climbs into the white cliffs. The Alton road spur of the byway travels north to Alton and provides better views of the pink cliffs, the Alton Amphitheater, and extinct volcanoes. The Alton road then loops northeast rejoining US-89 north of Glendale.

3.11.6 Transportation and Recreation

Recreationists currently use portions of the coal haul transportation route (see Section 2.5.4) for sightseeing, travel, or both to and from other recreation destinations described here. A transportation study (Fehr and Peers 2008) evaluates the existing condition of traffic on this route. The results of this study detailing the affected environment for transportation are included in Section 3.14 Transportation.

3.11.7 Other Recreation Opportunities, Management Objectives, and Experiences

Garfield and Kane counties both have management plans that provide direction for management of various activities within both counties. The Garfield County management plan has not completed the section regarding recreation management at this time. In the management plan, the county states that the "management direction for the Resource/Resource Use (Recreation) will be completed, subject to public comment, and adopted at some point in the future" (FCAOG 2007a). However, the plan does establish land-use management areas, including several recreation areas ranging from wilderness to developed recreation. According to the plan, areas around the tract are managed as Recreation II zones. Recreation II zones provide for the following:

> Motorized and nonmotorized recreation activities such as driving for pleasure, viewing scenery, picnicking, fishing, snowmobile riding, and cross country skiing are possible. Motorized travel may be restricted to designated routes to protect the physical and biological resources. Visual resources are managed so that management activities maintain or improve the quality of recreation opportunities. Management activities are not evident, remained visually subordinate, or may be dominant, but harmonize and blend with the natural setting. Landscape rehabilitation is used to restore landscapes to a desirable visual quality. Enhancement aimed at increasing positive elements of the landscape to improve visual variety is also used. Dispersed recreation is only lightly managed, and management prescriptions are generally limited to situations necessary to maintain ecological stability and visual objectives of the management area. These lands are generally managed for VRM Class III (FCAOG 2007a).

The *Kane County, Utah General Plan* (FCAOG 1998a) does not provide specific management direction for all recreation within the county. Much of the land within and adjacent to the tract is managed for agriculture. The agriculture zone does not provide any management prescriptions for recreation. However, the plan does provide for management direction relating to recreational use of federal public lands within the county. It contains a request for federal agencies to provide for multiple recreation uses in Kane County by maintaining existing amenities and providing new recreation sites for the public's enjoyment. It also contains a request for agencies to pursue motorized and nonmotorized public access opportunities and to collect, review, and analyze data on recreation use within the county.

3.12 Socioeconomics

3.12.1 Demographic Overview

In accordance with NEPA, this analysis of the local social and economic conditions addresses the relationships between the Alton Coal Tract and the communities it may affect. The following characterization of current social and economic conditions describes demographics, employment, income, fiscal and budgetary information, and community facilities in the region that could be affected by coal mining activities related to the tract.

The analysis area for social and economic resources (the tract's socioeconomic study area, or SESA) includes Kane, Garfield, and Iron counties. Although the tract is located in Kane County, 0.10 miles south of the town of Alton, impacts to the surrounding counties will be analyzed given the projected truck transportation and potential number of employees that may commute from surrounding counties.

3.12.1.1 SOCIAL SETTING

Presently, Kane, Garfield, and Iron counties are a collection of rural communities characterized by pastoral landscapes, open space, and small town qualities. Many of the area residents are of the Church of Jesus Christ of Latter Day Saints pioneer heritage and are prideful of the values, customs, and culture that have resulted from their historical connections (1998). Many of the area's residents are interested in maintaining a rural lifestyle and a quality environment that has been so much a part of their past. According to the Garfield County General Plan the county is committed to protecting the "custom, culture, and welfare of Garfield County's visitors and residents while providing for the conservation, use and/or enjoyment of its resources" (2007a).

With large percentages of lands under public ownership, many members of communities primarily within Kane and Garfield counties are very interested in public land-use management decisions. Because federal and state governments manage more than 95% of the land in Kane and Garfield counties, residents believe that much of the county's potential wealth is tied to its public lands. Therefore, county leaders are interested in developing cooperative working relationships with government agency managers (2007a). Although Iron County has a greater percentage of lands under private ownership (29%), the social values and issues are similar to Kane and Garfield counties. According to the Iron County Local Planning Summary, their primary goal is to "retain control of the issues which effect [affect] the County's custom, culture and economic stability" (Utah Governor's Office of Planning and Budget 2003).

3.12.1.2 POPULATION AND HOUSING

Due to the aridity, ruggedness, and isolation of the Alton Coal Tract, the overall population of the SESA is quite sparse. Garfield County has a population density of fewer than 0.9 people per square mile; Kane County has 1.5 people per square mile; and Iron County has more than 10.2 people per square mile (much higher than Garfield and Kane counties but much lower than the state average of 27.2 people per square mile).

Despite the small population relative to the geographic size of the counties, the population rates have steadily increased in recent years. Kane County's population has increased 23% since 1990 to 6,740 in 2009. The increase is attributed to consistent in-migration (more people moving into the county than out). The annual increase in Kane County is relatively low (1.2%). The town of Alton reported 142 people in 2009, a 34% increase from 1990. The largest city in Kane County is Kanab, with a population of 3,804 (UDWS 2010a). See Table 3.16 for county populations.

Garfield County, located directly north of Kane County, has experienced similar in-migration growth patterns. The population has steadily increased (24.5%) since 1990 to 5,149 in 2009. The population in Garfield County increased 2.1% from 2008 to 2009. The cities with the largest populations are also the areas experiencing the greatest amount of growth. These cities (populations in parentheses) are Panguitch (1,502), Escalante (757), and Tropic (472) (UDWS 2008a).

Iron County’s population is nearly eight times higher than Kane and Garfield counties and has expanded rapidly in recent years. However, the population growth slowed dramatically in 2009. The county’s annual growth rate of 1.0% ranked below the statewide average growth rate of 1.5%. Overall, the county’s population has increased 55.6% since 1990 to 46,825 residents in 2009. Cedar City maintains the bulk of the county’s residents with a 2009 population of 29,144 (UDWS 2010b).

Table 3.16. Population Characteristics of the Alton Coal Tract Socioeconomic Study Area

	1990	2000	2009	Percentage Change Since 1990
Kane County	5,169	6,046	6,740	23.3%
Garfield County	3,890	4,735	5,149	24.5%
Iron County	20,789	33,779	46,825	55.6%
State of Utah	1,722,850	2,233,169	2,2,757,779*	37.5%
Town of Alton	93	134	142	34.5%

Source: U.S. Census Bureau 2000b; UDWS 2008c; UDWS 2008a; UDWS 2008b.
*Population data are from 2008.

With regard to housing, property values are often a concern of local residents when considering changes to existing land uses in their community. Scoping comments for the Alton Coal EIS reflect concern over a decrease in property value with the introduction of a mine in the area. In general, the value of a residential property is primarily influenced by the taxes levied on the property. Property tax revenue helps fund state and local government budgets with regard to operating budgets as well as school and fire districts. Counties use property tax revenue to fund court systems, sherriff’s departments, transportation projects, and emergency services.

Property tax impacts could occur near the proposed mine due the physical change in land use and the concentration of mining activities in and around the Alton Coal Tract; as such, existing property values within Kane County (the county in which the mine would be located) are evaluated here. State of Utah numbers will be given for comparative purposes. In 2009, the average estimated residential sales price was $185,262 and the primary residential tax rate was 0.004854 in Kane County. The effective tax rate equals the total residential taxes charged divided by the total residential market values. The average property tax paid in Kane County in was $899. In 2009, the statewide average estimated residential sales price was $206,150, and the primary effective tax rate was 0.005910. The average property tax payment was $1,169 in (Utah State Tax Commission 2007). Second-home ownership is a difficult-to-measure yet important trend occurring in southern Utah. The challenge of tracking second-home ownership is to accurately disclose the percentage and valuation of new second-home permits versus permits for new houses for full-time residents. Because Kane County would likely be the only county in the SESA impacted by the tract due to proposed location of the mine, inquiries regarding second-home ownership were made only to Kane County. Although no official record currently exists, the Kane County Assessor reports that more than half of the homes in Kane County are second homes. Most of those homes are concentrated on Cedar Mountain (Little 2009).

Recent studies have indicated that second homes are typically built based on scenic beauty and recreation potential. A Colorado-based study reported the 95% of second-home owners selected their homes based on scenery, and 91% cited recreation opportunities as being important amenities that influence their decision (Venturoni et al. 2005). Initially, the construction of new second homes may be beneficial because they increase the local property tax base. However, a high concentration of second homes may also be problematic for local residents because they could increase the cost of living for local residents by increasing property taxes. There is a potential for conflict within communities between second-home owners and full-time residents because full-time residents often desire to diversify their economic base, become less dependent on tourism, and meet the basic needs of the community with respect to affordable housing and education (2008d).

3.12.1.3 EMPLOYMENT AND INCOME

The labor market in the SESA has been subject to the impacts of the slowing economy in recent years. The unemployment rates within the SESA and across the state have risen dramatically. With a 2009 unemployment rate of 6.6 in 2009, Utah's unemployment rate is the highest it has been in more than 20 years (UDWS 2010b). Job losses have been prevalent across a range of industries, but have been most heavily concentrated around the construction and manufacturing industries. See Table 3.17 for characteristics of the SESA's labor force.

Table 3.17. Labor Force Characteristics of the Alton Coal Tract Socioeconomic Study Area in 2009

	Labor Force	Employed	Unemployed	Percentage Unemployment Rate
Kane County	3,522	3,280	242	6.9%
Garfield County	2,866	2,594	272	9.5%
Iron County	20,795	19,155	1,693	7.9%
State of Utah	1,364,495	1,274,788	89,706	6.6%

Sources: UDWS 2007; 2008c; 2008a; 2008b; 2010b.

The distribution of employment by industry sector in the SESA appears in Table 3.18. Throughout the area, the government is the predominant employer, with just under 25% of residents per county employed in this industry sector. The leisure and hospitality sector also accounts for numerous jobs in the area. Garfield County has the highest percentage (37%) of residents employed in the leisure and hospitality sector. One of the largest employers in Garfield County is Ruby's Inn. Other tourism-based employers in the county include Bryce Canyon Resort, Offshore Marina, Bryce Canyon Pines, and the New Western Motel. In Kane County, where 29% of the workforce is employed in the leisure and hospitality sector, Aramark (Lake Powell Resorts) is one of the largest employers. Best Friends Animal Sanctuary is also one of the largest employers and hosts more than 20,000 visitors a year (Best Friends Animal Society 2008). Iron County maintains fewer jobs (12%) in the leisure and hospitality sector. However, the Utah Shakespearean Festival held at Southern Utah University draws thousands of tourists to Iron County annually. Currently, mining and natural resource development accounts for 71 jobs (less than 1% of jobs) in the entire SESA.

Table 3.18. Employment and Percentage Share by North American Industry Classification System Industry Sector in 2009

	Kane County	Garfield County	Iron County	Total per Sector
Natural resources and mining	6	9	56	71
	0.0%	*0.4%*	*0.4%*	*0.3%*
Construction	100	51	1,636	1,787
	5.8%	*2.3%*	*10.5%*	*8.3%*
Manufacturing	108	44	1,728	1,880
	3.6%	*1.9%*	*11.0%*	*8.8%*
Trade/transportation utilities	427	243	3,155	3,825
	14.3%	*10.8%*	*20.2%*	*17.8%*
Information	15	131	137	283
	0.5%	*5.8%*	*0.9%*	*1.3%*
Financial activities	123	29	783	935
	4.1%	*1.3%*	*5.0%*	*4.7%*
Profess/business services	45	17	1,305	1,367
	1.5%	*0.8%*	*8.3%*	*6.4%*
Education/health/ social services	115	263	1,566	1,944
	3.8%	*11.6%*	*10.0%*	*9.0%*
Leisure/hospitality (tourism)	874	834	1,923	3,631
	29.1%	*37.0%*	*12.3%*	*17.0%*
Other services	442	15	341	798
	14.8%	*0.6%*	*2.1%*	*3.7%*
Government	743	621	4,334	5,698
	24.8%	*28.0%*	*27.7%*	*26.0%*
Total	**2,996**	**2,258**	**15,648**	**21,436**

Sources: UDWS 2008c; 2008a; 2008b.

From 2007 to 2008, the average monthly wage increased slightly in the SESA despite the lean job markets. Despite this increase, the average monthly income in each county in the SESA is substantially lower than the state average (Table 3.19). The low wages are attributed to the high percentage of lower-paying, seasonal, tourism-related jobs in Kane and Garfield counties and to a large working student population in Iron County.

Table 3.19. Alton Coal Tract Socioeconomic Study Area Income and Wages in 2008

	Kane County	Garfield County	Iron County	State of Utah
Total personal income (millions)	$210.0	$127.7	$1,023.0	$82,890.1
Per capita income	$32,102.0	$27,770.0	$23,147.0	$30,291.0
Average monthly nonfarm wage	$2,094.0	$2,008.0	$2,218.0	$3,121.0

Sources: UDWS 2008c; 2008a; 2008b.

3.12.1.4 TOURISM

As mentioned in the Recreation section of Chapter 3, there are numerous recreation and tourism opportunities near the tract. Bryce Canyon National Park, Dixie National Forest, and Grand Staircase-Escalante National Monument are major tourist attractions in the area. Visitors to the area contribute to the local economy via direct spending, tourism-related employment, and tourism-based tax revenues. Tourism tax revenues are derived from local tax revenues from traveler spending, transient room tax, restaurant tax, car rental tax, and gross taxable retail sales. In general, spending by travelers in the SESA has fluctuated in recent years. The fluctuations in traveler spending are attributed to the weakening in the United States economy since 2007. Since 2007 spending by travelers in Kane and Garfield Counties has increased by 8.4% and 18.0%, respectively. Spending by travelers in Iron County decreased 5.2% from 2007 to 2008 (Utah Office of Tourism 2009). Table 3.20 reflects travel and tourism contributions in 2008.

Table 3.20. Alton Coal Tract Socioeconomic Study Area Tourism Profile 2008

	Kane County	Garfield County	Iron County
Spending by travelers (millions)	$75.4	$72.0	$99.2.0
Travel and tourism-related employment	705	708	1,412.0
Local tax revenue from traveler spending (000s)	$7,193.9	$6,873.0	$9,468.1
State ranking (spending by travelers per county)	12th	14th	9th

Source: Utah Office of Tourism 2009.

Within the SESA, there are numerous tourism-based businesses (Bed and Breakfasts, resorts, hotels, etc.) to accommodate visitors who are in the area to visit the national parks and other tourist destinations. According to local residents, tourism and recreation are the primary industries located on the coal haul transportation route. Locals have also reported a growing number of bicycling and motorcycling tours and OHVs along US-89.

Individuals who participated in the scoping process reported that tourists to the area contribute significantly to the local economy. Although it is difficult to predict exactly how much tourists spend in an area on a given day, previous researchers have developed some estimates. A 1994 survey by Utah State University economists estimated visitor spending for southern Utah in general and for three wilderness areas and one WSA in southern Utah (Keith and Fawson 1995). Table 3.21 summarizes this study (visitors include general leisure visitors, business visitors, and recreationists to these four areas).

Table 3.21. Spending Estimates for Visitors to Southern Utah and Visitors to Southern Utah Wilderness Areas and Wilderness Study Areas

	Expenditures Per Person Per Day (2010 dollars)
All visitors to southern Utah	$91
Visitors to three southern Utah wilderness areas and one WSA	$24–$33

Source: Kei h and Fawson 1995.

Notes: Original data in 2001 dollars for southern Utah visitors and 1994 dollars for Utah wilderness area visitors. Adjusted to 2010 dollars using Consumer Price Index inflation values.

Southern Utah visitors are divided into those visiting for leisure purposes (74%) and hose visiting for business purposes (26%).

The three Utah wilderness areas surveyed are Box-Death Hollow (Garfield County), Dark Canyon (San Juan County), and Paria Canyon (Kane County). Grand Gulch (San Juan County) is a WSA. These four areas in southern Utah are considered multi-day backpacking venues; therefore, the expenditures estimate may not be representative of day-use spending. Day-use spending can be higher because recreation day-use visitors may, for example, stay in motels, eat in restaurants, and purchase from local retailers. Also, these four areas are a mix of designated wilderness and WSAs.

Although the public lands within the SESA are not marketed, they do provide an economic and social value to local residents and tourists. Even if no money changes hands, visitors to the area and local residents find value and benefit by the presence of public lands because they provide satisfaction and unique opportunities. With specific regard to the SESA, the public lands that surround the town of Alton and other small communities contribute to the area's rural, small-town feel. The local residents enjoy the area because of the pristine beauty and opportunities for solitude that the public lands provide. According to newer residents in towns in the SESA, the area's peaceful lifestyle and slow pace was an attraction (FCAOG 2007b). Thus, the public lands are of value to local residents and the tourist who enjoy the area.

