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4.0 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

Chapter 4.0 describes the effects of implementing the alternatives on the affected human environment as described in Chapter 3.0. The resource-specific effects of the alternatives are evaluated both quantitatively and qualitatively, depending on available data and the nature of the resource analyzed. The impact analyses within this chapter also consider the resource-specific mitigation measures that are presented within each resource-specific analysis.

As discussed in **Section 3.1**, the baseline information in the affected environment and the corresponding analyses in this chapter include an assessment of the impacts of development on a number of special designations that were not carried forward in the Approved RMPs or have been modified in the Approved RMPs (e.g., the potential Desolation Canyon ACEC was not carried forward for management in the Approved Price RMP). The BLM determined that updating or removing certain components of the effects analysis, even if it has changed, is unnecessary for several reasons. First, the analysis contained within this FEIS is based on a more conservative baseline than the decisions included in Approved RMPs. Second, a discussion of the environmental consequences as contained in this EIS directly responds to issues and concerns brought forward by the public and CAs during public scoping and the public comment period for the DEIS. Third, while some of the information contained in this document may no longer be applicable within the context of the new RMPs, the discussion on environmental consequences is focused on the issues that are truly relevant to the action in question. Lastly, information provided within this chapter provides the decision maker with the information necessary to compare and contrast the predicted effects of the Proposed Action and alternatives, and make a reasoned and informed decision regarding which alternative or combination of alternatives to select in the ROD.

Within this chapter, the letter designations for the alternatives and the descriptive alternative names are used synonymously and interchangeably throughout the analyses (e.g., Alternative C and Transportation Impact Reduction Alternative are used synonymously and interchangeably). Similarly, within this chapter the terms “impact” and “effect”, and “impacted” or “affect” are used synonymously and interchangeably throughout the analyses.

It is also important to note that total resource-specific surface disturbances within the analyses in this chapter may differ slightly from the total surface disturbance calculations presented in Chapter 2.0. These minor differences are the result of both the conceptual nature of the project components and GIS-based analysis.

First, conceptual locations for proposed cross-country pipelines are not yet known and have not, therefore, been mapped for any of the alternatives (see **Section 2.1.1.3**). Since resource-specific disturbance estimates are calculated using GIS software, which requires mapped feature locations, the 48 acres of surface disturbance that would occur as a result of cross-country pipelines are not accounted for in this chapter. Similarly, under the Proposed Action, locations of conceptual roads within core winter use areas have not been determined (see **Section 2.2.1.2**). The estimated 73 acres of initial surface disturbance from those conceptual road/pipeline ROWs are accounted for in

Chapter 2 disturbance calculations, but are not accounted for in the resource-specific analyses of the Proposed Action in this Chapter.

Finally, resource-specific total surface disturbance calculations may differ from total surface disturbances presented in Chapter 2 as a result of GIS-based buffer and clip functions which, when used in combination, effectively remove any areas of overlap between resources (e.g., clipping minor overlap between 2 vegetation communities) and/or feature buffers (e.g. overlapping well pads and ROWs). The GIS analysis, therefore, leads to a lower total disturbance value than those presented in the alternative descriptions.

4.2 GEOLOGY, MINERALS, AND PALEONTOLOGY

4.2.1 Geology and Minerals

4.2.1.1 Alternative A – Proposed Action

Potential impacts to geologic and mineral resources from the Proposed Action include changes to the local topography, decreased slope stability, depletion of natural gas and sand and gravel resources, and interference with potential mining of oil shale and tar sands in the WTP Project Area.

Topography

Excavation for the construction of well pads, pipelines, compressor stations, access roads, and other project facilities would cause topographic changes including square- or rectangular-shaped cuts and fills in the sandstone-dominated bedrock underlying the WTP Project Area. These changes to the topographic character of the area would be minor, but long-term.

If the WTP Project Area proves to be productive for natural gas, and all proposed facilities are constructed, a total of 538 well pads would be constructed on the mesa tops, in canyon bottoms, and near the edges of canyon rims. Each single-well pad would initially disturb up to 2.85 acres. For multi-well pads, the well pad would be enlarged by approximately 0.2 acres for each additional well. The amount of cut-and-fill would vary according to the location of the pad and the depth to bedrock beneath the pad. Those well pads located on the canyon rims or the side slopes of canyons would result in the most bedrock disturbance. Additional bedrock disturbance would occur due to construction of access roads, pipeline corridors, compressor stations, water management impoundments, equipment storage areas, temporary worker housing areas, and three 2-acre rock borrow pits. A total of 178 miles of new access roads would be constructed. The primary impact of these topographic changes would be on visual resources within the canyons. Visual impacts are described in **Section 4.16.**

Geologic Hazards

The potential for increased landslides from the Proposed Action is considered to be minor because none of the rock units exposed in the area have a high potential for mass movements. As discussed in **Section 3.2**, only two landslide deposits have been identified in the WTP Project Area. Some small slumps may occur in the cuts created for the new access roads, pipelines, compressor stations, and well pads. However,

these mass movements would be localized in extent and would not affect any existing structures.

Rock falls could also occur locally as a result of blasting for well pad and access road construction. Areas along the side canyons where road construction is occurring would have the greatest potential for rock falls. The potential impacts from rock falls include the disruption of traffic routes and impacts to cultural resources such as rock art. In addition, rock falls that occur in steep canyons could cause safety concerns for project workers and the general public.

Debris flows commonly occur in the WTP Project Area, especially from the ephemeral drainages that enter Nine Mile Canyon from the north. The Proposed Action would have no effect on the frequency or magnitude of these flows.

Natural Gas

Potential impacts to natural gas resources include the depletion of these resources due to active extraction. While the ultimate recovery of natural gas from the WTP Project Area at full development is unknown, it is estimated that BBC and other operators' Proposed Action would result in a potential recovery of up to 250 MMscf per day. The Proposed Action would provide valuable exploratory information concerning the amount of recoverable gas resources available in formations deeper than the Mesaverde Group in the southern Uinta Basin.

Oil Shale

Development related to the Proposed Action could potentially conflict with future oil shale development. Oil shale is present as numerous thin beds within the Upper and Middle Members of the Green River Formation. The total thickness of the deposits is about 2.5 to 6 feet, but the potential for development is considered to be low (BLM 1990). This oil shale could potentially be mined by underground methods, but surface facilities would include processing plants and waste shale piles.

Long-term surface disturbance for the well pads, access roads, pipelines, compressor stations, and other facilities under the Proposed Action would be about 1.35 percent of the land surface within the WTP Project Area. This disturbed surface would be unavailable for oil shale development during the 33-year LOP. However, given the fact that many other areas within the Uinta and Piceance Basin contain oil shale deposits which are more favorable to mine, and the fact that none of the existing KOSLAs are located within the WTP Project Area, the potential impacts to future oil shale production are considered to be negligible.

Tar Sands

Areas with significant potential for mining of tar sands occur within the WTP Project Area (BLM 1990; Weiss et al. 1990). Portions of the Sunnyside STSA occur in the southern part of the WTP Project Area, including approximately 3,640 acres within the Jack Canyon and Desolation Canyon WSAs. This STSA is considered to have the largest, best-exposed oil-impregnated sand deposits in the southwestern Uinta Basin (BLM 1990). The tar sand deposits within the southern portion of the WTP Project Area may contain up to 10 million barrels of recoverable oil, or about 0.3 percent of the estimated

resources for the entire STSA. In addition, small areas to the north of Nine Mile Canyon within the WTP Project Area also contain deposits of tar sands (Blackett 1996; Weiss et al. 1990). These smaller deposits are contained within the Sunnyside STSA but have never been mined. Because of the depth to the tar sands in this area (over 1,000 feet), the potential for production from these areas has been considered to be low (BLM 1990).

A small portion of the Sunnyside STSA located within the WTP Project Area could be unavailable for tar sands development during the 33-year LOP. However, given the fact that the main portion of the Sunnyside STSA, located to the south of the WTP Project Area, contains abundant tar sand reserves at the surface and is closer to the population centers of Price and Wellington, the potential impacts to tar sands production from the Proposed Action are considered to be negligible.

Coal

Coal has been mined from the Blackhawk Formation to the south, southwest, and east of the WTP Project Area. Coal may also be present beneath the WTP Project Area at depths of about 6,000 feet. Because of the depth to coal deposits beneath the area, these deposits cannot be mined economically. Therefore, the Proposed Action would have no impacts on coal resources.

Salable Minerals

Existing sand and gravel quarries located on State lands in the WTP Project Area could become exhausted. However, three proposed 2-acre rock quarries located on the mesa tops within the WTP Project Area would supply the bulk of the aggregate materials needed for access road and well pad construction. In addition, large deposits of aggregate are located south of the WTP Project Area in the Price/Wellington area. Accordingly, potential impacts to existing salable aggregate resources (sand and gravel) from the construction of the Proposed Action would be minor.

The Upper and Middle Members of the Green River Formation produce stone that is used as decorative building materials. None of the four currently mined areas are located within the WTP Project Area (BLM 1984a). Limestone is also mined south of the WTP Project Area for use as crushed stone (Weiss et al. 1990). The Proposed Action would have no impact on these resources.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible Effects

Construction of well pads and associated facilities would result in topographical changes in the sandstone-dominated bedrock underlying the WTP Project Area.

Proposed development would result in depletion of natural gas resources within the WTP Project.

Construction of aggregate borrow areas would result in depletion of salable resources (sand and gravel) within the WTP Project Area.

Irretrievable Effects

A small portion of the Sunnyside STSA located within the WTP Project Area could be unavailable for tar sands development during the 33-year LOP.

4.2.1.2 Alternative B – No Action Alternative

Potential impacts to geologic and mineral resources from the No Action Alternative include changes to the local topography, decreased slope stability, and depletion of natural gas and sand and gravel resources.

Topography

Excavation for the construction of well pads, access roads, and other project facilities would cause topographic changes including square- or rectangular-shaped cuts and fills in the sandstone-dominated bedrock underlying the WTP Project Area. These changes to the topographic character of the area would be minor, but long-term. However, the amount of disturbance would be only approximately 17 percent of that under the Proposed Action.

If the WTP Project Area proves to be productive for natural gas, and all proposed facilities are constructed, a total of 54 well pads would be constructed on State of Utah and private lands on the mesa tops, in canyon bottoms, and near the edges of canyon rims. Each well pad would initially disturb up to 2.85 acres, and slightly more for multiple-well pads. Additional bedrock disturbance would also occur due to construction of access roads, pipeline corridors, compressor stations, water management impoundments, equipment storage areas, and temporary worker housing areas. A total of 32 miles of new access roads would be constructed. The primary impact of these topographic changes would be on visual resources within the canyons. The visual impacts are described in **Section 4.16**.

Geologic Hazards

Under the No Action Alternative, the potential for geologic hazards would be similar to that discussed under the Proposed Action but would be reduced in proportion to the level of proposed development.

Natural Gas

Potential impacts to natural gas resources include the depletion of these resources due to active extraction by the No Action Alternative. The expected LOP is approximately 27 years. Based on the level of proposed development, ultimate recovery of natural gas from the 81 new gas wells could reach 261 MMscf per day. However, under the No Action Alternative, formations deeper than the Mesaverde Group would not be targeted for production, which would substantially decrease predicted ultimate recovery. Therefore, the natural gas resources within these deeper formations would remain available for future extraction. However, additional exploratory information concerning the amount of recoverable gas resources available in these deeper formations would not be gathered.

Oil Shale

Under the No Action Alternative, impacts to oil shale resources and oil shale development would be similar to those discussed under the Proposed Action.

Tar Sands

Under the No Action Alternative, no project facilities would be constructed in the southeast portion of the WTP Project Area where the potential for tar sands development is greatest. In addition, the main portion of the Sunnyside STSA located south of the WTP Project Area contains abundant tar sand reserves at the surface. Therefore, the potential impacts to tar sands production from the No Action Alternative are considered to be negligible.

Coal

Coal may be present beneath the WTP Project Area at depths of about 6,000 feet. Because of the depth to coal deposits beneath the area, these deposits cannot be mined economically. Therefore, the No Action Alternative would have no impacts on coal resources or potential coal mining activities.

Salable Minerals

Impacts to salable minerals and development of those minerals under the No Action Alternative would be similar to those described for the Proposed Action.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would the same as those described under the Proposed Action.

4.2.1.3 Alternative C – Transportation Impact Reduction

Potential impacts to geologic resources from Alternative C – Transportation Impact Reduction, would be similar to those for the Proposed Action and would include changes to the local topography, decreased slope stability, depletion of natural gas and sand and gravel resources, and interference with potential mining of oil shale and tar sands in the WTP Project Area. Implementation of Alternative C would increase the LOP by about 7 years when compared to the Proposed Action.

Topography

Impacts to topography under Alternative C would be similar to those described for the Proposed Action.

A total of 538 well pads would be constructed on the mesa tops, in canyon bottoms, and near the edges of canyon rims. The amount of cut-and-fill would vary according to the location of the pad and the depth to bedrock beneath the pad. Well pads located in canyon bottoms and on mesa tops would likely disturb little or no bedrock, whereas those located on the canyon rims or the side slopes of canyons would require the most bedrock disturbance. Additional bedrock disturbance would also occur due to

construction of access roads, pipelines corridors, compressor stations, water management impoundments, equipment storage areas, temporary worker housing, and three 2-acre rock borrow pits. A total of 179 miles of new access roads would be constructed, including 2.85 miles of new access road in Trail Canyon. The construction of the alternative access route in Trail Canyon would alter the topography in this area and disturb about 14 acres that would not be disturbed under the Proposed Action. The primary impact of these topographic changes would be on visual resources within the canyon. Visual impacts are described in **Section 4.16.**

Geologic Hazards

The potential for geologic hazards under Alternative C would be similar to that described for the Proposed Action.

Natural Gas

Potential impacts to natural gas resources under Alternative C would be similar to those for the Proposed Action and include the depletion of these resources from the target formations due to active extraction. The expected LOP is approximately 40 years. The estimated ultimate recovery of natural gas from the WTP Project Area at full development would be similar to the Proposed Action.

However, under the Transportation Impact Reduction Alternative, the rate at which the WTP gas resources are developed would be potentially reduced by about 33 percent due to restrictions on winter drilling. Only two rigs would be allowed to operate during the winter period (November 1 – May 15). If drilling and completion processes at individual wells are interrupted and then resumed again after several months, the well bore would have to be plugged to prevent the potential for blowout. Therefore, due to potential well bore damage related to leaving drilling and completion fluids in contact with the formation for extended periods of time, the ultimate recovery of the gas resources could be diminished if drilling or completion operations are interrupted during the process.

The Transportation Impact Reduction Alternative would provide valuable exploratory information concerning the amount of recoverable gas resources available in formations deeper than the Mesaverde Group in the southern Uinta Basin.

Oil Shale

Impacts to oil shale and potential oil shale development under Alternative C would be similar to those described for the Proposed Action.

Tar Sands

Impacts to tar sands and potential tar sands development under Alternative C would be similar to those described for the Proposed Action.

Coal

Impacts to coal reserves and potential coal mining activities under Alternative C would be similar to those described for the Proposed Action.

Salable Minerals

Impacts to salable minerals and development of those minerals under Alternative C would be similar to those described for the Proposed Action.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would the same as those described under the Proposed Action.

4.2.1.4 Alternative D – Conservation Alternative

Potential impacts to geologic resources from Alternative D – Conservation Alternative, would be similar to, but of less magnitude, than those for the Proposed Action and would include changes to the local topography, decreased slope stability, depletion of natural gas and sand and gravel resources, and interference with potential mining of oil shale and tar sands in the WTP Project Area. Implementation of Alternative D would decrease the amount of disturbed surface area when compared to the Proposed Action, and would effectively eliminate surface disturbance in the WSAs, the Desolation Canyon NHL, unleased lands in the potential ACECs, and unleased lands with wilderness characteristics. In addition, as feasible (where to do so would not preclude the development of valid and existing lease rights), NSO would be allowed on Federal lands within canyon bottoms. A final component of Alternative D that reduces impacts is that NSO would be allowed on slopes greater than 30 percent.

Topography

Similar to the Proposed Action, excavation activities for the construction of well pads, access roads, and other project facilities would cause minor, long-term topographic changes including square- or rectangular-shaped cuts and fills in the sandstone-dominated bedrock underlying the WTP Project Area. The amount of long-term disturbance under Alternative D would be about 66 percent of that for the Proposed Action.

If the WTP Project Area proves to be productive for natural gas, and all proposed facilities are constructed, a total of 348 well pads would be constructed on the mesa tops and near the edges of canyon rims. Additional bedrock disturbance would also occur due to construction of access roads, pipeline corridors, compressor stations, water management impoundments, equipment storage areas, and two 2-acre aggregate borrow pits. A total of 127 miles of new access roads would be constructed.

Geologic Hazards

The potential for geologic hazards under Alternative D would be similar to that described for the Proposed Action.

Natural Gas

Potential impacts to natural gas resources from the Conservation Alternative include the depletion of these resources due to active extraction. The expected LOP is

approximately 46 years. Natural gas recovery from the proposed 558 new gas wells could reach up to 172 MMscf per day. However, the rate at which the WTP gas resources are developed could potentially be reduced by about 50 percent due to restrictions on winter drilling. If drilling and completion processes are interrupted and resumed after several months, the well bore would have to be plugged to prevent the potential for blowout. Therefore, due to potential well bore damage related to leaving drilling and completion fluids in contact with the formation for extended periods of time, the ultimate recovery of the gas resources could be diminished if drilling or completion operations are interrupted at certain points in the process.

The Conservation Alternative would provide valuable exploratory information concerning the amount of recoverable gas resources available in formations deeper than the Mesaverde Group in the southern Uinta Basin.

Oil Shale

Impacts to oil shale resources and potential oil shale development under Alternative D would be similar to those described under the Proposed Action.

Tar Sands

Under Alternative D, no project facilities would be constructed in the southeast portion of the WTP Project Area where the potential for tar sands development is greatest. In addition, the main portion of the Sunnyside STSA located south of the WTP Project Area contains abundant tar sand reserves at the surface. Therefore, the potential impacts to tar sands production under Alternative D are considered to be negligible.

Coal

Impacts to coal resources and potential coal mining activities under Alternative D would be similar to those described under the Proposed Action.

Salable Minerals

Impacts to salable minerals and potential development of salable minerals under Alternative D would be similar to those described under the Proposed Action.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would the same as those described under the Proposed Action.

4.2.1.5 Alternative E – Agency Preferred Alternative

Potential impacts to geologic resources from Alternative E – Agency Preferred Alternative, would be similar to those for the Proposed Action and would include changes to the local topography, decreased slope stability, depletion of natural gas and sand and gravel resources, and interference with potential mining of oil shale and tar sands in the WTP Project Area.

Topography

Excavation for the construction of well pads, access roads, and other project facilities would cause minor, long-term topographic changes including square- or rectangular-shaped cuts and fills in the sandstone-dominated bedrock underlying the WTP Project Area.

If the WTP Project Area proves to be productive for natural gas, and all proposed facilities are constructed, a total of 488 well pads would be constructed on the mesa tops, in canyon bottoms, and near the edges of canyon rims. The amount of cut-and-fill would vary according to the location of the pad and the depth to bedrock beneath the pad. Well pads located in canyon bottoms and on mesa tops would likely disturb little or no bedrock, whereas those located on the canyon rims or the side slopes of canyons would require the most bedrock disturbance. Additional bedrock disturbance would also occur due to construction of access roads, pipelines corridors, compressor stations, water management impoundments, equipment storage areas, temporary worker housing, and three 2-acre rock borrow pits. A total of 164 miles of new access roads would be constructed. The primary impact of these topographic changes would be on visual resources within the canyons. The visual impacts are described in **Section 4.16**.

Geologic Hazards

The potential for geologic hazards under Alternative E would be similar to that described under the Proposed Action.

Natural Gas

Potential impacts to natural gas resources from the Agency Preferred Alternative include the depletion of these resources due to active extraction. The expected LOP is approximately 34 years. The estimated ultimate recovery of natural gas from the WTP Project Area at full development under Alternative E would be identical to the Proposed Action (i.e., up to 250 MMscf per day).

Oil Shale

Impacts to oil shale resources and potential oil shale development under Alternative E would be similar to those described under the Proposed Action.

Tar Sands

Impacts to tar sands and potential tar sands development under Alternative E would be similar to those described under the Proposed Action.

Coal

Impacts to coal resources and potential coal mining activities under Alternative E would be similar to those described under the Proposed Action.

Salable Minerals

Impacts to salable mineral resources and potential development of salable resources under Alternative E would be similar to those described under the Proposed Action.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would the same as those described under the Proposed Action.

4.2.2 Paleontology

4.2.2.1 Alternative A – Proposed Action

Direct Impacts to Known and Unknown Paleontological Resources

Paleontological resources are nonrenewable resources. Disturbance to such resources, whether through mechanical surface disturbance, erosion, or paleontological excavation, irrevocably alters or destroys it. Those actions that may result in direct impacts, defined as the express disturbance or destruction of a paleontological resource. Direct impacts are impacts that occur at the same time and place as a disturbance and are predicated on changes to the characteristics of a paleontological resource.

Direct impacts to paleontological resources related to the WTP Project Area include surface disturbance during the construction of well pads, roads, pipelines, and other facilities. Buried pipelines have a greater potential for directly impacting paleontological resources than surface pipelines. As detailed in **Table 2.2-5**, the anticipated short-term surface disturbance under the Proposed Action is 3,656 acres. This total consists of only new disturbances and does not include maintenance of existing road and pipeline ROWs. The following discussion is framed in the context of the Proposed Action occurring as planned *without* a BLM permitted paleontologist being present during construction activities. This is appropriate given that that operator has not voluntarily committed to any paleontological mitigation measures as part of their Proposed Action.

As is discussed in **Section 3.2.3** and the Paleontology Report for the West Tavaputs Plateau (Hamblin 2006), the WTP Project Area has received little paleontological research attention and therefore known impacts are limited. **Figure 2.2-1** indicates that new surface disturbance consists of 538 well pad locations, associated access roads and pipelines, and ancillary facilities. There are four potential conflicts with known paleontological resource localities. Of these four conflicts, three are the result of recent well pad construction and were discovered as a result of mitigation procedures (i.e., monitoring) at the well pads during construction. Future expansion of the well pads would result in direct impacts.

Potential direct impacts to paleontological resources may occur in the process of maintaining or upgrading existing roads or from conditions that make such maintenance necessary. Regular maintenance and upgrades of existing roads could potentially disturb one or more known paleontological localities that are immediately adjacent to existing roads as shown in **Figure 2.2-1**.

Most of the known fossil localities occur along roads on the north side of the WTP Project Area. However, because the WTP Project Area has received such little paleontological research attention, this is likely not representative of the paleontological site distribution and potential of the entire WTP Project Area. At present, the entire WTP Project Area may be thought of as having a potential for paleontological resources. Paleontological monitoring at recently constructed well pads turned up vertebrate tracks, insect larva, and plant compressions (Sandau 2006). Direct impacts to unknown paleontological resources can be anticipated to be proportionate to the total area impacted.

Based on the known paleontological importance of the Green River Formation and several new discoveries during recent years, some direct impacts to unknown paleontological resources can be expected. Most of these can be mitigated by paleontological monitoring of surface-disturbing activities during construction.

Indirect Impacts

Indirect impacts are those impacts caused by the action, but occur later in time, or are farther removed in distance. Anticipated indirect impacts to paleontological resources within the WTP Project Area include increased visitation and vandalism, OHV use, and erosion.

Increased visitation throughout the WTP Project Area would likely occur as a result of increased access from new road construction. Increased visitation to the area may result in the unauthorized collection of fossils, and damage to localities caused through OHV use in unauthorized areas (e.g., cross-country travel not on an existing road). OHVs can also contribute to erosion in some areas. While erosion occasionally exposes fossils – leading to the discovery of new and/or scientifically important paleontological data – it can also be destructive to fossils, either directly or by creating an environment that facilitates unauthorized collecting. Opening currently inaccessible areas may also encourage amateur prospecting for fossils, particularly where there is a low or intermittent presence of activity. Visitation impacts are likely to occur within and outside of the disturbed areas resulting from the Proposed Action. It is possible that both known and unknown fossil localities would be adversely affected.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible Effects

Implementation of the Proposed Action could result in the destruction and/or removal of scientifically important paleontological resources from the WTP Project Area.

Irretrievable Effects

There would be no irretrievable effects.

4.2.2.2 Alternative B – No Action Alternative

Direct Impacts to Known and Unknown Paleontological Resources

Direct impacts to known paleontological resources would be similar to those described under the Proposed Action with the exception that one known fossil locality would not be impacted by road maintenance under this alternative. Direct impacts to unknown paleontological resources can be anticipated to be proportionate to the total area impacted. As such, anticipated direct impacts would be considerably less, with only a total of 626 acres of surface disturbance.

Based on the known paleontological importance of the Green River Formation and several new discoveries during the past year, some direct impacts to unknown paleontological resources can be expected on State and private lands as well as on areas with new road, pipelines, and other facilities needed on the BLM lands. Most of these can be mitigated by preconstruction surveys and paleontological monitoring of construction excavation sites.

Indirect Impacts

Indirect impacts to paleontological resources would be similar to those described under the Proposed Action except that visitation, vandalism, and OHV use would be lower under this alternative. However, any increase in visitation to the area may result in unauthorized collection of fossils, and damage to localities caused through the use of OHVs in unauthorized areas.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.2.2.3 Alternative C – Transportation Reduction Alternative

Direct Impacts to Known and Unknown Paleontological Resources

Potential direct impacts to known and unknown paleontological resources would be similar to those described under the Proposed Action. The construction of the alternative access route in Trail Canyon would add 14 acres of disturbance in an area that would be undisturbed under the Proposed Action.

As discussed in **Table 2.6-8**, under Alternative C, a paleontologist would be present on location during construction of all proposed pipelines, access roads, and well pads that could potentially impact the Green River Formation. Implementation of this measure would minimize impacts to subsurface paleontological resources. Provided that this mitigation measure is appropriately implemented, impacts to paleontological resources could be beneficial rather than adverse, as construction activities related to proposed oil and gas development could result in the discovery of new scientifically important resources.

Indirect Impacts

Potential indirect impacts to paleontological resources would be similar to those described under the Proposed Action, except that limiting traffic and spreading development over a longer period of time may help ease indirect impacts to paleontological resources under this alternative.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.2.2.4 Alternative D – Conservation Alternative

Direct Impacts to Known and Unknown Paleontological Resources

Direct impacts to known and unknown paleontological resources would be similar to those described under the Proposed Action, however, as direct impacts to paleontological resources can be anticipated to be proportionate to the total area impacted, impacts to fossils could be approximately 31 percent less than those under the Proposed Action because total area of surface disturbance is 31 percent less under this alternative.

As discussed in **Table 2.6-8**, under Alternative D, a paleontologist would be present on location during construction of all proposed pipelines, access roads, and well pads that could potentially impact the Green River Formation. Implementation of this measure would minimize impacts to subsurface paleontological resources. Provided that mitigation is appropriately implemented, impacts to paleontological resources could be beneficial rather than adverse, as construction activities related to proposed oil and gas development could result in the discovery of new scientifically important resources.

Indirect Impacts

Indirect impacts to paleontological resources would be similar to those described under the Proposed Action, or possibly less, as a result of the smaller acreage of surface disturbance proposed under this alternative. In addition, under Alternative D, there would be no worker housing, which would lessen the potential for worker-related impacts to paleontological resources in the WTP Project Area.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.2.2.5 Alternative E – Agency Preferred Alternative

Direct Impacts to Known and Unknown Paleontological Resources

Direct impacts to known and unknown paleontological resources would be similar to those described under the Proposed Action, however, as direct impacts to paleontological resources can be anticipated to be proportionate to the total area impacted, impacts to fossils could be approximately 9 percent less than those under the

Proposed Action because total area of surface disturbance is 9 percent less under this alternative.

In addition, as discussed in **Table 2.6-8**, under Alternative E, a paleontologist would be present on location during construction of all proposed pipelines, access roads, and well pads that could potentially impact the Green River Formation. Implementation of this measure would minimize impacts to subsurface paleontological resources. Provided that mitigation is appropriately implemented, impacts to paleontological resources could be beneficial rather than adverse, as construction activities related to proposed oil and gas development could result in the discovery of new scientifically important resources.

Indirect Impacts

Indirect impacts to paleontological resources would be similar to those described under the Proposed Action, or possibly less, as a result of the smaller acreage of surface disturbance proposed under this alternative.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.3 AIR QUALITY

The emission inventory for the project was revised following the release of the DEIS to account for additional controls agreed to for the project in response to public concerns about air quality effects. VOC emissions from pneumatic devices were added to the inventory. These added sources included pneumatic chemical pumps, heat trace pneumatic pumps, and pneumatic controls for each well.

All air quality analyses were completed prior to completion of the operator committed dust suppression plan for Nine Mile Canyon Road. Predicted impacts for fugitive dust are therefore conservative. Annual particulate matter emission estimates for each alternative are likely to be substantially reduced through the application of dust suppression in Nine Mile Canyon and tributary side canyons.

Ozone Standards

The current NAAQS for ozone as revised in 2008 is 0.075 ppm. While EPA has proposed to review and revise the ozone NAAQS, the new standards have not been finalized. As the new ozone standards are only “proposed”, no analysis was performed using the proposed ozone standards for the evaluation of potential project impacts.

1-Hour NO_2 Standard

The new 1-hour NO_2 standard will become effective April 12, 2010. The new standard is based upon the 3-year average of the 98th percentile of the annual distribution of daily maximum 1-hour average concentrations. Information for the application of the 1-hour NO_2 standard including background concentrations, significant impact levels, model factors to account for the conversion to NO to NO_2 in the atmosphere, in addition to modeling and detailed analysis guidance have not been developed by the EPA or state

(UDEQ) regulatory agencies. In addition, no monitoring data exists to facilitate comparative or quantitative analyses.

In the absence of necessary background information and data necessary for a quantitative analysis, the following qualitative overview is provided. Potential emissions from construction and development activities are temporary (less than 3 years) in any one location and will not otherwise contribute to NO_2 concentrations after these activities are completed. These temporary potential emissions will not result in any significant contribution to emission levels that would result in measurable incremental increase in NO_2 levels.

Potential emissions from production operations may provide an incremental increase in NO_2 levels that over time, may or may not contribute to levels relevant to the 3-year 98th percentile of the annual distribution of daily maximum 1-hour average concentrations (NAAQS). To accurately model 1-hour NO_2 impacts from operational facilities, a detailed plan of the facility is required. Because this analysis is for a Proposed Action, detailed information such as exact locations of equipment, building dimensions, stack heights, and emission controls are unavailable, and were therefore not modeled. Potential emissions from operational traffic are also not expected to adversely impact 1-hour NO_2 concentrations due to the low traffic volume associated with the proposed alternatives.

However, facilities that may be constructed and operated as part of this project would be subject to permitting requirements under the Clean Air Act including compliance with the NAAQS including the new 1-hour NO_2 standard. After issuance of a Record of Decision for this EIS, prior to construction of any relevant facility, BBC and other operators will be required to obtain all necessary permits under the Clean Air Act. Under this permit process, BBC and other operators will be required to demonstrate compliance with the 1-hour NO_2 NAAQS standard.

4.3.1 Alternative A – Proposed Action

Implementation of the Proposed Action would cause increased levels of pollutants in the ambient air.

4.3.1.1 Near-Field Air Quality

The near-field analysis considered potential impacts to air quality that may occur within 30 miles (50 km) of the WTP Project Area. The Near-Field Air Quality Technical Support Document (Buys & Associates 2007b and **Appendix J**) presents a complete description of the project emissions, the modeling protocol, and predicted impacts. The analysis considered short-term activities such as well pad and road construction, well drilling, and well completion activities and assessed impacts from long-term activities including production operations and natural gas treatment and compression.

Project Emissions

- Pollutant emissions from project activities would include the following sources:
- Well pad and road construction: equipment producing fugitive dust while moving and leveling earth;

- Drilling: vehicles generating fugitive dust on access roads, and drill rig engine exhaust;
- Completion: vehicles generating fugitive dust on access roads, frac pump engine and generator emissions, and completion flaring emissions;
- Vehicle tailpipe emissions associated with all development phases;
- Well production operations: three-phase separator emissions, flashing and breathing emissions from a condensate tank, well site dehydrator emissions, and pump jack engine emissions;
- Central production facility: compressor engines, central glycol dehydration unit emissions, flare emissions from central dehydrators, and central flashing and breathing emissions from condensate tanks: and
- VOC emissions from pneumatic devises including methanol injection pumps, heat trace pumps, and two liquid level controllers at each well.

The major pollutant associated with development activities would be PM_{10} and $PM_{2.5}$ generated by surface-disturbing and traffic activities. Additional NO_x and CO pollutants would be emitted from vehicle and equipment exhaust. The primary emission sources during the operational phase would include compressor stations, vehicle traffic, and well pad equipment operation. The near-field impact assessment also considered NO_X, CO, PM_{10}, $PM_{2.5}$ and HAP emissions during the operational phase of the WTP after full field development. Since SO_2 emissions during this phase were negligible, they were not included in the impact analysis. Total annual project emissions are shown in **Table 4-3.1**.

Table 4.3-1 WTP Annual Emissions for the Proposed Action

Pollutant	Project Emissions (tons/year)		Total Emissions (tons/year)
	Well Development	Project Production	
Criteria Pollutants & VOC			
NO_x	570.2	795.5	1,366
CO	681.7	959.3	1,641
VOC	106.3	12,024	12,130
SO_2	12.5	0.69	13.1
PM_{10}	7,256.7	1,687	8,944
$PM_{2.5}$	1,129.3	292.6	1,422
Hazardous Air Pollutants			
Benzene	0.00	95.7	95.7
Toluene	0.00	73.1	73.1
Ethylbenzene	0.00	1.96	1.96
Xylene	0.00	18.4	18.4
n-Hexane	0.00	223	223
Formaldehyde	0.75	20.9	21.7
Total HAPs	0.75	433	434
Greenhouse Gases			
CO_2	70,977	482,563	553,539
CH_4	79.3	2,550	2,629

Well Development Impacts

Criteria pollutant ambient air concentrations were predicted using dispersion modeling and compared to applicable short-term ambient air quality standards. Comparison to annual thresholds is also provided. However, the annual impacts assume that the activity would occur for an entire year at the same location, which is not the case.