Typically, nonmarket valuations have been used to estimate the monetary value individuals place on public lands. Nonmarket valuations view public lands in terms of their on-site value and their "passive" use or their off-site value. Economists have used data collected from actions or survey responses of visitors, homebuyers, and the public to simulate market conditions and elicit measures of value (BLM 2008g). The nonmarket value is the value received by the users and is above and beyond what they received for their direct expenditures. Table 3.22 presents average on-site use values for selected recreation activities that resemble public use activities near the Alton Coal Tract.

Table 3.22. Average Nonmarket Use Values of Recreation on Public Land from Existing Studies of Activities in the Intermountain Area

Recreation Type	Value Per Person Per Activity Day (2010 dollars)
Biking	$71
Camping	$29
Float boating	$49
General recreation	$17
Hiking	$36
Picnicking	$29
Sightseeing	$15
Wilderness recreation	$15
Wildlife viewing	$39

Source: BLM 2008f.

Notes: Original data are in 1996 dollars and have been adjusted here to 2010 dollars using the Consumer Price Index inflation rate. All values are rounded to the nearest dollar. Data are median values from existing studies. The Intermountain area is considered USFS Regions 1–4. General recreation is a composite of recreation opportuni ies at a site with a measure for the site, not a specific activity.

In contrast to the on-site valuation of public lands, it is important to understand the passive-use valuation of public lands. Passive-use studies measure the satisfaction of knowing that undeveloped, primitive public land is simply "there" and will be preserved. A passive-use valuation study of Utah wilderness, completed more than 15 years ago, found that Utah residents placed an economic value of $72 per household (in 2006 dollars) on the preservation of the 2.7 million acres of designated wilderness in Utah (2008f). Although the lands within the proposed Alton Coal Tract and surrounding areas are not designated wilderness areas, the example has been given to demonstrate the economic value of undeveloped, primitive landscapes. Although the economic value for passive use on public lands not containing a high level of wilderness characteristics would almost certainly be less than $72 per 2.7 million acres, the exact value households are willing to pay is unknown.

3.12.2 Government and Public Finance

3.12.2.1 REGIONAL COAL PRODUCTION

In 2008, Utah was ranked as the 14th highest coal-producing state with 24.3 million tons of coal being produced in mines throughout Utah (State of Utah 2009). Most Utah coal production occurs in Carbon, Emery, and Sevier counties. According to the BLM, no coal production has occurred in Kane and Garfield counties since 1971 (2008f). However, 53% of the state's estimated recoverable coal can be found in Kane County and 20.6% in Garfield County (Utah Geological Survey 2008). Iron County has 1.7% of the state's coal reserves with no coal mining currently occurring in the county.

In fiscal year 2008, the sales value of coal produced in Utah was more than $380 million dollars. Of the total sales value, more than $22 million was reported in royalty revenues. Of the $22 million, $12.0 million was disbursed to Utah. Bonus payment totaled $661,980.59 million in fiscal year 2008 (Bureau of Ocean Energy Management, Regulation and Enforcement 2010). ACD does not currently contribute any property taxes or royalties to the federal, state, or local government because they do not own or lease the land in the tract.

3.12.2.2 PERMANENT COMMUNITY IMPACT FUND BOARD

The Permanent Community Impact Fund Board (CIB) provides loans and/or grants to state agencies and subdivisions of the state that are or may be socially or economically impacted, directly or indirectly, by mineral resource development on federal lands. Projects eligible for funding include planning, construction, and maintenance of public facilities as well as provision of public services. Between fiscal years 2005 and 2009, Kane County received a total of $16,279,213 CIB funding ($2,050,213 in grants and $14,229,000 in loans). Of the 25 total projects funded by CIB, five were in the town of Alton. Garfield County received a total of $15,067,895 in funds ($4,700,895 in grants and $10,367,000 in loans). Iron County received at total of $13,577,750 in CIB funding ($546,750 in grants and $13,031,000 in loans) (Utah Department of Community and Culture 2009).

3.12.3 Public Health and Safety

3.12.3.1 TRANSPORTATION

Principal transportation routes in the SESA are US-89, SR-14, SR-20, and I-15. US-89 runs from north to south through the towns of Panguitch, Hatch, and Kanab, and serves as the main access road to south-central Utah including such national parks Bryce Canyon and Zion.

UDOT has five roadway improvement projects along US-89 scheduled for completion in the next five years according to the *Statewide Transportation Improvement Plan 2008–2013*. The projects include construction of a passing lane from Milepost 88.3 to 89.1 (estimated cost: $1.4 million) and partial realignment and pavement rehabilitation from 300 North in Kanab to Kanab Creek Bridge (estimated cost: $10 million). In Garfield County, intersection improvements at US-89 and SR-14 (Long Valley Junction) are underway (estimated cost: $16 million) and road widening along US-89 is projected (estimated cost: $9 million) (UDOT 2008).

In Kane, Garfield, and Iron counties, the county governments are responsible for ongoing road maintenance and repair. Special service districts undertake capital construction projects financed primarily by CIB funds. Local government assistance for road improvements includes Class B and Class C Road Funds programs as well as federal and state aid for specified projects.

3.12.3.2 LAW ENFORCEMENT

The Kane County Sherriff's Department employs 12 full-time law enforcement officers. They provide law enforcement services to the unincorporated areas of Kane County and several contract communities, including Alton. Kanab and Big Water have their own police departments.

Garfield County has one county sheriff, three deputy sheriffs, two Panguitch City police officers, two Utah Highway Patrol troopers, and one Escalante police officer. The sheriff's office has 21 volunteers from Panguitch, eight from Bryce Valley, and 19 from Escalante (FCAOG 1998b).

The Iron County Sherriff's Department has 33 full-time officers, 18 of which are patrol officers. The department provides law enforcement to the unincorporated areas of the county and small cities including Summit, Paragonah, Kanarraville, and Newcastle. The jail is operated by the Iron County Sherriff's Department and employs 45 officers, one full-time bailiff, and five officers are part-time bailiffs. Several cities in Iron County have their own police departments, including Cedar City, Enoch, Parowan, and Brian Head. Southern Utah University in Cedar City also has its own police department (Personal Communication, Evans 2008).

Crime in Kane County is considerably lower than the average for the State of Utah. In 2005, the crime rate per 1,000 people in Kane County was 11.77 (73 total index crimes) and Utah's crime rate per 1,000 was 40.35 (99,650 total index crimes). Index crimes are crimes against persons or property. There were 316 arrests made in Kane County in 2005. Larceny was the most reported crime with 44 reports, and aggravated assault was the second most reported crime with 17 reports. There were zero homicides and two reported rapes in the county in 2005 (Utah Department of Public Safety 2005).

Garfield County's crime rate per 1,000 was 34.23. The index crime rate in 2005 was 153. The county had 116 reports of larceny. There were zero homicides and two reported rapes in 2005 (Utah Department of Public Safety 2005).

The crime rate per 1,000 in Iron County was 28.24. The index crime rate in 2005 was 1,082. Larceny was also the most reported crime in Iron County with 753 reports. Approximately 1,656 arrests were made in the county. There was one homicide and 14 reported rapes in 2005 (Utah Department of Public Safety 2005).

3.12.3.3 FIRE PROTECTION

Kane County has nine fire departments, including one located in the town of Alton. The Alton fire department has two fire trucks, zero paid fire fighters, and two volunteers (FCAOG 2007b).

Garfield County has 11 fire departments. Most fire departments are staffed by volunteers and have no paid firefighters; with the exception of Boulder Fire Department which has 14 paid firefighters and zero volunteers. The number of fire trucks per department range from one to four and the types of trucks range from structure and brush trucks, wildland trucks, Type 1 through 3 engines, and water tender trucks.

Iron County has nine fire departments operated primarily by volunteers. The Cedar City Fire Department has four paid employees and 35 active volunteers. The range and types of fire trucks available in Iron County are similar to those in Garfield County.

3.12.3.4 HEALTHCARE

Within the SESA, there are three hospitals that provide 24-hour emergency care and physician staffing. Kane County Hospital in Kanab is a 38-bed facility with two full-time physicians. Garfield Memorial Hospital in Panguitch is a 20-bed facility with three full-time physicians. Valley View Medical Center in Cedar City (Iron County) is a 48-bed facility (Hospital-Data.com 2008). Garfield Memorial and Valley View are operated by Intermountain Health Care. All three hospitals accept Medicaid and Medicare patients. There are also hospitals with 24-hour emergency services in St. George (approximately 100 miles south of Alton) and Richfield (approximately 115 miles north of Alton). These hospitals are equipped to handle acute medical and trauma conditions, and air transport via Air-Med (University of Utah) or Life Flight (Intermountain Health Care) can provide emergency service to hospitals further away.

Numerous Intermountain Health Care healthcare clinics are available in the SESA, including Panguitch, Cedar City, Circleville, Escalante, Cannonville, and Orderville. The clinics provide family and internal medicine, pediatrics, lab, x-ray services, and so on.

3.12.3.5 AMBULANCE

Ambulance services are provided via local counties. Kane County Ambulance is operated out of Kanab. Garfield County Ambulance is located in Panguitch. Iron County Ambulance is located in Parowan.

3.12.4 Environmental Justice

3.12.4.1 EXECUTIVE ORDER BACKGROUND AND REGULATORY GUIDANCE

“Environmental justice” refers to the fair and equitable treatment of individuals regardless of race, ethnicity, or income level, in the development and implementation of environmental management policies and actions. In February 1994, President Clinton issued EO 12898, Federal Actions to Address Environmental Justice in Minority and Low Income Populations. The objective of this EO is to require each federal agency to “make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low income populations” (EO 12898).

Convened under the auspices of the EO, the Interagency Working Group defines Black/African American, Hispanic, Asian and Pacific Islander, American Indian, Eskimo, Aleut and other nonwhite persons as minority populations. Low-income populations are defined as persons living below the poverty level based on their total income. In 2007, the poverty threshold for a family of four was $21,386 according to the U.S. Census Bureau (U.S. Census Bureau 2008a).

The EPA has not specified what percentage of the population can be characterized as “significant” in order to define an environmental justice population. Therefore, for the purposes of this analysis, a conservative approach is taken in identifying potential environmental justice populations—it is assumed that if the affected area minority and/or poverty status populations are more than 1.5 times the percentage of the reference area (in this case, the State of Utah), there is likely an environmental justice population of concern. For example, if a statewide American Indian population is 9%, then any county in which the American Indian population is 13.5% or higher would be considered as having a potential environmental justice population.

3.12.4.2 RACE AND ETHNICITY

Overall, the SESA has a greater percentage of whites and a lower percentage of other races than the State of Utah as a whole. Also, the state population as a whole has more than double the Hispanic population of Kane, Garfield, and Iron counties. Information regarding racial and ethnic composition within the SESA is provided in Table 3.23. Because more recent population estimate data from the U.S. Census Bureau are not available for race and ethnicity, as it is for the general population, census data from the 2000 Census are used to illustrate racial and ethnic composition.

As stated earlier, a county is considered as having a potential disadvantaged population if the population that falls within the category equals or exceeds 1.5 times the percentage of the state as a whole. As indicated in Table 3.23, the American Indian, Eskimo or Aleut population is 1.75 times greater than the reference population (State of Utah). Because the Iron County American Indian population exceeds the 1.5 times the reference population threshold by one quarter of a percent, an impacts analysis will be carried forward in Chapter 4.

Table 3.23. Racial and Ethnic Composition of the Socioeconomic Study Area and State of Utah

Location	Percentage of Total Population					
	White	Black	American Indian, Eskimo, or Aleut	Asian or Pacific Islander	Other/Two or More Races	Hispanic/ All Races
Garfield County	95.0%	0.2%	1.8%	0.4%	1.5%	2.9%
Iron County	93.0%	0.4%	2.2%	1.0%	1.7%	4.1%
Kane County	96.0%	0.0%	1.6%	0.2%	1.4%	1.4%
State of Utah	89.2%	0.8%	1.3%	2.4%	2.11%	9.0%

Source: U.S. Census Bureau 2000a.

Notes: Population is broken out by both race and ethnicity because Hispanics can be of any race.

3.12.4.3 POVERTY RATES

The second element of environmental justice is the potential for disproportionate impacts on populations living below the poverty level. The number of people in Garfield and Kane counties living below the poverty line in 2005 was slightly lower than the state average (10.4% and 10.0%, respectively, versus 10.5%). Kane County and Garfield County poverty trends show a slight decrease over time, and rates remain similar to the state average. In 2005, the poverty level established by the U.S. Census Bureau for a family of four was $19,971, and in that year 10.4% or 635 people in Kane County and 12.0% or 546 people in Garfield County were living below the poverty level (U.S. Census Bureau 2008b). Iron County poverty rates are higher than Kane and Garfield counties and consistently higher than the state average. In 2005, Iron County had 5,758 people living below the poverty level. Table 3.24 reflects poverty rates within Kane, Garfield, and Iron counties and the State of Utah in 2000 and 2005 for comparative purposes. It should be noted that the most recent published U.S. Census poverty rate data for counties with a population fewer than 21,000 is from 2005. Because Kane and Garfield County populations do not exceed 21,000 more recent (2009) poverty data do not exist. Therefore, 2005 data from the SESA and the State of Utah will be used to examine the most up-to-date poverty rates.

Because the poverty rates of Kane and Garfield counties do not exceed the state average of 10.5%, and because Iron County's poverty rate is higher (15.4%) than the state average but is not greater than 1.5 times the percentage of the state, there are no environmental justice populations that are likely to be affected by coal mining activities on the tract as mentioned above, and this section will not be carried forward into Chapter 4.

Table 3.24. Poverty Rates within the Alton Coal Tract Area and in the State of Utah

	2000		2005	
	Percentage	**Number**	**Percentage**	**Number**
Garfield County	12.0%	546	10.0%	435
Iron County	15.1%	5,123	15.4%	5,758
Kane County	11.5%	687	10.4%	635
State of Utah	8.8%	198,434	10.5%	254,761

Source: U.S. Census Bureau 2008b.

3.13 Soils

Soils are the medium for plant growth and provide nourishment for nearly all terrestrial organisms. They support a number of vegetation and animal communities in the Alton Coal Tract. The following section describes the soils that occur in the tract, as categorized by the soil survey conducted as part of the 1987 UII PAP (UII 1987). The soil conditions described below are shown on Maps 3.12 and 3.13. Soils in the tract are derived primarily from sedimentary geologic deposits that occur throughout the region, including the Tropic Shale (61% of the tract) and Dakota Sandstone (16% of the tract) deposits (UII 1987). A variety of soil types exists in the tract, including highly saline and highly erodible soils (UII 1987). Soils that are highly saline, highly erodible, and have low water-holding capacity (drought intolerant) may be especially vulnerable to impacts and may be harder to reclaim or restore after disturbance. Certain biological soil crust communities significantly protect some soils from wind and water erosion. Disturbance of biological soil crusts affects most soils, but depending on the type of soil and biotic community, some are affected more than others.

3.13.1 Sensitive Soils

Sensitive soils have characteristics that make them more susceptible to impacts or more difficult to restore or reclaim after disturbance. These characteristics consist of moderate to high salinity, low nutrient levels, high runoff potential, and limitations to grazing, susceptibility to high wind or water erosion; or occurring on very steep slopes that are more susceptible to erosion. In this EIS, a sensitive soils designation refers to highly erodible soils, saline soils, drought intolerant soils, sodic soils, shallow soils (limited rooting depth), alkaline soils, and biological soil crusts. Sensitive soils are difficult to reclaim or restore, and once disturbed, the impact is usually long term. Table 3.25 shows the risk factors used to determine the sensitivity of soil units mapped for the UII PAP in 1987 (UII 1987). The table shows the specific factors used to determine the risk of rehabilitation restrictions for soils in the tract. Table 3.26 shows the number of acres in the tract that are at risk for restricted soil rehabilitation due to a number of restrictive soil features.

Table 3.25. Soil Rehabilitation Restrictions and Reclamation Risks

Factors	High Risk	Moderate Risk	Low Risk	Restrictive Feature
Erodibility				
Water erosion hazard (from 1987 Survey)[1]	High	Moderate	Slight to Moderate	Water erosion hazard
Limits on Reclamation				
Available water capacity (inches)[2]	<4	4–6	>6	Droughty soils
Salinity[3] (mmhos/cm; surface layer)[4]	>16	8–16	<8	Excess salt
Sodium adsorption ratio[5] (surface layer)[4]	>13	4–13	<4	Excess sodium
Depth to C horizon (inches)[4]	<10	10–20	>20	Rooting depth
A kalinity (pH of surface layer)[4]	>9.0	7.8–8.9	<7.8	Excess alkalinity

[1] Water erosion hazard was rated for bare soil areas based on inherent soil characteristics, such as texture, permeability, soil aggregate stability, and strength of soil structure.

[2] Maximum value for the range of available water capacity for the soil layer given as inches of water per 36 inches of soil.

[3] Maximum value for the range in soil salinity; mmhos/cm is a measure of electrical conductivity that is used to describe soil salinity.

[4] Draft parameters developed by the BLM's National Science and Technology Center, SSURGO soils mapping.

[5] Maximum value for the range in sodium adsorption ratio; sodium adsorption ratio is a measure of the ratio of the sodium to the calcium and magnesium in a soil.