Well development impacts, compared to the NAAQS for the Proposed Action, are shown in **Table 4.3-2**. Since well development activities are temporary and short-term in nature, comparisons to PSD increments are not appropriate. The modeling showed that no exceedances of NAAQS would be predicted for all development activities. The annual results demonstrate that even if these activities lasted for an entire year in the same location, the effects would be less than all applicable standards.

Diesel particulate matter (DPM) resulting from heavy equipment used during well construction, drill rigs, and temporary engines used during the well fracturing process was evaluated against the DPM RfC of 5 micrograms per cubic meter (µg/m^3) for chronic non-cancer respiratory effects of diesel exhaust on humans (EPA 2003a). The maximum predicted annual DPM concentration of 0.4 µg/m^3 represents 9 percent of the DPM RfC.

Table 4.3-2 WTP Proposed Action Near-Field Development Impacts

Pollutant and Averaging Period	Averaging Period	Ambient Air Concentration (µg/m^3)[a]				
		Predicted	Background[b]	Total	NAAQS	Percent of NAAQS (Project + Background)
SO_2	3-Hour	9.58	20	29.6	1,300	2
	24-Hour	2.41	10	12.4	365	3
	Annual	0.4	5	5.4	80	7
NO_2	Annual	23.3	17	40.3	100	40
PM_{10}	24-Hour	39.0	63.3	102	150	68
$PM_{2.5}$	24-Hour [c]	7.69	15/52[d]	22.69[e]	35	65
	Annual	1.89	11	12.89	15	86

[a] µ/m^3 is micrograms of pollutant per cubic meter of air.
[b] Source: Utah Division of Environmental Quality - Division of Air Quality (UDAQ).
[c] Concentration estimate represents the eighth maximum 24-hour $PM_{2.5}$ concentrations (on average over 3 years).
[d] The state of Utah currently does not require $PM_{2.5}$ modeling for new sources and does not have an official background. The $PM_{2.5}$ concentrations given in this table represent 98th percentile values from limited $PM_{2.5}$ monitoring conducted in Vernal and Uintah/Duchesne Counties in 2007. The smaller figure is representative of average summer concentrations, while the larger value is representative of winter inversion conditions, based on this monitoring.
[e] Because the winter inversion $PM_{2,5}$ value does not represent typical conditions in the WTP Project Area, the value for average summer conditions was used in analyzing $PM_{2.5}$ impacts from the Proposed Action. The $PM_{2.5}$ monitoring location in Uintah/Duchesne counties, Utah was located in an urban setting with a high density of inhabitants and in proximity to highways (Highway 40 and Highway 191). As such, the higher, winter time inversion $PM_{2.5}$ concentration value reflects impacts from activities and activity levels not expected in the rural and sparsely inhabited region of the Proposed Action. Potential impacts from agricultural activities and wood burning would not be expected to measurable contribute to $PM_{2.5}$ concentrations in the region of the Proposed Action.

Operational Impacts

Criteria Pollutants

The predicted criteria pollutant impacts are compared to applicable Utah and NAAQS standards and applicable PSD Class II increments. All comparisons with PSD Class II increments are intended only to evaluate potential significance, and do not represent a regulatory PSD increment consumption analysis. PSD increment consumption analyses are typically applied to large industrial sources during permitting, and are solely the responsibility of the State of Utah and the EPA.

Table 4.3-3 summarizes the criteria pollutant impacts resulting from Alternative A operations. All predicted concentrations remain below the NAAQS, and below the PSD Class II increments.

Table 4.3-3 WTP Proposed Action Near-Field Operations Predicted Impacts

Pollutant	Averaging Period	Predicted Concentration ($\mu g/m^3$)	Percent of PSD Class II Increment	Project + Background ($\mu g/m^3$)	Percent of NAAQS (Project + Background)
NO_2	Annual	22.5	90	39.5[a]	40
PM_{10}	24-hour	10.7	36	74.0[b]	49
$PM_{2.5}$	Annual	1.23	N/A	12.2[c]	82
$PM_{2.5}$	24-hour [g]	4.03	N/A	19.0[d]	54
CO	1-hour	786	N/A	1897[e]	5
CO	8-hour	433	N/A	1544[f]	15

[a] with NO_2 annual background 17 $\mu g/m^3$
[b] with PM_{10} 24-hour background 63.3 $\mu g/m^3$
[c] with $PM_{2.5}$ annual background 11 $\mu g/m^3$
[d] with $PM_{2.5}$ 24-hour background 15 $\mu g/m^3$
[e] with CO 1-hour background 1,111 $\mu g/m^3$
[f] with CO 8-hour background 1,111 $\mu g/m^3$
[g] Represents eighth-maximum concentration averaged over three years
N/A = not applicable
[h] The state of Utah currently does not require $PM_{2.5}$ modeling for new sources and does not have an official background. The $PM_{2.5}$ concentrations provided by UDEQ (15 $\mu g/m^3$ /52 $\mu g/m^3$) represent 98th percentile values from limited $PM_{2.5}$ monitoring conducted in Vernal and Uintah/Duchesne Counties in 2007. The smaller figure is representative of average summer concentrations, while the larger value is representative of winter inversion conditions, based on this monitoring. Because the winter inversion $PM_{2.5}$ value does not represent typical conditions in the project area, the value for average summer conditions was used in analyzing $PM_{2.5}$ impacts from the Proposed Action. The $PM_{2.5}$ monitoring location in Uintah/Duchesne counties, Utah was located in an urban setting with a high density of inhabitants and in proximity to highways (Highway 40 and Highway 191). As such, the higher, winter time inversion $PM_{2.5}$ concentration value reflects impacts from activities and activity levels not expected in the rural and sparsely inhabited region of the Proposed Action. Potential impacts from agricultural activities and wood burning would not be expected to measurable contribute to $PM_{2.5}$ concentrations in the region of the Proposed Action.

Ozone Impacts

An analysis of potential ozone impacts from WTP project emissions and cumulative emissions was performed using the Models-3 Community Multiscale Air Quality (CMAQ) modeling system, version 4.6 publicly released October 2006. Since ozone impacts can only be evaluated on a regional basis, the ozone impact results are presented in Chapter 5, Section 5.3, Air Quality Cumulative Impacts.

Hazardous Air Pollutants

Hazardous air pollutant emissions were evaluated against State of Utah thresholds. The State of Utah has adopted Toxic Screening Levels (TSLs) which are applied during the air permitting process to assist in the evaluation of hazardous air pollutants released into

the atmosphere (Utah Department of Environmental Quality-Air Quality Division 2000). These levels are not standards that must be met, but screening thresholds which if exceeded, would suggest that additional information is needed to evaluate potential health and environmental impacts. **Table 4.3-4** presents the predicted results in comparison to the State of Utah TSLs for averaging periods of one-hour (short-term) and 24-hour (chronic). None of the predicted pollutant levels exceed the TSLs for the State of Utah.

Table 4.3-4 WTP Proposed Action Utah Toxic Screening Level Impacts

Pollutant and Averaging Time	Predicted Maximum Impact ($\mu g/m^3$)	Toxic Screening Levels[b] ($\mu g/m^3$)	Percent of Toxic Screening Level
Benzene[a] (24-hour)	38.0	53	72
Toluene (24-hour)	43.1	6,280	1
Ethylbenzene (1-hour)	3.8	54,274	<1
Ethylbenzene (24-hour)	1.6	14,473	<1
Xylene (1-hour)	53.2	65,129	<1
Xylene (24-hour)	12.6	14,473	<1
n-Hexane (24-hour)	15.4	5,875	<1
Formaldehyde (1-hour)	28.9	37	78

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

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

Table 4.3-5 presents the acute RELs and chronic RfCs for non-cancer effects for the Proposed Action. The predicted maximum concentrations of all HAPs are compared against the REL and RfC for each pollutant. Predicted concentrations remain below all applicable significance criteria (shown in **Section 3.3.3.1**) for Alternative A.

Table 4.3-5 WTP Proposed Action Non-Carcinogenic Acute REL and RfC Impacts

HAP	REL ($\mu g/m^3$)	Predicted Maximum One-Hour Impact ($\mu g/m^3$)	Percent of REL	RfC[c] ($\mu g/m^3$)	Predicted Maximum Annual Impact ($\mu g/m^3$)	Percent of RfC
Benzene	1,300 [a]	160	12	30	8.15	27
Toluene	37,000 [a]	160	<1	400	8.16	2.0
Ethylbenzene	350,000 [b]	3.8	<1	1,000	0.26	<1
Xylenes	22,000 [a]	53.2	<1	100	2.68	2.7
n-Hexane	390,000 [b]	56.1	<1	200	2.83	1.4
Formaldehyde	94 [a]	28.9	31	9.8	0.99	10

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

Since benzene and formaldehyde are carcinogenic, annual average concentrations of these two HAPs were modeled and expressed as a long-term cancer risk (based on 70-year exposure). Cancer risk was estimated for two exposure scenarios: 1) most likely exposure (MLE) for residents and 2) a maximally exposed individual (MEI) corresponding to an individual that could be exposed for the entire LOP (assumed as 28 years of production emissions—the last five years of project life is for field abandonment and reclamation), such as compressor station workers. Resultant exposure adjustment factors for the MLE and MEI scenarios of 0.095 and 0.47 were applied to the estimated cancer risk to account for the actual time that an individual would be exposed during a 70-year lifetime.

Table 4.3-6 presents the unit risk factor, exposure adjustment factor, and the estimated cancer risk for the MLE and MEI exposure scenarios for benzene and formaldehyde. The unit risk factor is an upper-bound estimate of the probability of one additional person contracting cancer based on continuous exposure to 1 g/m^3 of the substance over a 70-year lifetime. A range of unit risk factors is available for benzene. The range of acceptable cancer risks when evaluating the health effects of an action varies from one in a million (1×10^{-6}) to one in ten thousand (1×10^{-4}) (40 CFR § 300.430 (e) (2) (i) (A) (2)). The increased cancer risk from benzene and formaldehyde are cumulative, because an individual is exposed to both compounds at the same time. Therefore for the increased risk to individuals receiving the most likely dose is $2.9 \times 10^{-6}$to 7.3×10^{-6}. A maximally exposed individual would have an increased risk of 1.2×10^{-5} to 3.1×10^{-5}. However it is common when carcinogens have similar target organs or modes of action. Benzene is a known human carcinogen; exposure is known to cause leukemia. Formaldehyde is a probable carcinogen, exposure is suspected to cause leukemia. Therefore this is a conservative estimate. The generally acceptable risk range is 1×10^{-6} to 1×10^{-4}.

Table 4.3-6 WTP Proposed Action Carcinogenic HAP Risk

Hazardous Air Pollutant	Exposure Scenario	Unit Risk Factor (1/µg/m^3)	Exposure Adjustment Factor	Modeled Annual Impact (µg/m^3)	Cancer Risk
Benzene	MLE	2.2 E-06 to 7.8 E-06	0.095	8.15	1.7 E-06 to 6.0 E-06
Formaldehyde	MLE	1.3×10^{-5}	0.095	0.99	1.2E-06
Benzene	MEI	2.2 E-06 to 7.8 E-06	0.40	8.15	7.2 E-06 to 2.5 E-05
Formaldehyde	MEI	1.3 E-05	0.40	0.99	5.1 E-06

MEI = maximally exposed individual
MLE = most likely exposure

Greenhouse Gases

Greenhouse gas (GHG) emissions are not currently regulated, but some form of regulatory action is being considered in the future. **Table 4.3-7** compares Proposed Action predicted GHG emissions to emissions from U.S. two-axle, four-tire vehicles

traveling 11,856 miles per year attaining an average fuel economy of 19.7 miles per gallon, US and worldwide emissions.

Table 4.3-7 Comparison of WTP Proposed Action Greenhouse Gas Emissions to USA and World Totals (2004)

Proposed Action	Emissions (tons/year)	WTP equivalent to annual GHG emissions from 'x' number of passenger vehicles*	WTP % of USA Emissions‡	WTP % World Emissions☌
WTP CO_2 Emissions	553,539	91,971	0.009	0.0018
WTP CH_4 Emissions	2,629	9,173	0.010 ☌	0.0009 ☌

* Source: http://www.epa.gov/solar/energy-resources/calculator.html
‡ Source: Climate Analysis Indicators Tool (CAIT) Version 5.0 (Washington, DC: World Resources Institute 2008)
☌ Compared to 2000 data

4.3.1.2 Far-Field Air Quality

The far-field air quality analysis focused upon project-related and cumulative impacts that could occur within areas of special concern (i.e., Federal designated Class I areas and sensitive Class II areas). The Far-Field Air Quality Technical Support Document (Buys & Associates 2007b and **Appendix J**) presents a complete description of the modeling protocol and predicted impacts. **Table 4.3-8** and **Table 4.3-9** present the areas of special concern and the associated high elevation lakes evaluated for the far-field analysis. **Figure 4.3-1** presents a map of the Class I and II areas and analysis domain.

Table 4.3-8 Class I and Sensitive Class II Areas

Sensitive Area	Federal Land Manager	PSD Designation
Arches NP	NPS	I
Black Canyon of the Gunnison	FS	I
Canyonlands NP	NPS	I
Capitol Reef NP	NPS	I
Flat Tops WA	FS	I
La Garita WA	FS	I
Maroon Bells-Snowmass WA	FS	I
Weminuche WA	FS	I
West Elk WA	FS	I
Brown Park NWR	FWS	II
Colorado NM	NPS	II
Dinosaur NM	NPS	II
Flaming Gorge NRA	NPS	II
High Uintas WA	FS	II
Ouray NWR	FWS	II
Ragged WA	FS	II

NPS = National Park Service
FS = Forest Service
FWS = Fish and Wildlife Service
NP = National Park
WA = Wilderness Area
NM = National Monument
NWR = National Wildlife Refuge
NRA = National Recreation Area

Figure 4.3-1 Class I and Sensitive Class II Areas within Analysis Area

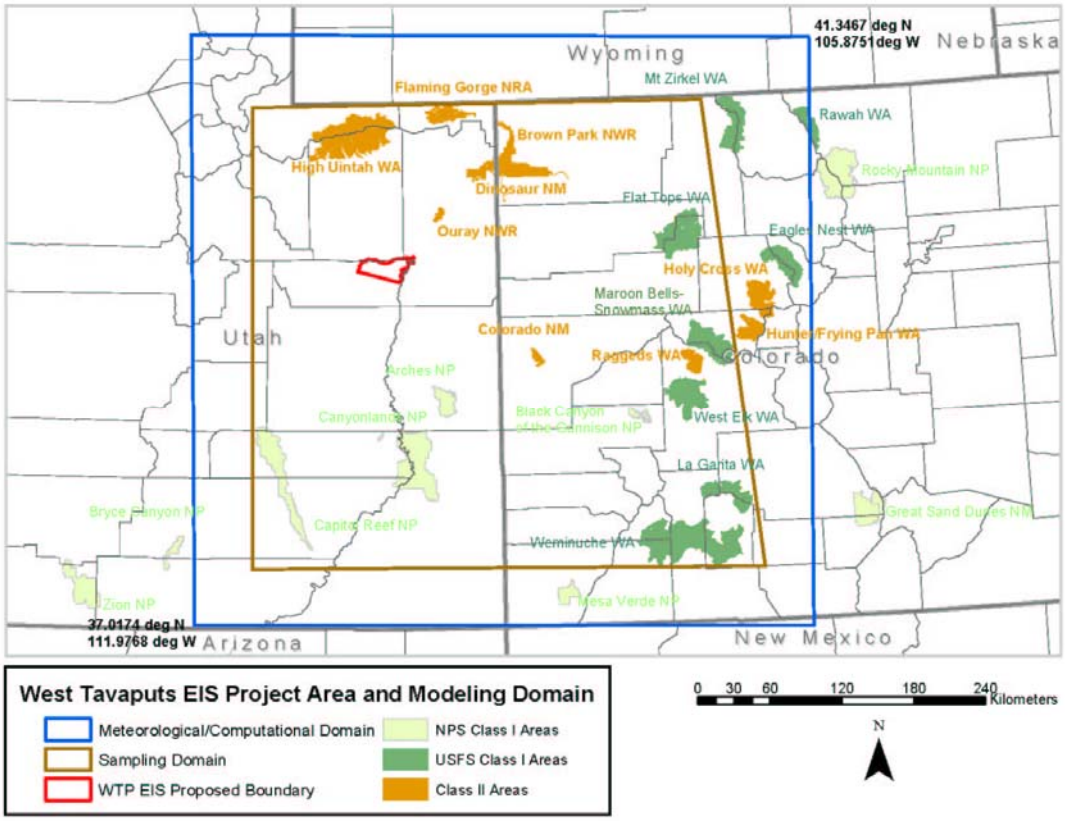

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Table 4.3-9 Sensitive Lakes	
Location	**Sensitive Lake**
Flat Tops WA	Ned Wilson
Flat Tops WA	Upper Ned Wilson
High Uintas WA	Dean
High Uintas WA	Pine Island
Maroon Bells WA	Moon
Raggeds WA	Deep Creek #1
West Elk WA	S. Golden

To assess potential far-field impacts, the CALPUFF set of dispersion models were applied. The CALPUFF set of models (CALMET, CALPUFF, CALPOST, and associated utilities) were designed specifically to assess ambient air quality impacts at significant distances from the source and therefore long pollutant travel times. The predicted pollutant concentrations were compared to the NAAQS and, for informational purposes only, the PSD Class I and II increments. In addition, the predicted concentration and deposition results were processed to evaluate potential visibility and acid deposition impacts for comparison with the Federal Land Manager (FLM) Limits of Acceptable Change (LAC). The analysis was performed utilizing three years of CALMET derived meteorological data (2001-2003).

In order to bracket a range of results, potential impacts were predicted for the Proposed Action, Alternative B, and Alternative E, based upon estimated emission rates presented in the Emissions Inventory report (Buys & Associates 2007a). The analysis applied predicted emission rates for production activities assuming full development of each alternative plus emissions that would occur as a result of peak year well development activities.

Throughout this analysis, all comparisons with PSD increments are intended only to evaluate a level of concern and do not represent a regulatory PSD increment consumption analysis. PSD increment consumption analyses are applied to large industrial sources and are solely the responsibility of the State of Utah with EPA oversight.

Ambient Air Quality Impacts

Significance criteria for potential criteria pollutant impacts include the NAAQS. Utah has adopted the NAAQS as the standard for the State.

Predicted far-field maximum pollutant concentrations that could occur as a result of the implementation of the Proposed Action are summarized in **Table 4.3-10** and compared with the NAAQS for years 2001-2003. As demonstrated, increases in pollutant concentrations are predicted to occur at levels below the ambient standards.

Prevention of Significant Deterioration Increments

The following tables compare the maximum far-field predicted pollutant concentrations with the PSD Class I and Class II Increments. **Table 4.3-11** presents the maximum predicted PSD increment consumption of the three years modeled. As demonstrated, increases in pollutant concentrations are not predicted to exceed the Increments.

Table 4.3-10 WTP Alternative A Far-Field Maximum Predicted Potential Impact NAAQS Comparison

Pollutant	Averaging Time	Maximum Predicted Impact ($\mu g/m^3$)	Maximum Impact Location	Background[a] Concentration ($\mu g/m^3$)	Background Plus Impact ($\mu g/m^3$)	NAAQS Standard ($\mu g/m^3$)	Impact Percentage of NAAQS
NO_2	Annual	0.1	Ouray	17	17	100	17
SO_2	3-hour	0.02	Ouray	20	20	1300	2
	24-hour	6 E-03	Ouray	10	10	365	3
	Annual	8 E-04	Ouray	5	5	80	6
PM_{10}	24-hour	14.6	Ouray	63.3	77.9	150	52
$PM_{2.5}$	24-hour[b]	1.9	Ouray	15/52[c]	16.9[d]	35	48
	Annual	0.4	Ouray	11	11.4	15	76

[a] Source: Utah Division of Environmental Quality - Division of Air Quality (UDAQ).
[b] Represents the modeled "eighth maximum" concentration
[c] The state of Utah currently does not require $PM_{2.5}$ modeling for new sources and does not have an official background. The $PM_{2.5}$ concentrations given in this table represent 98th percentile values from limited $PM_{2.5}$ monitoring conducted in Vernal and Uintah/Duchesne Counties in 2007. The smaller figure is representative of average summer concentrations, while the larger value is representative of winter inversion conditions, based on this monitoring.

[d] Because the winter inversion $PM_{2,5}$ value does not represent typical conditions in the WTP Project Area, the value for average summer conditions was used in analyzing $PM_{2.5}$ impacts from the Proposed Action. The $PM_{2.5}$ monitoring location in Uintah/Duchesne counties, Utah was located in an urban setting with a high density of inhabitants and in proximity to highways (Highway 40 and Highway 191). As such, the higher, winter time inversion $PM_{2.5}$ concentration value reflects impacts from activities and activity levels not expected in the rural and very sparsely inhabited region of the Proposed Action. Potential impacts from agricultural activities and wood burning would not be expected to measurable contribute to $PM_{2.5}$ concentrations in the region of the Proposed Action.

Table 4.3-11 WTP Alternative A Far-Field Maximum Predicted Potential Impacts PSD Class I & II Comparison

Area of Special Concern (and PSD Designation)	NO_2 (Max Percent of PSD)	SO_2 (Max Percent of PSD)			PM_{10} (Max Percent of PSD)	
	Annual	3-hour	24-hour	Annual	24-hour	Annual
Arches NP (I)	0	0	0	0	17	1
Black Canyon of the Gunnison WA (I)	0	0	0	0	4	0
Canyonlands NP (I)	0	0	0	0	32	1
Capitol Reef NP (I)	0	0	0	0	10	0
Flat Tops WA (I)	0	0	0	0	10	1
La Garita WA (I)	0	0	0	0	1	0
Maroon Bells-Snowmass WA (I)	0	0	0	0	5	0
Weminuche WA (I)	0	0	0	0	1	0

Table 4.3-11 WTP Alternative A Far-Field Maximum Predicted Potential Impacts PSD Class I & II Comparison						
Area of Special Concern (and PSD Designation)	NO_2 (Max Percent of PSD)	SO_2 (Max Percent of PSD)			PM_{10} (Max Percent of PSD)	
	Annual	3-hour	24-hour	Annual	24-hour	Annual
West Elk WA (I)	0	0	0	0	3	0
Dinosaur NM (II)	0	0	0	0	18	3
Brown Park NWR (II)	0	0	0	0	18	3
Colorado NM (II)	0	0	0	0	3	0
Flaming Gorge NRA (II)	0	0	0	0	4	1
Ouray NWR (II)	1	0	0	0	49	8
Ragged WA (II)	0	0	0	0	1	0
High Uintas WA (II)	0	0	0	0	3	0

NP = National Park
WA = Wilderness Area
NM = National Monument
NWR = National Wildlife Refuge
NRA = National Recreation Area

Terrestrial Acid Deposition

Annual terrestrial deposition impacts were predicted for dry and wet Nitrogen (N) and Sulfur (S) chemical species and compared to the USDA-Forest Service (Fox et al. 1989) threshold values of 3 kg/ha/yr for total sulfur and 5 kg/ha/yr for total nitrogen. **Table 4.3-12** presents the maximum predicted deposition results of the three years modeled. Deposition is not predicted to exceed the thresholds at any Class I or Class II area.

Table 4.3-12 WTP Alternative A Far-Field Maximum Predicted Potential Impacts Nitrogen and Sulfur Deposition					
Area of Special Concern (and PSD Designation)	Max. N Dep (kg/ha/yr)	Max S Dep (kg/ha/yr)	Area of Special Concern (and PSD Designation)	Max. N Dep (kg/ha/yr)	Max S Dep (kg/ha/yr)
Arches NP (I)	1.62E-03	2.05E-05	West Elk WA (I)	5.28E-04	6.29E-06
Black Canyon of the Gunnison WA (I)	6.71E-04	7.66E-06	Dinosaur NM (II)	8.82E-03	1.01E-04
Canyonlands NP (I)	1.01E-03	1.29E-05	Brown Park NWR (II)	4.53E-03	5.48E-05
Capitol Reef NP (I)	3.73E-04	3.82E-06	Colorado NM (II)	1.72E-03	2.04E-05
Flat Tops WA (I)	1.16E-03	1.34E-05	Flaming Gorge NRA (II)	3.12E-03	3.81E-05
La Garita WA (I)	2.52E-04	3.22E-06	Ouray NWR (II)	1.84E-02	1.93E-04
Maroon Bells-Snowmass WA (I)	6.54E-04	7.47E-06	Ragged WA (II)	5.26E-04	6.29E-06
Weminuche WA (I)	2.41E-04	2.97E-06	High Uintas WA (II)	1.80E-03	2.28E-05

NP = National Park
WA = Wilderness Area
NM = National Monument
NWR = National Wildlife Refuge
NRA = National Recreation Area

Aquatic Acid Deposition

Potential ANC impacts were calculated manually by applying the screening methodology prescribed by the U.S. Forest Service. **Table 4.3-13** presents the maximum predicted impact of the three years modeled. Predicted impacts at all lakes are less than one micro equivalent per liter (µeq/l) or a 10 percent change in ANC.

Table 4.3-13 WTP Alternative A Far-Field Maximum Predicted Potential Impacts Acid Neutralization Capacity

Lake	Ned Wilson	Upper Ned Wilson	Dean	Pine Island	Moon	Deep Creek #1	S. Golden
A (µeq/l)	38.5	12.8	57.3	95.6	51.5	44.3	111.0
Watershed area (ha)	8.5	3.1	117	192	251	360	112
Precipitation (m)	1.02	1.02	1.02	1.02	1.02	1.02	1.02
Et	0.33	0.33	0.33	0.33	0.33	0.33	0.33
ANC(o) (eq)	2207	267	45816	125439	88340	108989	84960
Maximum Calculated Potential Impacts							
Ds (kg/ha/yr)	9.67E-06	9.67E-06	9.35E-06	8.96E-06	2.77E-06	5.85E-06	5.11E-06
Dn (kg/ha/yr)	7.69E-04	7.69E-04	8.34E-04	7.97E-04	2.05E-04	4.88E-04	4.15E-04
Hs ($eq^2/m^2/yr$)	7.54E-08	7.56E-08	5.85E-08	5.60E-08	1.73E-08	3.66E-08	3.20E-08
Hn ($eq^2/m^2/yr$)	7.58E-06	7.60E-06	5.96E-06	5.69E-06	1.46E-06	3.49E-06	2.96E-06
Hdep (eq)	0.65	0.24	7.04	11.03	3.71	12.69	3.35
Percent ANC change [1]	0.03	0.01 µeq/l	0.02	0.01	0.00	0.01	0.00

[1] For lakes with existing ANC levels less than 25 microequivalents per liter (µeq/l), a LAC of no greater than one µeq/l is applied. For lakes with existing ANC levels greater than 25 µeq/l, the LAC is no greater than a 10 percent change in the background ANC

Visibility Impairment

The visibility assessment methodology utilized for this analysis utilized the BLM-suggested method for performing visibility impact assessments. This method involved a first level screening analysis for visibility following the recommendations in the Federal Land Managers' Air Quality Related Values Workgroup (FLAG 2000) Guideline document. If the seasonal screening analysis indicated that predicted changes in visibility exceeded the 1.0 deciview LAC on more than one day per year at any mandatory Federal PSD Class I area, a daily refined analysis was conducted based on hourly IMPROVE optical monitoring data measured at Canyonlands National Park for 1987 through 2004.

The screening results for the Proposed Action are presented in **Table 4.3-14.** Since there were no changes in visibility that exceeded 1.0 deciview LAC on more than one day per year at any Class I area, a refined analysis was not performed.

Table 4.3-14 WTP Alternative A Far-Field Screening Visibility Impacts						
Area of Special Concern (PSD Designation)	2001		2002		2003	
	Days Δ dV >1.0	Max Δ dV	Days Δ dV >1.0	Max Δ dV	Days Δ dV >1.0	Max Δ dV
Arches NP (I)	0	0.78	0	0.84	0	0.93
Black Canyon of the Gunnison WA (I)	0	0.15	0	0.29	0	0.12
Canyonlands NP (I)	1	1.41	0	0.72	0	0.91
Capitol Reef NP (I)	0	0.60	0	0.42	0	0.43
Flat Tops WA (I)	0	0.49	0	0.21	0	0.30
La Garita WA (I)	0	0.05	0	0.10	0	.05
Maroon Bells-Snowmass WA (I)	0	0.25	0	0.17	0	0.21
Weminuche WA (I)	0	0.05	0	0.08	0	0.06
West Elk WA (I)	0	0.15	0	0.23	0	0.17
Dinosaur NM (II)	28	2.72	11	1.46	13	1.54
Brown Park NWR (II)	0	0.82	0	0.65	0	0.67
Colorado NM (II)	0	0.51	0	0.54	0	0.53
Flaming Gorge NRA (II)	0	0.79	0	0.84	0	0.72
Ouray NWR (II)	121	6.51	95	5.76	82	5.53
Ragged WA (II)	0	0.18	0	0.19	0	0.21
High Uintas WA (II)	0	0.35	4	1.56	0	0.82

Δ = change
dV = deciview
NP = National Park
WA = Wilderness Area
NM = National Monument
NWR = National Wildlife Refuge
NRA = National Recreation Area

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible Effects

There would be no irreversible effects to air quality.

Irretrievable Effects

Air quality would be degraded in and around the WTP Project Area for the LOP.

4.3.2 Alternative B – No Action

4.3.2.1 Near-Field Air Quality

The near-field analysis followed the same process as that outlined for the Proposed Action. Annual emissions for Alternative B are summarized in **Table 4.3-15**.

Table 4.3-15 WTP Annual Emissions for the No Action Alternative			
Pollutant	**Project Emissions (tons/year)**		**Total Emissions [a] (tons/year)**
	Well Development	**Project Production**	
Criteria Pollutants & VOC			
NO_x	165	315	480
CO	222	409	631
VOC	35.2	1,067	1,102
SO_2	3.68	0.06	3.7
PM_{10}	2,229	157	2,386
$PM_{2.5}$	346.5	37.3	384
Hazardous Air Pollutants			
Benzene	0	8.60	8.6
Toluene	0	6.22	6.2
Ethylbenzene	0	0.03	0.0
Xylene	0	1.95	2.0
n-Hexane	0	12.0	12.0
Formaldehyde	0.2	13.2	13
Total HAPs	0.2	41.9	42
Greenhouse Gases			
CO_2	23,772	112,860	136,632
CH_4	27	1,849	1,876

Well Development Impacts

The major pollutant associated with development activities would be PM_{10} and $PM_{2.5}$ generated by surface-disturbing and traffic activities. Additional pollutants would be emitted from vehicle and equipment exhaust.

A likely development scenario based on the proposed drilling schedule was simulated to determine criteria pollutant impacts. Annual NO_2 and DPM impacts were modeled and compared to standards. Results show that impacts would be only slightly less than those under the Proposed Action (annual NO_2 plus background = 32 percent of NAAQS, annual DPM = 8 percent of DPM RfC) and less than applicable thresholds.

Fugitive dust (PM_{10} and $PM_{2.5}$) impacts modeled under Alternative A were scaled against traffic counts in order to estimate impacts under Alternative B. Since the maximum level of development of Alternative B would be approximately 33 percent of Alternative A, the PM_{10} and $PM_{2.5}$ impacts were estimated as 33 percent of Alternative A. The results are presented in **Table 4.3-16**. Estimated fugitive dust impacts are predicted to be below the NAAQS standards.

Table 4.3-16 WTP Alternative B Near-Field Estimated Potential Development Impacts

Pollutant and Averaging Period	Averaging Period	Ambient Air Concentration (µg/m^3)				
		Predicted	Background[a]	Total	NAAQS	Percent of NAAQS (Project + Background)
SO_2	3-Hour	3.16	20	23.2	1300	2
	24-Hour	0.80	10	10.8	365	3
	Annual	0.13	5	5.1	80	6
NO_2	Annual Mean	7.69	17	24.7	100	24.7
PM_{10}	24-Hour	12.9	63.3	76.2	150	51
$PM_{2.5}$	24-Hour	2.54[b]	15/52[c]	17.54[d]	35	50
	Annual	0.62	11	11.62	15	77

[a] Source: Utah Division of Environmental Quality - Division of Air Quality (UDAQ).
[b] Represents the modeled "eighth maximum" concentration
[c] The state of Utah currently does not require $PM_{2.5}$ modeling for new sources and does not have an official background. The $PM_{2.5}$ concentrations given in this table represent 98th percentile values from limited $PM_{2.5}$ monitoring conducted in Vernal and Uintah/Duchesne Counties in 2007. The smaller figure is representative of average summer concentrations, while the larger value is representative of winter inversion conditions, based on this monitoring.
[d] Because the winter inversion $PM_{2.5}$ value does not represent typical conditions in the WTP Project Area, the value for average summer conditions was used in analyzing $PM_{2.5}$ impacts from the Proposed Action. The $PM_{2.5}$ monitoring location in Uintah/Duchesne counties, Utah was located in an urban setting with a high density of inhabitants and in proximity to highways (Highway 40 and Highway 191). As such, the higher, winter time inversion $PM_{2.5}$ concentration value reflects impacts from activities and activity levels not expected in the rural and very sparsely inhabited region of the Proposed Action. Potential impacts from agricultural activities and wood burning would not be expected to measurable contribute to $PM_{2.5}$ concentrations in the region of the Proposed Action.

Operational Impacts

The near-field impact assessment also considered NO_X, CO, PM_{10}, $PM_{2.5}$ and HAP emissions during the operational phase of the WTP after full field development. Since SO_2 emissions during this phase were negligible, they were not included in the impact analysis. The primary emission sources during this phase include compressor stations, vehicle traffic, and well pad equipment operation.