Table 3.26. Acres (and percentage) of the Alton Coal Tract At Risk of Restricted Soil Rehabilitation

Restrictive Feature	High Risk	Moderate Risk	Low Risk
Erodibility			
Water erosion hazard	843 (23.6%)	2,515 (70.3%)	218 (6.1%)
Limits on Reclamation			
Droughty soils	627 (17.5%)	182 (5.1%)	2,768 (77.4%)
Excess salt	0 (0.0%)	0 (0.0%)	3,577 (100.0%)
Excess sodium	4 (0.1%)	0 (0.0%)	3,498 (97.8%)
Rooting depth (shallow soils)	2,872 (80.3%)	693 (19.4%)	12 (0.3%)
Excess a kalinity	0 (0.0%)	416 (11.6%)	3,161 (88.4%)

Notes: Because some soil units had missing data, risk factors may not total to 100% of the tract acreage.

3.13.1.1 WATER-EROSIVE SOILS

Water-erosive soils have naturally high rates of erosion; however, the erosion rates are easily accelerated by surface-disturbing activities. A total of 843 acres of water-erosive soils occurs on the tract (23.6% of the tract). A soils' potential for water erosion was estimated based on inherent soil characteristics such as soil texture, permeability, aggregate stability, and the strength of the soil structure (UII 1987). Observations of erosion in mapped soil units were also used to determine their risk for erosion. Accelerated erosion forms rills and gullies, and can contribute to excess sedimentation in streams and reservoirs. In addition, erosion reduces natural revegetation and the effectiveness of vegetation restoration efforts by removing topsoil, washing away plant seeds and propagules, and burying or damaging existing plants.

3.13.1.2 DROUGHT-INTOLERANT SOILS

Certain soil types are more sensitive to negative impacts during drought conditions. A number of soil units on the tract have a low available water capacity due to soil structure and composition (UII 1987); thus, these high risk soils and their associated vegetation may be severely affected by drought. Severe drought may adversely affect the production of perennial vegetation. Soils at high risk for poor reclamation occur over 627 acres, or 17.5%, of the tract. Areas at moderate risk occur over an additional 182 acres, or 5.1% of the tract. Areas with a low risk occur over 2,768 acres, or 77.4% of the tract.

3.13.1.3 SALINE SOILS

Soil salinity can influence the downstream effects of erosion and the reclamation potential of an area's soils. Highly saline soils limit the diversity of vegetation species that can be established on a site, and at very high levels, they may inhibit the establishment of even halophytic (salt-loving) plants. Erosion of saline soils impacts the water quality of downstream watersheds. Highly saline soils are soils with electrical conductivity levels of greater than 16 mmhos/cm. Moderately saline soils fall between 8 and 16 mmhos/cm. The tract contains only soils with electrical conductivity levels of less than 8 mmhos/cm, or low salinity.

3.13.1.4 SODIC SOILS

High sodium levels can affect the reclamation potential of disturbed soils by inhibiting the establishment of vegetation. Four acres (or 0.1%) of the Alton Coal Tract are highly sodic, or have a sodium adsorption ratio of greater than 13 mmhos/cm. The rest of the tract has low risk of sodic soils, or a sodium adsorption ratio of less than 4 mmhos/cm.

3.13.1.5 SHALLOW SOILS

A shallow topsoil layer (or A horizon) limits a plant's ability to root deeply. It may inhibit an area's restoration potential because of its limited depth, water holding capacity, and nutrients available for plant establishment. Rooting depth, or depth to the C horizon of the soil, affects restoration potential because plant root growth does not occur below the upper (A and B) soil horizons. The C horizon of the soil is characterized by unweathered parent material and generally does not support the biological activity necessary for soil development. It is assumed for this analysis that soils with an A horizon of less than 10 inches are at high risk for poor reclamation (based on draft parameters developed by the BLM's National Science and Technology Center). These soils occur over 2,872 acres, or 80.3%, of the tract. Areas at moderate risk (or with a rooting depth of 10–20 inches) occur over an additional 693 acres, or 19.4% of the tract. Areas with a low risk (a rooting depth greater than 20 inches) occur over 12 acres, or 0.3% of the tract.

3.13.1.6 ALKALINE SOILS

Alkalinity refers to soil pH. High pH, or an alkaline condition, generally limits a plant's ability to establish itself. A number of soil units on the tract are moderately alkaline (UII 1987). Approximately 416 acres of the tract have moderately alkaline conditions (11.6%), and 3,161 acres (88.4%) have a low risk of reclamation restriction due to alkalinity.

3.13.1.7 BIOLOGICAL SOIL CRUSTS

Some of the dominant vegetative communities in the tract, such as pinyon-juniper and sagebrush communities, have evolved with the presence of biological soil crusts. Biological soil crusts are made up of mats or filaments of cyanobacteria, lichens, and mosses. Development of biological soil crust is strongly influenced by soil texture, soil chemistry, and soil depth. Crusts are more developed in shallow, sandy, nonsaline soils. Biological soil crusts play a major role in reducing water and wind erosion and in preventing the establishment of invasive annual grasses (BLM 2001a). They fix atmospheric nitrogen and carbon, retain soil moisture, and provide surface cover. Crust composition and level of abundance can be used to determine the ecological history and condition of a site (BLM 2001a).

Loss of biological soil crust leads to reduced soil productivity, decreased plant cover and vigor, and increased wind and water erosion. Severity, size, frequency, and timing of a surface-disturbing activity affect the degree of impacts to biological soil crusts. Fine-textured soils have faster crust recovery rates than coarse-textured soils (BLM 2001a).

The distribution of soil crusts in the tract is unknown. Approximately 2,760 acres (77.1%) of the tract has soils associated with pinyon-juniper vegetation, which is often associated with biological soil crusts. An additional 513 acres (14.3%) of the tract has soils associated with sagebrush, which is also associated with soil crusts.

3.14 Transportation

3.14.1 Regional Overview

Existing vehicle traffic in and near the tract and coal haul transportation route consists of local residents; tourists to Bryce Canyon National Park, the Dixie National Forest, and public lands; and commercial truck traffic. Transportation infrastructure associated with the tract and coal haul transportation route would include numerous unimproved, dirt access roads and two-track trails, KFO Route 116, US-89, SR-20, I-15, and SR-56. The Union Pacific Railroad 21-mile branch to the Salt Lake City-Los Angeles line is located west of Cedar City, Utah. It is the nearest railroad facility to the tract. Current transportation facilities along the coal truck haul route can be found in Appendix H.

3.14.2 Existing Traffic Conditions on the Coal Haul Transportation Route

Existing traffic conditions for both roadways and intersections along the coal haul transportation route are quantified using a level of service (LOS) measurement. LOS is a measure of the quality of service on transportation infrastructure and generally indicates the level of traffic congestion. LOS on two-lane highways is a reflection of traffic flow conditions, average speed, and average time spent following other vehicles. LOS at intersections reflects the amount of congestion and delay experienced by motorists at intersections. LOS is rated on a scale of A (the best) to F (the worst). LOS-A on roadways occurs where traffic flows are at or above posted speed limits and where drivers have complete mobility between lanes. LOS-A at intersections occurs when drivers take less than 10 seconds to pass through an intersection. LOS-F occurs when the vehicle traffic flow exceeds the road segment capacity (Fehr and Peers 2008). Table 3.27 includes a description of LOS-A through LOS-F (Fehr and Peers 2008).

Table 3.27. Intersection Level of Service Descriptions

Level of Service	Description of Traffic Conditions
A	Free Flow/Insignificant Delay Extremely favorable progression. Individual users are virtually unaffected by others in the traffic stream.
B	Stable Operations/Minimum Delays Good progression. The presence of other users in the traffic stream becomes noticeable.
C	Stable Operations/Acceptable Delays Fair progression. The operation of individual users is affected by interactions with others in the traffic stream.
D	Approaching Unstable Flows/Tolerable Delays Marginal progression. Operating conditions are noticeably more constrained.
E	Unstable Operations/Significant Delays Can Occur Poor progression. Operating conditions are at or near capacity.
F	Forced Flows/Unpredictable Flows/Excessive Delays Unacceptable progression with forced or breakdown of operating conditions.

Source: Fehr and Peers 2008.

KFO Route 116 is the main graded dirt road that travels north–south through the tract. It becomes a paved, two-lane road from the town of Alton west to US-89. LOS data are not available for KFO Route 116. US-89 is a north–south highway that passes through the towns of Hatch and Panguitch. Most of US-89 is a two-lane highway, with passing lanes on steep climbs and a four-lane section in Panguitch. The speed limit is posted at 60 or 65 miles per hour (mph), except in Hatch and Panguitch where it is reduced to 40 mph and 35 mph, respectively. Four of the intersections in the transportation area of analysis occur on US-89 at SR-14, SR-12, south of SR-20, and SR-20. SR-12 is the main access road from US-89 east to Red Canyon (in the Dixie National Forest) and to Bryce Canyon National Park. None of these intersections have traffic signals.

SR-20 is an east–west state road that connects US-89 and I-15. SR-20 is a paved, two-lane road with a climbing lane on steep sections approaching the summit. The speed limit is posted at 60 mph from the junction with US-89 and the steep upgrade, 35 mph going over the summit, and 65 mph from the summit to I-15.

I-15 is a four-lane, divided, interstate freeway that runs north–south through Utah. Along the coal haul transportation route, I-15 has posted speed limits of 75 mph from SR-20 to Cedar City.

SR-56 is an east–west state road from Cedar City to the Nevada state line. SR-56 varies from four lanes through Cedar City to two lanes outside the city. The only intersection with a traffic signal along the coal haul transportation route occurs at I-15 and SR-56. SR-56 has a posted speed limit of 45 mph on the coal haul transportation route.

Existing conditions along the coal haul transportation route consist of low volumes of traffic generally moving at free-flow speeds. Haul route segments along US-89 and SR-20 operate at LOS-C or better during weekday and weekend traffic in both directions. LOS-C occurs on roadways at or below capacity where posted speed limits are easily maintained, but the ability to pass or change lanes is not always assured. The existing LOS along the directional segments of I-15 and SR-56 was not measured as part of the Fehr and Peers study (Fehr and Peers 2008).

Existing conditions at intersections along the coal haul transportation route include low delays per vehicle and little to no congestion. The four unsignalized intersections along US-89 operate at LOS-A during peak morning and peak evening hours. Although LOS was not measured on directional segments of I-15 and SR-56, the signalized intersection at SR-56 and I-15 operates at LOS-C or better during peak morning and peak evening hours (Fehr and Peers 2008).

A 2003–2005 study of vehicle accidents across the coal haul transportation route was prepared by UDOT (Fehr and Peers 2008). The study considered the following four segments of the haul route: US-89/SR-20 junction, US-89/SR-20 to SR-20/I-15 junction, SR-20/I-15 to I-15/SR-56 junction, and SR-56/I-15 to milepost 61 junction. The study shows that 74.1% of accidents across all four segments during the study period were single-vehicle accidents. Single-vehicle accidents along the haul route were wildlife or domestic animal related, or involved drivers running off the road because of excessive speed, weather, falling asleep, and driving under the influence. Most multi-vehicle accidents involved rear-end crashes from following too closely, and sideswipe crashes from attempting to pass under unsafe conditions (Fehr and Peers 2008).

3.15 Vegetation

3.15.1 Regional Overview

Kane County is located in the Colorado Plateau Semidesert Province (USFWS 1996) of south-central Utah. The Alton Coal Tract occurs in the semiarid foothills of this ecoregion (Woods et al. 2001). Vegetation communities on the tract are typical of what is found in the surrounding Colorado Plateau region, namely pinyon-juniper woodlands, sagebrush shrublands, and mountain brush communities. Details of vegetation communities in the tract are presented in the sections below.

Mean annual precipitation in the town of Alton was approximately 16 inches from 1928 to 2006, and mean annual temperature for this same period was 60.2°F (Western Regional Climate Center 2006). The Colorado Plateau province receives precipitation in a bimodal pattern; precipitation occurs in the form of snow during the winter months and in the form of monsoonal storms in late summer (West and Young 2000). The Alton area also receives its annual precipitation in a bimodal pattern (Western Regional Climate Center 2006). The climate of the Colorado Plateau supports plant species that are physiologically adapted to withstand drought and heat, such as through leaf texture, surface-area, and specialized photosynthetic processes (Willson et al. 2008).

Vegetation on public lands in the tract is managed by the BLM in accordance with the KFO RMP (BLM 2008b). Vegetation treatment and management on public lands would provide measures to maintain or improve the overall health of vegetation communities (BLM 2008b). Specific management for vegetation would target forests and woodlands, uplands, and riparian and wetland communities through implementation of controls on noxious and invasive weed species and application of *Standards for Rangeland Health and Guidelines for Grazing Management on BLM Lands in Utah* (BLM 1997). Vegetation treatments would consist of prescribed fire, mechanical, chemical and biological treatments, woodland product removal, and wildland fire.

3.15.2 Vegetation Communities in the Tract

Vegetation communities in the tract are pinyon-juniper woodland, mountain brush, meadow, rabbitbrush, riparian, sagebrush/grassland, and sagebrush/grassland (treated) (USFWS 1996). Pinyon-juniper woodlands include transition zones between this and other communities; pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush combinations also occur under this heading. Agricultural pastures on private surface lands are also found in the tract. Ecologists surveyed the tract in fall of 2007 to determine the specific locations and acreages of these communities (Table 3.28; Map 3.14). The tract had also been previously surveyed by Mt. Nebo Scientific in 2007. Descriptions of these vegetation communities and lists of dominant species are presented in the sections below.

Table 3.28. Acreages of Vegetation Communities in the Alton Coal Tract

Vegetation Community	Acres	Percentage of the Tract*
Pinyon-juniper woodland	1,430.0	40.2%
Pinyon-juniper/mountain brush	438.8	–
Pinyon-juniper/sagebrush	506.0	–
Pinyon-juniper/sagebrush/mountain brush	485.2	–
Sagebrush/grassland	860.2	24.1%
Sagebrush/grassland (treated) †	749.1	20.9%
Annual and perennial grasses	324.1	9.1%
Mountain brush	62.8	1.8%
Meadow	62.8	1.8%
Riparian	55.3	1.5%
Rabbitbrush	10.7	0.3%
Total	**3,555.0**	**99.4%**

*Unvegetated areas consist of 4.1 acres of open water and 17.4 acres of roads, or approximately 0.6% of 3,576.6 acres in the tract.

†Mechanically treated to remove encroaching pinyon pine and Utah juniper and seeded to restore forb and grass cover.

3.15.2.1 PINYON-JUNIPER WOODLAND

Pinyon-juniper woodland (1,430 acres) accounts for the greatest percentage of land in the tract (40%). For the purposes of the reconnaissance surveys, all vegetation communities with pinyon pine or Utah juniper (*Juniperus osteosperma*) trees as a dominant component of the overstory are considered to belong to the pinyon-juniper woodland community or one of its combinations (i.e., pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, or pinyon-juniper/sagebrush/mountain brush).

Understory species in pinyon-juniper woodlands include shrubs, grasses, and forbs that are also commonly found in other vegetation communities in the tract. Shrub species include black sagebrush (*Artemisia nova*), Gambel oak (*Quercus gambelii*), Utah serviceberry (*Amelanchier utahensis*), alder-leaf mountain mahogany (*Cercocarpus montanus*), wild crab apple (*Peraphyllum ramosissimum*), antelope bitterbrush (*Purshia alcinatio*), broom snakeweed (*Gutierrezia sarothrae*) and snowberry (*Cercocarpus oreophilus*). Grass and forb species include slender wheatgrass (*Elymus trachycaulus*), daisy (*Erigeron* spp.), buckwheat (*Eriogonum* spp.) and fescue (*Festuca* spp.). Cacti species include prickly pear (*Opuntia* spp.) and echinocactus (*Echinocereus* spp.).

3.15.2.2 MOUNTAIN BRUSH

Mountain brush accounts for 62.8 acres (1.8%) of land in the tract and occurs mainly in ravines and hillsides. Gambel oak is the dominant overstory species in this community. Understory shrubs identified in this community are black sagebrush, big sagebrush (*Artemisia alcinatio*), basin big sagebrush (*Artemisia alcinatio* var. *alcinatio*), mountain big sagebrush (*Artemisia alcinatio* var. *vaseyana*), rubber rabbitbrush (*Ericameria nauseosus*), Utah juniper, Rocky Mountain juniper (*Juniperus scopulorum*), pinyon pine, antelope bitterbrush, Woods' rose (*Rosa woodsii*), and snowberry. Grass and forb species in this community are crested wheatgrass (*Agropyron cristatum*), smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*), and prickly pear cactus (*Opuntia* spp.).

3.15.2.3 ANNUAL AND PERENNIAL GRASSES

Agriculture is practiced, or has historically been practiced, on 324 acres (9.1%) of private surface land in the northern half of the tract. Plant species identified in the annual and perennial grasses community are crested wheatgrass, black sagebrush, California brome (*Bromus carinatus*), smooth brome, thistle (*Cirsium* spp.), rubber rabbitbrush, orchardgrass (*Dactylis glomerata*), intermediate wheatgrass (*Elymus hispidus*), slender wheatgrass, Russian wheatgrass (*Elytrigia juncea*), curlycup gumweed (*Grindelia squarrosa*), broom snakeweed, and Indian ricegrass (*Stipa hymenoides*). Wheatgrasses (*Elymus* spp.) and crested wheatgrass were the dominant plants encountered during reconnaissance surveys.