Criteria Pollutants

The primary source of NO_x and CO emissions would be the compressor stations. Although less total compression is planned for Alternative B than for the Proposed Action, maximum impacts are observed surrounding the property line of the largest compressor station, which is common to both alternatives. Therefore, the predicted criteria pollutant impacts are comparable to the impacts presented for the Proposed Action.

Although vehicle traffic from operations will be substantially less, impacts from fugitive dust will be the same as Alternative A at any one location because modeling was based on the maximum possible traffic at one well on any given day. Concentrations are predicted to remain below PSD Class II increments and NAAQS standards.

Ozone Impacts

Ozone impacts can only be adequately evaluated on a regional basis. Therefore, the ozone impact analysis is presented in Chapter 5, Section 5.3, Air Quality Cumulative Impacts.

Hazardous Air Pollutants

The primary source of HAP emissions would be the compressor stations. Although less total compression and dehydrator capacity is planned for Alternative B than for the Proposed Action, maximum impacts are observed surrounding the property line of the largest compressor station, which is common to both alternatives. Therefore, the predicted HAP impacts are comparable to the impacts presented for the Proposed Action.

Greenhouse Gases

Greenhouse gas emissions are not currently regulated, but regulation is being considered. **Table 4.3-17** compares the No Action predicted emissions from U.S. two-axle, four-tire vehicles traveling 11,856 miles per year attaining an average fuel economy of 19.7 miles per gallon, US and worldwide emissions.

Table 4.3-17 Comparison of WTP Alternative B Greenhouse Gas Emissions to USA and World Totals (2004)

Alternative B	Emissions (tons/year)	WTP equivalent to annual GHG emissions from 'x' passenger vehicles*	WTP % of USA Emissions‡	WTP % World Emissions∂
WTP CO_2 Emissions	136,632	22,702	0.002	0.0004
WTP CH_4 Emissions	1,876	6,546	0.007 ∂	0.0007 ∂

* **Source:** http://www.epa.gov/solar/energy-resources/calculator.html
‡ Source: Climate Analysis Indicators Tool (CAIT) Version 5.0 (Washington, DC: World Resources Institute 2008)
∂ Compared to 2000 data

4.3.2.2 Far-Field Air Quality

The far-field air quality analysis focused upon project-related and cumulative impacts that could occur within areas of special concern (i.e., Federal designated Class I areas and sensitive Class II areas). These areas are the same as those described for the Proposed Action. As in the Proposed Action, the CALPUFF set of dispersion models were applied, and the predicted pollutant concentrations were compared to the NAAQS and, for informational purposes only, the PSD Class I and II increments. In addition, the predicted concentration and deposition results were processed to evaluate potential visibility and acid deposition impacts for comparison with the LAC. The analysis was performed utilizing three years of CALMET derived meteorological data (2001-2003).

Ambient Air Quality Standards

Predicted maximum pollutant concentrations that could occur as a result of the implementation of Alternative B are summarized in **Table 4.3-18** and compared with the NAAQS for years 2001-2003. As demonstrated, increases in pollutant concentrations are predicted to occur at levels below the ambient standards.

Table 4.3-18 WTP Alternative B Far-Field Maximum Predicted Potential Impacts NAAQS Comparison

Pollutant	Averaging Time	Maximum Predicted Impact ($\mu g/m^3$)	Maximum Impact Location	Background[a] Concentration ($\mu g/m^3$)	Background Plus Impact ($\mu g/m^3$)	NAAQS Standard ($\mu g/m^3$)	Impact Percentage of NAAQS
NO_2	Annual	0.1	Ouray	17	17	100	17
SO_2	3-hour	7E-03	Ouray	20	20	1300	2
	24-hour	2E-03	Ouray	10	10	365	3
	Annual	3E-04	Ouray	5	5	80	6
PM_{10}	24-hour	2.8	Ouray	63.3	66.1	150	44
$PM_{2.5}$	24-hour[b]	0.6	Ouray	15/52[c]	15.6[d]	35	45
	Annual	0.1	Ouray	11	11.1	15	74

[a] Source: Utah Division of Environmental Quality - Division of Air Quality (UDAQ).
[b] Represents the modeled "eighth maximum" concentration
[c] The state of Utah currently does not require $PM_{2.5}$ modeling for new sources and does not have an official background. The $PM_{2.5}$ concentrations given in this table represent 98th percentile values from limited $PM_{2.5}$ monitoring conducted in Vernal and Uintah/Duchesne Counties in 2007. The smaller figure is representative of average summer concentrations, while the larger value is representative of winter inversion conditions, based on this monitoring.
[d] Because the winter inversion $PM_{2.5}$ value does not represent typical conditions in the WTP Project Area, the value for average summer conditions was used in analyzing $PM_{2.5}$ impacts from the Proposed Action. The $PM_{2.5}$ monitoring location in Uintah/Duchesne counties, Utah was located in an urban setting with a high density of inhabitants and in proximity to highways (Highway 40 and Highway 191). As such, the higher, winter time inversion $PM_{2.5}$ concentration value reflects impacts from activities and activity levels not expected in the rural and very sparsely inhabited region of the Proposed Action. Potential impacts from agricultural activities and wood burning would not be expected to measurable contribute to $PM_{2.5}$ concentrations in the region of the Proposed Action.

PSD Increments

The following tables compare the maximum predicted pollutant concentrations with the PSD Class I and Class II Increments. As demonstrated in **Table 4.3-19,** increases in pollutant concentrations are not predicted to exceed the Increments.

Table 4.3-19 WTP Alternative B Far-Field Maximum Predicted Potential Impacts PSD Class I & II Comparison

Area of Special Concern (and PSD Designation	NO_2 (Max Percent of PSD)	SO_2 (Max Percent of PSD)			PM_{10} (Max Percent of PSD)	
	Annual	3-hour	24-hour	Annual	24-hour	Annual
Arches NP (I)	0	0	0	0	4	1
Black Canyon of the Gunnison WA (I)	0	0	0	0	1	0
Canyonlands NP (I)	0	0	0	0	4	0
Capitol Reef NP (I)	0	0	0	0	2	0
Flat Tops WA (I)	0	0	0	0	1	0

Table 4.3-19 WTP Alternative B Far-Field Maximum Predicted Potential Impacts PSD Class I & II Comparison

Area of Special Concern (and PSD Designation	NO_2 (Max Percent of PSD)	SO_2 (Max Percent of PSD)			PM_{10} (Max Percent of PSD)	
	Annual	3-hour	24-hour	Annual	24-hour	Annual
La Garita WA (I)	0	0	0	0	0	0
Maroon Bells-Snowmass WA (I)	0	0	0	0	1	0
Weminuche WA (I)	0	0	0	0	0	0
West Elk WA (I)	0	0	0	0	1	0
Dinosaur NM (II)	0	0	0	0	3	1
Brown Park NWR (II)	0	0	0	0	1	0
Colorado NM (II)	0	0	0	0	1	0
Flaming Gorge NRA (II)	0	0	0	0	1	0
Ouray NWR (II)	0	0	0	0	9	2
Ragged WA (II)	0	0	0	0	0	0
High Uintas WA (II)	0	0	0	0	2	0

NP = National Park
WA = Wilderness Area
NM = National Monument
NWR = National Wildlife Refuge
NRA = National Recreation Area

Terrestrial Acid Deposition

Terrestrial deposition impacts were predicted for dry and wet N and S chemical species and compared to the USDA-Forest Service (Fox et al. 1989) threshold values of three kilograms per hectare per year (kg/ha/yr) for total sulfur and five kg/ha/yr for total nitrogen. **Table 4.3-20** presents the deposition results. Deposition is not predicted to exceed the thresholds at any Class I or Class II area.

Table 4.3-20 WTP Alternative B Far-Field Maximum Predicted Potential Impacts Nitrogen and Sulfur Deposition

Area of Special Concern (and PSD Designation)	Max. N Dep (kg/ha/yr)	Max S Dep (kg/ha/yr)	Area of Special Concern (and PSD Designation)	Max. N Dep (kg/ha/yr)	Max. S Dep (kg/ha/yr)
Arches NP (I)	6.22E-04	7.34E-06	West Elk WA (I)	2.00E-04	2.25E-06
Black Canyon of the Gunnison WA (I)	2.56E-04	2.74E-06	Dinosaur NM (II)	3.33E-03	3.62E-05
Canyonlands NP (I)	3.82E-04	4.62E-06	Brown Park NWR (II)	1.71E-03	1.96E-05
Capitol Reef NP (I)	1.35E-04	1.37E-06	Colorado NM (II)	6.51E-04	7.31E-06
Flat Tops WA (I)	4.32E-04	4.80E-06	Flaming Gorge NRA (II)	1.17E-03	1.37E-05
La Garita WA (I)	9.65E-05	1.16E-06	Ouray NWR (II)	6.67E-03	6.91E-05
Maroon Bells-Snowmass WA (I)	2.47E-04	2.68E-06	Ragged WA (II)	1.99E-04	2.25E-06
Weminuche WA (I)	9.08E-05	1.06E-06	High Uintas WA (II)	6.40E-04	8.16E-06

NP = National Park
WA = Wilderness Area
NM = National Monument
NWR = National Wildlife Refuge
NRA = National Recreation Area

Aquatic Acid Deposition

Potential ANC impacts were calculated manually by applying the screening methodology prescribed by the U.S. Forest Service. Predicted impacts at all lakes are less than one µeq/l or a 10 percent change in ANC as summarized in **Table 4.3-21.**

Table 4.3-21 WTP Alternative B Far-Field Maximum Predicted Potential Impacts Acid Neutralization Capacity

Lake	Ned Wilson	Upper Ned Wilson	Dean	Pine Island	Moon	Deep Creek #1	S. Golden
A (µeq/l)	38.5	12.8	57.3	95.6	51.5	44.3	111.0
Watershed area (ha)	8.5	3.1	117	192	251	360	112
Precipitation (m)	1.02	1.02	1.02	1.02	1.02	1.02	1.02
Et	0.33	0.33	0.33	0.33	0.33	0.33	0.33
ANC(o) (eq)	2207	267	45816	125439	883340	108989	84960
Maximum Predicted Impacts							
Ds (kg/ha/yr)	4.32E-06	4.33E-06	3.35E-06	3.21E-06	9.91E-07	2.10E-06	1.83E-06
Dn (kg/ha/yr)	3.94E-04	3.95E-04	3.03E-04	2.90E-04	7.82E-05	1.85E-04	1.56E-04
Hs ($eq^2/m^2/yr$)	2.70E-08	2.71E-08	2.09E-08	2.01E-08	6.19E-09	1.31E-08	1.14E-08
Hn ($eq^2/m^2/yr$)	2.82E-06	2.82E-06	2.17E-06	2.07E-06	5.59E-07	1.32E-06	1.12E-06
Hdep (eq)	0.24	0.09	2.56	4.02	1.42	4.80	1.26
Percent ANC change[1]	0.01	0.0042 µeq/l	0.01	0.00	0.00	0.00	0.00

[1] For lakes with existing ANC levels less than 25 microequivalents per liter (µeq/l), a LAC of no greater than one µeq/l is applied. For lakes with existing ANC levels greater than 25 µeq/l, the LAC is no greater than a 10 percent change in the background ANC

Visibility Impairment

The visibility assessment methodology utilized for this analysis utilized the BLM-suggested method for performing visibility impact assessments. This method involved a first level screening analysis for visibility following the recommendations in the FLAG (2000) Guideline document. If the seasonal screening analysis indicated that predicted changes in visibility exceeded the 1.0 deciview LAC on more than one day per year at any mandatory Federal PSD Class I area, a daily refined analysis was conducted based on hourly IMPROVE optical monitoring data measured at Canyonlands National Park for 1987 through 2004.

The screening results for Alternative B are presented in **Table 4.3-22.** Since there were no changes in visibility that exceeded 1.0 deciview LAC on more than one day per year at any Class I area, a refined analysis was not performed.

Table 4.3-22 WTP Alternative B Far-Field Screening Visibility Impacts						
Area of Special Concern (and PSD Designation)	2001		2002		2003	
	Days Δ dV >1.0	Max Δ dV	Days Δ dV >1.0	Max Δ dV	Days Δ dV >1.0	Max Δ dV
Arches NP (I)	0	0.20	0	0.29	0	0.32
Black Canyon of the Gunnison WA (I)	0	0.05	0	0.11	0	0.04
Canyonlands NP (I)	0	0.28	0	0.26	0	0.31
Capitol Reef NP (I)	0	0.21	0	0.15	0	0.16
Flat Tops WA (I)	0	0.11	0	0.08	0	0.10
La Garita WA (I)	0	0.02	0	0.03	0	0.02
Maroon Bells-Snowmass WA (I)	0	0.05	0	0.06	0	0.07
Weminuche WA (I)	0	0.02	0	0.03	0	0.02
West Elk WA (I)	0	0.03	0	0.08	0	0.06
Dinosaur NM (II)	0	0.54	0	0.52	0	0.51
Brown Park NWR (II)	0	0.23	0	0.24	0	0.23
Colorado NM (II)	0	0.12	0	0.20	0	0.19
Flaming Gorge NRA (II)	0	0.26	0	0.31	0	0.26
Ouray NWR (II)	14	1.64	8	1.91	7	1.88
Ragged WA (II)	0	0.03	0	0.06	0	0.07
High Uintas WA (II)	0	0.09	0	0.55	0	0.28

Δ = change
dV = deciview
NP = National Park
WA = Wilderness Area
NM = National Monument
NWR = National Wildlife Refuge
NRA = National Recreation Area

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.3.3 Alternative C – Transportation Impact Reduction

4.3.3.1 Near-Field Air Quality

The sources of pollutant impacts are the same as for Alternative A. Annual emissions for Alternative C are summarized in **Table 4.3-23**.

Table 4.3-23 WTP Annual Emissions for Alternative C			
Pollutant	**Project Emissions (tons/year)**		**Total Emissions (tons/year)**
	Well Development	**Project Production**	
Criteria Pollutants & VOC			
NO_x	133	793	926
CO	239	955	1,193
VOC	40.5	6,937	6,977
SO_2	4.84	0.60	5.44
PM_{10}	2,784	934	3,719
$PM_{2.5}$	2,067	182	2,249
Hazardous Air Pollutants			
Benzene	0.00	39.5	39.5
Toluene	0.00	22.6	22.6
Ethylbenzene	0.00	0.12	0.12
Xylene	0.00	6.63	6.63
n-Hexane	0.00	101	101
Formaldehyde	0.28	20.9	21.2
Total HAPs	0.28	191.2	191.5
Greenhouse Gases			
CO_2	26,598	482,563	509,160
CH_4	29.6	2,009	2,038

Well Development Impacts

Since the proposed well development rate for Alternative C is equivalent to the peak year development configuration for Alternative B, well development impacts will be equivalent to those presented for Alternative B. However, criteria pollutant emissions will be slightly less due to the use of drill rigs meeting Tier II emissions standards, which are about 33 Percent of the existing drill rig engines proposed under the Proposed Action.

Operational Impacts

Since the proposed compression and number of wells and pads for Alternative C after full field development is equivalent to that for the Proposed Action, criteria pollutant impacts from operations will be the same as those presented for the Proposed Action. Alternative C includes the use of control devices on well site dehydrator and tank flash sources which reduce VOC emissions by 95 percent. Therefore, HAP impacts from operations will be the same as those presented for Alternative E.

Ozone Impacts

Ozone impacts can only be adequately evaluated on a regional basis. Therefore, the ozone impact analysis is presented in Chapter 5, Section 5.3, Air Quality Cumulative Impacts.

Greenhouse Gases

Greenhouse gas emissions are not currently regulated, but regulation is being considered. **Table 4.3-24** compares Alternative C predicted emissions to emissions from U.S. two-axle, four-tire vehicles traveling 11,856 miles per year attaining an average fuel economy of 19.7 miles per gallon, US and worldwide emissions.

Table 4.3-24 Comparison of WTP Alternative C Greenhouse Gas Emissions to USA and World Totals (2004)

Alternative C	Emissions (tons/year)	WTP equivalent to annual GHG emissions from 'x' passenger vehicles*	WTP % of USA Emissions‡	WTP % World Emissions‡
WTP CO_2 Emissions	509,160	84,597	0.008	0.0017
WTP CH_4 Emissions	2,038	7,111	0.008 ∂	0.0007 ∂

*Source: http://www.epa.gov/solar/energy-resources/calculator.html
‡ Source: Climate Analysis Indicators Tool (CAIT) Version 5.0 (Washington, DC: World Resources Institute 2008)
∂ Compared to 2000 data

4.3.3.2 Far-Field Air Quality

The far-field emissions for Alternative C, which would include peak year development emissions and emissions from operations after full field development, are bracketed by the inventories developed for the Proposed Action and Alternative B (Buys & Associates 2007a). Therefore, the far-field impacts resulting from Alternative C are expected to be larger than those predicted for Alternative B but less than those predicted for the Proposed Action.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.3.4 Alternative D – Conservation Alternative

4.3.4.1 Near-Field Air Quality

The sources of pollutant impacts are the same as for Alternative A. Annual emissions for Alternative D are summarized in **Table 4.3-25**.

Table 4.3-25 WTP Annual Emissions for Alternative D

Pollutant	Project Emissions (tons/year)		Total Emissions (tons/year)
	Well Development	Project Production	
Criteria Pollutants & VOC			
NO_x	89	480	569
CO	152	584	736
VOC	25.9	4,833	4,859

Table 4.3-25 WTP Annual Emissions for Alternative D			
Pollutant	**Project Emissions (tons/year)**		**Total Emissions (tons/year)**
	Well Development	**Project Production**	
SO_2	3.25	0.58	3.83
PM_{10}	1,626	811	2,437
$PM_{2.5}$	1,310	148	1,458
Hazardous Air Pollutants			
Benzene	0.00	28.9	28.9
Toluene	0.00	16.7	16.7
Ethylbenzene	0.00	0.08	0.08
Xylene	0.00	5.13	5.13
n-Hexane	0.00	67.1	67.1
Formaldehyde	0.17	10.7	10.9
Total HAPs	0.17	129	129
Greenhouse Gases			
CO_2	17,664	310,278	327,942
CH_4	19.3	1,877	1,896

Well Development Impacts

Since the proposed well development configuration (e.g., number of drilling activities, pad construction, and completion activities occurring simultaneously in a concentrated area) for Alternative D is equivalent to the Proposed Action in terms of resulting maximum short-term pollutant concentrations. However the criteria pollutant emissions will be less than the Proposed Action due to use of drill rigs meeting Tier II standards. Therefore, short-term well development impacts are expected to be slightly less than those predicted for the Proposed Action. Annual development impacts are expected to be substantially less than those occurring under the Proposed Action since a phased development approach will be applied, significantly reducing the number of wells to be developed on an annual basis.

Operational Impacts

Given the total number of wells proposed under Alternative D, it is expected that fugitive dust emission rates would lie between those estimated under the Proposed Action and No Action Alternative. Therefore, fugitive dust ambient air quality impacts would be bracketed by these alternatives. Since the proposed compression is half of Alternatives A, C, and E, criteria and HAP impacts from operations will be significantly less than for the other alternatives but higher than impacts predicted for Alternative B. Alternative D includes the use of control devices on well site dehydrator and tank flash sources which reduce VOC emissions by 95 percent therefore HAP impacts from operations will be similar to those presented for Alternative E. HAP emissions will be less than Alternative E because emissions from the compressor stations will be less than Alternative E.

Ozone Impacts

Ozone impacts can only be adequately evaluated on a regional basis. Therefore, the ozone impact analysis is presented in Chapter 5, Section 5.3, Air Quality Cumulative Impacts.

Greenhouse Gases

Greenhouse gas emissions are not currently regulated, but regulation is being considered. **Table 4.3-26** compares Alternative D predicted emissions to emissions from U.S. two-axle, four-tire vehicles traveling 11,856 miles per year attaining an average fuel economy of 19.7 miles per gallon, US and worldwide emissions traveling 11,856 miles per year attaining an average fuel economy of 19.7 miles per gallon, US and worldwide emissions.

Table 4.3-26 Comparison of WTP Alternative D Greenhouse Gas Emissions to USA and World Totals (2004)

Alternative D	Emissions (tons/year)	WTP equivalent to annual GHG emissions from 'x' passenger vehicles*	WTP % of USA Emissions‡	WTP % World Emissions‡
WTP CO_2 Emissions	327,942	54,488	0.005	0.0011
WTP CH_4 Emissions	1,896	6,615	0.007 ∂	0.0007∂

* Source: http://www.epa.gov/solar/energy-resources/calculator.html
‡ Source: Climate Analysis Indicators Tool (CAIT) Version 5.0 (Washington, DC: World Resources Institute 2008)
∂ Compared to 2000 data
% = percent

4.3.4.2 Far-Field Air Quality

The far-field emissions for Alternative D, which would include peak year development emissions and emissions from operations after full field development, are bracketed by the inventories developed for the Proposed Action and Alternative B (Buys & Associates 2007a). Therefore, the far-field impacts resulting from Alternative D are expected to be larger than those predicted for Alternative B but less than those predicted for the Proposed Action.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.3.5 Alternative E – Agency Preferred Alternative

4.3.5.1 Near-Field Air Quality

The near-field analysis (Buys & Associates 2007b) followed the same process as that outlined for the Proposed Action.

When compared to the Proposed Action, Alternative E includes additional air quality environmental protection measures to minimize emissions from various sources (See **Table 2.6-8**). For particulate matter, enhanced dust suppression actions required under the WTP PA for cultural resources would further reduce fugitive dust under Alternative E. However, because modeling for this project was completed prior to the completion of the WTP PA, the dust abatement and reduction in fugitive dust are not reflected in the predicted impacts for Alternative E.

Emissions

Annual estimated emissions for Alternative E are shown in **Table 4.3-27.**

Table 4.3-27 WTP Annual Emissions for Alternative E

Pollutant	Project Emissions (tons/year)		Total Emissions (tons/year)
	Well Development	Project Production	
Criteria Pollutants & VOC			
NO_x	281	574	856
CO	529	822	1,351
VOC	81.9	6,929	7,011
SO_2	9.92	0.58	10.50
PM_{10}	5,097	823	5,921
$PM_{2.5}$	770	156	926
Hazardous Air Pollutants			
Benzene	0.00	39.3	39.3
Toluene	0.00	21.5	21.5
Ethylbenzene	0.00	0.11	0.11
Xylene	0.00	6.61	6.61
n-Hexane	0.00	94.2	94.2
Formaldehyde	0.53	19.8	20.3
Total HAPs	0.53	181.5	182.0
Greenhouse Gases			
CO_2	55,414	445,835	501,249
CH_4	61.1	1,957	2,018

Well Development Impacts

The major pollutant associated with development activities would be PM_{10} and $PM_{2.5}$ generated by surface-disturbing and traffic activities. Additional pollutants would be emitted from vehicle and equipment exhaust.

Since the well development configuration applied in the Proposed Action is likely to closely represent the development configuration observed under Alternative E, no near-field modeling was performed for Alternative E. However the criteria pollutant emissions will be less than the Proposed Action due to use of drill rigs meeting Tier II standards. The use of Tier II Drill rigs would reduce the NOx emissions from drill rigs by 55 percent as compared to the Proposed Action. Therefore, short-term well development impacts

are expected to be slightly less than those predicted for the Proposed Action. Annual development impacts are assumed to be slightly less than those predicted for the Proposed Action due to the lower max development rate of 128 wells per year compared to 168 wells per year for the Proposed Action.

Operational Impacts

The near-field impact assessment also considered NO_X, CO, PM_{10}, $PM_{2.5}$ and HAP emissions during the operational phase of the WTP after full field development. Since SO_2 emissions during this phase were negligible, they were not included in the impact analysis. The primary emission sources during this phase include compressor stations, vehicle traffic, and well pad equipment operation. Alternative E includes the use of control devices on well site dehydrators and tank batteries when VOC emissions would exceed five tons per year. These control devises would reduce VOC emissions from well site dehydrators and tank batteries by 95 percent.

According to the Approved RMP (October 2008), the NOx emission rate from all new and replacement internal combustion field engines greater than 300 hp would not exceed 1.0 g/(hp-hr), and for new and replacement internal combustion field engines with less than 300 hp, but greater than 40 hp, the NOx emission rate would not exceed 2.0 g/(hp-hr).

Criteria Pollutants

The primary source of NO_x and CO emissions would be the compressor stations. The same level of compression is planned as in the Proposed Action, and maximum impacts are observed surrounding the property line of the largest compressor station, which is common to both alternatives. The implementation of the RMP required NOx emission factors would result in lower NOx emissions for Alternative E from compressor engines. Therefore, the predicted criteria pollutant impacts are comparable or slightly less to the impacts presented for the Proposed Action.

Although vehicle traffic from operations will be less than the Proposed Action, impacts from fugitive dust would be the same at any one location based on the maximum possible traffic at one well on any given day. However, Alternative E includes installation of a pipeline to decrease traffic for transporting produced water. When the pipeline is completed impacts from fugitive dust will be less than the Proposed Action.

Ozone Impacts

Ozone impacts can only be adequately evaluated on a regional basis. Therefore, the ozone impact analysis is presented in Chapter 5, Section 5.3, Air Quality Cumulative Impacts.

Hazardous Air Pollutants

The primary source of HAP emissions would be the compressor stations. Under Alternative E, the same level compression and dehydrator capacity is planned as in the Proposed Action. Since maximum impacts are observed surrounding the property line of the largest compressor station, which is common to both alternatives, predicted HAP impacts are the same as the impacts presented for the Proposed Action. The additional

controls on well site emissions were not a big enough reduction to impact predicted pollutant levels.

Greenhouse Gases

Greenhouse gas emissions are not currently regulated, but regulation is being considered. **Table 4.3-28** compares Proposed Action predicted emissions to emissions from U.S. two-axle, four-tire vehicles traveling 11,856 miles per year attaining an average fuel economy of 19.7 miles per gallon, US and worldwide emissions.

Table 4.3-28 Comparison of WTP Alternative E Greenhouse Gas Emissions to USA and World Totals (2004)

Alternative E	Emissions (tons/year)	WTP equivalent to annual GHG emissions from 'x' passenger vehicles*	WTP % of USA Emissions‡	WTP % World Emissions‡
WTP CO_2 Emissions	525,939	87,385	0.009	0.0017
WTP CH_4 Emissions	2,070	7,223	0.008ᵈ	0.0007ᵈ

*Source: http://www.epa.gov/solar/energy-resources/calculator.html
‡ Source: Climate Analysis Indicators Tool (CAIT) Version 5.0 (Washington, DC: World Resources Institute 2008)
ᵈ Compared to 2000 data

4.3.5.2 Far-Field Air Quality

The far-field air quality analysis focused upon project-related and cumulative impacts that could occur within areas of special concern (i.e., Federal designated Class I areas and sensitive Class II areas). These areas are the same as those described for the Proposed Action. As in the Proposed Action, the CALPUFF set of dispersion models were applied, and the predicted pollutant concentrations were compared to the NAAQS and, for informational purposes only, the PSD Class I and II increments. In addition, the predicted concentration and deposition results were processed to evaluate potential visibility and acid deposition impacts for comparison with the LAC. The analysis was performed utilizing three years of CALMET derived meteorological data (2001-2003).

Ambient Air Quality Standards

Predicted maximum pollutant concentrations that could occur as a result of the implementation of Alternative E are summarized in **Table 4.3-29** and compared with the NAAQS for years 2001-2003. As demonstrated, increases in pollutant concentrations are predicted to occur at levels below the ambient standards.

Table 4.3-29 WTP Alternative E Far-Field Maximum Predicted Potential Impacts NAAQS Comparison

Pollutant	Averaging Time	Maximum Predicted Impact ($\mu g/m^3$)	Maximum Impact Location	Background[a] Concentration ($\mu g/m^3$)	Background Plus Impact ($\mu g/m^3$)	NAAQS Standard ($\mu g/m^3$)	Impact Percentage of NAAQS
NO_2	Annual	0.12	Ouray	17	17	100	17
SO_2	3-hour	0.02	Ouray	20	20	1300	2
	24-hour	4.2E-03	Ouray	10	10	365	3
	Annual	6.5E-04	Ouray	5	5	80	6
PM_{10}	24-hour	6.68	Ouray	63.3	70.0	150	47
$PM_{2.5}$	24-hour[b]	1.4	Ouray	15/52[c]	16.4[d]	35	47
	Annual	0.27	Ouray	11	11.3	15	75

[a] Source: Utah Division of Environmental Quality - Division of Air Quality (UDAQ).
[b] Represents the modeled "eighth maximum" concentration
[c] The state of Utah currently does not require $PM_{2.5}$ modeling for new sources and does not have an official background. The $PM_{2.5}$ concentrations given in this table represent 98th percentile values from limited $PM_{2.5}$ monitoring conducted in Vernal and Uintah/Duchesne Counties in 2007. The smaller figure is representative of average summer concentrations, while the larger value is representative of winter inversion conditions, based on this monitoring.

[d] Because the winter inversion $PM_{2.5}$ value does not represent typical conditions in the WTP Project Area, the value for average summer conditions was used in analyzing $PM_{2.5}$ impacts from the Proposed Action. The $PM_{2.5}$ monitoring location in Uintah/Duchesne counties, Utah was located in an urban setting with a high density of inhabitants and in proximity to highways (Highway 40 and Highway 191). As such, the higher, winter time inversion $PM_{2.5}$ concentration value reflects impacts from activities and activity levels not expected in the rural and very sparsely inhabited region of the Proposed Action. Potential impacts from agricultural activities and wood burning would not be expected to measurable contribute to $PM_{2.5}$ concentrations in the region of the Proposed Action.

PSD Increments

The following tables compare the maximum predicted pollutant concentrations with the PSD Class I and Class II Increments. As demonstrated in **Table 4.3-30,** increases in pollutant concentrations are not predicted to exceed the increments.

Terrestrial Acid Deposition

Terrestrial deposition impacts were predicted for dry and wet N and S chemical species and compared to the USDA-Forest Service (Fox et al. 1989) threshold values of three kg/ha/yr for total sulfur and five kg/ha/yr for total nitrogen. **Table 4.3-31** presents the deposition results. Deposition is not predicted to exceed the thresholds at any Class I or Class II area.

Table 4.3-30 WTP Alternative E Far-Field Maximum Predicted Potential Impacts PSD Class I & II Comparison

Area of Special Concern	NO_2 (Maximum Percent of PSD)	SO_2 (Maximum Percent of PSD)			PM_{10} (Maximum Percent of PSD)	
	Annual	3-hour	24-hour	Annual	24-hour	Annual
Arches NP (I)	0	0	0	0	9	1
Black Canyon of the Gunnison WA (I)	0	0	0	0	3	0
Canyonlands NP (I)	0	0	0	0	10	1
Capitol Reef NP (I)	0	0	0	0	5	0
Flat Tops WA (I)	0	0	0	0	3	0

Table 4.3-30 WTP Alternative E Far-Field Maximum Predicted Potential Impacts PSD Class I & II Comparison						
Area of Special Concern	NO_2 (Maximum Percent of PSD)	SO_2 (Maximum Percent of PSD)			PM_{10} (Maximum Percent of PSD)	
La Garita WA (I)	0	0	0	0	1	0
Maroon Bells-Snowmass WA (I)	0	0	0	0	2	0
Weminuche WA (I)	0	0	0	0	1	0
West Elk WA (I)	0	0	0	0	2	0
Dinosaur NM (II)	0	0	0	0	6	2
Brown Park NWR (II)	0	0	0	0	2	1
Colorado NM (II)	0	0	0	0	2	0
Flaming Gorge NRA (II)	0	0	0	0	3	0
Ouray NWR (II)	0	0	0	0	23	6
Ragged WA (II)	0	0	0	0	1	0
High Uintas WA (II)	0	0	0	0	4	0

NP = National Park
WA = Wilderness Area
NM = National Monument
NWR = National Wildlife Refuge
NRA = National Recreation Area

Table 4.3-31 WTP Alternative E Far-Field Maximum Predicted Potential Impacts Nitrogen and Sulfur Deposition					
Area of Special Concern	Max N Dep (kg/ha/yr)	Max S Dep (kg/ha/yr)	Area of Special Concern	Max N Dep (kg/ha/yr)	Max S Dep (kg/ha/yr)
Arches NP (I)	1.20E-03	1.56E-05	West Elk WA (I)	4.81E-04	4.80E-06
Black Canyon of the Gunnison WA (I)	6.11E-04	5.85E-06	Dinosaur NM (II)	8.02E-03	7.71E-05
Canyonlands NP (I)	9.17E-04	9.84E-06	Brown Park NWR (II)	4.12E-03	4.18E-05
Capitol Reef NP (I)	3.39E-04	2.92E-06	Colorado NM (II)	1.56E-03	1.56E-05
Flat Tops WA (I)	1.06E-03	1.02E-05	Flaming Gorge NRA (II)	2.84E-03	2.91E-05
La Garita WA (I)	2.30E-04	2.47E-06	Ouray NWR (II)	1.67E-02	1.47E-04
Maroon Bells-Snowmass WA (I)	5.95E-04	5.71E-06	Ragged WA (II)	4.79E-04	4.80E-06
Weminuche WA (I)	2.19E-04	2.26E-06	High Uintas WA (II)	1.64E-03	1.74E-05

NP = National Park
WA = Wilderness Area
NM = National Monument
NWR = National Wildlife Refuge
NRA = National Recreation Area

Aquatic Acid Deposition

Potential ANC impacts were calculated manually by applying the screening methodology prescribed by the USFS. Predicted impacts at all lakes are less than one µeq/l or a 10 percent change in ANC as summarized in **Table 4.3-32.**

Table 4.3-32 WTP Alternative E Far-Field Maximum Predicted Potential Impacts Acid Neutralization Capacity							
Lake	**Ned Wilson**	**Upper Ned Wilson**	**Dean**	**Pine Island**	**Moon**	**Deep Creek #1**	**S. Golden**
A (μeq/l)	38.5	12.8	57.3	95.6	51.5	44.3	111.0
Watershed area (ha)	8.5	3.1	117	192	251	360	112
Precipitation (m)	1.02	1.02	1.02	1.02	1.02	1.02	1.02
Et	0.33	0.33	0.33	0.33	0.33	0.33	0.33
ANC(o) (eq)	2207.38	266.94	45815.82	125439.4	88339.7	108988.6	84960.29
Maximum Predicted Potential Impacts							
Ds (kg/ha/yr)	9.20E-06	9.23E-06	7.14E-06	6.84E-06	2.11E-06	4.47E-06	3.90E-06
Dn (kg/ha/yr)	9.65E-04	9.68E-04	7.61E-04	7.26E-04	1.87E-04	4.44E-04	3.78E-04
Hs ($eq^2/m^2/yr$)	5.75E-08	5.77E-08	4.46E-08	4.27E-08	1.32E-08	2.79E-08	2.44E-08
Hn ($eq^2/m^2/yr$)	6.89E-06	6.91E-06	5.43E-06	5.19E-06	1.33E-06	3.17E-06	2.70E-06
Hdep (eq)	0.428619	0.156299	5.136051	8.422974	3.376704	11.18423	3.048223
Percent ANC change[1]	0.03	0.010203 μeq/l	0.01	0.01	0.00	0.01	0.00

[1] For lakes with existing ANC levels less than 25 μeq/l, a LAC of no greater than one μeq/l is applied. For lakes with existing ANC levels greater than 25 μeq/l, the LAC is no greater than a 10 percent change in the background ANC

Visibility Impairment

The visibility assessment methodology utilized for this analysis utilized the BLM suggested method for performing visibility impact assessments. This method involved a first level screening analysis for visibility following the recommendations in the FLAG (2000) Guideline document. If the seasonal screening analysis indicated that predicted changes in visibility exceeded the 1.0 deciview LAC on more than one day per year at any mandatory Federal PSD Class I area, a daily refined analysis was conducted based on hourly IMPROVE optical monitoring data measured at Canyonlands National Park for 1987 through 2004.

The screening results for Alternative E are presented in **Table 4.3-33.** Since there were no changes in visibility that exceeded 1.0 deciview LAC on more than one day per year at any Class I area, a refined analysis was not performed.

Table 4.3-33 WTP Alternative E Far-Field Screening Visibility Impacts						
Area of Special Concern	**2001**		**2002**		**2003**	
	Days Δ dV >1.0	**Max Δ dV**	**Days Δ dV >1.0**	**Max Δ dV**	**Days Δ dV >1.0**	**Max Δ dV**
Arches NP (I)	0	0.49	0	0.69	0	0.77
Black Canyon of the Gunnison WA (I)	0	0.11	0	0.24	0	0.10
Canyonlands NP (I)	0	0.67	0	0.61	0	0.59
Capitol Reef NP (I)	0	0.50	0	0.35	0	0.36
Flat Tops WA (I)	0	0.26	0	0.18	0	0.25
La Garita WA (I)	0	0.04	0	0.08	0	0.04
Maroon Bells-Snowmass	0	0.12	0	0.14	0	0.17

Table 4.3-33 WTP Alternative E Far-Field Screening Visibility Impacts						
Area of Special Concern	2001		2002		2003	
	Days Δ dV >1.0	Max Δ dV	Days Δ dV >1.0	Max Δ dV	Days Δ dV >1.0	Max Δ dV
WA (I)						
Weminuche WA (I)	0	0.04	0	0.07	0	0.05
West Elk WA (I)	0	0.07	0	0.19	0	0.14
Dinosaur NM (II)	7	1.28	3	1.22	4	1.24
Brown Park NWR (II)	0	0.55	0	0.55	0	0.55
Colorado NM (II)	0	0.28	0	0.45	0	0.44
Flaming Gorge NRA (II)	0	0.64	0	0.71	0	0.61
Ouray NWR (II)	87	3.86	65	4.59	57	4.36
Ragged WA (II)	0	0.08	0	0.15	0	0.17
High Uintas WA (II)	0	0.22	3	1.28	0	0.69

dV = decivew
Δ = change
NP = National Park
WA = Wilderness Area
NM = National Monument
NWR = National Wildlife Refuge
NRA = National Recreation Area

4.3.6 Air Quality Impact Summary (across all alternatives)

4.3.6.1 Near-Field Air Quality

As a result of the implementation of the Proposed Action or alternatives, increases in air pollutant concentrations would occur. For the majority of the emitted pollutants, the magnitude of the potential impacts would vary in proportion with the scale of the alternative. The greatest impacts would occur with the implementation of the Proposed Action. For some pollutants and activities, impacts would be minimized with the implementation of Alternative B.

Well Development Impacts

Table 4.3-34 summarizes the well development impacts for each alternative:

Table 4.3-34 Summary of Near-Field Well Development Impacts						
Pollutant and Averaging Period	Averaging Period	Percent of NAAQS (Project + Background)				
		Proposed Action	Alternative B	Alternative C	Alternative D	Alternative E
SO_2	3-Hour	2	2	Equivalent to Alt B	Equivalent to PA	Equivalent to PA
	24-Hour	3	3	Equivalent to Alt B	Equivalent to PA	Equivalent to PA
	Annual	7	6	Equivalent to Alt B	Less than PA	Equivalent to PA
NO_2	Annual	40	25	Equivalent to Alt B	Less than PA	Equivalent to PA

Table 4.3-34 Summary of Near-Field Well Development Impacts						
Pollutant and Averaging Period	Averaging Period	Percent of NAAQS (Project + Background)				
		Proposed Action	Alternative B	Alternative C	Alternative D	Alternative E
PM_{10}	24-Hour	68	51	Equivalent to Alt B	Equivalent to PA	Equivalent to PA
$PM_{2.5}$	24-Hour	65	50	Equivalent to Alt B	Equivalent to PA	Equivalent to PA
	Annual	86	77	Equivalent to Alt B	Less than PA	Equivalent to PA

Alt. = Alternative
PA = Proposed Action

The maximum predicted annual DPM concentration represents 9 percent of the DPM RfC for the Proposed Action and 8 percent for Alternative B.

Operational Impacts

The following tables (**Tables 4.3-35** and **4.3-36**) summarize the operational impacts for each alternative after full field development:

Table 4.3-35 Summary of Near-Field Operation Maximum Impacts						
Pollutant and Averaging Period	Averaging Period	Percent of NAAQS (Project + Background)				
		Proposed Action	Alternative B	Alternative C	Alternative D	Alternative E
NO_2	Annual	40	Equivalent to Proposed Action	Equivalent to Proposed Action	Equivalent to Proposed Action	Equivalent to Proposed Action
PM_{10}	24-hour	49	Equivalent to Proposed Action	Equivalent to Proposed Action	Less than Proposed Action	Equivalent to Proposed Action
$PM_{2.5}$	Annual	54	Equivalent to Proposed Action	Equivalent to Proposed Action	Less than Proposed Action	Equivalent to Proposed Action
$PM_{2.5}$	24-hour	82	Equivalent to Proposed Action	Equivalent to Proposed Action	Less than Proposed Action	Equivalent to Proposed Action
CO	1-hour	5	Equivalent to Proposed Action	Equivalent to Proposed Action	Equivalent to Proposed Action	Equivalent to Proposed Action
CO	8-hour	15	Equivalent to Proposed Action	Equivalent to Proposed Action	Equivalent to Proposed Action	Equivalent to Proposed Action

Alt. = Alternative

Table 4.3-36 Summary of Near-Field Operation Maximum Impacts to PSD Class II Increments						
Pollutant and Averaging Period	Averaging Period	Percent of PSD Class II Increment				
		Proposed Action	Alternative B	Alternative C	Alternative D	Alternative E
NO_2	Annual	90	Equivalent to Proposed Action	Equivalent to Proposed Action	Equivalent to Proposed Action	Equivalent to Proposed Action
PM_{10}	24-hour	36	Equivalent to Proposed Action	Equivalent to Proposed Action	Less than Proposed Action	Equivalent to Proposed Action

Implementation of the Proposed Action or Alternatives would cause incremental increases in HAP concentrations. The increased concentration would be long term, lasting the LOP. Equivalent HAP impacts would occur for all alternatives. The acute and chronic non-cancerous health effects would be less than the REL and RfC thresholds, but would exceed the TSLs for formaldehyde and benzene. Minor increases in cancer risk are predicted to occur. However, the predicted incremental cancer risks would occur only within relatively small areas.

4.3.6.2 Far-Field Air Quality

As a result of the implementation of the Proposed Action or alternatives, increases in air pollutant concentrations would occur. For the majority of the emitted pollutants, the magnitude of the potential impacts would vary in proportion with the scale of the alternative. The greatest impacts would occur with the implementation of the Proposed Action. For some pollutants and activities, impacts would be minimized with the implementation of Alternative B.

Predicted criteria pollutant concentrations for all alternatives would be below NAAQS and PSD increments at all PSD Class I and sensitive Class II areas. Terrestrial deposition is not predicted to exceed the thresholds at any Class I or Class II area. Predicted impacts at all lakes are less than 1 μeq/l or a 10 percent change in ANC.

The screening visibility results indicate that there were no changes in visibility that exceeded 1.0 deciview LAC on more than one day per year at any mandatory Federal PSD Class I area for any alternative. Therefore a refined analysis was not performed for any of the alternatives. Moderate visibility impacts exceeding 1.0 deciview would be observed at several nearby Class II sensitive areas.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.4 SOIL RESOURCES

4.4.1 Alternative A - Proposed Action

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

Impacts to soils are generally described in terms of short-term and long-term impacts. In areas where interim reclamation is implemented, ground cover by herbaceous species could re-establish within 1 to 5 years following seeding of native plant species and diligent weed control efforts, consequently reducing soil erosion. These reclaimed areas are categorized as short-term disturbance.

4.4.1.1 Short-Term and Long-Term Soil Disturbance

Soils would be disturbed during construction of well pads, access roads, pipelines, compressor stations, equipment storage yards, aggregate borrow pits, temporary worker housing areas, airstrips, pump stations, and water management facilities. **Figure 2.2-1** shows the locations of the proposed project facilities. Prior to interim reclamation, a total of about 3,656 acres of soils would be disturbed during the construction of these project facilities during the short-term. This represents about 2.65 percent of the 137,930 acres in the WTP Project Area. Those portions of the well pads, access road ROWs, pipeline ROWs, and other facilities not needed for production operations would be reclaimed within one to two growing seasons following completion of the respective project facility. What remains after successful interim reclamation would be a “long-term” disturbance of approximately 1,864 acres (1.35 percent of the WTP Project Area) for the estimated 33-year LOP. **Table 2.2-5** provides a breakdown of the disturbed areas by facility type. **Table 4.4-1** provides summaries of the short-term and long-term soil disturbances by soil type for the Proposed Action, and the reclamation potential for each soil type. For the Proposed Action, approximately 96 percent of the surface disturbance would occur on soils that have a poor reclamation source material rating.

Table 4.4-1 Summary of Soil Disturbance by Soil Type for the Proposed Action

Soil Map Unit Number	Soil Unit Name	Short-Term Disturbance (Acres)[1]	Long-Term Disturbance (Acres)	Reclamation Source Material Rating
3	Badland-Rubbleland-Rock outcrop complex	22.4	12.1	NA
5	Beje Complex	75.4	30.7	Poor
10	Cabba family, 20-40% slopes	90.8	45.6	Poor
11	Cabba family, 40-70% slopes	16.9	10.1	Poor
13	Cabba family-Guben-Rock outcrop complex	315.2	179.7	Poor
14	Casmos-Rock outcrop complex, 2-25% slopes	8.4	3.5	Poor
15	Casmos-Rock outcrop complex, 40-70% slopes	385.5	192.8	Poor
25	Doney family	100.9	64.3	Poor

Table 4.4-1 Summary of Soil Disturbance by Soil Type for the Proposed Action				
Soil Map Unit Number	**Soil Unit Name**	**Short-Term Disturbance (Acres)[1]**	**Long-Term Disturbance (Acres)**	**Reclamation Source Material Rating**
41	Green River-Juva variant complex	0.5	0.5	Poor
43	Grobette-Cabba families association	49.7	29.5	Poor
50	Haverdad loam	137.8	78.4	Fair
82	Podo gravelly sandy loam	457.8	245.0	Poor
83	Podo-Cabba family complex	1093.6	593.1	Poor
84	Podo-Rock outcrop complex	57.1	28.9	Poor
107	Shupert-Winetti complex	90.7	45.0	Poor
120	Travessilla-Rock outcrop complex	5.4	2.8	Poor
121	Travessilla-Rock outcrop-Gerst complex	349.6	195.6	Poor
122	Travessilla-Travessilla family-Rock outcrop complex	39.8	22.7	Poor
123	Travessilla family, 1-8% slopes	130.0	64.1	Poor

NA = Not applicable; reclamation source material ratings are not assigned to rock outcrop units.
% percent

4.4.1.2 Erosion Calculations

The primary effect of surface disturbances on soil resources is increased erosion and the resulting potential increase in sediment yield to nearby ephemeral drainages, perennial streams, and livestock ponds. Excavation of proposed well pads would result in increased erosion of WTP Project Area soils. Additional erosion may also be expected from construction of access roads, pipelines, and other project facilities. The increased erosion of soils could potentially lead to increased sedimentation in watercourses, siltation of ponds, and loss of vegetative cover, if BMPs are not properly implemented.

In order to estimate potential erosion and sediment yield increases associated with the Proposed Action, the Water Erosion Prediction Project (WEPP) model developed by the USFS was used (USFS 1999b; USFS 2000). **Appendix K** describes the WEPP model and the assumptions and methods used to estimate the additional erosion that would be generated by the construction of the Proposed Action and alternatives.

Erosion calculations were performed for the Proposed Action for two subareas of the WTP Project Area: 1) areas to the west and north of Horse Bench and Cottonwood Ridge that drain to Nine Mile Creek (west), and 2) areas to the east and south of Horse Bench and Cottonwood Ridge that drain directly to the Green River (east). Model runs were performed for short-term and long-term conditions. Calculations were made for the following features in each subarea for the Proposed Action:

- Proposed co-located roads and pipelines,
- Proposed pipelines located along existing roads,
- Independent (cross-country) pipelines, and

- Well pads, compressor stations, airstrips, water management facilities, borrow pits, equipment storage areas, and temporary worker housing sites.
- Proposed road improvements and/or reroutes

Table 4.4-2 provides a summary of the erosion estimates for the Proposed Action. It should be noted that road improvements and reroutes were modeled separately from all other proposed development so that a direct comparison could be made between the amount of erosion that would occur from road improvements/reroutes under the Proposed Action, and the amount of erosion that would occur from the road improvements/reroutes proposed under Alternatives A, C, and E.

As illustrated in **Table 4.4-2**, an estimated 765 tons of erosion would be generated in the east subarea and 1,793 tons would be generated in the west subarea annually during the short-term (about 1 to 5 years). Therefore, estimated erosion would be approximately 2,557 tons annually.

In the long-term, the estimated additional erosion would drop to 271 tons per year for the east subarea and 616 tons per year for the west subarea (a total of about 887 tons annually).

Table 4.4-2 Summary of Erosion Calculations for the Proposed Action

Project Component	Short-Term Erosion	Long-Term Erosion
Improved and Rerouted Roads - East	70	43
Improved and Rerouted Roads - West	17	10
Co-located roads and pipelines - East	443	209
Co-located roads and pipelines - West	1113	553
Pipelines only - East	121	9
Pipelines only - West	322	26
Independent Pipelines - East	9	1
Independent Pipelines - West	19	2
Well pads, etc. – East[1]	121	9
Well pads, etc. - West[1]	322	26
Totals - East	**765**	**271**
Totals - West	**1793**	**616**
TOTALS	**2557**	**887**

All units in tons/year
[1]Includes erosion for proposed water management facilities, compressor stations, equipment storage areas, worker housing, airstrips, and pump stations

Erosion rates for the West Tavaputs Plateau have not been published. However, the current erosion from the WTP Project Area was estimated as follows: 1) using the median TSS concentration recorded at STORET water quality site 4933330 on Nine Mile Creek of 186.5 mg/L, and the estimated total annual runoff for Nine Mile Creek of 14,800 acre-feet (Price and Miller 1975), the current sediment loading to Nine Mile Creek was estimated to be about 117,600 tons per year; 2) the total area of the Nine Mile Creek watershed was calculated using GIS to be about 183,240 acres; 3) using these numbers, the average erosion rate in the Nine Mile Creek watershed is about 0.64 tons per acre per year; 4) using the total surface area for the WTP Project Area of 137,930 acres, the current estimated erosion for the WTP Project Area is 88,128 tons per year. This analysis assumes that all of the eroded material is eventually delivered to Nine Mile

Creek and the Green River, and that the erosion characteristics of the portions of the WTP Project Area that are not in the Nine Mile Creek watershed are similar.

For the Proposed Action, the estimated total of 2557 tons of additional erosion generated annually during the short-term would constitute a 2.9 percent increase over the estimated current erosion of 88,128 tons per year, using the standard statistical measure Relative Percent Difference (RPD). For the long-term, the total additional erosion of 887 tons per year would represent a 1.0 percent increase over current erosion levels.

For the Proposed Action, several roads would be rerouted or improved, as discussed in **Section 4.14**, Transportation. Erosion would likely increase in the short-term from the rerouting or improvement of these roads, and this increased erosion is summarized in **Table 4.4-2** above. However, over the long-term, it is expected that rerouting roads away from canyon bottoms, and improving steep sections of roads, would decrease the sediment delivery from current levels on these roads, even with the increased traffic.

These erosion estimates, as is the case for all erosion estimates, are subject to considerable uncertainty. Factors which contribute to the uncertainty include the exact location of the various facilities, the actual road and pipeline gradients, the effectiveness of BMPs, and climatic conditions. As such, these estimates should be considered to be accurate within the range of +/- 100 percent. However, because these estimates were made using the same set of assumptions, they provide a valuable way to compare the potential increased erosion that would result under the various alternatives.

The actual amount of additional sedimentation due to the increased erosion that would reach the drainages in the WTP Project Area, including Nine Mile Creek and the Green River, depends on the effectiveness of the BMPs employed and natural factors, and is discussed in **Section 4.5**, Water Resources.

It is also expected that following successful re-vegetation and approximately 1 to 5 growing seasons, the erosion rate and potential sedimentation increases would drop to near baseline conditions from well pads and pipeline ROWs, but would remain at elevated levels for the new access roads. That is because portions of the well pads and pipeline ROWs would be reclaimed and revegetated, whereas the access road surfaces would continue to be eroded, even in the absence of high traffic volumes.

In addition to increased water erosion, the additional traffic on WTP Project Area roads under the Proposed Action would increase the amount of dust generated. The dust generated can be washed into or fall on surface water channels and increase the sediment loading and turbidity of receiving streams (Addo et al. 2004; Sanders and Addo 1993; Stevenson 2004). The amount of additional sediment loading and increased turbidity that could potentially result from this mechanism cannot be estimated.

In response to public comments received on the DEIS, and at the request of the Nine Mile Canyon Road Cooperative Board, a dust suppression plan was prepared for the WTP Project Area (see **Appendix R**), as described in **Section 2.1.5.6**. This plan would be implemented for all alternatives. The plan recommends the use of two enhanced dust suppressants: Lignin Sulfonate and Soluble Polymer such as TerraLOC. These suppressants would be applied in Nine Mile Canyon between Harmon and Cottonwood Canyons (12 miles), in Harmon Canyon (1 mile), in Gate Canyon (1 mile) and in

Cottonwood Canyon (8 miles). A pilot dust-suppression program has been implemented by BBC on portions of these roads using ammonium lignin sulfonate during 2008 and 2009. Ammonium lignin sulfonate is a byproduct of the paper manufacturing process and is included in a class of dust suppressants described as organic, non-petroleum products which includes vegetable oils. The material is classified as non-toxic by the Food and Drug Administration and appears to have no negative impacts on soils. The use of enhanced dust suppressants would decrease the impact of dust on surface water within the canyons.

As an alternative to using dust suppression or due to safety concerns, certain road segments within Nine Mile, Gate, or the lower reaches of Harmon and Cottonwood Canyons, may be improved with hard surfacing, such as asphalt, chip and seal, or other materials, as approved by the BLM or counties as appropriate. Should BBC and other operators pave road segments, dust impacts would effectively be eliminated.

It is acknowledged however that hardening of road surfaces within the WTP Project Area could result in both positive and negative impacts on various resources. For example, hardening of road surfaces within the WTP Project Area could lead to increased runoff to adjacent creeks and/or drainages (i.e., Nine Mile, Cottonwood, and Harmon). Runoff could include pollutants typically associated with paving activities. However, if the road is paved, dust suppressants would not be needed and the potential impacts of dust suppressants to shallow groundwater and Nine Mile Creek would be reduced. Hardening of road surfaces would reduce the potential impacts of additional dust on surface water quality by substantially decreasing erosion and sediment yield to adjacent creeks and/or drainages.

4.4.1.3 Soil Contamination

Contamination of surface and subsurface soils near gas facilities can occur in oil and gas fields. Sources of potential contamination include leaks or spills of natural gas condensate liquids from wellheads, reserve pits, produced water sumps, condensate storage tanks located on the well pads, and other production facilities, leaks from natural gas gathering and conveyance pipelines and water management facilities, and spills of produced water or condensate from tanker trucks during transport of these materials. Of these materials, leaks or spills of natural gas condensate would have the greatest potential environmental impact. Leaks or spills of produced water, hydrofracturing chemicals, fuels, and lubricants could also result in soil contamination. This is because natural gas condensate liquids are composed primarily of benzene, toluene, ethylbenzene, and xylenes. These compounds are highly volatile, soluble in water, and tend to move rapidly through soil as compared to the heavier components of oil, thus contaminating larger volumes of soil if not remediated quickly.

Depending on the size and type of spill, the effect on soils would primarily consist of the potential loss of soil productivity, alteration of native microbial populations, and loss of biological crusts.. In addition, petroleum released to surface soils infiltrates the soil and, under the right conditions, can migrate vertically until the water table is encountered, thus contaminating shallow groundwater. Contaminated groundwater could then potentially be discharged by springs or as baseflow into stream channels, leading to surface water contamination. These potential impacts to water resources are discussed in **Section 4.5**, Water Resources.

Leaks of small amounts of petroleum on well pads are common occurrences; however, these small leaks generally affect relatively small areas. A traffic accident involving a tanker truck carrying condensate or produced water could lead to a larger release. Using the projected traffic for the Proposed Action, as described in **Section 4.14** (Transportation), an average of 5.5 accidents yearly involving tanker trucks could be expected under the Proposed Action, or a total of 154 accidents over the 28-year LOP. Brown et al. (2001) provided release probabilities for a variety of highway bulk containers. The probability of a release of a hazardous substance during an accident was found to range from 1.0 to 6.5 percent for different container types. Therefore, using the release probabilities reported, between 2 and 10 significant releases of condensate or produced water from a tanker truck could be expected to occur in the WTP Project Area during the 33-year LOP.

To reduce the potential for hydrocarbon contamination of soils, pipelines and associated collection piping would be designed to minimize the potential for spills and leaks. Storage tanks would be surrounded by berms capable of holding at least 110 percent of the largest single tank volume. Reserve pits would be lined with an impermeable liner to prevent infiltration of drilling fluids into the subsurface. Implementation of the project SPCC plans would minimize the risk of such spills by providing safeguards against spills and detailing reporting and cleanup measures to be taken in the event of a spill.

4.4.1.4 Rangeland Health Standards

The Proposed Action would have a minor impact on the attainment of Rangeland Health Standard 1, due to compaction and blending of soils in some locations. Compaction due to construction activities at the well pads and along access roads would reduce aeration, permeability, and water-holding capacity of the soils. An increase in surface runoff could be expected, potentially causing increased sheet, rill, and gully erosion. These impacts would be localized in nature and could potentially impact more than the 2.65 percent of the WTP Project Area directly disturbed in the short-term. This is because, in addition to the lands directly disturbed by construction activities, the area impacted could include lands adjacent to the proposed facilities if excessive erosion were to occur in these areas.

The excavation and reapplication of surface soils could cause the mixing of shallow soil horizons, resulting in a blending of soil characteristics and types. This blending would modify physical characteristics of the soils including structure, texture, and rock content, which could lead to reduced permeability and increased runoff from these areas. Because directional drilling is proposed, the amount of land affected by new road construction would be kept at a minimum in accordance with Rangeland Health Standard 1. The amount of land affected would be further minimized by careful placement of project facilities to avoid areas of high erosion potential and the successful implementation of BMPs. Compaction effects would be minimized through the application of appropriate BMPs. The actual BMPs that would be used for the project facilities would be specified during the APD process.

4.4.1.5 Biological Soil Crusts

It is estimated that biological soil crusts occur in approximately 30 percent of the WTP Project Area (BLM 2004b); however, detailed mapping of the distribution of these crusts has not been performed. If a conservative, uniform distribution of biological crusts is

assumed, the disturbance of 3,656 acres for the Proposed Action could result in the potential disturbance of approximately 1,097 acres of biological soil crusts. The loss of biological crusts can substantially increase runoff and the hazard of water and wind erosion and reduce surface albedo, which would cause an increase in soil temperatures that could affect soil productivity in these areas (Belnap et al. 2001).

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible Effects

The Proposed Action would result in the loss of biological soil crusts in the WTP Project Area. Surface disturbance would result in increased erosion and loss of WTP Project Area soils.

Irretrievable Effects

Construction of well pads, roads, and other facilities would result in compaction of soils, which would reduce aeration and permeability.

4.4.2 Alternative B - No Action Alternative

Under the No Action Alternative, the proposed development of natural gas wells on the BLM lands would not occur; however, natural gas development would likely occur on State of Utah and private lands within the WTP Project Area. Some construction and improvement of roads and pipelines would occur on Federal lands as necessary to provide reasonable access to the State and private lands. Potential impacts to soils from the No Action Alternative would be similar to, but less than those for the Proposed Action. Impacts could potentially include the removal of vegetation, mixing of soil horizons, soil compaction, increased susceptibility of the soils to wind and water erosion, contamination of soils with petroleum products, loss of topsoil productivity, and disturbance of biological soil crusts.

4.4.2.1 Short-Term and Long-Term Soil Disturbance

Under the No Action Alternative, soils would be disturbed during construction of well pads, access roads, pipelines, and other project facilities. A total of 81 wells could be drilled on 54 well pads. **Figure 2.3-1** shows the locations of the proposed project facilities for the No Action Alternative.

Prior to interim reclamation, a total of about 626 acres of soils would be disturbed during the short-term. This represents about 0.45 percent of the 137,930 acres in the WTP Project Area, or about 17 percent of the initial surface disturbance for the Proposed Action. Those portions of the well pads, access road and pipeline ROWs, and other facilities not needed for production operations would be reclaimed within one to two growing seasons following completion, resulting in long-term surface disturbance of approximately 279 acres (0.2 percent of the WTP Project Area) for the estimated 27-year LOP. **Table 2.3-3** provides a breakdown of the surface disturbance by facility type. **Table 4.4-3** provides summaries of the short-term and long-term soil disturbances by soil type for the No Action Alternative, and the reclamation potential for each soil type. For the No Action Alternative, approximately 98 percent of the surface disturbance would occur on soils that have a poor reclamation source material rating.

Table 4.4-3 Summary of Soil Disturbance by Soil Type for the No Action Alternative				
Soil Map Unit Number	**Soil Unit Name**	**Short-Term Disturbance (Acres)[1]**	**Long-Term Disturbance (Acres)**	**Reclamation Source Material Rating**
3	Badland-Rubbleland-Rock outcrop complex	1.2	0.5	NA
5	Beje Complex	34.6	12.3	Poor
10	Cabba family, 20-40% slopes	11.4	4.4	Poor
11	Cabba family, 40-70% slopes	0.9	0.3	Poor
13	Cabba family-Guben-Rock outcrop complex	47.5	28.1	Poor
15	Casmos-Rock outcrop complex, 40-70% slopes	86.4	42.4	Poor
25	Doney family	28.2	13.1	Poor
43	Grobette-Cabba families association	13.0	6.5	Poor
50	Haverdad loam	9.2	5.3	Fair
82	Podo gravelly sandy loam	66.7	27.9	Poor
83	Podo-Cabba family complex	90.8	59.1	Poor
84	Podo-Rock outcrop complex	22.5	9.5	Poor
107	Shupert-Winetti complex	37.6	14.5	Poor
120	Travessilla-Rock outcrop complex	4.3	2.4	Poor
121	Travessilla-Rock outcrop-Gerst complex	16.9	9.0	Poor
122	Travessilla-Travessilla family-Rock outcrop complex	6.8	3.3	Poor
123	Travessilla family, 1-8% slopes	56.0	22.7	Poor

NA = Not applicable; reclamation source material ratings are not assigned to rock outcrop units.
% = percent

4.4.2.2 Erosion Calculations

Construction of proposed well pads, access roads, and other project facilities for the No Action Alternative would result in increased erosion of WTP Project Area soils.

For Alternative B, the predicted impacts that were presented under the Proposed Action were pro-rated according to the amount of proposed surface disturbance, with the exception of proposed road improvements and reroutes, which were modeled separately to evaluate the effect of improving the BLM system roads. If the No Action Alternative were implemented total short-term disturbance would approximately 17 percent of that for the Proposed Action. Total long-term disturbance would be approximately 15 percent of that for the Proposed Action.

As discussed under the Proposed Action, erosion calculations were performed for two subareas of the WTP Project Area: 1) areas to the west and north of Horse Bench and

Cottonwood Ridge that drain to Nine Mile Creek (west), and 2) areas to the east and south of Horse Bench and Cottonwood Ridge that drain directly to the Green River (east).

Using the aforementioned percentages, it is anticipated that increased short-term erosion resulting from the No Action Alternative for project facilities other than improved and rerouted roads would be about 126 tons per year for the east subarea and 317 tons per year for the west subarea, for a total estimated increased erosion of about 443 tons annually. Results from the WEPP model indicate that increased erosion from improved and rerouted roads would total about 32 tons annually during the short-term.

Long-term erosion increases for the No Action Alternative for project facilities other than improved and rerouted roads would be about 35 tons per year for the east subarea and 93 tons per year for the west subarea (a total of about 128 tons annually). Erosion along improved and rerouted roads would drop to about 19 tons per year for the long-term.

For the No Action Alternative, the estimated total of 475 tons of additional erosion generated annually during the short-term would constitute a 0.54 percent increase over the estimated current erosion of 88,128 tons per year. For the long-term, the total additional erosion of 147 tons per year would represent a 0.17 percent increase over current erosion levels.

As described for the Proposed Action, it is expected that following re-vegetation and about 1 to 5 growing seasons, the erosion rate and potential sedimentation increases would drop to near baseline conditions from well pads and pipeline corridors, but would remain at elevated levels for the new access roads.

4.4.2.3 Soil Contamination

The risk of soil contamination and the probability of a significant release of condensate or produced water would be about 17 percent of that for the Proposed Action.

4.4.2.4 Rangeland Health Standards

Similar to the Proposed Action, the No Action Alternative would have a minor impact on the attainment of Rangeland Health Standard 1, due to compaction and blending of soils in some locations. These impacts would be localized in nature and could potentially impact more than the 0.45 percent of the WTP Project Area that would be directly disturbed in the short-term.

4.4.2.5 Biological Soil Crusts

It is estimated that soil crusts occur in approximately 30 percent of the WTP Project Area (BLM 2004b); however, detailed mapping of the distribution of these crusts has not been performed. If a uniform distribution of biological crusts is assumed, the disturbance of 626 acres under the No Action Alternative could result in the potential disturbance of approximately 188 acres of biological soil crusts. This is about 17 percent of the estimated loss for the Proposed Action.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.4.3 Alternative C – Transportation Impact Reduction

Potential impacts to soils in the WTP Project Area from the Transportation Impact Reduction Alternative are similar to those for the Proposed Action, and include the removal of vegetation, mixing of soil horizons, soil compaction, increased susceptibility of the soils to wind and water erosion, contamination of soils with petroleum products, loss of topsoil productivity, and disturbance of biological soil crusts.

4.4.3.1 Short-Term and Long-Term Soil Disturbance

Under the Transportation Impact Reduction Alternative, the total unreclaimed surface disturbance (short-term disturbance) would be limited to 280 acres on Federal lands and a total of 2,250 acres on all lands in the WTP Project Area at any one time.

A total of about 3,640 acres of short-term soil disturbance would occur during the construction of project facilities for this alternative, subject to the limitations described above. This represents about 2.64 percent of the 137,930 acres in the WTP Project Area. Those portions of the well pads, access road and pipeline ROWs, and other facilities not needed for production operations would be reclaimed within one to two growing seasons following completion of the respective project facility. The long-term disturbance would be approximately 1,839 acres (1.33 percent of the WTP Project Area) for the estimated 40-year LOP. Included within these disturbances estimates is the alternative access road in Trail Canyon, which would add 2.85 miles of roadway and disturb about 14 acres in Trail Canyon. **Table 2.4-5** provides a breakdown of the disturbed areas by facility type. **Table 4.4-4** provides summaries of the short-term and long-term soil disturbances by soil type for the Transportation Impact Reduction Alternative, and the reclamation potential for each soil type. For the Transportation Impact Reduction Alternative, approximately 96 percent of the surface disturbance would occur on soils that have a poor reclamation source material rating.