3.15.2.4 MEADOW

The meadow vegetation community accounts for 62.8 acres (1.8%) of land near the northern end of the tract. Vegetation in the meadow community consists of hydrophytic plants such as wiregrass (*Juncus arcticus*), small-wing sedge (*Carex microptera*), Missouri iris (*Iris missouriensis*), foxtail barley (*Hordeum jubatum*), and seaside arrowgrass (*Triglochin alcinat*). Canada thistle (*Cirsium arvense*), a Utah state-listed noxious weed, is also located in this vegetation community.

Hydrologic resources in this part of the tract are likely runoff from agriculture practices in the northwestern part of the tract. It is likely that areas within this community would be considered wetland; however, no formal delineations have been done. Based on surveys of the vegetation, soils, and hydrology of the area conducted in November 2007, and June and July 2008 (Collins 2008b: Appendix F); this vegetation community is assumed to be a jurisdictional wetland for purposes of analysis.

3.15.2.5 RABBITBRUSH

The rabbitbrush vegetation community occurs on 10.7 acres (0.3%) of the tract. This community is similar in structure and vegetative composition to the sagebrush/grassland vegetation community but also includes four-wing saltbush (*Atriplex canescens*) and a greater concentration of rubber rabbitbrush. This community occurs in some areas adjacent to riparian communities in the tract.

3.15.2.6 RIPARIAN

This vegetation community accounts for 55.3 acres of land along streams in the tract. This community represents 1.5% of the total land in the tract. Species such as willows (*Salix* spp.), cottonwoods (*Populus* spp.), Russian olive (*Elaeagnus angustifolia*), and tamarisk (*Tamarix* spp.) occur in the overstory of the tract's riparian communities. Understory species include wiregrass and saltgrass (*Distichlis spicata*) and weedy species such as curlycup gumweed and broom snakeweed (SWCA 2007b). A portion of the understory is disturbed (SWCA 2007b).

3.15.2.7 SAGEBRUSH/GRASSLAND

The sagebrush/grassland vegetation community accounts for 860.2 acres (24.1%) of land in the tract. Black sagebrush is the dominant shrub species in this community, with some big sagebrush and rabbitbrush plants also included in the shrub stratum. A few small Utah junipers and pinyon pines are occasional components of this community. Understory species include crested wheatgrass, California brome, cheatgrass, foxtail barley, thistle, slender wheatgrass, western wheatgrass (*Elymus smithii*), Sandberg bluegrass (*Poa secunda*), broom snakeweed, Palmer's penstemon (*Penstemon palmeri*), and flixweed (*Syssimbrium* spp.).

3.15.2.8 SAGEBRUSH/GRASSLAND (TREATED)

This vegetation community accounts for 749.1 acres (20.9%) in the tract. Dominant species are similar to those identified in the sagebrush/grassland vegetation community and include black sagebrush, big sagebrush, and rubber rabbitbrush in the shrub stratum. Utah juniper, pinyon pine, and Gambel oak are also present in this stratum, although these species are not dominant. Understory species in this community are broom snakeweed, Russian wildrye, slender wheatgrass, thistles, cheatgrass, California brome, Palmer's penstemon, crested wheatgrass, and yarrow (*Achillea millefolium*).

The ground in this community is covered partially with chipped remnants of Utah juniper and pinyon pine trees. These trees were removed during past prescription fuels treatments, chipped on-site, and broadcasted over the immediate area (Personal Communication, Gubler 2008).

3.15.3 Invasive and Noxious Weeds

All non-native plant species identified during 2007 field reconnaissance surveys are listed in Table 3.29. This list includes invasive, noxious, and introduced weed species. Most of these species occur in disturbed sites such as private annual and perennial grasses communities and where vegetation treatments have occurred.

Table 3.29. Introduced, Invasive, and Noxious Weed Species Identified in the Alton Coal Tract

Common name	Scientific name	Status*	Location
Canada thistle	*Cirsium arvense*	Noxious	Meadow
Cheatgrass	*Bromus tectorum*	Invasive	Sagebrush
Common mullein	*Verbascum thapsus*	Invasive	Sagebrush/grassland (treated)
Crested wheatgrass	*Agropyron cristatum*	Introduced	Sagebrush and annual and perennial grasses
Intermediate wheatgrass	*Elymus hispidus*	Introduced	Annual and perennial grasses
Kentucky bluegrass	*Poa pratensis*	Native and introduced infra-taxa	Sagebrush and mountain brush
Orchardgrass	*Dactylis glomerata*	Introduced	Annual and perennial grasses
Small burnet	*Sanguisorba minor*	Introduced	Sagebrush/grassland (treated)
Tall tumble mustard	*Sisymbrium altissimum*	Invasive	Sagebrush/grassland (treated)

* Data from U.S. Department of Agriculture [USDA] 2008, Whitson 1996.

Introduced species are those that are not native to the lower 48 states. Many of the introduced species on this list, such as crested wheatgrass and intermediate wheatgrass, are forage plants brought intentionally to the United States for use as livestock feed. The USDA plants database (USDA 2008) was used to determine introduced statuses.

Invasive weeds are mostly introduced plant species that are able to spread faster than neighboring native species by being better equipped to take advantage of available water, sunlight, and nutrients. There are no federal or state lists of invasive weeds; the text *Weeds of the West* (Whitson 1996) was used to determine invasiveness statuses. Cheatgrass, tall tumble mustard, and common mullein are invasive weeds that occur in various communities in the tract.

Noxious weeds are plant species that have been formally recognized by federal, state, or county governments to pose serious risks to the economy of an area. The State of Utah has 19 listed noxious weed species. One of the Utah noxious weed species, Canada thistle, has been identified in the tract. A few individuals of this species are located in the meadow vegetation community in the northwest section of the tract.

3.15.4 Special Status Species

Two BLM-listed special status species (sandloving penstemon [*Penstemon ammophilus*] and slender camissonia [*Camissonia exilis*]), three Utah rare plants (Paria breadroot [*Pediomelum pariense*], Ruth's sphaeromeria [*Sphaeromeria ruthiae*], Charleston Mountain violet [*Viola charlestonensis*]) (Utah Native Plant Society 2007), and one federally listed threatened species (Jones cycladenia [*Cycladenia humilis* var. *jonesii*]) are known to occur in Kane County, Utah at elevations similar to elevations in the tract. Surveys for suitable habitat for these species were done in November 2007, August 2008, and September 2008 (Appendix F). During the November 2007 surveys, it was determined that habitat for many of these species does not exist on the tract. Potential habitat for sandloving penstemon and Ruth's sphaeromeria was identified. Sandloving penstemon is a BLM sensitive species that occurs on sandy soils derived from Navajo sandstone in ponderosa pine, oak (*Quercus* spp.), Douglas fir (*Pseudotsuga menziesii*), mountain mahogany, bigtooth maple (*Acer grandidentatum*), and mixed shrublands. Surveys for sandloving penstemon were conducted in May 2008. Neither the plant nor its habitats were found during these surveys, and there is a low probability that the species occurs in the tract (Collins 2008a: Appendix F). Ruth's sphaeromeria is a Utah rare plant ((Utah Native Plant Society 2007) that occurs in oak and mountain mahogany vegetation communities on Navajo sandstone. Surveys for Ruth's sphaeromeria were conducted in September 2008. Based on the survey results, there is a low probability that this species occurs in the tract. Because there are no special status plant species in the tract, they are not discussed in Chapter 4.

3.16 Water Resources

The Alton Coal Tract is located in the upper reaches of the Kanab Creek watershed, a sub-drainage to the Colorado River. The Kanab Creek watershed drains approximately 1,512,091 acres that include the tract, the towns of Alton and Kanab, Utah, and Fredonia, Arizona (Map 3.15). The watershed covers an elevation range from approximately 2,100 feet at the confluence with the Colorado River to 9,345 feet at the headwaters of Kanab Creek, which originates upstream of the tract on the Paunsaugunt Plateau. Kanab Creek flows in a south-southwesterly direction through the tract and downstream into Arizona. Within the Kanab Creek watershed, the tract is located in the lower portions of the following three sub-watersheds: Lower Robinson Creek, Kanab Creek below Reservoir Canyon, and Sink Valley Wash. These three sub-watersheds have a combined area of 47,040 acres. The tract makes up 8% of these three sub-watersheds and 0.25% of the entire Kanab Creek watershed.

The tract is located within an arid region where the average annual precipitation is approximately 12 inches per year in the lower elevations. Precipitation in the Kanab Creek basin increases with elevation and can exceed 40 inches per year in the upper elevations. Most precipitation occurs as snow.

The only tributary to Kanab Creek within the tract is Lower Robinson Creek. This creek originates from small canyons in the foothills of the Paunsaugunt Plateau east of the tract and flows east to west through the middle of the tract. Flows in Lower Robinson Creek are minimal. Stream flows have not been observed in Lower Robinson Creek at monitoring stations SW-4 and SW-101 (Map 3.16), except during periods of spring runoff or large precipitation events. In addition to the arid climate, the low flow conditions of Lower Robinson Creek are also attributable to the fact that it is a losing stream, which loses flow to alluvial deposits under its channel. In addition, the creek crosses a north-south trending ridge of Tropic Shale located along the Sink Valley fault that tends to divert water flowing through this alluvium along the fault and into shallow aquifers in Sink Valley rather than diverting it downstream. Although flows are not generally observed along most of Robinson Creek, minor flows are measured below a seepage location at monitoring station SW-5, where the creek meets Kanab Creek (see Map 3.16). Petersen Hydrologic (2007) reports that the small discharge usually present at SW-5 is derived from the seepage of alluvial groundwater into the Lower Robinson Creek stream channel, and discharges where the stream channel intersects the relatively impermeable Dakota Formation.

Groundwater resources within and adjacent to the tract are present in shallow, low-producing aquifers in alluvial sediments, the Tropic Shale, and the Dakota Formation. The first significant water-bearing stratum beneath the tract from which appreciable quantities of groundwater can be produced is from the Navajo Sandstone aquifer. However, the Navajo Sandstone aquifer is more than 1,000 feet below the surface, and the cost of well construction and pumping likely prohibit local access to this groundwater resource.

Other water-related features that occur within the tract are riparian areas, probable wetlands, floodplains, and AVFs.

3.16.1 Surface-water Resources

3.16.1.1 SURFACE-WATER OCCURRENCE AND USE

Kanab Creek and Lower Robinson Creek are the dominant surface-water features within the tract. Lower Robinson Creek is a tributary to Kanab Creek; their confluence is located on the western border of the tract. Through most of the tract the main stem of Kanab Creek is categorized in the National Hydrography Dataset as a perennial stream that has flow throughout the year. However, observed flow in Kanab Creek is highly dependent on climate and upstream water use and has been observed to run very low (less than 0.1 cubic feet per second [cfs]) through the tract during the summer (Petersen Hydrologic 2007). Robinson Creek is an intermittent stream throughout the tract with flow occurring primarily during large precipitation events and spring runoff (Petersen Hydrologic 2007) and Map 3.16).

The primary use of surface water in Kanab Creek and its tributaries is irrigation and stock watering. Irrigation in Alton makes up a significant portion of this use (Petersen Hydrologic 2008). In addition to snow melt and storm runoff, Kanab Creek is also fed by a spring located directly south of the town of Alton (the discharge rate for this spring is unknown). These spring waters flow southward and enter Kanab Creek in the northwest quarter of Section 24, Township 39 South, Range 6 West. In this area Kanab Creek is diverted into transmission ditches that store the water in earthen ponds for irrigation. Irrigation in the area is predominantly conducted with sprinklers, although some flood irrigation is also used. Flood irrigated lands are found in the Kanab Creek Valley below the confluence with Lower Robinson Creek and just south of the town of Alton (Petersen Hydrologic 2008).

3.16.1.2 STREAM PROPER FUNCTIONING CONDITION

The natural drainage channels associated with Kanab Creek and Lower Robinson Creek are susceptible to downcutting and mass wasting (Petersen Hydrologic 2007). Petersen Hydrologic (2007) reports that there are up to several tens of feet of downcutting below the surrounding topography throughout large portions of these channels. Petersen Hydrologic also reports that there is headcutting in the Sink Valley Wash and active erosion and collapse of the steep arroyo walls along Robinson Creek. Kanab Creek is a deeply incised arroyo channel with steep walls lining the creek bed where the stream has downcut into nearby sediment (Cordova 1981). As recently as 2005, landslides along the arroyo faces of Kanab Creek have been reported as a natural slope-failure slide (Lund 2005). Kanab Creek, Lower Robinson Creek, and Sink Valley Wash all experience downcutting during large precipitation events, creating near-vertical streambanks. These streambanks are unstable and result in mass wasting of sediment into the channel. The movement of large quantities of sediment during spring melt and large precipitation events modifies the stream channel on a regular basis. The deteriorated condition of the stream channel is largely attributed to historic land-management practices and the natural erosive properties of the soil and geology in this area (Petersen Hydrologic 2007). Along the creek margin, where lower slopes make it possible, cottonwood and willow trees along with sagebrush and grasses grow in a limited riparian area, thereby stabilizing the streambank in these areas. As defined by the BLM’s Proper Functioning Condition Assessment protocol (BLM 2008e) and based on a field assessment conducted in November 2010 the functional rating of Upper Kanab Creek is “Proper Function Condition” whereas the functional rating of Lower Robinson Creek is “Functional – At Risk”.

3.16.1.3 SURFACE-WATER HYDROLOGY

Around the tract, most of the annual runoff volume in streams draining the mountainous areas occurs during spring and early summer as a result of snowmelt and precipitation onto saturated soils. The highest peak discharge commonly occurs during summer monsoonal storm events, which produce short bursts of intense precipitation. The total mean annual runoff from the Upper Kanab Creek basin into Arizona is approximately 50,000 acre-feet (Cordova 1981). Stream flows generally peak during March, but may vary from year to year depending on local weather conditions and yearly snowpack. Summer and early fall baseflow is typically much lower than spring conditions, except when infrequent storm-produced flows occur. Flows in the lower elevation streams are generally more variable than are flows originating in the mountainous region. The flows are influenced by lowland snowmelt as well as rainstorms during the remainder of the summer and fall. These streams are more likely to have little or no flow during the late summer and early winter. The closest USGS gaging station to the tract is located downstream north of Kanab, Utah (Station No. 09403600, see Map 3.16). The closest National Climatic Data Center (NCDC) weather station to the tract is located in the northern portion of the town of Alton, Utah (NCDC Alton Station No. 420086, see Map 3.16). Figure 3.4 shows Kanab Creek discharge from the USGS gaging station and precipitation recorded at the NCDC Alton Station from July 2000 to July 2010. Although the precipitation and stream discharge measurements were not taken within the tract, they are approximately representative of the relationship between rainfall and stream flow in the tract area.

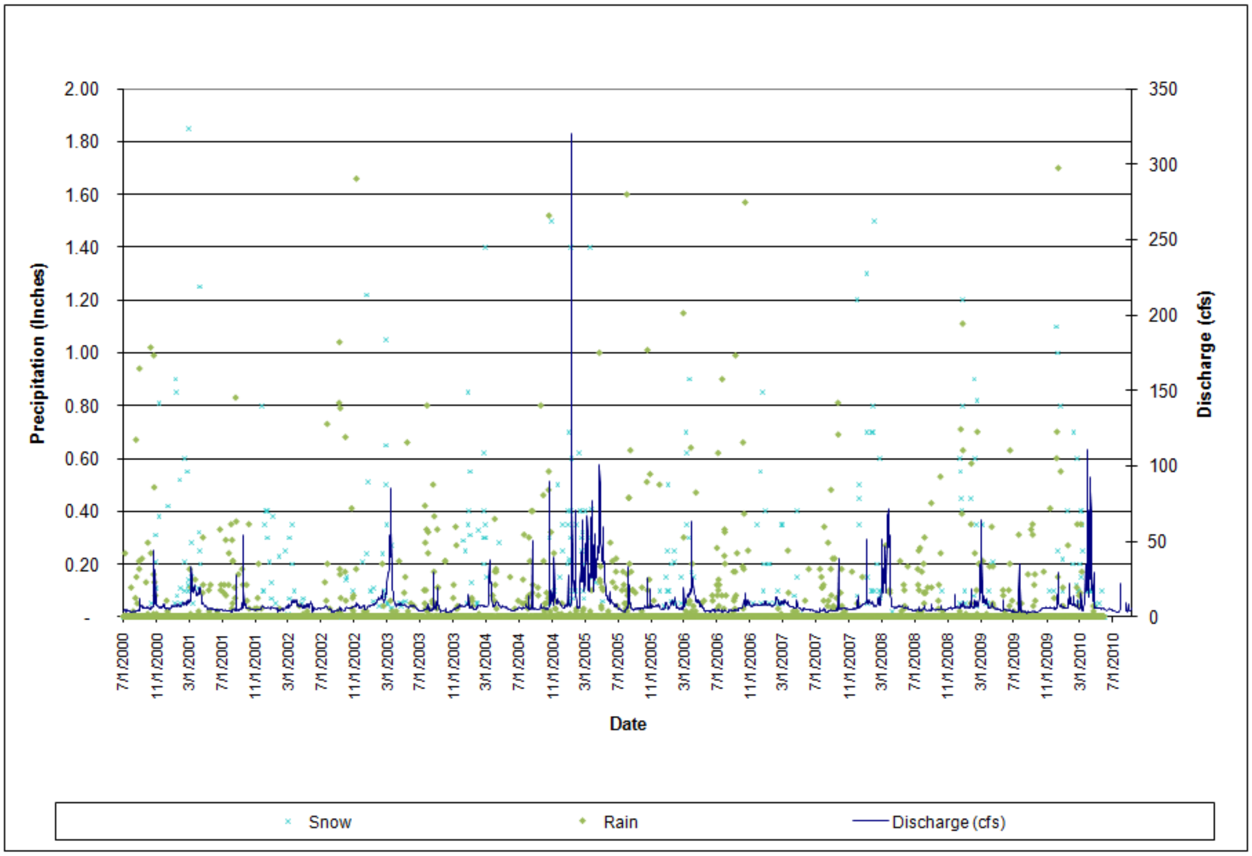

Figure 3.4. Precipitation at National Climatic Data Center Alton Station No. 420086 and Kanab Creek Discharge at U.S. Geological Survey gaging station No. 09403600 from July 2000 to July 2010.