Table 4.4-4 Summary of Soil Disturbance by Soil Type for the Transportation Impact Reduction Alternative

Soil Map Unit Number	Soil Unit Name	Short-Term Disturbance (Acres)	Long-Term Disturbance (Acres)	Reclamation Source Material Rating
3	Badland-Rubbleland-Rock outcrop complex	22.4	12.1	NA
5	Beje Complex	76.2	32.4	Poor
10	Cabba family, 20-40% slopes	98.1	47.1	Poor
11	Cabba family, 40-70% slopes	15.1	8.2	Poor
13	Cabba family-Guben-Rock outcrop complex	325.9	176.2	Poor
14	Casmos-Rock outcrop complex, 2-25% slopes	8.4	3.5	Poor
15	Casmos-Rock outcrop	382.9	195.0	Poor

Table 4.4-4 Summary of Soil Disturbance by Soil Type for the Transportation Impact Reduction Alternative				
Soil Map Unit Number	**Soil Unit Name**	**Short-Term Disturbance (Acres)**	**Long-Term Disturbance (Acres)**	**Reclamation Source Material Rating**
	complex, 40-70% slopes			
25	Doney family	92.0	53.9	Poor
41	Green River-Juva variant complex	1.7	1.3	Poor
43	Grobette-Cabba families association	44.9	23.7	Poor
50	Haverdad loam	129.8	69.8	Fair
82	Podo gravelly sandy loam	440.6	222.4	Poor
83	Podo-Cabba family complex	1,092.8	589.7	Poor
84	Podo-Rock outcrop complex	48.5	25.5	Poor
107	Shupert-Winetti complex	112.6	55.0	Poor
120	Travessilla-Rock outcrop complex	5.4	2.8	Poor
121	Travessilla-Rock outcrop-Gerst complex	341.6	176.6	Poor
122	Travessilla-Travessilla family-Rock outcrop complex	42.9	24.3	Poor
123	Travessilla family, 1-8% slopes	127.8	62.1	Poor

NA = Not applicable; reclamation source material ratings are not assigned to rock outcrop units.
% percent

4.4.3.2 Erosion Calculations

For Alternative C, the predicted impacts presented under the Proposed Action were pro-rated according to the amount of proposed surface disturbance, with the exception of proposed road improvements and reroutes, which were modeled separately to evaluate the effect of improving the BLM system roads.

Because the amount of surface disturbance is slightly less under Alternative C than under the Proposed Action, erosion resulting from the construction of well pads, new roads, pipelines, and other facilities would be reduced in proportion to the reductions in proposed surface disturbance. However, given that under Alternative C, BBC and other operators would be required to improve each of the primary roads within the WTP Project Area and construct a new route through Trail Canyon, erosion from road improvements and/or reroutes would be substantially higher under Alternative C than under the Proposed Action. Therefore, if Alternative C were implemented, total erosion would be higher than under the Proposed Action. Short- and long-term erosion estimates for both alternatives are displayed in **Table 4.4-5**.

Table 4.4-5 Erosion Estimates Under Alternative C Compared with the Proposed Action

Alternative	Short-Term			Long-Term		
	Estimated Erosion for construction roads, pipelines, and well pads[1]	Estimated Erosion for Improved and Rerouted Roads	Total Erosion	Estimated Erosion for construction roads, pipelines, and well pads[1]	Estimated Erosion for Improved and Rerouted Roads	Total Erosion
Proposed Action	2,470	+87	=2,557	834	+53	=887
Alternative C	2,445	+433	=2,878	643	+270	=913

All units in tons/year
[1]Includes erosion from proposed water management facilities, compressor stations, equipment storage areas, worker housing, airstrips, and pump stations

As shown in **Table 4.4-5**, if Alternative C were implemented, erosion would likely increase in the short-term from the rerouting or improvement of primary roads. However, over the long-term, it is expected that rerouting roads away from canyon bottoms, and improving steep sections of roads, could potentially decrease the sediment delivery from current levels on these roads, even with increased traffic. In addition, approximately 19 miles of existing roadways would be reclaimed, further reducing erosion as compared to the Proposed Action.

As discussed under the Proposed Action, erosion calculations were performed for the Proposed Action for two subareas of the WTP Project Area: 1) areas to the west and north of Horse Bench and Cottonwood Ridge that drain to Nine Mile Creek (west), and 2) areas to the east and south of Horse Bench and Cottonwood Ridge that drain directly to the Green River (east).

Increased short-term erosion resulting from the Transportation Impact Reduction Alternative for project facilities other than improved and rerouted roads would be about 852 tons per year for the east subarea and 2,027 tons per year for the west subarea, for a total of 2,878 tons annually. Long-term erosion increases for the Transportation Impact Reduction Alternative would be about 276 tons per year for the east subarea and 638 tons per year for the west subarea, for a total of 913 tons per year. In addition, the construction of the alternate access route would slightly increase erosion rates in Trail Canyon.

The estimated total of 2,878 tons of additional erosion generated annually during the short-term would constitute a 3.2 percent increase over the estimated current erosion of 88,128 tons per year. For the long-term, the total additional erosion of 913 tons per year would represent a 1.0 percent increase over current erosion levels.

Alternative C contains numerous components that have the potential to further reduced erosion; however, they are difficult to quantify. In particular, if Alternative C were implemented, BBC and other operators would be required to comply with disturbance thresholds, special protection measures for certain resources (see **Section 2.4.1.2**), and the mitigation measures contained in **Tables 2.6-7** and **2.6-8**. The construction of the alternative route in Trail Canyon would reduce heavy truck traffic on the segment of Nine Mile Creek Road between Harmon Canyon and Gate Canyon, reducing the potential impacts from erosion and dust generation in that portion of Nine Mile Canyon. In

addition, BBC and other operators would implement the dust suppression plan (**Appendix R**) described in **Section 2.1.5.6**.

As an alternative to using dust suppression or due to safety concerns, certain road segments within Nine Mile, Gate, or the lower reaches of Harmon and Cottonwood Canyons, may be improved with hard surfacing, such as asphalt, chip and seal, or other materials, as approved by the BLM or counties as appropriate. Should BBC and other operators pave road segments, dust impacts would effectively be eliminated.

It is acknowledged however that hardening of road surfaces within the WTP Project Area could result in both positive and negative impacts on various resources. For example, hardening of road surfaces within the WTP Project Area could lead to increased runoff to adjacent creeks and/or drainages (i.e., Nine Mile, Cottonwood, and Harmon). Runoff could include pollutants typically associated with paving activities. However, if the road is paved, dust suppressants would not be needed and the potential impacts of dust suppressants to shallow groundwater and Nine Mile Creek would be reduced. Hardening of road surfaces would reduce the potential impacts of additional dust on surface water quality by substantially decreasing erosion and sediment yield to adjacent creeks and/or drainages.

4.4.3.3 Soil Contamination

Under the Transportation Impact Reduction Alternative, the risk of accidents would be slightly reduced from that for the Proposed Action due to the longer LOP, restrictions on the timing of heavy truck traffic, and the expanded use of air travel for worker transportation, and the use of water/condensate pipelines. The risk of soil contamination and the probability of a significant release of condensate or produced water would also be slightly less than that for the Proposed Action. In addition, the construction of the alternative access route in Trail Canyon would reduce the potential for contamination of soils along that portion of Nine Mile Canyon between Harmon Canyon and Gate Canyon.

4.4.3.4 Rangeland Health Standards

The Transportation Impact Reduction Alternative would have a minor impact on the attainment of Rangeland Health Standard 1, due to compaction and blending of soils in some locations. These impacts would be localized in nature and could potentially impact more than the 2.64 percent of the WTP Project Area directly disturbed in the short-term.

In addition, under this alternative, approximately 19 miles of existing roads would be reclaimed. The amount of land affected would be further minimized by careful placement of project facilities to avoid areas of high erosion potential and the successful implementation of BMPs. Compaction effects would be minimized through the application of appropriate BMPs (see **Tables 2.6-7** and **2.6-8**). The actual BMPs that would be used for the project facilities would be specified during the APD process.

4.4.3.5 Biological Soil Crusts

It is estimated that biological soil crusts occur in approximately 30 percent of the WTP Project Area (BLM 2004b); however, detailed mapping of the distribution of these crusts has not been performed. If a uniform distribution of biological crusts is assumed, the

disturbance of 3,640 acres under the Transportation Impact Reduction Alternative could result in the potential disturbance of approximately 1,092 acres of biological soil crusts, similar to that for the Proposed Action.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.4.4 Alternative D – Conservation Alternative

Implementation of Alternative D – Conservation Alternative would decrease the amount of disturbed surface area when compared to the Proposed Action, and would prohibit surface disturbance in the WSAs, the Desolation Canyon NHL, unleased Federal lands within potential ACECs. In addition the BLM would not lease and unleased lands with wilderness characteristics. Finally, as feasible (where to do so would not preclude the development of valid and existing lease rights), NSO would be allowed on Federal lands within canyon bottoms.

Under Alternative D, conservation of resources would be accomplished by observing land use plan-developed stipulations field-wide (see **Section 2.5**). Therefore, no construction would be allowed on slopes greater than 30 percent, and construction would not occur on 100-year floodplains, in riparian areas, or within 660 feet of springs. Construction in high country watersheds (areas above 7,000 feet in elevation) would also be restricted from December 1– April 15.

4.4.4.1 Short-Term and Long-Term Soil Disturbance

Under the Conservation Alternative, the total unreclaimed surface disturbance would be limited to 1,440 acres at any one time and new surface disturbance would be limited to 180 acres yearly.

A total of about 2,510 acres of short-term soil disturbance would occur during the construction of project facilities for this alternative, subject to the limitations described above. This represents about 1.82 percent of the 137,930 acres in the WTP Project Area. Those portions of the well pads, access road and pipeline ROWs, and other facilities not needed for production operations would be reclaimed within one to two growing seasons following completion of the respective project facility. The long-term disturbance would be approximately 1,237 acres (0.9 percent of the WTP Project Area) for the estimated 46-year LOP. **Table 2.5-5** provides a breakdown of the disturbed areas by facility type. **Table 4.4-6** provides summaries of the short-term and long-term soil disturbances by soil type for the Conservation Alternative, and the reclamation potential for each soil type. For the Conservation Alternative, approximately 95 percent of the surface disturbance would occur on soils that have a poor reclamation source material rating.

Table 4.4-6 Summary of Soil Disturbance by Soil Type for the Conservation Alternative				
Soil Map Unit Number	**Soil Unit Name**	**Short-Term Disturbance (Acres)[1]**	**Long-Term Disturbance (Acres)[1]**	**Reclamation Source Material Rating**
3	Badland-Rubbleland-Rock outcrop complex	19.3	10.9	NA
5	Beje Complex	75.8	32.4	Poor
10	Cabba family, 20-40% slopes	72.1	37.5	Poor
11	Cabba family, 40-70% slopes	14.4	7.9	Poor
13	Cabba family-Guben-Rock outcrop complex	215.2	113.3	Poor
15	Casmos-Rock outcrop complex, 40-70% slopes	273.0	136.5	Poor
25	Doney family	86.5	50.1	Poor
41	Green River-Juva variant complex	1.2	0.8	Poor
43	Grobette-Cabba families association	34.2	18.1	Poor
50	Haverdad loam	104.2	58.0	Fair
82	Podo gravelly sandy loam	345.6	167.6	Poor
83	Podo-Cabba family complex	707.1	381.1	Poor
84	Podo-Rock outcrop complex	28.1	12.3	Poor
107	Shupert-Winetti complex	38.9	15.6	Poor
120	Travessilla-Rock outcrop complex	5.8	3.0	Poor
121	Travessilla-Rock outcrop-Gerst complex	209.0	102.6	Poor
122	Travessilla-Travessilla family-Rock outcrop complex	14.9	8.0	Poor
123	Travessilla family, 1-8% slopes	96.7	45.6	Poor

NA = Not applicable; reclamation source material ratings are not assigned to rock outcrop units.
% percent
[1]Disturbances due to construction of cross-country pipelines and the proposed airstrip on Prickly Pear Mesa are not accounted for.

4.4.4.2 Erosion Calculations

For Alternative D, the modeled results that were presented under the Proposed Action were pro-rated according to the amount of proposed surface disturbance, with the exception of proposed road improvements and reroutes, which were modeled separately

to evaluate the effect of improving the BLM system roads. If the Alternative D were implemented total short-term disturbance would be approximately 69 percent of that for the Proposed Action. Total long-term disturbance would be approximately 66 percent of that for the Proposed Action.

As discussed under the Proposed Action, erosion calculations were performed for two subareas of the WTP Project Area: 1) areas to the west and north of Horse Bench and Cottonwood Ridge that drain to Nine Mile Creek (west), and 2) areas to the east and south of Horse Bench and Cottonwood Ridge that drain directly to the Green River (east).

Based on the aforementioned percentages, the increased short-term erosion resulting from the Conservation Alternative for project facilities other than improved and rerouted roads would be about 482 tons per year for the east subarea and 1,231 tons per year for the west subarea, for a total estimated increased erosion of about 1,713 tons annually. Based on results from the WEPP model, it is assumed that improved and rerouted roads would generate an additional 333 tons of erosion annually during the short-term.

Long-term erosion increases for the Conservation Alternative for project facilities other than improved and rerouted roads would be about 151 tons per year for the east subarea and 401 tons per year for the west subarea, for a total of about 552 tons annually. Erosion along improved and rerouted roads would drop to about 206 tons per year for the long-term.

For the Conservation Alternative, the estimated total of 2,046 tons of additional erosion generated annually during the short-term would constitute a 2.3 percent increase over the estimated current erosion of 88,128 tons per year. For the long-term, the total additional erosion of 758 tons per year would represent a 0.9 percent increase over current erosion levels.

Alternative D contains numerous components that have the potential to further reduced erosion that are not accounted for in the erosion calculations presented above. In particular, if Alternative D were implemented, BBC and other operators would be required to comply with disturbance thresholds and the mitigation measures contained in **Tables 2.6-7** and **2.6-8**. Conservation of resources would also be accomplished by observing land use plan-developed stipulations field-wide, which would eliminate surface disturbance in areas susceptible to erosion (i.e., slopes greater than 30 percent, high-country watersheds, and floodplains). In addition, under the Conservation Alternative, no development would be allowed within the WSAs or canyon bottoms, which would substantially reduce the amount of erosion within the Jack and Dry Creek drainages. Finally, BBC and other operators would implement the dust suppression plan (**Appendix R**) described in **Section 2.1.5.6**.

As an alternative to using dust suppression or due to safety concerns, certain road segments within Nine Mile, Gate, or the lower reaches of Harmon and Cottonwood Canyons, may be improved with hard surfacing, such as asphalt, chip and seal, or other materials, as approved by the BLM or counties as appropriate. Should BBC and other operators pave road segments, dust impacts would effectively be eliminated.

It is acknowledged however that hardening of road surfaces within the WTP Project Area could result in both positive and negative impacts on various resources. For example,

hardening of road surfaces within the WTP Project Area could lead to increased runoff to adjacent creeks and/or drainages (i.e., Nine Mile, Cottonwood, and Harmon). Runoff could include pollutants typically associated with paving activities. However, if the road is paved, dust suppressants would not be needed and the potential impacts of dust suppressants to shallow groundwater and Nine Mile Creek would be reduced. Hardening of road surfaces would reduce the potential impacts of additional dust on surface water quality by substantially decreasing erosion and sediment yield to adjacent creeks and/or drainages.

4.4.4.3 Soil Contamination

Under the Conservation Alternative, the risk of soil contamination and the probability of a significant release of condensate or produced water would be about 69 percent of that for the Proposed Action. In addition, the chance of leaks or spills in critical areas (ACECs, WSAs, canyon bottoms, floodplains, riparian areas, near springs, and in high country watersheds), would be reduced from that under the Proposed Action because new surface disturbance would largely be prohibited in these areas.

4.4.4.4 Rangeland Health Standards

The Conservation Alternative would have a minor impact on the attainment of Rangeland Health Standard 1, due to compaction and blending of soils in some locations. These impacts would be localized in nature and could potentially impact more than the 1.82 percent of the WTP Project Area directly disturbed in the short-term.

Compaction effects would be minimized through the application of appropriate BMPs (see **Table 2.6-7**). The actual BMPs that would be used for the project facilities would be specified during the APD process.

4.4.4.5 Biological Soil Crusts

It is estimated that biological soil crusts occur in approximately 30 percent of the WTP Project Area (BLM 2004b); however, detailed mapping of the distribution of these crusts has not been performed. If a uniform distribution of biological crusts is assumed, the disturbance of 2,510 acres under the Conservation Alternative could result in the potential disturbance of approximately 753 acres of biological soil crusts, or about 69 percent of that under the Proposed Action.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.4.5 Alternative E – Agency Preferred Alternative

Potential impacts to soils in the WTP Project Area from the Agency Preferred Alternative are similar to those for the Proposed Action, and include the removal of vegetation, mixing of soil horizons, soil compaction, increased susceptibility of the soils to wind and water erosion, contamination of soils with petroleum products, loss of topsoil productivity, and disturbance of biological soil crusts. However, the Agency Preferred Alternative would minimize impacts by combining key elements of the Proposed Action, Transportation Reduction Alternative, and Conservation Alternative.

4.4.5.1 Short-Term and Long-Term Soil Disturbance

Figure 2.6-1 shows the locations of the proposed project facilities for the Agency Preferred Alternative. Under the Agency Preferred Alternative, the total unreclaimed surface disturbance (short-term disturbance) would be limited to 540 acres on Federal lands and a total of 2,310 acres on all lands in the WTP Project Area at any one time.

A total of about 3,339 acres of short-term soil disturbance would occur during the construction of project facilities for this alternative, subject to the limitations described above. This represents about 2.42 percent of the 137,930 acres in the WTP Project Area. Those portions of the well pads, access road and pipeline ROWs, and other facilities not needed for production operations would be reclaimed within one to two growing seasons following completion of the respective project facility. The long-term disturbance would be approximately 1,678 acres (1.22 percent of the WTP Project Area) for the estimated 34-year LOP. **Table 2.6-5** provides a breakdown of the disturbed areas by facility type. **Table 4.4-7** provides summaries of the short-term and long-term soil disturbances by soil type for the Agency Preferred Alternative, and the reclamation potential for each soil type. For the Agency Preferred Alternative, approximately 96 percent of the surface disturbance would occur on soils that have a poor reclamation source material rating.

Table 4.4-7 Summary of Soil Disturbance by Soil Type for the Agency Preferred Alternative

Soil Map Unit Number	Soil Unit Name	Short-Term Disturbance (Acres)[1]	Long-Term Disturbance (Acres)	Reclamation Source Material Rating
3	Badland-Rubbleland-Rock outcrop complex	22.4	12.1	NA
5	Beje Complex	76.0	32.0	Poor
10	Cabba family, 20-40% slopes	84.1	41.1	Poor
11	Cabba family, 40-70% slopes	15.1	8.2	Poor
13	Cabba family-Guben-Rock outcrop complex	271.2	148.1	Poor
14	Casmos-Rock outcrop complex, 2-25% slopes	8.4	3.5	Poor
15	Casmos-Rock outcrop complex, 40-70% slopes	383.5	195.0	Poor
25	Doney family	87.5	51.4	Poor
41	Green River-Juva variant complex	1.7	1.3	Poor
43	Grobette-Cabba families association	44.9	23.7	Poor
50	Haverdad loam	122.7	65.8	Fair
82	Podo gravelly sandy loam	426.5	213.4	Poor
83	Podo-Cabba family complex	1,087.9	587.0	Poor
84	Podo-Rock outcrop complex	27.9	12.2	Poor
107	Shupert-Winetti complex	48.0	20.7	Poor
120	Travessilla-Rock outcrop complex	5.4	2.8	Poor
121	Travessilla-Rock outcrop-	307.6	159.8	Poor

Table 4.4-7 Summary of Soil Disturbance by Soil Type for the Agency Preferred Alternative				
Soil Map Unit Number	**Soil Unit Name**	**Short-Term Disturbance (Acres)[1]**	**Long-Term Disturbance (Acres)**	**Reclamation Source Material Rating**
	Gerst complex			
122	Travessilla-Travessilla family-Rock outcrop complex	42.9	24.3	Poor
123	Travessilla family, 1-8% slopes	127.7	62.4	Poor

NA = Not applicable; reclamation source material ratings are not assigned to rock outcrop units.
% percent

4.4.5.2 Erosion Calculations

For Alternatives E, the modeled results presented under the Proposed Action were pro-rated according to the amount of proposed surface disturbance, with the exception of proposed road improvements and reroutes, which were modeled separately to evaluate the effect of improving the BLM system roads.

Because the amount of surface disturbance is less under Alternative E than under the Proposed Action (approximately 317 acres), erosion resulting from the construction of well pads, roads, pipelines, and other facilities would be reduced in proportion to the reductions in proposed surface disturbance. However, given that under Alternative E, BBC and other operators would be required to improve each of the primary roads that would be used to access well locations within the WTP Project Area, erosion from road improvements and/or reroutes would be substantially higher under Alternative E than under the Proposed Action. Therefore, if Alternative E were implemented, total erosion would be slightly higher in the short-term than under the Proposed Action. Short- and long-term erosion estimates for both alternatives are displayed in **Table 4.4-8**.

However, as shown in **Table 4.4-8**, if Alternative E were implemented, over the long-term, it is expected that rerouting roads away from canyon bottoms, and improving steep sections of roads, could potentially decrease the sediment delivery, even with increased traffic. In addition, approximately 19 miles of existing roadways would be reclaimed, further reducing erosion as compared to the Proposed Action.

Table 4.4-8 Erosion Estimates Under Alternative E Compared with the Proposed Action						
Alternative	**Short-Term**			**Long-Term**		
	Estimated Erosion for construction roads, pipelines, and well pads[1]	**Estimated Erosion for Improved and Rerouted Roads**	**Total Erosion**	**Estimated Erosion for construction roads, pipelines, and well pads[1]**	**Estimated Erosion for Improved and Rerouted Roads**	**Total Erosion**
Proposed Action	2,470	+87	=2,557	834	+53	=887
Alternative E	2,248	+403	=2,651	602	+251	=853

All units in tons/year
[1]Includes erosion from proposed water management facilities, compressor stations, equipment storage areas, worker housing, airstrips, and pump stations

As discussed under the Proposed Action, erosion calculations were performed for the for two subareas of the WTP Project Area: 1) areas to the west and north of Horse Bench and Cottonwood Ridge that drain to Nine Mile Creek (west), and 2) areas to the east and south of Horse Bench and Cottonwood Ridge that drain directly to the Green River (east).

Increased short-term erosion resulting from the Agency Preferred Alternative would be about 806 tons per year for the east subarea and 1,845 tons per year for the west subarea, for a total of 2,651 tons annually. Long-term erosion increases under the Agency Preferred Alternative would be about 261 tons per year for the east subarea and 592 tons per year for the west subarea, for a total of 853 tons per year.

The estimated total of 2,651 tons of additional erosion generated annually during the short-term would constitute a 3.0 percent increase over the estimated current erosion of 88,128 tons per year. For the long-term, the total additional erosion of 853 tons per year would represent a 1.0 percent increase over current erosion levels.

As previously mentioned, Alternative E contains numerous components from Alternatives C and D that have the potential to further reduced erosion that are not accounted for in the erosion calculations presented above. In particular, if Alternative E were implemented, BBC and other operators would be required to comply with disturbance thresholds, special protection measures for certain resources (see **Section 2.4.1.2**), and the mitigation measures contained in **Tables 2.6-7** and **2.6-8**. In addition, if Alternative E were implemented, there would be no development in canyon bottoms, with the exception of Jack Canyon. Anticipated surface disturbance in Jack Canyon under Alternative E would be less than under the Proposed Action (see **Figure 2.6-1**). Finally, BBC and other operators would implement the dust suppression plan (**Appendix R**) described in **Section 2.1.5.6**.

As an alternative to using dust suppression or due to safety concerns, certain road segments within Nine Mile, Gate, or the lower reaches of Harmon and Cottonwood Canyons, may be improved with hard surfacing, such as asphalt, chip and seal, or other materials, as approved by the BLM or counties as appropriate. Should BBC and other operators pave road segments, dust impacts would effectively be eliminated.

It is acknowledged however that hardening of road surfaces within the WTP Project Area could result in both positive and negative impacts on various resources. For example, hardening of road surfaces within the WTP Project Area could lead to increased runoff to adjacent creeks and/or drainages (i.e., Nine Mile, Cottonwood, and Harmon). Runoff could include pollutants typically associated with paving activities. However, if the road is paved, dust suppressants would not be needed and the potential impacts of dust suppressants to shallow groundwater and Nine Mile Creek would be reduced. Hardening of road surfaces would reduce the potential impacts of additional dust on surface water quality by substantially decreasing erosion and sediment yield to adjacent creeks and/or drainages.

4.4.5.3 Soil Contamination

Under the Agency Preferred Alternative, the risk of soil contamination and the probability of a significant release of condensate or produced water would be similar to that for the Proposed Action.

4.4.5.4 Rangeland Health Standards

The Agency Preferred Alternative would have a minor impact on the attainment of Rangeland Health Standard 1, due sheet, rill, and gully erosion. These impacts would be localized in nature and could potentially impact more than the 2.42 percent of the WTP Project Area directly disturbed in the short-term.

By the use of directional drilling, where feasible, the amount of land affected by new road construction for the Agency Preferred Alternative would be kept at a minimum in accordance with Rangeland Health Standard 1. In addition, under this alternative, up to 17 miles of existing roads would be reclaimed. The amount of land affected would be further minimized by careful placement of project facilities to avoid areas of high erosion potential and the successful implementation of BMPs. Compaction effects would be minimized through the application of appropriate BMPs (see **Tables 2.6-7** and **2.6-8**). The actual BMPs that would be used for the project facilities would be specified during the APD process.

4.4.5.5 Biological Soil Crusts

It is estimated that biological soil crusts occur in approximately 30 percent of the WTP Project Area (BLM 2004b); however, detailed mapping of the distribution of these crusts has not been performed. If a uniform distribution of biological crusts is assumed, the disturbance of 3,339 acres for the Agency Preferred Alternative could result in the potential disturbance of approximately 1,002 acres of biological soil crusts, or about 91 percent of that under the Proposed Action.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.5 WATER RESOURCES

4.5.1 Alternative A - Proposed Action

4.5.1.1 Surface Water

Potential impacts to surface water resources from the Proposed Action include:

- Increased sedimentation and turbidity of perennial WTP Project Area streams, including Nine Mile Creek, Jack Creek, and the lower reaches of Cottonwood, Dry, and Harmon Canyons, as a result of increased soil erosion and sediment delivery to surface waters, and the deposition of fugitive dust within streams and on rock surfaces;

- Increased sediment loading to the Green River, potentially increasing salinity levels in the Colorado River system;
- Increased runoff to Nine Mile Creek, potentially increasing erosion of the channel banks;
- Adverse effects on surface water quality – i.e., potential contamination of surface water resources from spills or discharges of drilling fluids, petroleum, dust suppressants, or other chemicals used for natural gas drilling and production activities;
- Adverse effects on surface water quality from the storage or disposal of drill cuttings in the WTP Project Area;
- Depletion of stream flows in Nine Mile Creek and the Green River from the removal of water for drilling operations; Impacts to floodplains.

The magnitude of these potential impacts depends on several factors, including the proximity of surface disturbances to perennial streams and ephemeral tributaries of Nine Mile Creek and the Green River, slope aspect and gradient, soil type, the duration and timing of the construction activity, and the success or failure of reclamation and mitigation measures. The potential for adverse impacts to surface water resources would be greatest during project construction activities and would likely decrease in time due to natural stabilization, interim and final reclamation, and revegetation efforts.

Increased Sedimentation and Turbidity

Increased erosion of soils and subsequent increased sediment delivery to perennial streams and ephemeral drainages within the WTP Project Area could occur as a result of the Proposed Action.

In sufficient amounts, the additional sediment from construction activities and operational facilities could:

- Degrade aquatic habitat within Nine Mile Creek by covering stream substrates with fine sediment and clogging the interstitial pores of the substrate;
- Increase the turbidity within Nine Mile Creek, Jack Creek, the lower portions of Cottonwood, Dry, and Harmon Creeks, and the Green River;
- Clog road culverts and cause road damage;
- Transport pollutants (trace metals, herbicides, petroleum constituents, and constituents of dust suppressants);
- Contribute to a degraded sediment regime, which could result in down cutting of the channels of Nine Mile Creek and its tributaries and bank destabilization;
- Increase temperatures within Nine Mile Creek; and
- Increase salinity levels in the Green River (Colorado River system).

Erosion calculations were performed for the Proposed Action for two subareas of the WTP Project Area: 1) areas to the west and north of Horse Bench and Cottonwood Ridge that drain to Nine Mile Creek (west), and 2) areas to the east and south of Horse

Bench and Cottonwood Ridge that drain directly to the Green River (east), as described in **Appendix K** and **Section 4.4.1.2**. Erosion calculations reveal that an estimated 1,793 tons per year of additional erosion could be expected to occur within the watersheds that drain to Nine Mile Creek as a result of the Proposed Action during the short-term (about 1 to 5 years). An additional 765 tons per year would be generated in the watersheds that drain directly to the Green River, including the Jack Creek watershed. This erosion would add to the current estimated erosion of 88,128 tons per year for the WTP Project Area. After interim reclamation, the additional erosion would be reduced to approximately 616 tons per year for the Nine Mile Creek (west) drainage subarea and 271 tons per year in the Green River (east) drainage subarea.

Over time, short-duration precipitation events and snowmelt could cause soil lost from the proposed facilities in the WTP Project Area to reach adjacent ephemeral drainages. This fine sediment could then eventually be transported down these ephemeral drainages to Cottonwood Creek, Dry Creek, Harmon Creek, Nine Mile Creek, Jack Creek, and the Green River.

With the proper application and maintenance of BMPs for erosion and runoff control, and the use of dust suppressants, the actual amount of sediment that would be transported to the ephemeral drainages within the WTP Project Area and on to Nine Mile Creek and the Green River would be much less than additional gross erosion estimated above. The amount of additional sediment that would reach the drainages in the WTP Project Area depends on natural factors and the effectiveness of the BMPs and dust suppressants employed. Natural factors which attenuate the transport of sediment into creeks include water available for overland flow, the texture of the eroded material, the amount and kind of ground cover, the slope shape, gradient, and length, and surface roughness (Barfield et al. 1981). The presence of biological crusts also inhibits sediment transport (Belnap et al. 2001).

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

Studies concerning the effectiveness of the BMPs for oil and gas sites have not been conducted. However, several studies conducted in urban settings provide some insight into the potential effectiveness of the BMPs that would likely be employed for erosion control in the WTP Project Area. EPA (1999) estimated that the theoretical TSS removal efficiency for retention basins, infiltration basins, and vegetated filter strips are all in the range of 50-80 percent. Actual performance for these BMP types was measured at urban sites and was reported to be 70 percent for retention basins, 89 percent for infiltration basins, and 81 percent for vegetated filter strips. In another study, EPA (2004) reported ranges of TSS removal of 58-78 percent for retention basins, 75 percent for infiltration basins, and 54-84 percent for vegetated filter strips. Using these studies as examples, it is assumed that the BMPs employed would be about 70 percent effective in removing TSS from surface waters that runoff from the project facilities. Therefore, for the purposes of estimating the amount of increased sediment delivery, it is assumed that

30 percent of the increased erosion calculated could be expected to eventually be delivered to Nine Mile Creek and the Green River.

If the natural factors that affect sediment delivery are ignored, the estimated additional sediment delivery to Nine Mile Creek from the Proposed Action is about 538 tons per year and the estimated additional sediment delivered directly to the Green River would be about 230 tons per year during the short-term.

Using the median TSS concentration recorded at STORET water quality site 4933330 on Nine Mile Creek of 186.5 mg/L, and the estimated total annual runoff for Nine Mile Creek of 14,800 acre-feet (Price and Miller 1975), the current sediment loading to Nine Mile Creek was estimated for this EIS to be about 117,600 tons per year. Therefore, the Proposed Action would increase the sediment loading to Nine Mile Creek by about 0.46 percent in the short-term. This increased sediment loading could lead to slightly higher temperatures in Nine Mile Creek, which could possibly prevent the removal of Nine Mile Creek from Utah's 303(d) list and cause further impairment of the beneficial use Class 3A (cold-water game fish) for this stream. Also, these higher temperatures could have an adverse impact on aquatic organisms in the stream.

For the Green River, the current sediment loading rate, calculated from data collected at the USGS gauging station near Ouray, is about 6,789,000 tons annually. If it assumed that all sediment delivered to Nine Mile Creek is eventually transported to the Green River, the additional sediment loading to the Green River from the Proposed Action would be about 768 tons per year, or an increase of about 0.011 percent from current levels. Salinity levels in the Green River would increase by a similar amount. For the long-term, the increased sediment loading to Nine Mile Creek would be about 185 tons per year (an increase of about 0.16 percent over current levels), and the increased sediment loading to the Green River would be about 266 tons per year (an increase of about 0.0039 percent).

It is important to note that these calculations are approximate. The actual amount of additional sediment loading to Nine Mile Creek and the Green River is dependent on the natural factors listed above, precipitation amounts and timing, channel conditions in Nine Mile Creek, BMP efficiency, and reclamation success or failure. In addition, the erosion calculations are also approximate, and should be regarded as accurate only to within +/- 100 percent. Nonetheless, these estimates provide a useful way to compare the potential impacts of the various alternatives against each other, in addition to providing estimates of the increased sediment delivery to Nine Mile Creek and the Green River.

In addition to the direct erosion of soil surfaces described above, increased traffic levels associated with the Proposed Action would increase the amount of dust generated in the WTP Project Area. Deposition of fugitive dust on vegetation and rock surfaces and directly in stream channels has the potential to slightly increase turbidity levels within the perennial creeks in the WTP Project Area. The amount of potential turbidity increase via this mechanism cannot be quantified, but is expected to be small when compared to the amount of increased turbidity that would potentially result from the increased erosion of soils. Implementation of the dust suppression plan (**Appendix R**) would minimize the potential impacts from dust generation along Nine Mile Creek and segments of Harmon Canyon, Gate Canyon, and Cottonwood Canyon.

Increased Runoff

Soils compacted on existing roads, new access roads, and well pads generate more runoff than undisturbed sites. The increased runoff could lead to slightly higher peak flows in Nine Mile Creek and its perennial tributaries, potentially increasing erosion of the channel banks. The increased runoff could also lead to more efficient sediment delivery and increase turbidity in Nine Mile Creek during storm events. The magnitude of these impacts cannot be quantified, but is expected to be minor based on the small increase in surface water runoff that would be generated.