Discharge in the upper reaches of Kanab Creek, including tributaries that flow through the tract, is generally seasonal. Most of the water in Kanab Creek upstream of the town of Alton is diverted for irrigation, leaving low flows in Kanab Creek downstream of the town of Alton and through the tract (Petersen Hydrologic 2008). It is common for Kanab Creek to have little or no discharge south of the tract during much of the year.

Flow data have been collected by Petersen Hydrologic on a quarterly basis since 2005 at three monitoring sites on Kanab Creek. These monitoring stations include, from upstream to downstream, SW-1, SW-3, and SW-2. Flows have also been collected at a fourth monitoring site (SW-5) located on Lower Robinson Creek before it enters Kanab Creek (see Map 3.16). Figure 3.5 shows the flows measured at each station along Kanab Creek between 2005 and 2007; flows entering Kanab Creek from Lower Robinson Creek ranged from 0 to 0.9 cfs during this period.

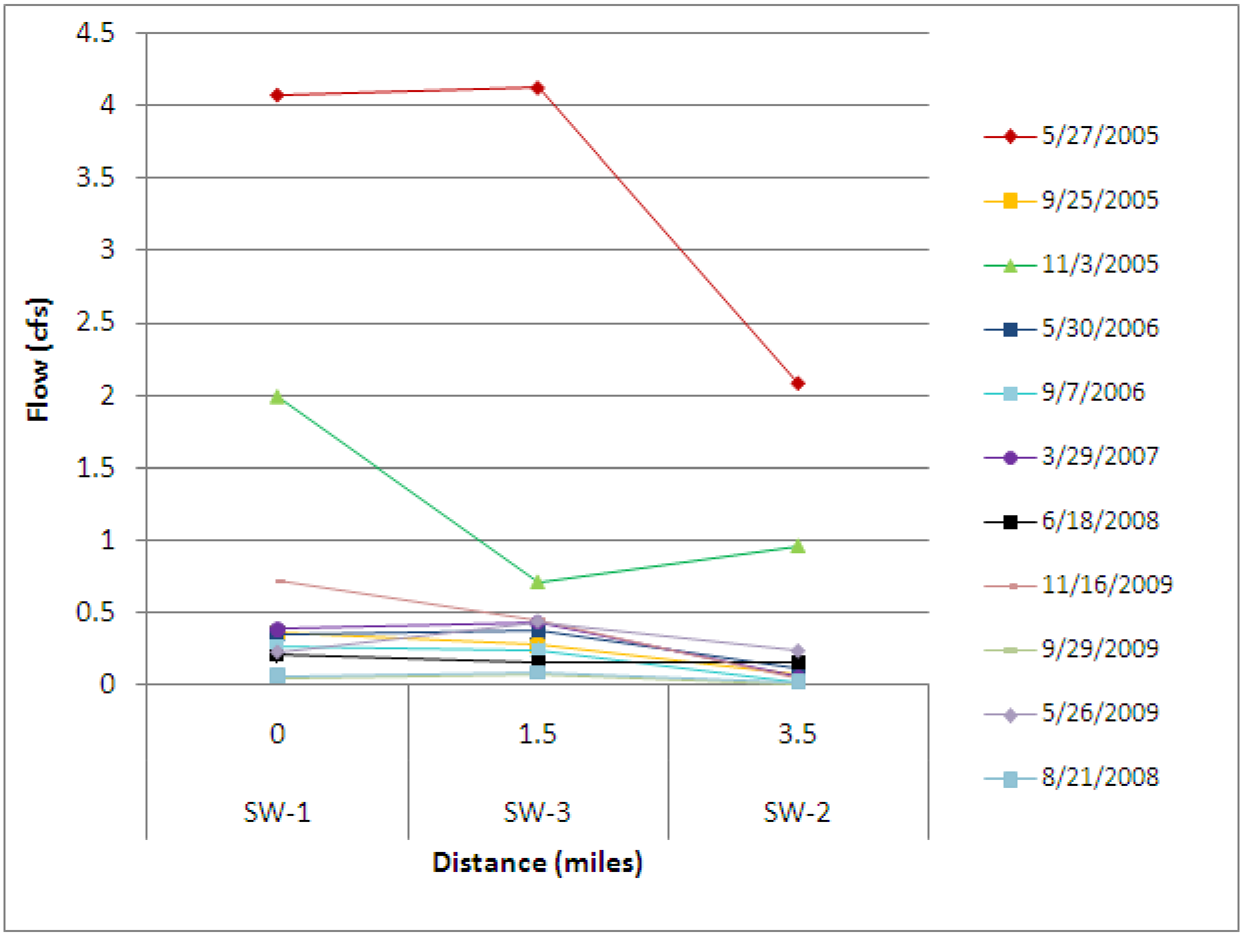

Figure 3.5. Discharge (flow) at surface-water monitoring sites in the Alton Coal Tract, 2005–2009 (Utah Division of Oil, Gas, and Mining 2010). Distance starts at the first upstream monitoring station (SW-1) (Petersen Hydrologic 2007). See Map 3.16 for location of monitoring stations.

It is apparent in Figure 3.5 that flows in Kanab Creek generally decrease from SW-1 to SW-3. The decrease in flows between SW-3 and SW-2 are due to a combination of factors including 1) irrigation diversions located approximately a half mile downstream from SW-3, 2) lack of local or regional recharge to the shallow aquifer sufficient to sustain baseflow (a losing stream), and 3) loss of water to evapotranspiration. It is common for Kanab Creek to have little or no discharge south of the tract during much of the year. Therefore, flows in Kanab Creek at the tract's southern boundary are minimal or nonexistent for most of the year.

The other potentially significant surface-water resource near the tract is flows exiting from Sink Valley Wash. Surface-water flows exiting Sink Valley Wash near the tract's southeastern edge are also intermittent with flow occurring only during spring melt or large precipitation events (see Table 3.30).

Table 3.30. Flows Measured at SW-9 in Sink Valley Wash

Date	Flow (cfs)
01/13/1988	0.00
02/16/1988	1.70
03/24/1988	0.00
06/17/2005	0.00
09/24/2005	0.00
11/03/2005	0.00
03/30/2006	0.02
05/29/2006	0.00
06/18/2006	0.00
12/20/2006	0.00
03/29/2007	0.00
06/20/2007	0.00
09/30/2007	0.00
12/29/2007	0.00
03/21/2008	0.41
03/22/2008	0.00
6/17/2008	0.00
8/20/2008	0.00
12/30/2008	0.00
3/18/2009	0.00
5/24/2009	0.00
9/29/2009	0.00
11/18/2009	0.00
3/30/2010	0.02

Source: Petersen Hydrologic 2008.

3.16.1.4 SURFACE-WATER QUALITY

The State of Utah has designated the following three beneficial uses to the surface waters found in the tract (Kanab Creek below the confluence with Reservoir Canyon and Lower Robinson Creek): secondary contact recreation (2B), nongame fish and associated food chains (3C), and agricultural water supply (4).

Secondary contact recreation (2B) refers to uses where full immersion does not occur, such as boating and wading. Waters designated for secondary contact recreation are required to maintain low bacteria counts to maintain healthy conditions for recreational users. Waters designated for nongame fish and associated food chains (3C) are required to exhibit appropriate levels of dissolved oxygen, temperature, Ph, and other parameters needed to support aquatic life. Waters designated as agricultural water supply (4) (including irrigation and livestock watering) are required to be suitable for the irrigation of crops or as water for livestock. As such, they are required to meet general surface-water quality criteria for TDS, a common measure of salinity and various metals such as lead and cadmium.

Water-quality criteria are specific to designated beneficial uses; they include both numeric limits for individual pollutants or conditions and narrative descriptions of desired conditions. Section 303(d) of the CWA requires each state to submit a list to the EPA every two years identifying waters that fail state water-quality standards. The waters identified on the 303(d) list are known as impaired waters. None of the water bodies in the tract are listed on the 2008 303(d) list of impaired waters. However, outside the tract, the lower portion of Kanab Creek (17.6 miles), from the Utah-Arizona state line north to Four-mile Hollow (13 miles north of Kanab, Utah), is listed on the 2008 list of impaired waters for exceedances of the TDS standard (1,200 mg/L for irrigation water use).

A summary of current (2005–2010) water quality data for streams in the tract is contained in Table 3.31. This table also presents the applicable state water-quality standards for each constituent. These data were obtained for eight sites in or near the tract from a DOGM water-quality database (DOGM 2008b). These data indicate exceedances of state water quality standards for nitrate, TDS, and temperature. The maximum nitrate value of 4.2 mg/L was collected on September 27, 2007 at Site RID-1 in Robinson Creek (see Map 3.16). This sample represents the only exceedance of the state water-quality standard for nitrate of 4.0 mg/L. The maximum recorded TDS value of 3,429 mg/L was collected at site SW-101 in Robinson Creek on May 6, 2010. Of the 98 TDS values recorded at sites in and around the tract, 31% exceed the state standard of 1,200 mg/L. The temperature criterion of 27 degrees for warm-water fisheries was exceeded at Robinson Creek on June 18, 2008. No other surface water-quality parameters recorded in or around the tract exceed state water-quality standards.

Although there is no longer a state standard for total suspended solids, the maximum values recorded in and around the tract are very high. The maximum recorded TSS value near the tract is 22,752 mg/L at SW-101 on March 18, 2009. Similarly high values were recorded at the same location on 3/21/2008 (13,404 mg/L) and on 3/30/2010 (9,020 mg/L).

The State of Utah has established a threshold indicator value of 0.05 mg/L total phosphorus concentration in streams and rivers as a trigger for further, in-depth assessment of water body condition and needs. This indicator value applies to recreation use in the watershed. Total phosphorus exceedances of the designated beneficial use threshold (0.05 mg/L) occur routinely in surface waters in and around the tract, with 93% of data showing total phosphorus concentrations greater than 0.05 mg/L.

Table 3.31. Summary of Utah Division of Oil, Gas, and Mining Water Quality Data in and Around the Alton Coal Tract

	Average	Maximum	Minimum	State Standard	Associated Beneficial Use
Temperature (°C)	11.6	27.4	–	27	3C
Ph	8.4	9.05	7.6	6.5–9	2B, 3C, 4
Dissolved oxygen (mg/L)	8.2	12.1	5.6	3.0*	3C
Total suspended solids (mg/L)	949.8	22,752	2.5	None	–
Nitrate and nitrite as N (mg/L)	1.6	4.2	0.03	4.0	2B
Total phosphorus (mg/L)	0.52	2.94	0.05	0.05†	2B
TDS (mg/L)	883	3,429	127	1,200.0	4

*One-day minimum standard.
†Threshold value.

3.16.2 Groundwater

3.16.2.1 GROUNDWATER OCCURRENCE AND USE

Shallow groundwater resources beneath the tract are present in alluvial sediments, the Tropic Shale, and the Dakota Formation. However, most of these shallow groundwater resources are not supportive of a readily developable groundwater resource due to low permeability of the associated geologic units. Based on estimates provided by Petersen (Personal Communication 2010), approximately 10,000 acre-feet of groundwater are available in the zone (generally alluvial sediments) from which groundwater resources would be extracted for use in mining operations on the tract. The first significant quantities of groundwater underlying the tract are from the deep Navajo Sandstone aquifer.

On a regional scale, groundwater from the Navajo Sandstone is used for domestic, agricultural, and municipal wells. This groundwater also provides baseflow to springs and streams in the region. However, the Navajo Sandstone aquifer is not tapped by any wells in or adjacent to the tract. Within the tract, the depth of the Navajo Sandstone ranges from approximately 1,300 feet to 2,450 feet below land surface (see Figure 3.3). Therefore, the groundwater resources available in the Navajo Sandstone aquifer are not reasonably available for development near the tract because of the high costs of well construction and groundwater pumping.

3.16.2.2 GROUNDWATER HYDROLOGY

Aquifer properties and groundwater resources beneath the Alton Coal Field have been investigated through extensive drilling, hydrogeologic characterization, and surface and groundwater monitoring (Doelling and Graham 1972a; 1987; Petersen Hydrologic 2007).

The tract is located at the base of a valley, along the north-south axis of Kanab Creek, where shallow aquifers could support stream flows during periods of peak runoff. During these periods of peak runoff, areas along Kanab Creek could be considered groundwater discharge zones. The principal recharge areas to the shallow aquifers are located outside the tract on Paunsaugunt Plateau. Groundwater in the bedrock stratigraphic sequence of the Paunsaugunt Plateau east of the tract are located large distances laterally and topographically up-gradient of the tract. Local recharge to shallow aquifers occurs as diffuse infiltration through the unsaturated zone during precipitation events. This would likely occur in up-gradient areas along mountain fronts and loosing stream reaches. The clayey surface sediments in the valleys limit the potential for vertical recharge to groundwater systems.

The complex geology and structure (faults and folds) of the Alton Coal Field forms a complex hydrogeologic setting vertically and laterally across and adjacent to the tract. In general, the vertical hydrogeologic units consist of unconsolidated clay, silt, sand, and gravel alluvial sediments that have been deposited near drainages and overlay the relatively impermeable Tropic Shale. The hydrogeology below the Tropic Shale consists predominately of low-permeability shaley strata interbedded with lenticular (lens-like), fine- to medium-grained sandstones of the Dakota Formation. The Smirl Coal Zone, which is located at the top of the Dakota Formation near the contact with the Tropic Shale, is reported to have a moisture content of approximately 13% (2004).

Laterally within the tract, the alluvium deposits range from a thin covering to a thicker covering of 10 feet or more. However, east of the southeastern border of the tract in Sink Valley, the alluvium deposits approach a thickness of 50 feet, and are reported to be 120–140 feet thick along the eastern edge of Sink Valley (Petersen Hydrologic 2007). The alluvium deposits in Sink Valley are also capped by a thick sequence (up to 60 feet) of clay material. Also unique to Sink Valley is the presence of the Tropic Shale along its margins that creates a hydrogeologic boundary which, in essence, creates a “bathtub” within the valley (UII 1987). Furthermore, Sink Valley is located at the base of numerous drainages (Petersen Hydrologic 2007) that are recharged from the Paunsaugunt Plateau. Therefore, numerous springs and wells are located in Sink Valley Wash, a groundwater discharge area. See Section 3.16.3 for discussion of AVFs.

Another groundwater discharge area is located in the most northwest portion of the tract, just south of the town of Alton. In this area, a flowing spring is present. Saturated soils are also present north of the spring. However, these saturated soils are believed to be from irrigation sub-flows off irrigated fields south of the town of Alton, rather than groundwater discharge.

No other springs or seeps with measurable discharge have been identified in the tract. Furthermore, no water supply wells are known to exist in either the Tropic Shale or the Dakota Formation in the tract, demonstrating the inability of these formations to transmit useful quantities of water to wells. Due to the low permeability of these units, groundwater from the Tropic Shale and Dakota Formation does not contribute measurable baseflow to streams in the tract (Petersen Hydrologic 2007). Groundwater recharge in the area is from precipitation and percolation to shallow aquifers with little value. In addition, the Navajo Sandstone aquifer is effectively isolated from the proposed mining areas in the tract by more than 1,000 feet of low-permeability rock strata of the Dakota and Carmel formations. These formations contain large thicknesses of low-permeability shales, siltstones, mudstones, and bentonite. Therefore, the Navajo Sandstone aquifer would not be impacted by mining operations in the tract and is not further evaluated.

3.16.2.3 GROUNDWATER QUALITY

Groundwater-quality data are available for 11 wells and 26 springs located near the southeastern border of the tract. All of these sampling sites are within or near Sink Valley Wash (see Map 3.16), and are not representative of groundwater conditions in the entire tract. Groundwater-quality data for the 11 wells and 26 springs are listed in Table 3.32 for select parameters. These data are summarized from data obtained from the DOGM water quality database.

Groundwater quality data for TDS are available for six wells and 10 spring monitoring sites located near the southeastern border of the tract. All of these sampling sites are within or near Sink Valley Wash. The average TDS concentrations measured in groundwater from wells and springs in Sink Valley Wash are 623 and 394 mg/L, respectively. These concentrations are well below the state standard for irrigation and stock watering. Groundwater collected from a well (Y-36) completed in the Smirl coal seam had a TDS concentration of 1,320 mg/L. This TDS result slightly exceeds the state standard for irrigation; however, only one sample result was available. The average selenium concentration measured in groundwater from all wells and springs was less than laboratory detection limits (typically 0.001–0.02 mg/L). The average boron concentration measured in groundwater from all wells and springs was 0.2 mg/L.

Table 3.32. Summary of Selected Groundwater Quality Data Adjacent to the Alton Coal Tract

Groundwater Source	Parameter	Minimum	Maximum	Average
Wells located in Sink Valley Wash alluvium	Ph	7.0	8.0	7.4
	Conductivity (µS/cm)	602	2,680	910
	TDS (mg/L)	378	2,060	623
Wells located in Lower Robinson Creek	Ph	6.6	7.9	7.2
	Conductivity (µS/cm)	1,622	5,490	3,365
	TDS (mg/L)	1,172	5,208	3,197
Well located in the Smirl Coal Seam of Sink Valley Wash	Ph	7.2	7.9	7.6
	Conductivity(µS/cm)	1,320.0	1,320.0	1,320.0
	TDS (mg/L)	784.0	815.0	800.0
Springs located in Sink Valley Wash alluvium	Ph	7.0	9.1	7.6
	Conductivity (µS/cm)	482	4,150	1,045
	TDS (mg/L)	381	1,182	662
Springs located in Lower Sink Valley Wash	Ph	7.0	7.8	7.5
	Conductivity(µS/cm)	686	2,470	1,662
	TDS (mg/L)	394	594	518

Notes: Wells located in Sink Valley Wash alluvium include the following sites: C5-130, LS-15, LS-60, LS-85, SS-15, SS-30, Y-102, Y-61.

Wells located in Lower Robinson Creek include the following sites: LR-45 and UR-70.

Alluvium Sink Valley Wash Springs include the following sites: Sorenson Spring, SP-14, SP-15, SP-16, SP-17, SP-18, SP-19, SP-20, SP-21, SP-22, SP-23, SP-24, SP-25, SP-26, SP-28, SP-29, SP-30, SP-31, SP-32, SP-33, SP-35, SP-6, and SP-8.

Lower Sink Valley Wash Springs include the following sites: SP-3, SP-34, SP-4.

3.16.3 Wetlands, Riparian Areas, Floodplains, and Alluvial Valley Floors

3.16.3.1 WETLANDS

Approximately 62.8 acres of wetlands are assumed to be present in Block NW of the tract. Preliminary field assessments in the fall of 2007 and summer of 2008 (SWCA 2007b: Appendix F; Collins 2008b: Appendix F) resulted in an estimate of approximately 37.5 acres of wetland with wet meadow characteristics (see Map 3.17 and Appendix F) however the larger figure is used in the analysis because a complete wetland delineation on the tract has not been performed. For purposes of analysis, this area is considered to be a jurisdictional wetland. A jurisdictional wetland is a wetland subject to regulation by USACE under Section 404 of the CWA (i.e., it is within USACE “jurisdiction”).

The wetlands present in Block NW are, based on the preliminary field assessments, characterized by hydrophytic vegetation including wire grass, small-wing sedge, and Missouri iris. Further, based on a small number of sample holes, soils in the wetland area exhibit characteristics typical of hydric (wetland) soils. Wetland hydrology data were not gathered during preliminary field investigations. However, based on aerial photograph examinations coupled with field observations, it appears that the water supporting the wetland area is primarily a result of irrigation runoff from the agricultural fields directly north and adjacent to the wetlands. Other natural sources of water to the wetlands, such as springs or seeps, were not observed during preliminary field assessments, although springs are known to be present in the area.

3.16.3.2 RIPARIAN AREAS

There are approximately 55.3 acres of riparian area on the tract (approximately 1.5% of the total tract area) largely along Kanab Creek and Lower Robinson Creek (see Map 2.2). Species such as willows, cottonwoods, Russian olive, and tamarisk occur in the overstory of the tract riparian communities. Understory species include wiregrass and saltgrass as well as disturbed-area weedy species such as curlycup gumweed and broom snakeweed (2007a).

3.16.3.3 FLOODPLAINS

Approximate floodplain locations and extents within and adjacent to the tract were assessed as part of the reconnaissance-level AVF investigation conducted by Petersen (Petersen Hydrologic 2008) that is described in Section 3.16.3.4 below. Petersen's investigation indicated that map-able floodplains within the tract are located adjacent to Kanab Creek in the no-coal zone (see US.3). The total acreage of this floodplain area within the tract is approximately 57 acres. Petersen's study area for the AVF investigation included areas adjacent to the tract as well. Kanab Creek north and south of the tract boundary also has an associated map-able floodplain in addition to lower Sink Valley Wash southeast of the tract. The total approximate acreage of floodplains outside of the tract defined in the AVF investigation is approximately 476 acres.

Floodplains are protected by EO 11988. This EO requires federal agencies to take action to reduce the risk of flood loss; minimize the impact of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains.

3.16.3.4 POTENTIAL OCCURRENCE OF ALLUVIAL VALLEY FLOORS

Areas identified as AVFs are subject to special mining considerations and protections under the SMCRA. The intent of these special considerations is to protect certain alluvial valleys that are of special importance to farming in the arid and semiarid western United States (west of the 100th meridian). Accordingly, it is useful to delineate areas that may possibly be determined to be AVFs in future mine permitting activities.

Under the governing State of Utah coal mining rules (R645-302; Special categories and areas of mining), if AVFs are present in or adjacent to a proposed mining area, special rules apply to coal mining in these areas. The special rules are generally more restrictive and reclamation requirements are more stringent for AVF areas than for other areas. Specifically, mining in or adjacent to an AVF is prohibited except where it can be shown that mine-related activities will not 1) interrupt, discontinue or preclude farming on AVFs, or 2) cause material damage to the quantity of water in surface or underground water systems that supply AVFs. Statutory exclusions from these considerations are granted where the pre-mining land use of an AVF is undeveloped rangeland which is not significant to farming, or where farming on the AVF that would be affected is of such small acreage as to be of negligible impact on a farm's production. An exclusion is also granted where significant mining at an operation occurred within or adjacent to an AVF prior to August 3, 1977.

A reconnaissance-level AVF investigation was conducted on the tract in spring of 2008 by Erik Petersen (Petersen Hydrologic, 2008, see Appendix E for the complete report). This study was intended to provide baseline information concerning potential AVFs occurring on and adjacent to the tract. The performance of detailed, site-specific AVF studies typically involves the collection and analysis of large amounts of data, and requires considerable effort and expense. Consequently, where necessary, detailed, site-specific AVF studies are typically performed during the permitting stage of mine development rather than at the leasing stage when the successful bidder and detailed mine plans are unknown.

The identification criteria used to delineate probable AVFs in the reconnaissance study were based on the information provided in *Alluvial Valley Floor Identification and Study Guidelines* published by the OSM (OSM 1983). Although the concept of an AVF may have a technical meaning to a geologist, in the context of

SMCRA, an AVF is a regulatory term that has been defined in statute and clarified in legislative history, court decisions, regulations, and ongoing administrative decisions (OSM 1983). The AVF identification criteria established by SMCRA and outlined by OSM were strictly adhered to in the reconnaissance investigation. These delineation criteria are summarized below.

The SMCRA definition of an AVF is based on agricultural water use and the surficial geologic characteristics of a stream valley. An AVF is defined by SMCRA as:

> The unconsolidated stream-laid deposits holding streams with water availability sufficient for sub-irrigation or flood irrigation agricultural activities but does not include upland areas which are generally overlain by a thin veneer of colluvial deposits composed chiefly of debris from sheet erosion, deposits formed by unconcentrated runoff or slope wash, together with talus, or other mass-movement accumulations and windblown deposits. (30 U.S.C. 1234-1328)

Regulations, judicial review, and administrative decisions have expanded and clarified the statutory definition as follows (OSM 1983):

- The geologic criteria of an AVF are understood to be
    - a topographic valley with a continuous perennial, intermittent, or ephemeral stream channel running through it; and
    - those surface landforms that are either floodplains or terraces if these landforms are underlain by unconsolidated deposits; and
    - within that valley, those side-slope areas that can reasonably be shown to be underlain by alluvium, and which are adjacent to floodplain or terrace landform areas.
- The water availability criteria are met if
    - water is available by surface-water irrigation or sub-irrigation and is being or has successfully been used to enhance production of agriculturally useful vegetation; or
    - surface water is available in sufficient quantities to support agricultural activities.

Additionally, stream valleys which do not have any agricultural importance or whose importance is not related to the greater water availability of the valleys are not AVFs (OSM 1983).

Any areas meeting all the geologic criteria and one of the water availability criteria are considered probable AVFs for the purposes of initial, reconnaissance-level identification (OSM 1983).

Based on the reconnaissance-level identification study criteria outlined above, six probable AVF areas were identified (see Map 2.2). The delineations of these six probable AVF areas were determined based on 1) specific water availability criteria for each area, 2) the physical capability and historical extent of flood irrigation of the land in each area, and 3) the presence or absence of flood plain and terrace geomorphic features in each area. Those areas that satisfied the geologic and water availability criteria were delineated as probable AVF areas in the reconnaissance investigation. Areas not meeting both criteria were excluded as probable AVFs. The six areas identified as probable AVFs in the tract area are situated along the Kanab Creek and Sink Valley Wash drainages (see Map 2.2).These areas encompass those lands within the study area that appear to have the greatest likelihood for being potential AVFs (probable AVFs in OSM parlance). The total acreage of probable AVFs in the study area is approximately 533 acres. Of this, approximately 57 acres of probable AVFs occur within the tract. Approximate floodplain acreages and locations described above are the same as approximate acreages and locations of probable AVFs described here. See Appendix E for a more detailed description of the investigation conducted and the study results.

3.17 Wildlife and Special Status Species

The wildlife and special status species addressed in this section consist of animal species that are 1) federally listed as threatened, endangered, or candidate; 2) Utah BLM state director's sensitive species; 3) UDWR sensitive species; 4) wildlife species managed by the UDWR; or 5) wildlife species protected under other federal or state laws or conservation agreements. The federal ESA of 1973 (Public Law 93-205, as amended) provides protection to federally listed species from actions that may jeopardize their existence. This could occur through direct harm; activities resulting in increased stress during critical life history stages such as nesting, migration, or wintering; loss or degradation of critical habitat; or loss or degradation of occupied or potential habitats. Fish and wildlife habitats are generally managed according to the guiding principles outlined by the BLM *Wildlife 2000*, *The Riparian-Wetlands Initiative for the 1990s*, *A Strategy for Future Waterfowl Habitat Management on Public Lands* and other species- and habitat-specific direction such as the *National Sage-Grouse Habitat Conservation Strategy* (BLM 2004a), and the KFO RMP (BLM 2008c).

3.17.1 Regional Overview

Wildlife and special status species with suitable habitats on or adjacent to the tract or coal haul transportation route are listed in Table 3.33. The tract and coal haul transportation route are located in the northwestern corner of Kane County, the western edge of Garfield County, and the eastern half of Iron County. The assessment areas considered in this analysis include the Alton Coal Tract as defined under each action alternative, and the coal haul transportation route. The status and habitats of listed species were obtained from the BLM, from the Utah Conservation Data Center (UDWR 2008), and from wildlife surveys conducted in 2007 and 2008. (Appendix F lists the wildlife and special status animal species eliminated from detailed analysis and any reasons the species were not analyzed.)

Table 3.33. Wildlife and Special Status Animal Species with Potential to Occur on the Tract and/or Coal Haul Transportation Route

Common Name (*scientific name*)	**Status**
Federally Listed Species	
Utah prairie dog (*Cynomys parvidens*)	Federally Threatened
Sensitive Species	
Allen's big-eared bat (*Idionycteris phyllotis*)	BLM Sensitive, SPC
Arizona toad (*Bufo microscaphus*)	BLM Sensitive, SPC
Bald Eagle (*Haliaeetus leucocephalus*)	SPC
Big free-tailed bat (*Nyctinomops macrotis*)	BLM Sensitive, SPC
Black Swift (*Cypseloides niger*)	BLM Sensitive, SPC, PIF
Bonneville cutthroat trout (*Oncorhynchus alcina utah*)	BLM Sensitive, CS
Burrowing Owl (*Athene cunicularia*)	BLM Sensitive, SPC
Desert sucker (*Catostomus alcina*)	SPC
Ferruginous Hawk (*Buteo regalis*)	BLM Sensitive, SPC

Table 3.33. Wildlife and Special Status Animal Species with Potential to Occur on the Tract and/or Coal Haul Transportation Route

Common Name (*scientific name*)	**Status**
Fringed myotis (*Myotis thysanodes*)	BLM Sensitive, SPC
Golden Eagle (*Aquila chrysaetos*)	SPC
Greater Sage-grouse (*Centrocercus urophasianus*)	BLM Sensitive, SPC
Kit fox (*Vulpes macrotis*)	SPC
Leatherside chub (*Gila copei*)	BLM Sensitive, SPC
Lewis's Woodpecker (*Melanerpes lewis*)	BLM Sensitive, SPC
Long-billed Curlew (*Numenius americanus*)	BLM Sensitive, SPC
Northern Goshawk (*Accipiter gentilis*)	BLM Sensitive, CS
Pygmy rabbit (*Brachylagus idahoensis*)	BLM Sensitive, SPC
Short-eared Owl (*Asio flammeus*)	BLM Sensitive, SPC
Spotted bat (*Euderma maculatum*)	BLM Sensitive, SPC
Three-toed Woodpecker (*Picoides tridactylus*)	BLM Sensitive, SPC
Townsend's big-eared bat (*Corynorthinus townsendii*)	BLM Sensitive, SPC
Virgin spinedace (*Lepidomeda mollispinis*)	CS
Western toad (*Bufo boreas*)	SPC
Wildlife Species	
Mule deer (*Odocoileus heminonus*)	UDWR Managed
Pronghorn antelope (*Antilocapra americana*)	UDWR Managed
Rocky Mountain elk (*Cervus alcinatio*)	UDWR Managed
Migratory and Nonmigratory Bird Species	
Bendire's Thrasher (*Toxostoma bendirei*)	BOCC, PIF
Black-chinned Sparrow (*Spizella atrogularis*)	BOCC
Black-throated Gray Warbler (*Dendroica nigrescens*)	BOCC, PIF
Brewer's Sparrow (*Spizella breweri*)	BOCC, PIF
Broad-tailed Hummingbird (*Selasphorus platycercus*)	PIF
Gambel's Quail (*Callipepla gambelii*)	PIF
Gray Vireo (*Vireo vicinior*)	BOCC, PIF
Loggerhead Shrike (*Lanius ludovicianus*)	BOCC
Lucy's Warbler (*Vermivora luciae*)	PIF
Mountain Plover (*Charadrius montanus*)	BOCC, PIF
Northern Harrier (*Circus cyaneus*)	BOCC
Peregrine Falcon (*Falco alcinatio*)	BOCC
Pinyon Jay (*Gymnorhinus cyanocephalus*)	BOCC

Table 3.33. Wildlife and Special Status Animal Species with Potential to Occur on the Tract and/or Coal Haul Transportation Route

Common Name (*scientific name*)	Status
Prairie Falcon (*Falco mexicanus*)	BOCC
Red-naped Sapsucker (*Sphyrapicus nuchalis*)	BOCC
Sage Sparrow (*Amphispiza belli*)	BOCC, PIF
Swainson's Hawk (*Buteo swainsoni*)	BOCC
Virginia's Warbler (*Vermivora virginiae*)	BOCC, PIF

Notes:

SPC = Wildlife Species of Concern (UDWR 2008).

CS = Species receiving special management under a conservation agreement to preclude the need for federal listing (UDWR 2008).

BOCC = Birds of Conservation Concern (USFWS 2002).

PIF = Utah Partners in Flight Priority Species (Parrish et al. 2002).

Vegetation on the tract is primarily pinyon-juniper woodland, sagebrush/grassland, and sagebrush/grassland (treated) (pinyon pine and Utah juniper cover has been mostly removed) (see the vegetation communities map in Chapter 3). Table 3.34 shows land-cover acreages and associated wildlife and special status animal species. These land-cover types are based on a vegetation community survey of the tract conducted in fall 2007 (2007a). As indicated in Table 3.34, there is considerable overlap in the habitat associations of the species addressed in this section. See the Vegetation section of Chapter 3 for a detailed description of the vegetation communities presented in Table 3.34. See Table 3.35 for migratory bird habitat associations on the tract and along coal haul transportation route.