Water Use

Under the Proposed Action, approximately 2.0 acre-feet (16,667 barrels) of water would be needed to drill and complete each shallow well, and 3.5 acre-feet (29,167 barrels) of water would be needed to drill and complete each deep well (see **Section 2.2.7**). Assuming that BBC and other operators complete an average of 101 wells per year over the 8-year development phase, approximately 202 acre-feet of water would be used annually for drilling and completion activities, with the peak development year using about 372 acre-feet. In addition, about 28.5 acre-feet of water would be used for dust suppression annually, for a total water use of about 228 acre-feet annually and a total peak-year use of 407 acre-feet.

It is assumed that 75 percent of this water would be obtained from existing permitted surface water sources on Nine Mile Creek and 25 percent of the water would be extracted from the proposed water production wells or obtained from other sources, as described in **Section 2.1.7**. The total runoff from Nine Mile Creek has been estimated to be about 14,800 acre-feet (Price and Miller 1975). Therefore, using these assumptions, development of the Proposed Action would consume about 1.15 percent of the total flow of Nine Mile Creek over the 8-year development period.

Surface Water Quality

Contamination of surface water can occur in oil and gas fields. Sources of potential contamination include leaks from wellheads, conveyance pipelines, storage tanks, and tanker trucks; leaching of contaminants from impacted soils near these facilities; accidental spills of hydrocarbon products, including fuels and petroleum products, or produced water; and the use of dust suppressants. Spills of petroleum products, fuels, and lubricants would have the highest potential to contaminate surface waters, especially if the spills were to occur when flow was present in the ephemeral drainages of the WTP Project Area or the spill occurred directly into Nine Mile Creek, Jack Creek, or perennial sections of Cottonwood, Dry, and Harmon Canyons. As described in **Section 4.4.1.3**, between 2 and 10 significant releases of condensate or produced water from a tanker truck could be expected in the WTP Project Area during the 33-year LOP.

A spill of natural gas condensate that enters a stream would have the greatest potential environmental impact on surface water. Potential effects from a spill of natural gas condensate include an increase in biological oxygen demand (BOD) resulting in the depletion of oxygen in the water and sediments during the short-term. This depletion of oxygen could have deleterious effects on aquatic organisms.

The storage, use, or disposal of drill cuttings within the WTP Project Area could result in contamination of surface water due to leaching of metals, hydrocarbons, and salts from the cuttings. The magnitude of potential impacts would depend on a number of variables including 1) cuttings management practices, 2) the concentrations and types of contaminants within the cuttings material, 3) the leaching potential of these contaminants, and 4) proximity of the cuttings to surface water bodies. Prior to surface use of drill cuttings, testing would be conducted as described in **Section 2.1.2**. Testing would allow the BLM or the appropriate surface management agency to evaluate whether surface use is permissiable.

Produced water would be temporarily stored in steel tanks at each well site. The contents of the tanks would be pumped out as needed and transported by tanker truck to licensed disposal sites or reused for drilling at other well locations. A spill of produced water into a perennial stream could result in negative impacts, including an increase of sodium, chloride, and other constituents, and aquatic organism mortality. In addition, significant leaks of produced water from routine loading operations on the well pad and at water management facilities could potentially enter and impact surface water.

Increased sedimentation to WTP Project Area streams could cause an increase in turbidity levels and TSS concentrations in Nine Mile Creek and its perennial tributaries, and the Green River. As presented above, the estimated increased sedimentation to Nine Mile Creek from the Proposed Action would be about 538 tons per year during the short-term, or an increase of about 0.46 percent over current levels. Turbidity and mean TSS concentrations could be expected to increase by a similar amount. The slightly higher TSS loads could lead to increased erosion of channel banks. Increased turbidity could have adverse effects on aquatic organisms, as discussed in **Section 4.9.** In addition, the increased turbidity may raise temperatures slightly within Nine Mile Creek, causing further impairment of the beneficial use Class 3A (cold-water game fish) for this stream. These higher temperatures could have an adverse impact on aquatic organisms in the stream, as discussed in **Section 4.9**. These impacts would lessen in time as disturbed areas of the WTP Project Area are reclaimed.

Hydrofracturing would be conducted as part of the Proposed Action. Hydrofracturing is commonly used to enhance the recovery of natural gas from relatively impermeable “tight” sandstones, and involves the injection of water or other fluids, which may contain some petroleum constituents, and sand or some other “proppant” into the formation. Hydrofracturing would occur at depths that are at least 5,000 feet or more below the surface. Therefore, because of the great depth at which hydrofracturing would be conducted, the potential for impacts to surface water resources from the proposed hydrofracturing is considered to be negligible.

Dust generated from the roads within the WTP Project Area also could increase the sediment loading and turbidity of receiving streams (Addo et al. 2004; Sanders and Addo 1993; Stevenson 2004). The dust suppression plan (**Appendix R**) would minimize the impacts of dust on surface water along Nine Mile Creek and portions of Harmon Canyon, Gate Canyon, and Cottonwood Canyon. In addition to water, two types of dust suppressants would be used in the WTP Project Area: Lignin sulfonate and a soluble polymer such as TerraLOC. Magnesium chloride would no longer be used for dust suppression in the WTP Project Area.

Water is the least effective dust suppressant but causes little potential impacts to surface water quality except for potential depletion of flows. In addition to water, ammonium lignin sulfonate would be used as a dust suppressant in the WTP Project Area. Potential impacts to surface water resources from the use of lignin sulfonate dust suppressants include increased biological oxygen demand and the associated potential for decreased dissolved oxygen, and increased coloring of surface water (Addo et al. 2004). Because it is organic in nature, there are no other potential impacts to surface water. However, lignin sulfonate is soluble and thus tends to be washed away during rain storms (Addo et al. 2004; Stevenson 2004). Thus, discoloration of surface water near application areas will likely occur occassionally. However, because the acute toxicity of ammonium lignin sulfonate is very low (LC50 = 7,300 mg/l), no impacts to aquatic organisms are expected.

As an alternative to using dust suppression, certain road segments within Nine Mile, Gate, or the lower reaches of Harmon and Cottonwood Canyons, may be improved with hard surfacing, such as asphalt, chip and seal, or other materials, as approved by the BLM or counties as appropriate. Should BBC and other operators pave road segments, dust impacts would effectively be eliminated.

It is acknowledged however that hardening of road surfaces within the WTP Project Area could result in both positive and negative impacts on various resources. For example, hardening of road surfaces within the WTP Project Area could lead to increased runoff to adjacent creeks and/or drainages (i.e., Nine Mile, Cottonwood, and Harmon). Runoff could include pollutants typically associated with paving activities. However, if the road is paved, dust suppressants would not be needed and the potential impacts of dust suppressants to shallow groundwater and Nine Mile Creek would be eliminated. Hardening of road surfaces would reduce the potential impacts of additional dust on surface water quality by substantially decreasing erosion and sediment yield to adjacent creeks and/or drainages.

Floodplains

Floodplains are protected by Executive Order 11988, which requires that all Federal agencies take action to reduce the risk of flood loss; to minimize the impact of floods on human safety, health, and welfare; and to restore and preserve the natural and beneficial values served by floodplains. Potential impacts to floodplains from the Proposed Action include increased sedimentation, pollution of surface water or shallow groundwater due to accidental spills or loss of containment of petroleum products, fuels and other chemicals, impacts due to the use of dust suppressants, and damage to or loss of riparian vegetation.

Floodplains within the WTP Project Area are located along Nine Mile Creek, the Green River, and the lower reaches of Dry, Harmon, Jack, and Cottonwood Canyons. Under the Proposed Action, approximately 91 acres would be disturbed in floodplains.

4.5.1.2 Groundwater

Potential impacts to groundwater resources from the Proposed Action include contamination of groundwater with produced water, drilling fluids, petroleum constituents, and constituents of dust suppressants, and impacts to spring water quality and flow rates.

Groundwater exists in shallow unconsolidated alluvium along Nine Mile Creek and the lower reaches of Cottonwood, Dry, Jack, and Harmon Canyons, as isolated zones of perched groundwater within the Green River Formation, in two bedrock aquifers within the Green River Formation, and in deeper bedrock formations beneath the WTP Project Area.

Shallow Alluvial Groundwater

Spills of fuels or produced fluids have the potential to contaminate groundwater resources, especially the shallow alluvial groundwater. A spill of natural gas condensate from a tanker truck directly into a surface water drainage would have the greatest potential to contaminate groundwater. As discussed above for surface water, approximately 2 to 10 spills from a tanker truck could be expected to occur over the LOP on WTP Project Area roads. Therefore, the probability of a spill occurring directly into a drainage is less than one event over the LOP. If a spill is detected, the SPCC Plan would be implemented to minimize, control, and cleanup the affected area. The measures provided in the SPCC Plan would minimize the chance that spilled material enters a surface water feature and subsequently impacts shallow groundwater by providing a rapid response to any spill events.

No produced water would be discharged into surface water drainages or allowed to flow onto the ground surface. There is a slight chance that produced water could be spilled during the loading operations and enter and contaminate shallow alluvial aquifers.

Springs

Potential impacts to springs from the Proposed Action include decreased flows and contamination by petroleum constituents.

Groundwater would be extracted from up to six new production wells under the Proposed Action. The depths and aquifers that these wells would extract water from have not been determined. However, it is likely that sufficient water for the project can only be produced from the Douglas Creek aquifer, which is located in the Lower Member of the Green River Formation at depths that are lower than the bottoms of the stream canyons in the WTP Project Area. The existing springs in the WTP Project Area are mostly located near the upper reaches of the major canyons, and discharge from the Middle and Upper Members of the Green River Formation, and from alluvium that mantles the surface. Although the hydraulic connection between the members of the Green River Formation is poor (Holmes and Kimball 1987), extraction of groundwater for project use could potentially impact flows from springs.

Springs located near wells or production facilities could potentially be contaminated by benzene or other petroleum constituents, as has recently occurred in other gas fields in Colorado. Benzene and other constituents could potentially migrate along fracture systems to springs, if proper completion and cementing procedures are not followed.

The potential radius of influence of hydrofracturing depends largely on two factors: 1) the structural grain of the rocks being hydrofractured and 2) the stress field operating on the rocks at the time of the hydrofracturing. Neither of these factors is well known for the geologic formations in the WTP Project Area. However, it is expected that

hydrofracturing effects would not extend beyond 500 feet from the well bore. Accordingly, the potential for contamination of groundwater by the fracing fluids, which could include diesel fuel, or migration of natural petroleum constituents from the well bore, would be limited to this distance from each well over the production interval. Because hydrofracturing would be conducted at considerable depths (5,000 feet or more below ground surface), groundwater resources near the surface, such as springs and the shallow alluvium, would not be affected.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible Effects

There would be no irreversible impacts to water resources.

Irretrievable Effects

The Proposed Action would result in increased sedimentation in perennial streams within the WTP Project Area.

The Proposed Action would result in depletion of stream flows in Nine Mile Creek and the Green River during drilling operations.

The Proposed Action would result in increased sediment loading to the Green River, potentially increasing salinity levels in the Colorado River system.

4.5.2 Alternative B - No Action Alternative

Under the No Action Alternative, the proposed development of natural gas wells on the BLM lands would not occur; however, natural gas development would likely occur on State of Utah and private lands within the WTP Project Area. Some construction and improvement of roads and pipelines would occur on Federal lands as necessary to provide reasonable access to the State and private lands. Under the No Action Alternative, soils would be disturbed during construction of well pads, access roads, pipelines, and other project facilities. A total of 81 wells could be drilled on 54 well pads.

4.5.2.1 Surface Water

Potential impacts to surface water resources from the No Action Alternative are similar to, but less than those for the Proposed Action, and include increased sedimentation to WTP Project Area streams, increased salinity levels in the Green River, increased runoff, adverse effects on surface water quality, and depletion of stream flows from the removal of water for drilling operations.

Increased Sedimentation and Turbidity

Erosion calculations (presented in **Section 4.4.2.2**) reveal that an estimated 334 tons per year of additional erosion (above the current erosion) could be expected to occur within the watersheds that drain to Nine Mile Creek as a result of the construction of the No Action Alternative during the short-term. Another 141 tons per year would be generated in the watersheds that drain directly to the Green River, including the Jack Creek watershed. After interim reclamation, the additional erosion would be reduced to

approximately 103 tons per year for the Nine Mile Creek (west) drainage subarea and 44 tons per year in the Green River (east) drainage subarea. Under the No Action Alternative, the estimated additional erosion would be about 17 percent of that for the Proposed Action for the short-term and 15 percent of the Proposed Action for the long-term.

Sediment from the construction of the project facilities could eventually be transported to Nine Mile Creek and the Green River and increase the current sediment loading rates. If it is assumed that the BMPs employed would be about 70 percent effective in removing TSS from surface waters, as described above under the Proposed Action, and if the natural factors that affect sediment delivery are ignored, the estimated additional sediment delivery to Nine Mile Creek from the No Action Alternative would be about 100 tons per year and the estimated additional sediment delivered directly to the Green River would be about 43 tons per year during the short-term. Using these numbers, and the average current sediment loading to Nine Mile Creek of 117,600 tons per year, the No Action Alternative would increase the sediment loading to Nine Mile Creek by about 0.086 percent over the short-term. This increased sediment loading and higher turbidity could lead to slightly higher temperatures in Nine Mile Creek, which could possibly prevent the removal of Nine Mile Creek from Utah's 303(d) list and cause further impairment of the beneficial use Class 3A (cold-water game fish) for this stream. Also, these higher temperatures could have an adverse impact on aquatic organisms in the stream, as discussed in **Section 4.9**.

If it assumed that all sediment delivered to Nine Mile Creek is eventually transported to the Green River, the additional sediment loading to the Green River from the No Action Alternative would be about 143 tons per year, or an increase of about 0.002 percent from current levels. It can be assumed that salinity levels in the Green River would also increase by a similar amount. For the long-term, the increased sediment loading to Nine Mile Creek would be about 31 tons per year (an increase of about 0.028 percent) and the increased sediment loading to the Green River would be about 44 tons per year (an increase of about 0.0007 percent).

In addition to the direct erosion of soil surfaces described above, increased traffic levels associated with the No Action Alternative would increase the amount of dust generated in the WTP Project Area. Deposition of fugitive dust on vegetation and rock surfaces and directly in stream channels has the potential to slightly increase turbidity levels within the perennial creeks in the WTP Project Area. The amount of potential turbidity increase via this mechanism cannot be quantified, but is expected to be small when compared to the amount of increased turbidity that would potentially result from the increased erosion of soils. The dust suppression plan (**Appendix R**) would minimize the impacts of dust on surface water along Nine Mile Creek and portions of Harmon Canyon, Gate Canyon, and Cottonwood Canyon.

Increased Runoff

Potential impacts related to increased runoff under the No Action Alternative would be similar to those discussed for the Proposed Action.

Water Use

Under the No Action Alternative, approximately 2.0 acre-feet (16,667 barrels) of water would be needed to drill and complete each well (all wells would be shallow wells). Assuming that BBC and other operators complete an average of 60 wells per year, approximately 120 acre-feet of water would be used annually for drilling and completion activities over a period of less than two years. An additional 20.5 acre-feet of water would be used for dust suppression annually, for a total water use of about 140.5 acre-feet annually. It is assumed that 75 percent of this water would be obtained from existing permitted surface water sources on Nine Mile Creek and 25 percent of the water would be extracted from the proposed water production wells or obtained from other sources, as described in **Section 2.1.7**. Based on the total estimated annual runoff from Nine Mile Creek of 14,800 acre-feet, development of the No Action Alternative would consume about 0.71 percent of the total flow of Nine Mile Creek over the approximately 2-year development period.

Surface Water Quality

Sources of potential contamination include leaks from wellheads, conveyance pipelines, storage tanks, and tanker trucks; leaching of contaminants from impacted soils near these facilities; accidental spills of hydrocarbon products, including fuels and petroleum products, or produced water; and the use of dust suppressants. Spills of petroleum products, fuels, and lubricants would have the highest potential to contaminate surface waters, especially if the spills were to occur when flow was present in the ephemeral drainages of the WTP Project Area. A spill of natural gas condensate that enters a stream would have the greatest potential environmental impact on surface water. Potential effects from a spill of natural gas condensate include an increase in biological oxygen demand (BOD) resulting in the depletion of oxygen in the water and sediments during the short-term. This depletion of oxygen could have deleterious effects on aquatic organisms.

The storage, use, or disposal of drill cuttings within the WTP Project Area could result in contamination of surface water due to leaching of metals, hydrocarbons, and salts from the cuttings. The magnitude of potential impacts would depend on a number of variables including 1) cuttings management practices, 2) the concentrations and types of contaminants within the cuttings material, 3) the leaching potential of these contaminants, and 4) proximity of the cuttings to surface water bodies. Prior to surface use of drill cuttings, testing would be conducted as described in **Section 2.1.2**. Testing would allow the BLM or the appropriate surface management agency to evaluate whether surface use is permissiable.

Produced water would be temporarily stored in steel tanks at each well site. The contents of the tanks would be pumped out as needed and transported by tanker truck to licensed disposal sites or reused for drilling at other well locations. A spill of produced water into a perennial stream could result in negative impacts, including an increase of sodium, chloride, and other constituents, and aquatic organism mortality. In addition, significant leaks of produced water from routine loading operations on the well pad and at water management facilities could potentially enter and impact surface water.

Increased sedimentation to WTP Project Area streams could cause an increase in turbidity levels and TSS concentrations within Nine Mile Creek. As presented above, the

estimated increased sedimentation to Nine Mile Creek from the No Action Alternative would be about 101 tons per year during the short-term, or an increase of about 0.086 percent over current levels. Turbidity and mean TSS concentrations could be expected to increase by a similar amount. The slightly higher TSS loads could lead to increased erosion of channel banks. Increased turbidity could lead to increased temperatures and have adverse effects on aquatic organisms, as discussed in **Section 4.9.** These impacts would lessen in time as disturbed areas of the WTP Project Area are reclaimed.

Under the No Action Alternative, the use of dust suppressants on certain canyon roads could potentially impact surface waters, as described under the Proposed Action.

As an alternative to using dust suppression, certain road segments within Nine Mile, Gate, or the lower reaches of Harmon and Cottonwood Canyons, may be improved with hard surfacing, such as asphalt, chip and seal, or other materials, as approved by the BLM or counties as appropriate. Should BBC and other operators pave road segments, dust impacts would effectively be eliminated.

It is acknowledged however that hardening of road surfaces within the WTP Project Area could result in both positive and negative impacts on various resources. For example, hardening of road surfaces within the WTP Project Area could lead to increased runoff to adjacent creeks and/or drainages (i.e., Nine Mile, Cottonwood, and Harmon). Runoff could include pollutants typically associated with paving activities. However, if the road is paved, dust suppressants would not be needed and the potential impacts of dust suppressants to shallow groundwater and Nine Mile Creek would be eliminated. Hardening of road surfaces would reduce the potential impacts of additional dust on surface water quality by substantially decreasing erosion and sediment yield to adjacent creeks and/or drainages.

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

Floodplains

Under the No Action Alternative, a total of 62.5 acres of floodplains would be disturbed during construction of 4 well pads, 3.5 miles of co-located road and pipeline, and 2.6 miles of independent pipeline. The disturbance to floodplains for the No Action Alternative would be about 69 percent of that for the Proposed Action.

4.5.2.2 Groundwater

Potential impacts to groundwater resources from the No Action Alternative are similar to those for the Proposed Action, and include contamination of groundwater with produced water, drilling fluids, petroleum constituents, and constituents of dust suppressants, and impacts to spring water quality and flow rates.

Shallow Alluvial Groundwater

Spills of fuels or produced fluids have the potential to contaminate the shallow alluvial groundwater. A spill of natural gas condensate from a tanker truck directly into a surface water drainage would have the greatest potential to contaminate groundwater. As discussed above for the Proposed Action, the probability of such an occurrence is less

than one event over the LOP. If a spill is detected, the SPCC Plan would be implemented to minimize, control, and cleanup the affected area. The measures provided in the SPCC Plan would minimize the chance that spilled material enters a surface water feature and subsequently impacts shallow groundwater by providing a rapid response to any spill events.

A spill of produced water from routine loading operations could potentially enter and contaminate shallow alluvial aquifers.

Springs

Potential impacts to springs from the No Action Alternative include decreased flows and contamination by petroleum constituents.

Groundwater would be extracted from up two new production wells for the No Action Alternative. As discussed above for the Proposed Action, sufficient water for the project can likely only be produced from the Douglas Creek aquifer at depths that are lower than the bottoms of the stream canyons in the WTP Project Area, and existing springs discharge from the Middle and Upper Members of the Green River Formation, and from alluvium that mantles the surface. Although the hydraulic connection between the members of the Green River Formation is poor (Holmes and Kimball 1987), extraction of groundwater for the No Action Alternative could potentially impact flows from springs.

Springs located near wells or production facilities could potentially be contaminated by benzene or other petroleum constituents, as has recently occurred in other gas fields in Colorado. Benzene and other constituents could potentially migrate along fracture systems to springs, if proper completion and cementing procedures are not followed.

As described above for the Proposed Action, hydrofracturing would not affect groundwater resources near the surface, such as springs and the shallow alluvium.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.5.3 Alternative C – Transportation Impact Reduction

Under the Transportation Impact Reduction Alternative, the maximum annual unreclaimed surface disturbance (short-term disturbance) would be limited to 280 acres on Federal lands, and the total unreclaimed surface disturbance would be limited to 2,250 acres at any given time.

In addition, produced water and condensate would be transported by pipeline only to the proposed SWD wells or water management facilities.

Finally, BMPs contained in **Table 2.6-7**, mitigation measures contained in **Table 2.6-8**, and special protection measures for water resources (see **Section 2.4.1.2**) have the potential to reduce impacts to water quality when compared to the Proposed Action.

One of the special protection measures included in Alternative C is an annual water quality monitoring program (see **Appendix Q**). Implementation of the monitoring

program would allow the BLM to detect or determine any degradation of water quality as a result of the WTP project. This monitoring program would also allow the BLM to evaluate the effectiveness of the BMPs and mitigation measures included in **Tables 2.6-7** and **2.6-8**.

4.5.3.1 Surface Water

Potential impacts to surface water resources from the Transportation Impact Reduction Alternative are similar to those for the Proposed Action, but would occur over a longer time frame.

Increased Sedimentation and Turbidity

Erosion calculations (presented in **Section 4.4.3.2**) reveal that an estimated 2,027 tons per year of additional erosion (above the current erosion) could be expected to occur within the watersheds that drain to Nine Mile Creek as a result of the construction of the Transportation Impact Reduction Alternative during the short-term. In addition, another 852 tons per year of additional erosion would occur in the watersheds that drain directly to the Green River, including the Jack Creek watershed. After interim reclamation, and successful reclamation of approximately 19 miles of existing roads that would be performed under the Transportation Impact Reduction Alternative, the additional erosion would be reduced to approximately 889 tons per year for the Nine Mile Creek (west) drainage subarea and 424 tons per year for the Green River (east) drainage subarea. Under the Transportation Impact Reduction Alternative, the estimated additional erosion would be about 111 percent of that for the Proposed Action for the short-term and about 103 percent of that for the Proposed Action for the long-term.

Sediment from the construction of the project facilities could eventually be transported to Nine Mile Creek and the Green River and increase the current sediment loading rates. If it is assumed that the BMPs employed would be about 70 percent effective in removing TSS from surface waters, as described above for the Proposed Action, and if the natural factors that affect sediment delivery are ignored, the estimated additional sediment delivery to Nine Mile Creek from the Transportation Impact Reduction Alternative is about 608 tons per year and the estimated additional sediment delivered directly to the Green River would be about 256 tons per year during the short-term. Using these numbers, and the average current sediment loading to Nine Mile Creek of 117,600 tons per year, the Transportation Impact Reduction Alternative would increase the sediment loading to Nine Mile Creek by about 0.52 percent over the short-term. This increased sediment loading could lead to slightly higher temperatures in Nine Mile Creek, which could possibly prevent the removal of Nine Mile Creek from Utah's 303(d) list and cause further impairment of the beneficial use Class 3A (cold-water game fish) for this stream. Also, these higher temperatures could have an adverse impact on aquatic organisms in the stream, as discussed in **Section 4.9**.

If it assumed that all sediment delivered to Nine Mile Creek is eventually transported to the Green River, the additional sediment loading to the Green River from the Transportation Impact Reduction Alternative would be about 864 tons per year, or an increase of about 0.013 percent from current levels. It can be assumed that salinity levels in the Green River would also increase by a similar amount. For the long-term, the increased sediment loading to Nine Mile Creek would be about 191 tons per year (an

increase of about 0.16 percent) and the increased sediment loading to the Green River would be about 274 tons per year (an increase of about 0.004 percent).

In addition to the direct erosion of soil surfaces described above, increased traffic levels would increase the amount of dust generated in the WTP Project Area. Due to the extended LOP and restrictions on traffic, the amount of dust generated would be substantially less than for the Proposed Action. Deposition of fugitive dust on rock surfaces and directly in stream channels has the potential to slightly increase turbidity levels within the perennial creeks in the WTP Project Area. The amount of potential turbidity increase via this mechanism cannot be quantified, but is expected to be small when compared to the amount of increased turbidity that would potentially result from the increased erosion of soils. The dust suppression plan (**Appendix R**) would minimize the impacts of dust on surface water along Nine Mile Creek and portions of Harmon Canyon, Gate Canyon, and Cottonwood Canyon.

Increased Runoff

Potential impacts related to increased runoff under Alternative C would be similar to those discussed for the Proposed Action.

Water Use

Under the Transportation Impact Reduction Alternative, approximately 2.0 acre-feet (16,667 barrels) of water would be needed to drill and complete each shallow well, and 3.5 acre-feet (29,167 barrels) of water would be needed to drill and complete each deep well. Assuming that BBC and other operators complete an average of 54 wells per year, approximately 108 acre-feet of water would be used annually for drilling and completion activities, with the peak development year using about 124 acre-feet. An additional 21.4 acre-feet of water would be used for dust suppression annually, for a total water use of about 129.4 acre-feet annually and a total peak year use of 144.8 acre-feet. It is assumed that 75 percent of this water would be obtained from existing permitted surface water sources on Nine Mile Creek and 25 percent of the water would be extracted from the proposed water production wells or obtained from other sources, as described in **Section 2.1.7**. Based on the total estimated annual runoff from Nine Mile Creek of 14,800 acre-feet, development of the Transportation Impact Reduction Alternative would consume about 0.65 percent of the total flow of Nine Mile Creek over the 15-year development period.

Surface Water Quality

Because the proposed level of development under Alternative C is nearly identical to that under the Proposed Action, the chance of surface water contamination and accidental spills would be about the same as for the Proposed Action.

The storage, use, and disposal of drill cuttings within the WTP Project Area could result in contamination of surface water due to leaching of metals, hydrocarbons, and salts from the cuttings. The magnitude of potential impacts would depend on a number of variables including 1) cuttings management practices, 2) the concentrations and types of contaminants within the cuttings material, 3) the leaching potential of these contaminants, and 4) proximity of the cuttings to surface water bodies. Prior to surface use of drill cuttings, testing would be conducted as described in **Section 2.1.2**. Testing

would allow the BLM or the appropriate surface management agency to evaluate whether surface use is permissiable. Additional testing, evaluation, and mitigation required under Alternative C (see **Table 2.6-8**) would further reduce the potential for contamination to surface water from drill cuttings.

Increased sedimentation to WTP Project Area streams could cause an increase in turbidity levels and TSS concentrations within Nine Mile Creek. As presented above, the estimated increased sedimentation to Nine Mile Creek from the Transportation Impact Reduction Alternative would be about 617 tons per year during the short-term, or an increase of about 0.52 percent over current levels. Turbidity and mean TSS concentrations could be expected to increase by a similar amount. The slightly higher TSS loads could lead to increased erosion of channel banks. Increased turbidity could lead to higher temperatures in Nine Mile Creek and have adverse effects on aquatic organisms, as discussed in **Section 4.9.** These impacts would lessen in time as disturbed areas of the WTP Project Area are reclaimed.

The use of dust suppressants could potentially impact surface waters, as described above for the Proposed Action. Implementation of the long-term monitoring program (see **Appendix Q**) would assist the BLM in monitoring any changes in surface water quality in the WTP Project Area.

As an alternative to using dust suppression, certain road segments within Nine Mile, Gate, or the lower reaches of Harmon and Cottonwood Canyons, may be improved with hard surfacing, such as asphalt, chip and seal, or other materials, as approved by the BLM or counties as appropriate. Should BBC and other operators pave road segments, dust impacts would effectively be eliminated.

It is acknowledged however that hardening of road surfaces within the WTP Project Area could result in both positive and negative impacts on various resources. For example, hardening of road surfaces within the WTP Project Area could lead to increased runoff to adjacent creeks and/or drainages (i.e., Nine Mile, Cottonwood, and Harmon). Runoff could include pollutants typically associated with paving activities. However, if the road is paved, dust suppressants would not be needed and the potential impacts of dust suppressants to shallow groundwater and Nine Mile Creek would be eliminated. Hardening of road surfaces would reduce the potential impacts of additional dust on surface water quality by substantially decreasing erosion and sediment yield to adjacent creeks and/or drainages.

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

Floodplains

Under Alternative C, approximately, 104 acres of floodplains would be disturbed. However, the impacts would occur over a longer timeframe under Alternative C. In addition, under Alternative C, BBC and other operators would be required to comply with the measures described in **Tables 2.6-7** and **2.6-8.** Implementation of these measures would substantially reduce the impacts to floodplains when compared with the Proposed Action.

4.5.3.2 Groundwater

Potential impacts to groundwater resources from the Transportation Impact Reduction Alternative are similar to the Proposed Action and include contamination of groundwater with produced water, drilling fluids, petroleum constituents, and constituents of dust suppressants, and impacts to spring water quality and flow rates. Implementation of the long-term monitoring program (see **Appendix Q**) would assist the BLM in monitoring any changes in groundwater quality in the WTP Project Area. Furthermore, compliance with the draft BLM Utah Oil and Gas Development Ground Water Protection Measures (**Appendix P**) would further reduce effects of the proposed project on groundwater resources within the WTP Project Area.

Shallow Alluvial Groundwater

Potential impacts to shallow alluvial groundwater would be similar to those described under the Proposed Action, but slightly reduced through application of the BMPs and mitigation measures contained in **Table 2.6-7** and **Table 2.6-8**.

Springs

Potential impacts to springs would be similar to those described under the Proposed Action, but slightly reduced through application of the BMPs and mitigation measures contained in **Table 2.6-7** and **Table 2.6-8**. In addition, implementation of the long-term monitoring program (see **Appendix Q**) would assist the BLM in monitoring any changes to springs in the WTP Project Area.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.5.4 Alternative D – Conservation Alternative

Under the Conservation Alternative the amount of surface disturbance would be less than under the Proposed Action. This is primarily because the BLM would not lease unleased lands with wilderness characteristics (and therefore, there would be limited or no surface disturbance within these areas); and, NSO would be allowed in the WSAs, the Desolation Canyon NHL, or on unleased Federal lands within the potential ACECs. Furthermore, as feasible (where to do so would not preclude the development of valid and existing lease rights), NSO would be allowed on Federal lands within canyon bottoms.

Under Alternative D, there would be no exceptions, waivers, or modifications to land use plan stipulations. As such, no construction would be allowed on slopes greater than 30 percent, and construction would not occur on 100-year floodplains, in riparian areas, or within 660 feet of springs. Construction in high country watersheds (areas above 7,000 feet) would be restricted from December 1 – April 15.

Under the Conservation Alternative, the total unreclaimed surface disturbance would be limited to 1,440 acres at any one time and new surface disturbance would be limited to 180 acres yearly.

4.5.4.1 Surface Water

Potential impacts to surface water resources from the Conservation Alternative are similar to, but less than those for the Proposed Action.

Increased Sedimentation and Turbidity

Erosion calculations (presented in **Section 4.4.4.2**) reveal that an estimated 1,417 tons per year of additional erosion (above the current erosion) could be expected to occur within the watersheds that drain to Nine Mile Creek as a result of the construction during the short-term. Another 629 tons per year of additional erosion would occur in the watersheds that drain directly to the Green River, including the Jack Creek watershed. After interim reclamation, the additional erosion would be reduced to approximately 517 tons per year for the Nine Mile Creek (west) drainage subarea and 241 tons per year in the Green River (east) drainage subarea. Under the Conservation Alternative, the estimated additional erosion would be about 69 percent of that for the Proposed Action for the short-term and 66 percent of that for the Proposed Action for the long-term.

Sediment from the construction of the project facilities could eventually be transported to Nine Mile Creek and the Green River and increase the current sediment loading rates. If it is assumed that the BMPs employed would be about 70 percent effective in removing TSS from surface waters, as described above under the Proposed Action, and if the natural factors that affect sediment delivery are ignored, the estimated additional sediment delivery to Nine Mile Creek from the Conservation Alternative is about 425 tons per year and the estimated additional sediment delivered directly to the Green River would be about 189 tons per year during the short-term. Using these numbers, and the average current sediment loading to Nine Mile Creek of 117,600 tons per year, the Conservation Alternative would increase the sediment loading to Nine Mile Creek by about 0.36 percent over the short-term.

If it assumed that all sediment delivered to Nine Mile Creek is eventually transported to the Green River, the additional sediment loading to the Green River from the Conservation Alternative would be about 614 tons per year, or an increase of about 0.009 percent from current levels. The actual amount of additional sediment that would be delivered to WTP Project Area streams is likely lower, because under the Conservation Alternative, no construction would be allowed in canyon bottoms (except as necessary to provide access to valid lease locations), or on slopes greater than 30 percent or on 100-year floodplains. It can be assumed that salinity levels in the Green River would increase by a similar amount. For the long-term, the increased sediment loading to Nine Mile Creek would be about 155 tons per year (an increase of about 0.13 percent) and the increased sediment loading to the Green River would be about 227 tons per year (an increase of about 0.0033 percent). This increased sediment loading could lead to slightly higher temperatures in Nine Mile Creek, which could possibly prevent the removal of Nine Mile Creek from Utah's 303(d) list and cause further impairment of the beneficial use Class 3A (cold-water game fish) for this stream. Also, these higher temperatures could have an adverse impact on aquatic organisms in the stream, as discussed in **Section 4.9**.

In addition to the direct erosion of soil surfaces described above, increased traffic levels associated with the Conservation Alternative would increase the amount of dust generated in the WTP Project Area. Deposition of fugitive dust on rock surfaces and

directly in stream channels has the potential to slightly increase turbidity levels within the perennial creeks in the WTP Project Area. The amount of potential turbidity increase via this mechanism cannot be quantified, but is expected to be small when compared to the amount of increased turbidity that would potentially result from the increased erosion of soils. The dust suppression plan (**Appendix R**) would minimize the impacts of dust on surface water along Nine Mile Creek and portions of Harmon Canyon, Gate Canyon, and Cottonwood Canyon.

Increased Runoff

Potential impacts related to increased runoff under Alternative D would be similar to those discussed for the Proposed Action.

Water Use

Under the Conservation Alternative approximately 2.0 acre-feet (16,667 barrels) of water would be needed to drill and complete each well. Assuming that BBC and other operators complete an average of 26 wells per year, approximately 52 acre-feet of water would be used annually for drilling and completion activities, with the peak development year using about 80 acre-feet. An additional 16.2 acre-feet of water would be used for dust suppression annually, for a total water use of about 68 acre-feet annually and a total peak year use of 98 acre-feet. It is assumed that 75 percent of this water would be obtained from existing permitted surface water sources on Nine Mile Creek and 25 percent of the water would be extracted from the proposed water production wells or obtained from other sources, as described in **Section 2.1.7**. Based on the total estimated annual runoff from Nine Mile Creek of 14,800 acre-feet, development of the Conservation Alternative would consume about 0.35 percent of the total flow of Nine Mile Creek over the 20-year development period.

Surface Water Quality

Because of the restrictions discussed above, and the smaller number of proposed well pads, the chance of such occurrence under the Conservation Alternative would be substantially less than that for the Proposed Action.

The storage, use, and disposal of drill cuttings within the WTP Project Area could result in contamination of surface water due to leaching of metals, hydrocarbons, and salts from the cuttings. The magnitude of potential impacts would depend on a number of variables including 1) cuttings management practices, 2) the concentrations and types of contaminants within the cuttings material, 3) the leaching potential of these contaminants, and 4) proximity of the cuttings to surface water bodies. Prior to surface use of drill cuttings, testing would be conducted as described in **Section 2.1.2**. Testing would allow the BLM or the appropriate surface management agency to evaluate whether surface use is permissiable. Additional testing, evaluation, and mitigation required under Alternative D (see **Table 2.6-8**) would further reduce the potential for contamination to surface water from drill cuttings.

Increased sedimentation to WTP Project Area streams could cause an increase in turbidity levels and TSS concentrations within Nine Mile Creek. As presented above, the estimated increased sedimentation to Nine Mile Creek from the Conservation Alternative would be about 431 tons per year during the short-term, or an increase of about 0.37

percent over current levels. Turbidity and mean TSS concentrations could be expected to increase by a similar amount. The slightly higher TSS loads could lead to increased erosion of channel banks. Increased turbidity could have adverse effects on aquatic organisms, as discussed in **Section 4.9.** These impacts would lessen in time as disturbed areas of the WTP Project Area are reclaimed.

As previously discussed, changes in the level and type of traffic would increase dust generation. The dust suppression plan (**Appendix R**) would minimize the impacts of dust on surface water along Nine Mile Creek and portions of Harmon Canyon, Gate Canyon, and Cottonwood Canyon.

As an alternative to using dust suppression, certain road segments within Nine Mile, Gate, or the lower reaches of Harmon and Cottonwood Canyons, may be improved with hard surfacing, such as asphalt, chip and seal, or other materials, as approved by the BLM or counties as appropriate. Should BBC and other operators pave road segments, dust impacts would effectively be eliminated.

It is acknowledged however that hardening of road surfaces within the WTP Project Area could result in both positive and negative impacts on various resources. For example, hardening of road surfaces within the WTP Project Area could lead to increased runoff to adjacent creeks and/or drainages (i.e., Nine Mile, Cottonwood, and Harmon). Runoff could include pollutants typically associated with paving activities. However, if the road is paved, dust suppressants would not be needed and the potential impacts of dust suppressants to shallow groundwater and Nine Mile Creek would be eliminated. Hardening of road surfaces would reduce the potential impacts of additional dust on surface water quality by substantially decreasing erosion and sediment yield to adjacent creeks and/or drainages.

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

Floodplains

Under the Conservation Alternative, approximately 59 acres of floodplains would be disturbed. The disturbance to floodplains for the Conservation Alternative would be about 64 percent of that under the Proposed Action.

4.5.4.2 Groundwater

Potential impacts to groundwater resources from the Conservation Alternative are similar those for the Proposed Action and include contamination of groundwater with produced water, drilling fluids, petroleum constituents, and constituents of dust suppressants, and impacts to spring water quality and flow rates. Compliance with the draft BLM Utah Oil and Gas Development Ground Water Protection Measures (**Appendix P**) would further reduce effects of the proposed project on groundwater resources within the WTP Project Area.

Shallow Alluvial Groundwater

Under Alternative D, no development is proposed in canyon bottoms; therefore, the likelihood of spills would be less than under the Proposed Action. In addition, potential

impacts to shallow alluvial groundwater would be reduced through application of the BMPs and mitigation measures contained in **Table 2.6-7** and **Table 2.6-8**.

Springs

Potential impacts to springs would be similar to those described for the Proposed Action. However, under the Conservation Alternative, no construction would be allowed within 660 feet of springs, whether flowing or not. This measure would provide additional protection for springs as compared to the Proposed Action.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.5.5 Alternative E – Agency Preferred Alternative

The Agency Preferred Alternative would minimize environmental impacts while allowing for the efficient extraction of natural gas resources by combining key elements of the Proposed Action, Transportation Reduction Alternative, and Conservation Alternative. Under the Agency Preferred Alternative, the annual unreclaimed surface disturbance (short-term disturbance) would be limited to 540 acres on Federal lands and a total of 2,310 acres at any given time. In addition, BMPs contained in **Table 2.6-7**, mitigation measures contained in **Table 2.6-8**, and special protection measures for water resources would be applied, which would reduce impacts when compared to the Proposed Action. One of the special protection measures included in the Agency Preferred Alternative is an annual water quality monitoring program (see **Appendix Q**). Implementation of the monitoring program would allow the BLM to detect or determine any degradation of water quality as a result of the WTP project. This monitoring program would also allow the BLM to evaluate the effectiveness of the BMPs and mitigation measures included in **Tables 2.6-7** and **2.6-8**.

4.5.5.1 Surface Water

Potential impacts to surface water resources from the Agency Preferred Alternative are similar to those for the Proposed Action, and include increased sedimentation to WTP Project Area streams, increased salinity levels in the Green River, increased runoff, adverse effects on surface water quality, and depletion of stream flows from the removal of water for drilling operations.

Increased Sedimentation and Turbidity

Erosion calculations (presented in **Section 4.4.5.2**) reveal that an estimated 1,896 tons per year of additional erosion could be expected to occur within the watersheds that drain to Nine Mile Creek as a result of the construction of the Agency Preferred Alternative during the short-term. Another 806 tons per year of additional erosion would occur in the watersheds that drain directly to the Green River, including the Jack Creek watershed. After interim reclamation, and successful reclamation of approximately 17 miles of existing roads that would be performed under the Agency Preferred Alternative, the additional erosion would be reduced to approximately 592 tons per year for the Nine Mile Creek (west) drainage subarea and 261 tons per year in the Green River (east) drainage subarea. Under the Agency Preferred Alternative, the estimated additional

erosion would be about 106 percent of that for the Proposed Action for the short-term and about 96 percent of that for the Proposed Action for the long-term.

Sediment from the construction of the project facilities could eventually be transported to Nine Mile Creek and the Green River and increase the current sediment loading rates. If it is assumed that the BMPs employed would be about 70 percent effective in removing TSS from surface waters, and if the natural factors that affect sediment delivery are ignored, the estimated additional sediment delivery to Nine Mile Creek from the Agency Preferred Alternative is about 566 tons per year and the estimated additional sediment delivered directly to the Green River would be about 242 tons per year during the short-term. Using these numbers, and the average current sediment loading to Nine Mile Creek of 117,600 tons per year, the Agency Preferred Alternative would increase the sediment loading to Nine Mile Creek by about 0.48 percent over the short-term. This increased sediment loading could lead to slightly higher temperatures in Nine Mile Creek, which could possibly prevent the removal of Nine Mile Creek from Utah's 303(d) list and cause further impairment of the beneficial use Class 3A (cold-water game fish) for this stream. Also, these higher temperatures could have an adverse impact on aquatic organisms in the stream, as discussed in **Section 4.9**.

If it assumed that all sediment delivered to Nine Mile Creek is eventually transported to the Green River, the additional sediment loading to the Green River from the Agency Preferred Alternative would be about 808 tons per year, or an increase of about 0.0119 percent from current levels. As discussed above, the special protective measures contained **Section 2.1.6.4** would minimize the amount of sediment that actually reaches the perennial streams in the WTP Project Area. It can be assumed that salinity levels in the Green River would also increase by a similar amount. For the long-term, the increased sediment loading to Nine Mile Creek would be about 178 tons per year (an increase of about 0.15 percent) and the increased sediment loading to the Green River would be about 256 tons per year (an increase of about 0.0038 percent).

In addition to the direct erosion of soil surfaces described above, increased traffic levels associated with the Agency Preferred Alternative would increase the amount of dust generated in the WTP Project Area. The amount of dust generated would be less than for the Proposed Action because of the transportation restrictions specified in **Section 2.1.6.2**. Deposition of fugitive dust on rock surfaces and directly in stream channels has the potential to slightly increase turbidity levels within the perennial creeks in the WTP Project Area. The amount of potential turbidity increase via this mechanism cannot be quantified, but is expected to be small when compared to the amount of increased turbidity that would potentially result from the increased erosion of soils. The dust suppression plan (**Appendix R**) would minimize the impacts of dust on surface water along Nine Mile Creek and portions of Harmon Canyon, Gate Canyon, and Cottonwood Canyon.

Increased Runoff

Potential impacts related to increased runoff under Alternative E would be similar to those discussed for the Proposed Action.

Water Use

Under the Agency Preferred Alternative, approximately 2.0 acre-feet (16,667 barrels) of water would be needed to drill and complete each shallow well, and 3.5 acre-feet (29,167 barrels) of water would be needed to drill and complete each deep well. Assuming that BBC and other operators complete an average of 90 wells per year, approximately 180 acre-feet of water would be used annually for drilling and completion activities, with the peak development year using about 256 acre-feet. An additional 19.4 acre-feet of water would be used for dust suppression annually, for a total water use of about 199.4 acre-feet annually and a total peak year use of 285.3 acre-feet. It is assumed that 75 percent of this water would be obtained from existing permitted surface water sources on Nine Mile Creek and 25 percent of the water would be extracted from the proposed water production wells or obtained from other sources, as described in **Section 2.1.7**. Based on the total estimated annual runoff from Nine Mile Creek of 14,800 acre-feet, development of the Agency Preferred Alternative would consume about 1.01 percent of the total flow of Nine Mile Creek over the 9-year development period.

Surface Water Quality

Increased sedimentation to WTP Project Area streams could cause an increase in turbidity levels and TSS concentrations within Nine Mile Creek. As presented above, the estimated increased sedimentation to Nine Mile Creek from the Agency Preferred Alternative would be about 577 tons per year during the short-term, or an increase of about 0.49 percent over current levels. Turbidity and mean TSS concentrations could be expected to increase by a similar amount. The slightly higher TSS loads could lead to additional sediment deposition under normal flows. Increased turbidity could have adverse effects on aquatic organisms, as discussed in **Section 4.9.** These impacts would lessen in time as disturbed areas of the WTP Project Area are reclaimed.

The storage, use, and disposal of drill cuttings within the WTP Project Area could result in contamination of surface water due to leaching of metals, hydrocarbons, and salts from the cuttings. The magnitude of potential impacts would depend on a number of variables including 1) cuttings management practices, 2) the concentrations and types of contaminants within the cuttings material, 3) the leaching potential of these contaminants, and 4) proximity of the cuttings to surface water bodies. Prior to surface use of drill cuttings, testing would be conducted as described in **Section 2.1.2**. Testing would allow the BLM or the appropriate surface management agency to evaluate whether surface use is permissiable. Additional testing, evaluation, and mitigation required under Alternative E (see **Table 2.6-8**) would further reduce the potential for contamination to surface water from drill cuttings.

The use of dust suppressants could potentially impact surface waters, as described above for the Proposed Action. The long-term monitoring program would allow the BLM to monitor changes in surface water quality.

As an alternative to using dust suppression, certain road segments within Nine Mile, Gate, or the lower reaches of Harmon and Cottonwood Canyons, may be improved with hard surfacing, such as asphalt, chip and seal, or other materials, as approved by the BLM or counties as appropriate. Should BBC and other operators pave road segments, dust impacts would effectively be eliminated.

It is acknowledged however that hardening of road surfaces within the WTP Project Area could result in both positive and negative impacts on various resources. For example, hardening of road surfaces within the WTP Project Area could lead to increased runoff to adjacent creeks and/or drainages (i.e., Nine Mile, Cottonwood, and Harmon). Runoff could include pollutants typically associated with paving activities. However, if the road is paved, dust suppressants would not be needed and the potential impacts of dust suppressants to shallow groundwater and Nine Mile Creek would be eliminated. Hardening of road surfaces would reduce the potential impacts of additional dust on surface water quality by substantially decreasing erosion and sediment yield to adjacent creeks and/or drainages.

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

Floodplains

Under the Agency Preferred Alternative, approximately 60 acres of floodplains would be disturbed. However, under the Agency Preferred Alternative, construction would not be allowed within 330 feet of the centerline of streams, or on 100-year floodplains, except as necessary to provide access to valid lease areas. Therefore, the potential impacts to riparian vegetation would be lower under the Agency Preferred Alternative as compared to the Proposed Action. In addition, under the Agency Preferred Alternative, BBC and other operators would be required to comply with the measures included in **Tables 2.6-7** and **2.6-8.** Implementation of these measures would substantially reduce the impacts to floodplains when compared with the Proposed Action.

4.5.5.2 Groundwater

Potential impacts to groundwater resources from the Agency Preferred Alternative are similar to those for the Proposed Action, and include contamination of groundwater with produced water, drilling fluids, petroleum constituents, and constituents of dust suppressants, and impacts to spring water quality and flow rates. Implementation of the long-term monitoring program (see **Appendix Q**) would assist the BLM in monitoring any changes in groundwater quality in the WTP Project Area. Furthermore, compliance with the draft BLM Utah Oil and Gas Development Ground Water Protection Measures (**Appendix P**) would further reduce effects of the proposed project on groundwater resources within the WTP Project Area.

Shallow Alluvial Groundwater

Under Alternative E, no development is proposed in Dry Canyon and fewer well pads would be constructed in Jack Canyon; therefore, the likelihood of spills would be less than under the Proposed Action. In addition, potential impacts to shallow alluvial groundwater would be reduced through application of the BMPs and mitigation measures contained in **Table 2.6-7** and **Table 2.6-8**.

Springs

Potential impacts to springs would be similar to those described under the Proposed Action, but slightly reduced through application of the BMPs and mitigation measures

contained in **Table 2.6-7** and **Table 2.6-8**. Implementation of the long-term monitoring program (see **Appendix Q**) would assist the BLM in monitoring any changes in springs in the WTP Project Area.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.6 LAND USE AND STATUS

4.6.1 Alternative A- Proposed Action

Approximately 86 percent of the proposed surface disturbance under Alternative A would occur on Federal lands administered by the BLM. Of the remaining disturbance, approximately 11 percent would occur on State of Utah lands administered by SITLA, and 3 percent would occur on private lands. **Table 4.6-1** summarizes surface disturbance by land ownership.

Table 4.6-1 Surface Disturbance by Land Ownership[1]

Surface Ownership	Total Surface WTP Project Area	Short-Term Disturbance	Long-Term Disturbance
BLM	119,476	3,028	1,603
State	10,400	370	227
Private	8,030	63	28
Total	137,907	3,461	1,858

[1]Disturbance numbers in this table do not include cross country pipeline or road and pipeline construction within sage grouse use areas. Minor discrepancies exist due to rounding.

Following completion activities, portions of the well pads, and access road and pipeline ROWs that are not needed for production activity, would be reclaimed. The long-term or residual disturbance resulting from the Proposed Action would be approximately 1,864 acres. Reclamation requirements would be determined by the appropriate surface management agency.

4.6.1.1 Public Lands

Under the Proposed Action, an increase in natural gas development would lead to adjustments in the existing land uses in the WTP Project Area. Existing land uses would be displaced by surface-disturbing activity during both the construction and operation phases of the project. Land users would be affected by intrusive impacts. Examples of intrusive impacts include increases in traffic, noise, dust, and human activity, as well as changes in the visual landscape. These impacts could be a source of potential conflict with recreational users seeking solitude or recreational opportunities in a relatively pristine landscape, and ranchers that would be impacted by temporary forage losses on BLM-administered grazing allotments. Impacts to individual land uses are analyzed in other resource sections of this chapter. Impacts would occur for the LOP, as well as after the project, since it is possible that some areas would not be fully reclaimed to original condition.

4.6.1.2 Private Lands

Intrusive impacts to private properties would occur from the sights and sounds of resource development on all land jurisdictions in the WTP Project Area. These impacts could include increased traffic, fugitive dust, noise, the loss of privacy that results from increased human activity (e.g., crews and equipment), and visual or aesthetic impacts that could devalue private property. In general, implementation of the Proposed Action and the construction of oil and gas facilities would change the character of the landscape from a rural to a more industrialized setting. Impacts would occur for the LOP as well as after the project, since some areas would not be fully reclaimed to original condition.

As discussed in **Section 3.6.3**, most private lands within the WTP Project Area serve as a base for livestock operations that depend upon the use of the surrounding public lands for livestock grazing. Therefore, decisions made on Federal land that decrease available livestock forage have an impact on private land owners.

Development on private land in the WTP Project Area would lead to adjustments in existing land uses including loss of private rangeland and irrigatable cropland. The severity of the impacts would vary depending on surface and mineral ownership at specific locations. Land owners who own mineral rights for the property are able to decide whether to allow development on their land. Land use conflicts are most likely to occur where wells are located on split-estate properties that have private surface ownership without mineral-estate ownership. The specific locations of facilities would be negotiated with landowners on split-estate lands.

As discussed in **Section 3.6**, a limited number of the leased lands within the WTP Project Area are held in split estate. Two proposed wells located in Nine Mile Canyon (Section 36, T11S:R14E), and four proposed wells located on Prickly Pear Mesa (Sections 23 and 24, T12S:R14E) are proposed on split-estate properties.

Section 1835 of the 2005 Energy Policy Act requires the BLM to review current policies and practices with respect to management of split-estate lands. Public comments received during the scoping process expressed concern related to several types of effects on both privately owned surface and private landowners. Concerns generally revolve around: (1) disturbance of resource values; (2) changes in quality of life for the landowner; and (3) loss of economic value, either from the loss of intangible values such as “solitude” or “personal wilderness” or resulting from the lack of compensation. The following are some of the specific public scoping comments regarding potential impacts on private lands:

- Increased erosion, water quality issues, and the spread of noxious weeds.
- Direct effects from development, including the number of roads, traffic, noise and dust, are increasing as activity increases.
- Loss of wildlife habitat on private surface lands.
- Damage to soils and vegetation that extends far beyond the immediate “footprint” of the development.
- Loss of privacy that results from oil and gas development, including the presence of oil and gas personnel, archaeologists, wildlife biologists, plant specialists, etc., on private land.

- Increased theft and vandalism
- Increased interest by members of the public, which can reduce the privacy enjoyed by the private surface owner.
- Results of particular environmental studies may have a continuing effect on the surface owner in regard to proposals for other land uses after the permitting for oil and gas development has been completed.
- No fair method of compensation for the surface owner for impacts such as road construction and associated traffic.
- Increased truck traffic and number of drill rigs, along with the construction and noise, have caused landowners to give up trying to use property as a rustic retreat or for hunting purposes.

4.6.1.3 Right of Way

As discussed in **Section 3.6.6**, there are several pending and authorized ROWs within the WTP Project Area. During the development phase, the integrity of existing ROWs would potentially be impacted by construction activities. In addition, implementation of the Proposed Action would require that BBC and other operators apply for additional ROWs across public lands on areas outside their leases.

Construction of additional pipelines and increased traffic on roads co-located with pipelines creates a potential safety hazard. Pipelines could be damaged by heavy equipment used for natural gas development within the WTP Project Area. Potential safety hazards are addressed in **Section 4.15**.

Potential impacts to current land uses resulting from the authorization of additional ROWs across public land include losses of livestock forage due to surface disturbance; losses of wildlife habitat and displacement of wildlife due to surface disturbance and habitat fragmentation; and visual impacts to recreational users.

In general, resources protected by Federal laws (e.g., cultural resources or threatened and endangered species) would not be impacted by authorization of additional ROWs. As required by the BLM, surveys would be conducted for threatened and endangered (T&E) species and cultural resources prior to authorization.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible Effects

There would no irreversible effects for land uses in the WTP Project Area.

Irretrievable Effects

Increases in natural gas development would result in the displacement of existing land uses on public and private lands in the WTP Project Area.

4.6.2 Alternative B - No Action Alternative

If the No Action Alternative were implemented, BBC and other operators would develop approximately 81 wells from 54 locations on State and private land. The estimated short-term disturbance from wells, roads, pipelines and ancillary facilities would be approximately 626 acres. Surface disturbance would take place during the development phase which is anticipated to last approximately 2 years.

As required by FLPMA and the MLA, the BLM would be required to grant BBC and other operators' reasonable access to valid leases on State and private land in the WTP Project Area. Potential impacts to current land uses resulting from the authorization of additional ROWs across public land include losses of livestock forage due to surface disturbance; losses of wildlife habitat and displacement of wildlife due to surface disturbance and habitat fragmentation; and visual impacts to recreation users.

If the No Action Alternative were selected, impacts would be similar to those described under the Proposed Action. However, the extent of land uses displaced by oil and gas facilities would be less on public lands.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.6.3 Alternative C - Transportation Impact Reduction Alternative

In general, if Alternative C were implemented, land use impacts would be similar in nature to those described in the Proposed Action with the following exceptions.

Under Alternative C, maximum annual surface disturbance would be limited to 280 acres per year, whereas, if the Proposed Action were selected, surface disturbance during the peak-year of development would be approximately 760 acres. Under Alternative C, the total surface disturbance at any given time would also be limited to 2,250 acres. In addition to surface disturbance thresholds the number of rigs operating in the WTP Project Area would be limited to two rigs during the winter (November 1 – May 15), and six rigs during other seasons.

The combination of surface disturbance thresholds and limitations placed on the number of rigs operating at any given time in the WTP Project Area would limit the annual and total amount of surface disturbance. As such, the extent of land uses displaced would be less than under the Proposed Action. Phased development would also reduce the intensity of traffic, fugitive dust, noise, and human activity in the WTP Project Area. Consequently, private land owners and public land users would not be as severely affected by these intrusive impacts. The potential impacts to current land uses that would result from the authorization of additional ROWs across public lands would be similar to those described in the Proposed Action. However, potential safety hazards associated with natural gas transmission would be partially mitigated by burying new pipelines along road segments in the WTP Project Area. In addition, seasonal and permanent closures of roads in the WTP Project Area would prevent public access on roads that could potentially be hazardous. Finally, any road that provides access to proposed well locations in the WSAs would be gated (i.e., limited administrative access only).

As a component of Alternative C, approximately 19 miles of existing roads would be reclaimed. Reclamation of existing roads would partially mitigate the effects of new surface disturbance and reduce the extent of land use alterations.

Construction and use of a new route through Trail Canyon would reduce impacts such as traffic, noise, dust, and loss of privacy that results from oil and gas development, to private land owners between Gate and Harmon Canyons. However, the new route would bisect private lands at the mouth of Trail Canyon.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.6.4 Alternative D - Conservation Alternative

If Alternative D were implemented, the extent of land uses displaced and the intensity of traffic, fugitive dust, noise, and human activity would be less than under the Proposed Action.

Under the Conservation Alternative the BLM would not lease unleased lands with wilderness characteristics (and therefore, there would be limited or no surface disturbance within these areas); and, NSO would be allowed in the WSAs, the Desolation Canyon NHL, or on unleased Federal lands within the potential ACECs. Furthermore, as feasible (where to do so would not preclude the development of valid and existing lease rights), NSO would be allowed on Federal lands within canyon bottoms. Therefore, intrusive effects would particularly be limited in areas where individuals are inclined to recreate. In addition, surface disturbance would be restricted in canyon bottoms, unless doing so would prevent BBC and other operators from developing their leases.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.6.5 Alternative E - Agency Preferred Alternative

In general, if the Agency Preferred Alternative were implemented, land use impacts would be similar in nature to those described in the Proposed Action with the following exceptions.

Surface disturbance thresholds would limit the annual and total amount of surface disturbance. As such, the extent of land uses displaced would be less during the first or peak-year of development. Phased development would also reduce the intensity of traffic, fugitive dust, noise, and human activity during the first or peak-year of development. Consequently, private land owners and public land users would not be as severely impacted by intrusive effects during the beginning of the development phase.

Through the use of directional drilling, the number of prospective well pads and the amount of surface disturbance within the WSAs would be substantially reduced when compared with the Proposed Action. In addition, surface disturbance would be restricted

in canyon bottoms, unless doing so would prevent BBC and other operators from accessing their reserves. These restrictions would reduce intrusive effects in areas where individuals are inclined to recreate.

If the Agency Preferred Alternative were implemented, the potential impacts to current land uses resulting from the authorization of additional ROWs across public lands would be similar to those described in the Proposed Action. However, potential safety hazards associated with natural gas transmission would be partially mitigated by burying the majority of new pipelines along road segments in the WTP Project Area. In addition, public closures of all roads longer than 2 miles in sensitive resource areas could prevent motorized access in areas that were previously not accessible. Finally, any new road that provides access to proposed wells in the WSAs would be gated (i.e., limited administrative access only).

As a component of the Agency Preferred Alternative, approximately 17 miles of existing roads would be reclaimed. Reclamation of existing roads would partially mitigate the effects of new surface disturbance and reduce the extent of land use alterations.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.7 RANGELAND MANAGEMENT AND WILD HORSES

4.7.1 Alternative A – Proposed Action

4.7.1.1 Rangeland Resources

Implementation of the Proposed Action would result in direct and indirect impacts to rangeland management activities and rangeland resources within the WTP Project Area. Construction, drilling, completion, and production operations would specifically:

- Remove forage, thereby impacting available AUMs within the Dry Canyon, Green River, and Stone Cabin grazing allotments;
- Potentially increase difficulties in management of livestock herds;
- Increase the potential for the introduction and spread of invasive and noxious plants;
- Cause avoidance or displacement from foraging areas near airstrips due to increased noise levels;
- Increase the potential for transportation-related collisions with livestock;
- Increase the potential for livestock harassment due to increased project personnel on project roads, at construction and drilling locations, and at temporary worker housing locations; and
- Cause avoidance by livestock of areas affected by dust from road traffic and areas around drill pads due to increased noise, harassment and activity.

Construction activities under the Proposed Action would impact approximately 212 AUMs on three grazing allotments within the WTP Project Area (**Table 4.7-1**). Assuming that interim reclamation is successful (e.g., interim reclamation would be conducted on portions of well pads not needed for production and along portions of access road and pipeline ROWs not needed for operations), portions of these affected AUMs would again become available as forage.

Livestock herd management activities could be affected by changes to existing range facilities (e.g., damage to gates or stock ponds). Construction of new roads and increased traffic on new and existing roads could lead to gates being left open or closed unnecessarily and thereby result in the unintentional movement of herds or restriction of movement of herds. However, **Section 2.1.4** states that interim reclamation efforts would include the repair of range management facilities and improvements that had been altered by project-related activities (e.g., the installation of cattle guards where new access roads crossed allotment fences). As such, if damaged fences, gates, or cattleguards are fixed as soon as they are damaged, the potential for unintentional movements or restriction of livestock herds would be reduced.

Table 4.7-1 Approximate Surface Disturbances within Grazing Allotments under the Proposed Action

Allotment Name	Grazing Allotments on the BLM Lands within the WTP Project Area (Acres)[1]	Active Federal AUMs within WTP Project Area	Acres per AUM	Estimated Surface Disturbance on Grazing Allotments within the WTP Project Area (Acres)[1]	Impacted Active Federal AUMs Within WTP Project Area	Percent of Impacted Federal AUMs within the WTP Project Area
Dry Canyon	1,963	640	3	66	22	3.4
Green River	30,013	2,011	15	1,463	98	4.9
Stone Cabin	8,386	1,625	5	474	92	5.7

[1]It is important to note that GIS-based calculations do not take into consideration those BLM lands with a slope greater than 20 percent. Also, GIS calculations contain minor discrepancies due to rounding.

Increased traffic levels and activities on new and existing roads could also result in increased levels of livestock and vehicle collisions, potentially resulting in direct mortality of individual animals. This could also result in avoidance by livestock of areas being developed and further decrease livestock use while development of the area is in progress. Livestock permittees may also hesitate to graze areas being developed due to the described risks, thus increasing livestock pressure on areas within the allotment not being developed resulting in further losses of AUMs to the permittee. Also, increased access into the WTP Project Area could lead to increases OHV use, which could result in increased levels of harassment to livestock. In addition, aerial transportation and use of the WTP Project Area landing strips would result in the increased potential for plane/livestock collisions and could cause avoidance or displacement from foraging areas near airstrips due to increased noise levels.

Livestock herd management activities in the Green River allotment could also be affected by project activities during inclement winter weather. Although new and existing roads could serve as travel corridors for livestock during heavy periods of snow, plowed roads without exit points could hinder movement in areas where snow walls develop.

The potential for vehicle-induced introduction and/or spread of invasive and noxious plants within the WTP Project Area would likely increase under implementation of the Proposed Action (see **Section 4.8**). Noxious weeds are generally unpalatable to livestock; however, if populations of noxious weeds become established and proliferate within the affected allotments, a reduction of available palatable forage could occur.

4.7.1.2 Wild Horses

Impacts to wild horses from oil and gas development have not been widely studied or documented; therefore, inferences regarding potential impacts to the Range Creek herd are based on BLM observations of current oil and gas activities on the herd, and on known impacts to other large mammals (e.g., mule deer and elk) that are dependent upon similar habitats and forage within the WTP Project Area (refer to **Section 4.9**).

Surface-disturbing activities under the Proposed Action would result in the removal of approximately 1,091 acres of habitat and forage from a portion of the Range Creek HMA. However, loss of habitat function to wild horses would not likely be limited to areas of surface disturbance. Habitat loss and fragmentation could result in reduced habitat use by horses within disturbed areas, displacement from disturbed areas (such as near roads, construction and drilling locations, and worker housing locations), increased densities in adjoining habitats, and increased stress from intra- and inter-specific competition for resources. Fragmentation of habitat could also restrict the herd's ability to access and utilize the entire HMA. As discussed in **Section 3.7.2.4**, a baseline habitat fragmentation model (refer to **Appendix I**) was conducted to estimate the amount of existing habitat fragmentation that has occurred as a result of existing surface disturbance and infrastructure within the WTP Project Area. Results from the model showed that approximately 11,008 acres of wild horse use areas in the Range Creek HMA within the WTP Project Area have already been fragmented by existing development. Based on the modeling exercise conducted for the Proposed Action, proposed natural gas development would fragment an additional 6,823 acres of wild horse use areas in the Range Creek HMA. Thus, between existing surface disturbance and proposed surface disturbance under the Proposed Action, approximately 17,831 acres (approximately 49 percent) of the Range Creek HMA that occurs within the WTP Project Area boundaries would be fragmented following project implementation.

The Price Field Office has attributed some displacement of horses from normal winter distribution patterns to ongoing oil and gas exploration. For example, in recent winters, the BLM observed that the majority of horses did not migrate to lower elevation wintering areas but instead stayed away from development activities, remaining on higher elevation, summer areas (Tweddell 2007a). Conversely, the BLM has also observed that a small number of horses did move into lower elevation areas around ongoing oil and gas activity and appear to be habituating to development (Tweddell 2007a). For horses that avoid development and human activity, their avoidance behavior has increased the use of forage on critical-use areas in summer range. Because these summer range areas have been carefully managed over the past 10+ years, it does not appear that wild horse health has been compromised due to recent, increased use of summering habitats (Crompton 2006). However, horses, like mule deer and elk, typically experience higher levels of physiological stress during the winter due to higher energy requirements necessary for survival and reproduction. Therefore, wild horse health could become compromised if deep snow or low temperatures reduces available

forage causing horses using these summer areas in the winter to drop weight (Tweddell 2007a).

Under the Proposed Action, drilling and completion activities would be conducted on a year-round basis. Year-round activity in the Range Creek HMA could reduce relative habitat values for horses throughout the year, especially during periods of heavy snow cover and cold temperatures, and conversely during extended periods of drought. In addition, proposed development on benches or along ridgelines could alter migration routes for the herd since horses commonly use open parks and benches within the HMA and typically avoid deep canyons (e.g., Cottonwood Canyon) by migrating along ridgelines (not between ridges). For horses that avoid development activity, lack of access to suitable forage, water, and migration routes could lead to increased stress and poor nutrition. This could be a factor in survival during harsh winters when temperatures tend to remain below zero for extended periods of time, water is not readily available, and accumulation of snowfall is high, all of which further restrict herd movement. New roads and increased traffic on new and existing roads could also result in increased levels of horse and vehicle collisions, resulting in direct mortality of some individuals. Also, increased access into the WTP Project Area could lead to increases in recreational activities such as OHV use, which could result in increased levels of harassment to horses.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible Effects

There would be no irreversible effects on range resources or wild horses within the WTP Project Area.