Table 3.34. Land-cover Acreages in the Alton Coal Tract and Associated Wildlife and Special Status Animal Species

Cover Type	Associated Wildlife and Special Status Animal Species	Acres	Percentage of Tract
Pinyon-juniper woodland	Allen's big-eared bat, Arizona toad, elk, Ferruginous Hawk, Lewis's Woodpecker, Townsend's big-eared bat	1,430.0	40.0%
Sagebrush/grassland	Burrowing Owl, e k, Ferruginous Hawk, fringed myotis, Golden Eagle, Greater Sage-grouse, kit fox, Long-billed Curlew, mule deer, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat	860.2	24.1%
Sagebrush/grassland (treated)	Burrowing Owl, e k, Ferruginous Hawk, fringed myotis, Golden Eagle, Greater Sage-grouse, kit fox, Long-billed Curlew, mule deer, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat	749.1	20.9%
Annual and perennial grasses	Elk, Ferruginous Hawk, Long-billed Curlew, mule deer, Short-eared Owl	324.1	9.1%
Mountain brush	Elk, Ferruginous Hawk, Lewis's Woodpecker	62.8	1.8%
Meadow (wetland)	Elk, mule deer, western toad	62.8	1.8%
Riparian	Allen's big-eared bat, Arizona toad, Bald Eagle, big free-tailed bat, e k, Lewis's Woodpecker, Northern Goshawk, western toad	55.3	1.5%
Rabbitbrush	Burrowing Owl, e k, Ferruginous Hawk, Golden Eagle, Greater Sage-grouse, kit fox, pygmy rabbit, Short-eared Owl, spotted bat	10.7	0.3%
Bedrock, cliff, and canyon	Allen's big-eared bat, Black Swift, big free-tailed bat, Golden Eagle, fringed myotis, spotted bat, Townsend's big-eared bat	0.0	0.0%

Table 3.34. Land-cover Acreages in the Alton Coal Tract and Associated Wildlife and Special Status Animal Species

Cover Type	Associated Wildlife and Special Status Animal Species	Acres	Percentage of Tract
Open water	Black swift, Bonneville cutthroat trout, desert sucker, leatherside chub, virgin spinedace	4.1	<0.1%
Roads	None	17.4	0.5%
Total		**3,576.5**	**100.0%**

The sagebrush/grassland (treated) cover type and the sagebrush/grassland cover type differ in that 1) sagebrush/grassland contains an occasional Utah juniper or pinyon pine, and 2) understory species composition and grass/forb cover may be reduced in sagebrush/grassland (treated) due to the presence of chipped tree remnants. However, any reduction in value for wildlife species following treatment would temporary, and some wildlife species would use these disturbed areas in the interim due to the more open landscape and production of understory species.

Land-cover types described for the tract and coal haul transportation route differ for several reasons: 1) land cover was based on detailed vegetation community surveys for the tract, 2) land cover was based on Southwest Regional Gap Analysis Project (SWReGAP) coverage for the coal haul transportation route, and 3) land-cover types are not identical between the tract and coal haul transportation route. Vegetation community surveys were not conducted along the coal haul transportation route because SWReGAP analysis was deemed to be sufficient for assessment and quantification of habitat areas. Land cover adjacent to the 110-mile proposed coal haul transportation route is primarily sagebrush habitats (39.0%) and developed areas (38.7%). Table 3.35 lists land cover, vegetation acreages, and the special status animal and wildlife species associated with each cover type.

Table 3.35. Land-cover Miles Adjacent to the Coal Haul Transportation Route and Associated Wildlife and Special Status Animal Species

Cover Type	Associated Wildlife and Special Status Animal Species	Miles	Percentage of Route
Agriculture	E k, Ferruginous Hawk, Long-billed Curlew, mule deer, pronghorn, Short-eared Owl	7.3	6.6%
Bedrock, cliff, and canyon	Allen's big-eared bat, black swift, big free-tailed bat, fringed myotis, spotted bat, Townsend's big-eared bat	1.0	0.9%
Developed*	None	42.6	38.8%
Grassland (native and invasive grasses/forbs)	Burrowing Owl, elk, Ferruginous Hawk, fringed myotis, Long-billed Curlew, mule deer, pronghorn, Short-eared Owl, Utah prairie dog	0.1	0.1%
Open water	Black Swift, Bonneville cutthroat trout, desert sucker, leatherside chub, virgin spinedace	0.1	0.1%
Pinyon-juniper woodland	Allen's big-eared bat, Arizona toad, elk, Ferruginous Hawk, Lewis's Woodpecker, Townsend's big-eared bat	9.9	9.0%
Riparian	Allen's big-eared bat, Arizona toad, Bald Eagle, big free-tailed bat, Lewis's Woodpecker, Northern Goshawk, Western toad	<0.1	<0.1%
Sagebrush	Burrowing Owl, elk, Ferruginous Hawk, fringed myotis, Golden Eagle, Greater Sage-grouse, kit fox, mule deer, pronghorn, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat	43.0	39.2%

Table 3.35. Land-cover Miles Adjacent to the Coal Haul Transportation Route and Associated Wildlife and Special Status Animal Species

Cover Type	Associated Wildlife and Special Status Animal Species	Miles	Percentage of Route
Salt desert scrub	Big free-tailed bat, Burrowing Owl, Ferruginous Hawk, Golden Eagle, kit fox, long-billed Curlew, pronghorn, Short-eared Owl, spotted bat	0.1	0.1%
Shrub steppe	Burrowing Owl, elk, Ferruginous Hawk, Golden Eagle, Greater Sage-grouse, kit fox, Long-billed Curlew, pronghorn, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat, Utah prairie dog	3.5	3.2%
Woodland-shrubland	Black Swift, elk, Ferruginous Hawk, Lewis's Woodpecker, Three-toed Woodpecker	2.2	2.0%
Total		**109.8**	**100.0%**

* Developed land cover is composed of open space and low-intensity development (i.e., human-modified land cover such as lawns and parks), and medium-to-high-intensity development (i.e., roads, other paved surfaces, and structures).

3.17.2 Wildlife Occurring on the Tract and Coal Haul Transportation Route Assessment Areas

Crucial summer habitat for mule deer and crucial summer and yearlong substantial habitats for Rocky Mountain elk are present on the tract and/or coal haul transportation route. Crucial winter and crucial yearlong pronghorn habitats occur along the coal haul transportation route. Suitable habitat for fish, amphibians, raptors, other resident birds, and neotropical migratory birds is also present on or adjacent to the tract and coal haul transportation route. The tract is located within UDWR's PPMA. The area encompasses approximately 894,000 acres and is managed as a trophy-hunting unit.

3.17.2.1 MULE DEER

Mule deer are widespread in Utah, but are present in the greatest densities in shrublands on rough, broken terrain with abundant browse and cover. Deer migrate into the same areas every winter, regardless of forage availability or condition. Winter range habitat consists primarily of shrub-covered, south-facing slopes and often coincides with areas of concentrated human use and occupation (BLM 2008c). Sagebrush serves as primary forage for mule deer during the winter season. Mule deer summer range habitat types include spruce/fir, aspen, alpine meadows, and large grassy parks located at higher elevations. Crucial and high-value mule deer habitats exist in the western portions of Kane County and throughout Garfield County (BLM 2008c). There are 3,577 acres of crucial mule deer summer range on the tract. Mule deer habitats adjacent to the coal haul transportation route consist of 89.7 miles of crucial winter habitat (81.5% of the route), 28.5 miles of crucial summer habitat (25.9% of the route), 14.5 miles of yearlong substantial value habitat (13.2% of the route), and 2.8 miles of substantial value winter habitat (2.5% of the route).

3.17.2.2 ELK

The Rocky Mountain elk is a generalist that inhabits grasslands, woodlands, riparian, shrub, sagebrush, and pinyon-juniper habitats (UDWR 2008). There are 3,505.7 acres of crucial summer habitat and 71.7 acres of yearlong substantial value habitat on the tract. Elk habitats adjacent to the coal haul transportation route consist of 53.5 miles of crucial winter habitat (48.6% of the route) and 11.5 miles of crucial summer habitat (10.5% of the route).

3.17.2.3 PRONGHORN ANTELOPE

In Utah, pronghorn antelope prefer desert, grassland, and sagebrush habitats (UDWR 2008). Suitable pronghorn habitats in sagebrush/grassland, sagebrush/grassland (treated), and annual and perennial grasses exist on 1,946.8 acres (54.4%) of the tract. However, there are no UDWR-designated pronghorn habitat areas on the tract. Pronghorn habitats adjacent to the coal haul transportation route consist of 54.0 miles of crucial yearlong habitat (49.1% of the route) and 5.9 miles of crucial winter habitat (5.3% of the route).

3.17.3 Special Status Species Occurring on the Tract and Coal Haul Transportation Route Assessment Areas

3.17.3.1 GREATER SAGE-GROUSE

The Greater Sage-grouse is dependent on sagebrush-dominated habitats (*Artemisia* species, especially *A. alcinatio*) with an understory of forbs and grasses and associated wet meadow habitat (Gregg et al. 1993; Connelly et al. 2000). The species distribution is closely associated with that of sagebrush due to the sage-grouse's use of sagebrush for food, thermal cover, and/or breeding habitats throughout the year. Range-wide, Greater Sage-grouse numbers have declined approximately 50%, and available habitats have declined approximately 60% from historic levels (Beck et al. 2003). Population declines are primarily due to habitat loss, habitat fragmentation, and reduced habitat quality from urban expansion, conversion of habitats to agriculture, and alteration of habitats by invasive species that reduce habitat quality by reducing herbaceous forage and/or increasing the frequency and intensity of ground fires (2002; Bosworth 2003; 2005). The species' sagebrush steppe habitats and associated herbaceous understory have been reduced by improper grazing, invasive plant species, altered fire regimes, pinyon-juniper encroachment, and oil and gas industry expansion (2005). Pinyon-juniper woodland encroachment into sagebrush habitats has reduced the quality and quantity of sagebrush stands and contributed to a range-wide decline in sage-grouse abundance (Connelly et al. 2004). Other specific threats to the species are limited distribution, West Nile virus, and predation by invasive animal species (Connelly et al. 2004; UDWR 2005). Fences can also pose a threat to sage-grouse as vertical barriers, collision risks, and raptor perches (Curtis and Frey 2007). The Alton sage-grouse population has experienced high mortality from predation, with a relatively large number of sage-grouse known to have been killed by predators since 2005 (Curtis and Frey 2007). Increasing predation by non-native predators (domestic pets, red foxes, raccoons) and native ravens is of concern (Frey et al. 2006).

In Utah, Greater Sage-grouse are present in scattered populations north and west of the Colorado River (2002) on approximately 40% of their historic range (Beck et al. 2003). The Alton sage-grouse population is very small (estimated at 30–40 birds), and exclusively uses the Alton–Sink Valley sage-grouse lek (courtship display site) and nesting, brood-rearing and wintering habitats in the Alton–Sink Valley area (Personal Communication, Frey 2009). The Alton–Sink Valley sage-grouse lek is the southernmost active Greater Sage-grouse lek in North America (Curtis and Frey 2007; BLM 2008b). Because sage-grouse exhibit high fidelity to lekking and nesting sites (Fischer et al. 1993), lek counts are widely used to estimate local population size (Connelly et al. 2004). The historic (pre-settlement) size of the Alton sage-grouse population is not known, but is believed to have never been large (Personal Communication, Frey 2009). Lek count data since 1955 indicate fluctuations in male grouse attendance at the Alton–Sink Valley lek, with declines in lek attendance in 2002 and 2003 (presumably in response to extreme drought in the region) and an upturn in lek attendance in 2005 (Frey et al. 2006). Lek attendance at the Alton–Sink Valley lek declined from approximately 20 males in 1984 to 11 males in 2005 (Frey et al. 2006). The local population is estimated at approximately three times the male lek count. In 2008, the maximum Alton–Sink Valley lek count was 12 males (Personal Communication, Frey 2009).

There are three inactive Greater Sage-grouse leks south of the Alton–Sink Valley lek at Skutumpah and Ford Pasture. These historic leks have been inactive for 10–15 years and may represent the southern limit of the species' range (Personal Communication, Frey 2009). The closest active lek to the Alton–Sink Valley lek is the Heut's Ranch lek, approximately 6 miles north of Alton, which contains an estimated 40 males, or approximately 120 sage-grouse total. There is bird movement from Heut's Ranch to the Alton–Sink Valley lek, but no other source of genetic exchange with the Alton sage-grouse population is known. Relatively large numbers of sage-grouse (60–70) visit Alton–Sink Valley in winter, but they do not stay and breed with the Alton population, and the source of these birds is not known (Personal Communication, Frey 2009). Because of its small size, the Alton–Sink Valley population is highly susceptible to extirpation from environmental or demographic stochastic events, such as severe drought or disease outbreak, respectively (Personal Communication, Frey 2009). Specific threats to the Alton sage-grouse population include West Nile virus, increasing predation, severe drought, habitat loss, or a combination of these events.

The Alton sage-grouse population occurs within the 5 million-acre Color Country sage-grouse management area in south-central Utah (UDWR 2002). The *Color Country Adaptive Resource Management Sage-grouse Conservation Plan* (Frey et al. 2006) was produced as a result of the *2002 Utah Greater Sage-grouse Strategic Management Plan* (UDWR 2002) to assess the status of the Color Country sage-grouse population. In March 2005, radio tracking of individual birds, annual lek counts, and vegetation monitoring were implemented as part of a joint effort by the BLM, UDWR, Utah State University Extension, and Southern Utah University to assess the size of and year-round habitat use by the Alton sage-grouse population (Frey et al. 2006). The Alton sage-grouse study coincided with sagebrush habitat restoration efforts by the BLM (see below).

The Greater Sage-grouse is a sagebrush-obligate species that requires contiguous sagebrush-dominated habitats (Connelly et al. 2004). In Utah, nesting sage-grouse have been demonstrated to prefer sagebrush more than 16 inches (40 cm) tall and 15%–50% canopy cover of tall grasses and other concealing vegetation (Connelly et al. 2004). These conditions are consistent with mature, well-developed sagebrush communities. Range-wide, sage-grouse use other sagebrush-dominated habitats and forage in riparian, wet meadow, and agricultural habitat types during the summer nesting and brood-rearing season, and are dependent on mature sagebrush stands for forage and shelter in winter (Connelly et al. 2004). The Alton sage-grouse population uses sagebrush-steppe, agricultural, pinyon-juniper woodland, and riparian habitats in the Alton–Sink Valley area; however, the quality of sagebrush habitats has been reduced due to pinyon-juniper encroachment and loss of understory forbs and grasses. In fall 2005, the BLM removed 99% of pinyon-juniper trees on 1,700 acres in the Alton–Sink Valley area and seeded the treated area with forbs and grasses to restore sagebrush-steppe habitat (Frey et al. 2006). The treatments resulted in increased forb and grass cover and increased use of treated areas by sage-grouse in summer and fall. Sage-grouse had a mixed response in their use of treated habitats in spring and winter (Frey 2008). Curtis and Frey (2007) found Alton sage-grouse to occur in greater numbers in treated habitats compared to other vegetation types ($p<0.05$), and in greater numbers in sagebrush than in agricultural fields or pinyon-juniper/sagebrush vegetation.

Greater sage-grouse occupy rabbitbrush, sagebrush/grassland, and sagebrush/grassland (treated) habitats on approximately 1,620 acres (45%) of the tract, and sagebrush and shrub steppe habitats along 47 miles (42%) of the coal haul transportation route. The species is also known to use annual and perennial grasses and meadow (wetland) habitats on 324 acres (9%) and 53 acres (1.5%), respectively, in Block NW. There are no known lekking habitats on the tract. Sage-grouse appear to nest exclusively in sagebrush habitats adjacent to the Alton–Sink Valley lek based on the fact that no radio-collared females nested outside of this area (Curtis and Frey 2007). Nesting habitats include sagebrush/grassland, and sagebrush/grassland (treated) habitats in the southeastern portion of the tract (Block S). Summer brood-rearing habitats include sagebrush/grassland, sagebrush/grassland (treated), annual and perennial grasses in the southern portion of the tract, and grassland and meadow habitats in the northern portion of the tract. During summer brood-rearing season, approximately one third of nesting females move their chicks from nesting habitats to horse pastures and wetlands north of the tract (Curtis and Frey 2007). Wintering habitats include all habitat types on the tract.

3.17.3.2 PYGMY RABBIT

The pygmy rabbit requires dense, tall stands of sagebrush (*Artemisia* spp., especially *A. alcinatio*) with sandy or alluvial soils that are conducive to burrowing (Bosworth 2003). Population densities vary in response to habitat quality, but the habitat or environmental factors that cause population fluctuations are poorly understood (Green and Flinders 1980). The species is believed to have declined from historic levels in response to reduced habitat quality and quantity. Habitat loss and degradation are primarily due to changes in fire regimes, land conversion for development and agriculture, livestock grazing, and weed invasions (Bosworth 2003).

The pygmy rabbit is known to occur on the tract and coal haul transportation route. The species occurs in rabbitbrush, sagebrush/grassland, and sagebrush/grassland (treated) habitats on approximately 1,620 acres (45%) of the tract, and on sagebrush and shrub steppe habitat along 47 miles (42%) of the coal haul transportation route.

3.17.3.3 UTAH PRAIRIE DOG

The Utah prairie dog is endemic to southwestern Utah in the southern Bonneville Basin and in central Utah at high elevations (Bosworth 2003). Critical habitat has not been designated for the species. A recovery plan was completed for the Utah prairie dog in 1991 (USFWS 1991), and the Utah Prairie Dog Interim Conservation Strategy was completed in 1997 (Utah Prairie Dog Implementation Team 1997). The UDWR initiated a translocation program in 1972 to move Utah prairie dogs from private lands to areas of historical occupancy on public lands. The prairie dog translocation program has become a key element in Utah prairie dog management and recovery, and is authorized by the USFWS under the ESA.

Prairie dog habitats consist of continuous grassland and other vegetation on flat plains (BLM 2008c). Succulent vegetation is crucial for Utah prairie dog survival during drought (Crocker-Bedford and Spillett 1981). Populations have declined dramatically from historic levels to the current total of 3,500–6,000 adults (Bosworth 2003). The primary threat to the species is direct habitat loss from development and agricultural use (Bosworth 2003). Bubonic plague (2005) and sylvatic plague can cause dramatic population fluctuations, and poisonings and shootings have affected populations in some areas (Bosworth 2003). Populations of Utah prairie dog are not present on the tract or on BLM-managed lands elsewhere in Kane County, but populations are known to exist along the coal haul transportation route. Suitable Utah prairie dog habitat occurs in sagebrush, grassland, and shrub steppe habitats adjacent to US-89, SR-20, I-15, and SR-56 along approximately 47 miles (43%) of the coal haul transportation route. The USFWS has established a 350-foot buffer as the range within which normal behavior of individual Utah prairie dogs may be disrupted by noise or human presence (Personal Communication, Fox 2010). Known Utah prairie dog colonies occur within 350 feet of the coal haul transportation route on 640 acres and are estimated to contain approximately 309 prairie dogs, or 6.1% of the total known Utah prairie dog population within the West Desert and Paunsaugunt Recovery Units (UDWR 2010).

3.17.3.4 KIT FOX

The kit fox inhabits the western United States and northern Mexico, but is not widely abundant in Utah (UDWR 2008). The species prefers sparsely vegetated greasewood, shadscale, or sagebrush-dominated habitats (Bosworth 2003), and has the potential to occur on the tract and along the coal haul transportation route. The kit fox’s specific distribution is not known, but high- and substantial-value habitats exist on or near the western portion of the coal haul transportation route in Iron County (UDWR 2008). Suitable habitats consist of sagebrush/grassland, sagebrush/grassland (treated), and rabbitbrush habitats on 1,620 acres (45%) of the tract, and on sagebrush and shrub steppe habitats along 47 miles (43%) of the coal haul transportation route.

3.17.3.5 BAT SPECIES

Five bat species have suitable habitats on the tract and coal haul transportation route. These bat species occupy a variety of habitats, but their ecological needs are fundamentally the same and consist of secure roosting sites and insect prey. Reductions in the prey base from pesticide use, disturbance of roost sites, and mine closures are the primary threats to bat species (2005). The species addressed here use rocky cliffs, crevices, or outcroppings as roost sites. However, caves or mines in any habitat may be used as a roosting site. Bat roost sites in cliff and canyon habitats do not exist on the tract, but do exist along approximately 1 mile (1%) of the coal haul transportation route. Some bat species are also known to use stream and riparian habitats, which are quantified within 100 feet of the coal haul transportation route based on the maximum likely distance that coal could be transported from the route.

Allen's big-eared bat occurs in Garfield and Kane counties (2005). The species prefers riparian areas dominated by cottonwood and willow trees, forested mountain areas, and pinyon-juniper habitats (Foster et al. 1996). In addition to roosting sites in cliff and canyon habitat, suitable roosting and foraging areas occur in pinyon-juniper woodland and riparian habitats on 1,485 acres (42%) of the tract and along 10 miles (9%) of the coal haul transportation route. There are approximately 38.3 acres of riparian habitat within 100 feet of the route.

The **big free-tailed bat** inhabits rugged, rocky terrain, and roosts in rock crevices and cliff faces (Foster et al. 1996). The species forages in desert scrub and riparian habitats. In addition to roosting habitat in cliff and canyon habitat types along the coal haul transportation route, foraging habitats exist in riparian habitat on 55 acres (1.5%) of the tract and in salt desert scrub along 0.1 mile (0.1%) of the route. There are approximately 38.3 acres of riparian habitat within 100 feet of the route.

The **fringed myotis** is associated with rocky outcroppings, cliffs, and canyons (Bosworth 2003), and are known to use sagebrush and grasslands as foraging habitats (Foster et al. 1996). In addition to suitable roosting sites in cliff and canyon habitat, foraging habitats for this species include sagebrush/grassland and sagebrush/grassland (treated) habitats on 1,609 acres (45%) of the tract, and in sagebrush and grassland habitats along 43 miles (39%) of the coal haul transportation route.

The **spotted bat** is associated with deep, narrow, rocky canyons with precipitous cliffs and crevices in cliff walls. The species is known to use open sagebrush or desert scrub as foraging habitat (Foster et al. 1996). In addition to roosting sites in cliff and canyon habitat, foraging habitats for this species include sagebrush/grassland, sagebrush/grassland (treated), and rabbitbrush habitats on 1,620 acres (45%) of the tract, and sagebrush, shrub steppe, and salt desert scrub along 47 miles (43%) of the coal haul transportation route.

Townsend's big-eared bat occurs in sagebrush steppe, pinyon-juniper, and other habitat types with caves or mines for roost sites (Foster et al. 1996). In addition to roosting sites in cliff and canyon habitat, foraging habitat for this species occurs in pinyon-juniper woodland, sagebrush/grassland, and sagebrush/grassland (treated) habitats on 3,039 acres (85%) of the tract, and in sagebrush, pinyon-juniper woodland, and shrub steppe along 56 miles (51%) of the coal haul transportation route.

3.17.3.6 RAPTOR SPECIES

Habitat needs for raptors include nesting sites, foraging areas, and roosting or resting sites. Roosting generally occurs in riparian areas and on cliff faces. Potential nesting and roosting sites occur in riparian habitats on approximately 55 acres (1.5%) of the tract, and in cliff and canyon habitats along approximately 1 mile (0.9%) of the coal haul transportation route. Cliff and canyon habitat does not occur on the tract. Stream and riparian habitats occur on approximately 38.3 acres within 100 feet of the coal haul transportation route (the maximum likely distance that coal could be transported from the route).

Habitat loss and disturbance to nest sites, reduction of the prey base, electrocution from power lines, and environmental contaminants are the primary threats to raptor species (Parrish et al. 2002). In addition to the six raptor species addressed here, migratory raptor species are discussed in the Migratory Birds section.

The **Bald Eagle** winters in Utah along rivers, streams, lakes, reservoirs, ponds, and sewage lagoons within riparian or sub-montane woodlands (Bosworth 2003). There are no active breeding sites in Garfield, Kane, or Iron counties (Bosworth 2003). Riparian areas on the tract and coal haul transportation route, quantified above, could provide wintering habitat for this species.

The B**urrowing Owl** prefers sagebrush steppe, desert scrub, and other shrub-dominated habitats with abandoned animal burrows for nesting sites (Bosworth 2003). Suitable nesting and foraging habitats in sagebrush/grassland, sagebrush/grassland (treated), and rabbitbrush occur on 1,620 acres (45%) of the tract, and in sagebrush, shrub steppe, grassland, and salt desert scrub habitats along 47 miles (43%) of the coal haul transportation route.

The **Ferruginous Hawk** forages in grasslands, agricultural lands, mixed shrub habitats, and on the periphery of pinyon-juniper forests. Breeding occurs in pinyon-juniper and juniper shrub habitat assemblages and sagebrush steppe (Walters and Sorensen 1983). Suitable nesting and foraging habitats occur in pinyon-juniper woodland, sagebrush/grassland, sagebrush/grassland (treated), annual and perennial grasses, mountain brush and rabbitbrush on 3,437 acres (96%) of the tract, and in pinyon-juniper woodland, sagebrush, agriculture, shrub steppe, woodland-shrubland, grassland and salt desert scrub along 66 miles (60%) of the coal haul transportation route.

The **Golden Eagle** nests in cliff habitats and forages in high desert scrub (Parrish et al. 2002). Suitable foraging habitats in sagebrush/grassland, sagebrush/grassland (treated), and rabbitbrush occur on 1,620 acres (45%) of the tract, and in sagebrush, shrub steppe, and salt desert scrub along 47 miles (43%) of the coal haul transportation route.

The **Northern Goshawk** prefers mountain forest and riparian habitats and is a year-round resident of Utah (UDWR 2008). Winter foraging and roosting habitats occur in pinyon-juniper woodlands on 1,430 acres (40%) of the tract. Potential nesting habitats are limited to riparian habitats on 55 acres (1.5%) of the tract, and 38.3 acres within 100 feet of the coal haul transportation route.

The **Short-eared Owl** is a ground nester that inhabits arid grasslands, croplands, cold desert shrub, and sagebrush-rabbitbrush habitats (Bosworth 2003). The species may migrate or remain as a year-round resident in Utah (UDWR 2008). Suitable foraging and nesting habitats in sagebrush/grassland, sagebrush/grassland (treated), annual and perennial grasses, and rabbitbrush occur on 1,944 acres (54%) of the tract, and in sagebrush, agriculture, shrub steppe, grassland, and salt desert scrub along 54 miles (49%) of the coal haul transportation route.

3.17.3.7 MIGRATORY BIRD SPECIES

Migratory birds require nesting and brooding habitat, nonbreeding foraging and resting habitat, habitat along migratory routes, and wintering habitat. Neotropical migratory bird populations are in decline due to habitat fragmentation, habitat loss and modification, urban expansion, loss of nonbreeding habitats and habitats along migratory routes, and brood parasitism (Parrish et al. 2002).

In addition to migratory and nonmigratory bird species addressed in the sections above, 11 migratory bird species have potential to occur on the tract or coal haul transportation route. These species are listed in Table 3.36. Seven nonmigratory species—Gambel's Quail, Loggerhead Shrike, Northern Harrier, Peregrine Falcon, Pinyon Jay, Prairie Falcon, and Sage Sparrow—are also included due to their status as

USFWS birds of conservation concern (USFWS 2002) and their potential to occur on the tract or along the coal haul transportation route. As indicated in Parrish et al. (2002), a tally of the bird species associated with a habitat type provides a coarse estimate of the habitat's relative importance to migratory birds. Riparian, wetland, agriculture, and desert scrub are particularly important as breeding and wintering migratory bird habitats (Parrish et al. 2002). The habitat associations in Table 3.36 are approximate because the habitats presented in Parrish et al. (2002) do not directly correspond to the cover types presented here. Grassland, rabbitbrush, and open water cover types are not included in the table because either migratory or birds of conservation concern species do not occur in the cover type, or the bird species that do occur in those habitats are covered elsewhere in Section 3.17. Table 3.36 does not include migratory or nonmigratory bird species covered elsewhere in this section.

Table 3.36. Migratory Bird Habitat Associations by Habitat and Cover Type on the Alton Coal Tract and Coal Haul Transportation Route

Habitat Type*	Tract Cover Type	Transportation Route Cover Type	Associated Migratory Bird Species
Agriculture	Annual and perennial grasses	Agriculture	Peregrine Falcon, Prairie Falcon, Swainson's Hawk
Cliff	n/a	Bedrock, cliff, and canyon	Peregrine Falcon, Prairie Falcon
Low desert scrub High desert scrub	n/a	Salt desert scrub	Bendire's Thrasher, Black-chinned Sparrow, Brewer's Sparrow, Gambel's Quail, Loggerhead Shrike, Lucy's Warbler, Mountain Plover, Northern Harrier, Prairie Falcon, Sage Sparrow
Lowland riparian	Riparian	Riparian	Broad-tailed Hummingbird, Gambel's Quail, Lucy's Warbler, Peregrine Falcon
Mountain shrub Northern oak	Mountain brush	Woodland-shrubland	Black-throated Gray Warbler, Gray Vireo, Virginia's Warbler
Pinyon-juniper	Pinyon-juniper woodland	Pinyon-juniper woodland	Black-throated Gray Warbler, Gray Vireo, Loggerhead Shrike, Virginia's Warbler
Shrub steppe	Sagebrush/grassland, Sagebrush/grassland (treated)	Sagebrush, shrub steppe	Brewer's Sparrow, Sage Sparrow
Wetland	Meadow (wetland)	n/a	Northern Harrier

Sources: Parrish et al. 2002; 2008a, UDWR 2008.

3.17.3.8 OTHER BIRD SPECIES

The **Black Swift** is very rare in Utah with no confirmed nesting sites in Garfield, Kane, or Iron counties (Parrish et al. 2002; Bosworth 2003). The species only nests near or behind waterfalls, and no potential breeding sites are known to exist on the tract or within 100 feet of the coal haul transportation route. The species is migratory, arriving in Utah in late May or early June and remaining as late as October (Parrish et al. 2002). The Black Swift feeds exclusively on flying insects, and may forage over rivers and streams up to 25 miles from nesting colonies (Parrish et al. 2002). Loss of nesting habitat due to reduction or loss of water flow, reduced prey base due to pesticide use, and direct disturbance to nesting sites are the primary causes of reduced distribution and declining populations (Parrish et al. 2002). Foraging habitat may occur in association with riparian areas on 55 acres (1.5%) of the tract and on 38.3 acres of the coal haul transportation route.

Lewis's Woodpecker is a cavity nester that breeds in ponderosa pine habitats, but may also use riparian cottonwoods or mountain shrub habitats (Parrish et al. 2002). The species eats insects during breeding season, and nuts and berries in fall and winter (Ehrlich et al. 1988). Lewis's Woodpecker inhabits open habitats with widely spaced trees and an understory of grasses and shrubs to provide insect prey and plant forage (Parrish et al. 2002). Loss of habitat due to tree removal and changes in forest structure as well as grazing by livestock are the primary threats to the species (Parrish et al. 2002). Secondary breeding habitat may occur in pinyon-juniper woodland, riparian, and mountain brush habitats on 1,548 acres (43%) of the tract, and in pinyon-juniper woodland and woodland-shrubland habitats along 12 miles (11%) of the coal haul transportation route. In addition, there are approximately 38.3 acres of riparian habitat within 100 feet of the coal haul transportation route.

The **Long-billed Curlew** is a migrant and summer resident in Utah that requires short grass and bare-ground breeding habitats with shade and abundant small vertebrate prey (Pampush 1980; Parrish et al. 2002). Uncultivated rangelands and pastures support most of the breeding population in Utah. Loss and modification of breeding habitats and predation by foxes and domestic pets are the primary threats to the species and have caused dramatic population declines. Breeding habitats include pasture, meadow, and sagebrush/grassland. Suitable breeding habitats include sagebrush/grassland, sagebrush/grassland (treated), and annual and perennial grasses on 1,933 acres (54%) of the tract, and in agriculture, shrub steppe, grassland, and salt desert scrub habitats along 11 miles (10%) of the coal haul transportation route.

The **Three-toed Woodpecker** is a cavity nester that breeds and winters in high-elevation coniferous forests in Utah (Parrish et al. 2002). The species requires coniferous trees (living and dead) to support its prey of wood-boring insect larvae, but may also use mixed forest habitats (Hill et al. 2001). Populations fluctuate in response to bark beetle outbreaks. Tree removal and fire suppression that remove standing dead trees are the primary threat to the species (Parrish et al. 2002). Suitable breeding and foraging habitats are limited to woodland-shrubland habitats along approximately 2.2 miles (2%) of the coal haul transportation route. No suitable coniferous forest habitat occurs on the tract.

3.17.3.9 AMPHIBIAN SPECIES

The **Arizona toad** is present in Kane County with most of its Utah distribution concentrated to the west in the Virgin River basin in Washington County (2005). In Utah, this species inhabits juniper-dominated habitats and low-elevation riparian habitats near permanent or semipermanent water bodies (Bosworth 2003). The Arizona toad lays eggs on the bottoms of shallow, slow-moving streams. Threats to this species include loss of native vegetation and riparian corridors (2005) as well as water withdrawals (Bosworth 2003). Suitable habitats in pinyon-juniper habitats near water bodies and riparian habitats occur on a maximum of 1,430 acres (40%) of the tract. In addition, there are approximately 38.3 acres of riparian habitat within 100 feet of the coal haul transportation route.

The **western toad** inhabits montane areas in riparian, shrub, mixed conifer, and aspen-conifer habitats associated with permanent bodies of water, and breeds in small bodies of water and along creeks and rivers (Bosworth 2003). Suitable western toad habitat in meadow wetlands and riparian habitat occurs on 118 acres (3%) of the tract. In addition, there are approximately 38.3 acres of riparian habitat within 100 feet of the coal haul transportation route.

3.17.3.10 FISH SPECIES

No special status fish species are known to occur on the tract or in water bodies intersected by the coal haul transportation route. Because special status fish species and their habitats do not occur within or below the Virgin River system and Bonneville Basin where the Alton tract and coal haul transportation route would occur, these species have been eliminated from further analysis.