Irretrievable Effects

Construction activities would impact AUMs on three grazing allotments within the WTP Project Area.

Surface-disturbing activities would result in the loss of wild horse habitat from the Range Creek HMA and increase existing habitat fragmentation for the herd.

4.7.2 Alternative B – No Action Alternative

4.7.2.1 Range Management

Under the No Action Alternative, impacts to rangeland resources would be similar in nature to those described under the Proposed Action. Specific differences are described below.

Surface-disturbing activities under the No Action Alternative would impact approximately 21 AUMs on three grazing allotments within WTP Project Area (**Table 4.7-2**). This is approximately 90 percent less than the number of AUMs affected under the Proposed Action.

Table 4.7-2 Approximate Surface Disturbances within Grazing Allotments under the No Action Alternative

Allotment Name	Grazing Allotments on the BLM Lands within the WTP Project Area (Acres)[1]	Active Federal AUMs within WTP Project Area	Acres per AUM	Estimated Surface Disturbance on Grazing Allotments within the WTP Project Area (Acres)[1]	Impacted Active Federal AUMs Within WTP Project Area	Percent of Impacted Federal AUMs within the WTP Project Area
Dry Canyon	1,963	640	3	17	6	0.9
Green River	30,013	2,011	15	92	6	0.3
Stone Cabin	8,386	1,625	5	48	9	0.6

[1]It is important to note that GIS-based calculations do not take into consideration those BLM lands with a slope greater than 20 percent. Also, GIS calculations contain minor discrepancies due to rounding.

Although development of new gas wells under the No Action Alternative would only occur on State and private lands, impacts to grazing allotments and livestock from access road and pipeline construction, and increased human presence on Federal lands would still occur. However, these potential impacts would be less relative to those discussed under the Proposed Action. In addition, assuming interim reclamation efforts are successful (see **Section 2.1.4**); the above-mentioned potential impacts would be negligible to grazing allotments and livestock resources within the WTP Project Area.

4.7.2.2 Wild Horses

Under the No Action Alternative, general impacts to wild horses would be similar in nature to those described under the Proposed Action. Specific differences are described below.

Implementation of the No Action Alternative would result in the removal of approximately 99 acres of habitat and forage for the Range Creek HMA. However, similar to the Proposed Action, loss of habitat function to wild horses would not be limited to areas of surface disturbance.

Although development of new gas wells under the No Action Alternative would only occur on State and private lands, impacts to wild horses from access road and pipeline construction and increased human presence on Federal lands would still occur. However, these impacts would be smaller relative to those under the Proposed Action. In addition, assuming interim reclamation efforts (see **Section 2.1.4**) are successful, the above-mentioned potential impacts would be negligible to wild horses utilizing the Range Creek HMA within the WTP Project Area.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.7.3 Alternative C – Transportation Impact Reduction

4.7.3.1 Range Management

Under Alternative C, impacts to rangeland resources would be similar in nature to those described under the Proposed Action. Specific differences are described below.

Surface-disturbing activities under Alternative C would impact approximately 210 AUMs on three grazing allotments within the WTP Project Area, and less than 1 AUM in the Parleys Canyon grazing allotment located to the northwest, and outside of, the WTP Project Area (**Table 4.7-3**). This is 0.9 percent less than the number of AUMs affected under the Proposed Action.

Table 4.7-3 Approximate Surface Disturbances within Grazing Allotments under Alternative C

Allotment Name	Grazing Allotments on the BLM Lands within the WTP Project Area (Acres)[1]	Active Federal AUMs within WTP Project Area	Acres per AUM	Estimated Surface Disturbance on Grazing Allotments within the WTP Project Area (Acres)[1]	Impacted Active Federal AUMs Within WTP Project Area	Percent of Impacted Federal AUMs within the WTP Project Area
Dry Canyon	1,963	640	3	66	22	3.4
Green River	30,013	2,011	15	1,451	97	4.8
Parleys Canyon[2]	N/A	N/A	41	14[2]	<1[2]	<0.1[2]
Stone Cabin	8,386	1,625	5	468	91	5.6

[1]It is important to note that GIS-based calculations do not take into consideration those BLM lands with a slope greater than 20 percent. Also, GIS calculations contain minor discrepancies due to rounding.
[2]The Parleys Canyon grazing allotment is located to the northwest, and outside of, the WTP Project Area. The entire allotment includes 14,608 acres of public land and 356 active Federal AUMs. Cited acreage within the Parleys Canyon grazing allotment does not exclude lands with slopes greater than 20 percent. The percent of impacted Federal AUMs are a percentage of the entire Parleys Canyon grazing allotment.

As compared to the Proposed Action, impacts related to intensity of development on livestock grazing allotments within the WTP Project Area would be less under Alternative C, primarily due to restrictions placed on the number of rigs allowed to operate within the WTP Project Area at any given time. This restriction (see **Section 2.4)** could reduce impacts on rangeland management related to intensity of development as follows:

- Special mitigation or environmental protection measures for winter drilling activities, as outlined in **Sections 2.4.1.2**, **2.4.1.3**, and **Appendix E** (Agency Wildlife Mitigation Plan), would indirectly minimize or reduce impacts to livestock caused by winter drilling.
- Gating of all proposed roads longer than 2 miles after drilling and completion activities are completed and gating all roads that provide access to proposed well locations in the WSAs (i.e., limited administrative access only) could reduce impacts from increased human interaction (i.e., avoidance and increased potential for vehicle mortality). (LIHT 2010) Seasonal gating of Cottonwood Canyon would result in the same decreases in vehicle-related impacts on livestock in the Green River Allottment during the short timeframe during which

seasonal closures would overlap with the permitted season of use. However, as no additional fencing would be built, gating of roads would not prevent livestock from moving between suitable grazing habitats.

- Use of aerial transportation for transport of drilling workforce and supplies would reduce impacts from increased human interaction (i.e., avoidance and increased potential for vehicle collisions and mortality of livestock); however, aerial transportation could result in avoidance or displacement from foraging areas near airstrips due to increased noise levels. In addition, increased use of aerial transportation to transport crews could potentially increase the possibility of plane/animal collisions and/or mortality of livestock during takeoff and landings.
- Gating of Horse Bench to the general public would decrease the potential for vehicle-induced spread of non-native and noxious plants. As weed species reduce the quality and quantity of native forage, measures that reduce the potential for weed infestation would have an indirect, positive impact on domestic animals and wildlife.
- Incentives for interim reclamation would potentially decrease the potential spread of non-native and noxious plants in disturbed areas, which would reduce potential forage loss for livestock.
- Requiring industrial traffic using Harmon Canyon to use the Trail Canyon alternative access route would reduce impacts from increased human interaction (i.e., avoidance and increased potential for vehicle collisions and mortality of livestock) in portions of Nine Mile Canyon.

Mitigation measures listed in **Table 2.6-8**, specifically those dealing with noxious weed control, protocol for snow removal and aerial transportation, and construction of watering facilities could also minimize impacts to livestock and affected grazing allotments in the WTP Project Area and in the Parleys Canyon grazing allotment under Alternative C.

4.7.3.2 Wild Horses

Under Alternative C, general impacts to wild horses due to construction, drilling, completion, and production activities would be similar in nature to those described under the Proposed Action. Specific differences are described below.

Surface-disturbing activities under Alternative C would result in the removal of approximately 1,116 acres of habitat and forage within the Range Creek HMA. However, similar to the Proposed Action, loss of habitat function to wild horses would not be limited to areas of surface disturbance, and therefore, the amount of suitable habitat loss would likely be greater than 1,116 acres. Habitat fragmentation under Alternative C would be similar to that modeled for the Proposed Action.

Under Alternative C, only two drill rigs would operate during the winter season (November 1 – May 15). Horses, like mule deer and elk, typically experience higher levels of physiological stress during the winter due to higher energy requirements for survival and reproduction. Although higher winter physiological stress levels would still likely occur in wild horses under Alternative C, impacts associated with increased stress levels could be lower than under the Proposed Action because fewer drill rigs would operate in the winter. This restriction (see **Section 2.4**) could reduce impacts on wild horses related to intensity of development as follows:

- Special mitigation or environmental protection measures for winter drilling activities, as outlined in **Sections 2.4.1.2**, **2.4.1.3**, and **Appendix E** (Agency Wildlife Mitigation Plan) would indirectly minimize or reduce impacts to livestock caused by winter drilling.
- Gating of all proposed roads longer than 2 miles after drilling and completion activities are completed and gating all roads that provide access to proposed well locations in the WSAs (i.e., limited administrative access only) could reduce impacts from increased human interaction with wild horses (i.e., harassment of horse, avoidance of areas by horses, and increased potential for vehicle mortality) (LIHT 2010, BLM 2009b).
- Administrative access on Cottonwood Canyon Road from December 1 – April 15 would reduce potential displacement of horses from foraging areas in periods of heavy snow and colder temperatures.
- Use of aerial transportation for transport of drilling workforce and supplies would reduce impacts from increased human interaction (i.e., avoidance and increased potential for vehicle collisions and mortality of horses); however, aerial transportation could result in avoidance or displacement from foraging areas near airstrips due to increased noise levels.
- Incentives for interim reclamation would potentially decrease the spread of non-native and noxious plants in disturbed areas, which would reduce potential forage loss for wild horses.

Mitigation measures listed in **Table 2.6-8**, specifically those dealing with noxious weed control, requirements for snow removal and aerial transportation, and construction of watering facilities could also minimize impacts to wild horses utilizing the Range Creek HMA within the WTP Project Area under Alternative C.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible Effects

Irreversible effects under Alternative C would be the same as under the Proposed Action.

Irretrievable Effects

Construction activities would impact AUMs on three grazing allotments within the WTP Project Area, and one grazing allotment northwest of the WTP Project Area.

Irretrievable effects for wild horses under Alternative C would be the same as under the Proposed Action.

4.7.4 Alternative D – Conservation Alternative

4.7.4.1 Range Management

Under Alternative D, impacts to rangeland resources would be similar in nature as those described under the Proposed Action. Specific differences are described below.

Surface-disturbing activities under Alternative D would impact approximately 159 AUMs on three grazing allotments within WTP Project Area (**Table 4.7-4**). This is 25 percent less than the number of AUMs affected under the Proposed Action.

As compared to the Proposed Action, impacts related to the magnitude and intensity of development to livestock grazing allotments within the WTP Project Area would be less under Alternative D, primarily due a smaller loss of foraging habitat (fewer AUMS), transportation restrictions, surface occupancy restrictions placed on sensitive areas, prohibition of winter drilling on elk and mule deer critical winter ranges during the winter season (November 1 – May 15), and increased requirements for interim reclamation.

Table 4.7-4. Approximate Surface Disturbances within Grazing Allotments under Alternative D

Allotment Name	Grazing Allotments on the BLM Lands within the WTP Project Area (Acres)[1]	Active Federal AUMs within WTP Project Area	Acres per AUM	Estimated Surface Disturbance on Grazing Allotments within the WTP Project Area (Acres)[1]	Impacted Active Federal AUMs Within WTP Project Area	Percent of Impacted Federal AUMs within the WTP Project Area
Dry Canyon	1,963	640	3	40	13	2.0
Green River	30,013	2,011	15	850	57	2.8
Stone Cabin	8,386	1,625	5	461	89	5.5

[1]It is important to note that GIS-based calculations do not take into consideration those BLM lands with a slope greater than 20 percent. Also, GIS calculations contain minor discrepancies due to rounding.

These strategies and restrictions on disturbance in sensitive areas (see **Section 2.5**) would reduce impacts related to magnitude and intensity of development as follows:

- No leasing of unleased Non-WSA lands with wilderness characteristics; and, NSO on Federal lands within Jack Canyon and Desolation WSAs, Desolation Canyon NHL, unleased lands within the potential Nine Mile Canyon and Desolation Canyon ACECs, or within canyon bottoms would result in the development of fewer wells, roads, pipelines, and other facilities and would require less surface disturbance and therefore, result in less foraging habitat loss on WTP Project Area allotments.
- No leasing of unleased Non-WSA lands with wilderness characteristics; and, NSO on Federal lands within Jack Canyon and Desolation WSAs, Desolation Canyon NHL, unleased lands within the potential Nine Mile Canyon and Desolation Canyon ACECs, or within canyon bottoms would also reduce impacts related to increased traffic levels (i.e., would result in less avoidance potential for vehicle/livestock collisions) in sensitive areas.
- No winter exploration, drilling, and other development activities (November 1 – May 15 as defined in the Price River MFP) would negate or substantially reduce potential impacts related to increased physiological stress during periods of heavy snow and freezing temperatures.
- Year-round gating of the roads to Cedar Ridge and Horse Bench would decrease the potential for vehicle-induced spread of invasive and noxious plants within the Project Area, and could reduce impacts from human interaction with livestock

(i.e., avoidance of areas by livestock, increased potential for vehicle mortality, etc.) by reducing public activity in gated areas (LIHT 2010). However, as no additional fencing would be built under Alternative D, gating of these roads would not necessarily prevent livestock from moving between suitable grazing habitats.

- Use of aerial transportation for transport of drilling workforce would reduce impacts from increased human interaction (i.e., avoidance and increased potential for vehicle collisions and mortality of individual livestock); however, aerial transportation could result in avoidance or displacement from foraging areas near airstrips due to increased noise levels.
- Incentives for interim reclamation would potentially decrease the spread of non-native and noxious plants in disturbed areas. As weed species reduce the quality and quantity of native forage, measures that reduce the potential for weed infestation would have an indirect, positive impact on domestic animals and wildlife.

Mitigation measures listed in **Table 2.6-8**, specifically those dealing with noxious weed control, aerial transportation, and construction of watering facilities could also minimize impacts to livestock and affected grazing allotments in the WTP Project Area under Alternative D.

4.7.4.2 Wild Horses

Under Alternative D, general impacts to wild horses would be similar in nature those described under the Proposed Action. Specific differences are described below.

Surface-disturbing activities under Alternative D would result in the removal of approximately 726 acres of habitat and forage for the Range Creek HMA within the WTP Project Area. However, habitat loss would not be limited to areas of surface disturbance; avoidance of human-related activities could occur and therefore, the amount of suitable habitat loss would be greater than the directly affected 726 acres. As previously discussed, results from the baseline modeling exercise showed that approximately 11,008 acres of wild horse use areas in the Range Creek HMA within the WTP Project Area have already been fragmented by existing development. Based on the modeling exercise conducted for Alternative D, proposed natural gas development would fragment an additional 4,469 acres of wild horse use areas in the Range Creek HMA. Thus, between existing surface disturbance and proposed surface disturbance under Alternative D, approximately 15,477 acres (approximately 42 percent) of the Range Creek HMA that occurs within the WTP Project Area boundaries would be fragmented following project implementation.

As compared to the Proposed Action, impacts to wild horses within the WTP Project Area would be less under Alternative D, primarily due a smaller loss of foraging habitat, transportation restrictions, surface occupancy restrictions placed on sensitive areas, prohibition of winter drilling on elk and mule deer critical winter ranges during the winter season (November 1 – May 15), and interim enhanced requirements for reclamation. These strategies and restrictions on disturbance in sensitive areas (see **Section 2.5**) would reduce wild horse impacts related to magnitude and intensity of development as follows:

- Development of fewer wells and roads would require less surface disturbance and therefore, result in a smaller loss of foraging habitat on the Range Creek HMA.
- No leasing of unleased Non-WSA lands with wilderness characteristics; and, NSO on Federal lands within Jack Canyon and Desolation WSAs, Desolation Canyon NHL, unleased lands within the potential Nine Mile Canyon and Desolation Canyon ACECs, or within canyon bottoms would reduce impacts related to increased traffic levels (i.e., avoidance and increased potential for mortality) in sensitive areas.
- No winter exploration, drilling, and other development activities between November 1 and May 15 would negate or substantially reduce impacts related to increased physiological stress during periods of heavy snow and freezing temperatures.
- Year-round gating of the roads to Cedar Ridge to the general public would decrease the potential for vehicle-induced spread of invasive and noxious plants, and could reduce impacts from human interaction with wild horses (i.e., harassment, avoidance or displacement of gated areas by horses, and potential for vehicle mortality) by reducing motorized activity in gated areas. However, as no additional fencing would be built under Alternative D, gating of these roads would not necessarily prevent wild horses from moving between suitable grazing habitats (LIHT 2010, BLM 2009b).
- Incentives for interim reclamation would potentially decrease the spread of non-native and noxious plants in disturbed areas. As weed species reduce the quality and quantity of native forage, measures that reduce the potential for weed infestation would have an indirect, positive impact on domestic animals and wildlife.

Mitigation measures listed in **Table 2.6-8**, specifically those dealing with noxious weed control, aerial transportation, and construction of watering facilities could also minimize impacts to wild horses utilizing the Range Creek HMA within the WTP Project Area under Alternative D.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.7.5 Alternative E – Agency Preferred Alternative

4.7.5.1 Range Management

Under Alternative E, impacts to rangeland resources would be similar in nature as those described above under the Proposed Action. Specific differences are described below.

Surface-disturbing activities under Alternative E would impact approximately 197 AUMs on three grazing allotments within the WTP Project Area (**Table 4.7-5**). This is 7.1 percent less than the number of AUMs affected under the Proposed Action.

Table 4.7-5 Approximate Surface Disturbances within Grazing Allotments under Alternative E

Allotment Name	Grazing Allotments on the BLM Lands within the WTP Project Area (Acres)[1]	Active Federal AUMs within WTP Project Area	Acres per AUM	Estimated Surface Disturbance on Grazing Allotments within the WTP Project Area (Acres)[1]	Impacted Active Federal AUMs Within WTP Project Area	Percent of Impacted Federal AUMs within the WTP Project Area
Dry Canyon	1,963	640	3	38	12	1.9
Green River	30,013	2,011	15	1,407	94	4.7
Stone Cabin	8,386	1,625	5	467	91	5.6

[1]It is important to note that GIS-based calculations do not take into consideration those BLM lands with a slope greater than 20 percent. Also, GIS calculations contain minor discrepancies due to rounding.

As compared to the Proposed Action, impacts related to intensity of development to livestock and grazing allotments within the WTP Project Area would be slightly less under Alternative E, primarily due to transportation restrictions, special environmental protection measures for winter drilling activities, and additional requirements for interim reclamation. These strategies and restrictions on surface disturbance within the WTP Project Area (see **Section 2.6**) could reduce impacts related to intensity of development as follows:

- Special mitigation or environmental protection measures for winter drilling activities, as outlined in **Sections 2.6.1.4**, **2.6.1.5**, and **Appendix E** (Agency Wildlife Mitigation Plan) would indirectly minimize or reduce impacts to livestock caused by winter drilling.
- Gating of roads longer than 2 miles after drilling and completion activities are completed in sensitive resource areas and gating of all roads that provide access in the WSAs (i.e., limited administrative access only) could reduce impacts from increased human interaction (i.e., avoidance and increased potential for vehicle mortality); however, as no additional fencing would be built, gating of roads would not prevent livestock from moving between suitable grazing habitats.
- Incentives for interim reclamation would decrease the potential spread of non-native and noxious plants in disturbed areas. As weed species reduce the quality and quantity of native forage, measures that reduce the potential for weed infestation would have an indirect, positive impact on domestic animals and wildlife.

Mitigation measures listed in **Table 2.6-8**, specifically those dealing with noxious weed control, requirements for snow removal and aerial transportation, and construction of watering facilities could also minimize impacts to livestock and affected grazing allotments in the WTP Project Area under Alternative E.

4.7.5.2 Wild Horses

Under Alternative E, general impacts to wild horses would be similar in nature as those described under the Proposed Action. Specific differences are described below.

Implementation of Alternative E would result in the removal of approximately 1,002 acres of habitat and forage, which is approximately 2.6 percent of the Range Creek HMA within the WTP Project Area. However, habitat loss would not be limited to areas of

surface disturbance; avoidance of human-related activities could occur and therefore, the amount of suitable habitat loss would be greater than the directly affected 1,002 acres. Habitat fragmentation within the Range Creek HMA would be similar to that modeled for the Proposed Action.

As compared to the Proposed Action, impacts to wild horses within the WTP Project Area would be slightly reduced under Alternative E, primarily due to transportation restrictions, mitigation for winter drilling activities, and interim reclamation. These strategies and restrictions on surface disturbance within the WTP Project Area (see **Section 2.6**) would reduce impacts related to intensity of development as follows:

- Special mitigation or environmental protection measures for winter drilling activities, as outlined in **Sections 2.6.1.4**, **2.6.1.5**, and **Appendix E** (Agency Wildlife Mitigation Plan) would indirectly minimize or reduce impacts to horses caused by winter drilling.
- Gating of roads longer than 2 miles after drilling and completion activities are completed in sensitive resource areas and gating of all roads that provide access in the WSAs (i.e., limited administrative access only) could reduce impacts from increased human interaction (i.e., avoidance and increased potential for vehicle mortality); however, as no additional fencing would be built, gating of roads would not prevent wild horses from moving between suitable grazing habitats.
- Incentives for interim reclamation would decrease the potential spread of non-native and noxious plants in disturbed areas. As weed species reduce the quality and quantity of native forage, measures that reduce the potential for weed infestation would have an indirect, positive impact on domestic animals and wildlife.

Mitigation measures listed in **Table 2.6-8**, specifically those dealing with noxious weed control, requirements for snow removal and aerial transportation, and construction of watering facilities could also minimize impacts to wild horses utilizing the Range Creek HMA within the WTP Project Area under Alternative E.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Under the Agency Preferred Alternative, irreversible and irretrievable effects would be the same as under the Proposed Action.

4.8 VEGETATION

4.8.1 Alternative A – Proposed Action

4.8.1.1 WTP Project Area Vegetation

The primary impact to upland vegetation resources under the Proposed Action would be the direct disturbance or removal of approximately 3,656 acres of vegetation within the WTP Project Area due to surface disturbances from construction, drilling, and completion activities. Vegetation and topsoil would be removed for the construction of well pads, roads, pipelines, and all ancillary facilities as disclosed in **Section 2.1**. Vegetation loss would occur within 9 of the 13 Utah GAP vegetation cover types

identified by GAP data within the WTP Project Area. **Table 4.8-1** lists approximate surface disturbance acreage estimates for each of the respective Utah GAP vegetative communities that would be directly impacted under the Proposed Action. Surface disturbance activities would be greatest in the pinyon-juniper and sagebrush communities, while no direct disturbance would occur in aspen, lowland riparian, mountain fir, or spruce-fir communities. It should be noted that recovery of vegetation following interim and final reclamation would vary by community (e.g., grasslands would recover before woodlands).

Indirect impacts would include increased deposition of fugitive dust, spread of invasive and noxious weeds, and the increased potential for wildfires. Given the special management considerations paid to preventing and controlling noxious weed infestations throughout the State of Utah, impacts caused by the spread of invasive and noxious weeds are addressed in **Section 4.8.1.4**.

Table 4.8-1 Approximate Surface Disturbances By Utah GAP Vegetation Cover Type Under the Proposed Action (Alternative A)

Utah GAP Vegetation Cover Type	Surface Disturbance	
	Short-term (acres)	Long-term (acres)
Aspen	0	0
Dry Meadow	35	20
Grassland	5	0
Juniper	115	66
Lowland Riparian	0	0
Mountain Fir	0	0
Pinyon	143	75
Pinyon-Juniper	1,857	1,014
Ponderosa Pine/Mountain Shrub	54	24
Sagebrush	875	455
Sagebrush/Perennial Grass	214	118
Salt Desert Scrub	164	86
Spruce-Fir	0	0

Fugitive Dust

Increased traffic levels within the WTP Project Area would cause increased deposition of fugitive dust on vegetation located adjacent to roadways and ROWs. Dust settling on vegetation may alter or limit plants' abilities to photosynthesize and/or reproduce until the dust is removed via precipitation or wind. Although dust commonly occurs within the WTP Project Area, increased traffic levels and surface disturbance in construction areas would increase the presence of fugitive dust, which could decrease productivity of vegetation communities along roads and ROWs within the WTP Project Area.

Implementation of the dust suppression plan (**Appendix R**) on Nine Mile Canyon Road, in between Harmon and Cottonwood Canyons (and on portions of Harmon, Gate, and

Cottonwood Canyon Roads), would substantially reduce fugitive dust from industrial traffic, and dust-related impacts on vegetation in those areas. In addition, the use of water for dust suppression on major WTP Project Area roads could reduce fugitive dust, and dust-related impacts on vegetation, in other areas of the WTP Project Area.

Wildfire

The potential for wildfires could increase within the WTP Project Area due to increased human activity and use of machinery for construction, drilling, and completion activities. In the event of a wildfire, vegetation would likely be destroyed but could reestablish itself in successional stages. Eventually, a composition of native vegetation and invasive or noxious communities could replenish areas disturbed by wildfire. Although activities under the Proposed Action could increase the potential for wildfires, applicant-committed measures in **Table 2.2-6** that would prohibit firearms, campfires, or uncontained fires, implement strict smoking-designated areas, and require generators to have spark arrestors could greatly reduce anthropogenic causes of wildfire within the WTP Project Area. In addition, newly constructed roads that intersect the Project Area would serve as fuel breaks that could make suppression of fires more manageable.

4.8.1.2 Riparian Areas

According to the Utah GAP vegetation cover data analysis, no lowland riparian habitat loss would occur as the result of surface disturbance under the Proposed Action. However, given the scale of Utah GAP vegetation mapping (1:119,000), pockets of riparian habitat not identified by GAP data may exist along Nine Mile Creek, along the lower portions of Dry Creek, Harmon Creek, and Cottonwood Creek, and along other area drainages. Individual riparian stands may range from a few square feet to a few acres.

It is likely that impacts to riparian areas associated with implementation of the Proposed Action would be similar in nature to those previously discussed above in **Section 4.8.1.1**, with one noted exception. Unlike surrounding upland areas, the most damaging influences to riparian areas may not be limited to where they occur; many influences become cumulative downstream or lower within the watershed (Winward 2000). Also, some disturbance events may alter the composition of riparian vegetation communities for considerable distances from the original event location, especially if the disturbances occur upstream (Winward 2000).

Under the Proposed Action, direct riparian vegetation loss could occur from the removal of trees, mature woody overstory, and herbaceous species. In addition, productivity (i.e., photosynthesis) of vegetative understory species could be altered and/or hindered by increased sedimentation caused by erosion of exposed soils and degradation of stream banks, or by deposition of fugitive dust from increased traffic levels and construction, drilling, and completion activities. Increased sedimentation and fugitive dust could also affect water quality, which could further degrade riparian vegetation productivity and overall functioning condition of riparian areas. Long-term impacts to riparian areas could include changes in the microclimate (temperature and moisture retention), depending on the quantity and type of vegetation removed.

The construction and development of well pads, pipelines, and roads in or near riparian areas could increase the potential for contamination of riparian vegetation in the event of

a spill. However, compliance with SPCC regulations would minimize these impacts.

Implementation of the dust suppression plan (**Appendix R**) on Nine Mile Canyon Road, in between Harmon and Cottonwood Canyons (and on portions of Harmon, Gate, and Cottonwood Canyon Roads), would substantially reduce fugitive dust from industrial traffic, and dust-related impacts on riparian vegetation in those areas. In addition, the use of water for dust suppression on major WTP Project Area roads could reduce fugitive dust, and dust-related impacts on riparian vegetation, in other areas of the WTP Project Area.

4.8.1.3 Wetland Areas

According to Utah GAP vegetation cover data analysis, no lowland riparian habitat (which includes wetlands) loss would occur as a result of surface disturbance under the Proposed Action. However, given the scale of Utah GAP vegetation mapping (1:119,000), pockets of riparian habitat and wetlands not identified by GAP data may exist along Nine Mile Creek, along the lower portions of Dry Creek, Harmon Creek, and Cottonwood Creek, and along area drainages. Other wetland areas may occur within the WTP Project Area in high meadows associated with seeps and springs. Individual wetlands may range from a few square feet to a few acres. It is likely that impacts to wetlands areas associated with implementation of the Proposed Action would be similar in nature to those previously discussed for WTP Project Area Vegetation (**Section 4.8.1.1**) and Riparian Areas (**Section 4.8.1.2**).

Implementation of the Proposed Action could impact two types of wetlands within the WTP Project Area: wetlands areas created by wildlife and wetlands naturally associated with seeps and springs. Wetlands associated with active beaver dams in Nine Mile Creek could be impacted by the removal of cattail (*Typha latifolia*), bullrush (*Scirpus* spp.), sedge (*Carex* spp.), and other wetland vegetation species if these wetlands occur near construction areas (e.g., near two proposed pump stations in Nine Mile Canyon). In addition, these wetland areas could be degraded by fugitive dust, and increased erosion and sedimentation caused by elevated traffic levels on the existing road in Nine Mile Canyon. Wetland impacts related to construction near natural seeps and springs would likely affect the local hydrology of the area, and therefore the viability of the wetland community and function of the system.

Implementation of the dust suppression plan (**Appendix R**) on Nine Mile Canyon Road, in between Harmon and Cottonwood Canyons (and on portions of Harmon, Gate, and Cottonwood Canyon Roads), would substantially reduce fugitive dust from industrial traffic, and dust-related impacts on wetlands in those areas. In addition, the use of water for dust suppression on major WTP Project Area roads could reduce fugitive dust, and dust-related impacts on wetlands, in other areas of the WTP Project Area.

4.8.1.4 Invasive and Noxious Plants

The spread of invasive and noxious weeds is a concern in areas proposed for surface-disturbing activities. Many invasive and noxious plants can spread through areas undeterred, producing changes in native vegetation communities. Disturbed areas where native vegetation and topsoil have been removed are particularly susceptible to noxious weed invasions. Specific adverse effects of invasive plants and noxious weeds can include 1) reduction in the overall visual character of an area, 2) competition with, or

elimination of native plants, 3) reduction or fragmentation of wildlife habitats, and 4) increased soil erosion. Construction, drilling, and completion activities, increased soil disturbance, and higher traffic volumes could potentially spur the introduction and spread of new and existing weed species within the WTP Project Area (Gelbard and Belnap 2003).

Invasive weed infestations already occur on disturbed areas throughout the WTP Project Area, primarily along existing roadsides. As such, increased travel on these roads could potentially lead to the transport of weed seeds through the WTP Project Area. Similarly, pull-offs onto road edges with equipment and vehicles, or parking on disturbed areas in route to construction areas, could result in vehicle tires and undercarriages transporting weed seeds to additional locations in the WTP Project Area, including those disturbed by development activities (e.g., pipeline and access ROWs, and well pads). Weed infestations could also occur at temporary worker housing locations where project personnel and vehicles would be concentrated.

Although implementation of the Proposed Action would likely increase the spread of invasive and noxious weeds by increasing traffic and human activity within the WTP Project Area, the above-described potential impacts could be partially reduced by interim reclamation and the following applicant-committed measures (**Table 2.2-6**): 1) conducting reclamation as soon as practical after disturbance occurs, 2) using weed-free mulch and native seeds during reclamation, and 3) applying herbicides as necessary and determined by the BLM or appropriate SMA.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible Effects

No irreversible effects are anticipated under the Proposed Action.

Irretrievable Effects

The Proposed Action would result in the irretrievable loss of vegetation within the WTP Project Area. The Proposed Action could result in an irretrievable loss of wetlands and riparian areas.

4.8.2 Alternative B – No Action

General impacts common to Utah GAP vegetation communities under the No Action Alternative would be similar in nature to those discussed under the Proposed Action with the following noted exceptions:

- Impacts related to the magnitude of vegetation degradation (e.g., acres of surface disturbance) due to direct vegetation removal, increased erosion, sediment yield, and potential for exposure to hazardous substances in the event of a spill would be less under the No Action Alternative because natural gas well development would only occur on State of Utah and private lands.
- Impacts related to intensity of development would be less under the No Action Alternative because development would occur on a shorter, less intense drilling schedule.

Impacts specific to particular vegetation communities under the No Action Alternative are discussed in the sections below.

4.8.2.1 WTP Project Area Vegetation

Impacts to WTP Project Area upland vegetation under the No Action Alternative would be similar in nature to those discussed under the Proposed Action; however, comparatively, the magnitude and intensity of impacts related to vegetation loss and degradation would be much less under the No Action Alternative as less development would occur and drilling would occur on a shorter, less intense drilling schedule. Implementation of the No Action Alternative would result in the initial, direct loss of approximately 626 acres of vegetation. **Table 4.8-2** lists surface disturbance acreage estimates for each of the respective Utah GAP vegetative communities that would be directly impacted under the No Action Alternative. Similar to vegetation loss discussed for the Proposed Action in **Table 4.8-1**, surface disturbance under the No Action Alternative would be greatest in the pinyon-juniper and sagebrush communities, while no direct disturbance would occur in aspen, lowland riparian, mountain fir, or spruce-fir communities.

Table 4.8-2 Approximate Surface Disturbances By Utah GAP Vegetation Cover Type Under the No Action Alternative (Alternative B)

Utah GAP Vegetation Cover Type	Surface Disturbance	
	Short-term (acres)	Long-term (acres)
Aspen	0	0
Dry Meadow	13	6
Grassland	5	1
Juniper	4	9
Lowland Riparian	0	0
Mountain Fir	0	0
Pinyon	17	9
Pinyon-Juniper	258	130
Ponderosa Pine/Mountain Shrub	1	0
Sagebrush	219	104
Sagebrush/Perennial Grass	34	17
Salt Desert Scrub	18	8
Spruce-Fir	0	0

4.8.2.2 Riparian and Wetland Areas

Impacts to WTP Project Area riparian and wetland areas under the No Action Alternative would be similar in nature to those discussed under the Proposed Action; however, comparatively, the magnitude of impacts related to riparian and wetland vegetation loss and degradation would be much less under the No Action Alternative because fewer riparian areas exist on State and private lands (i.e., where new well development would occur). It should be noted that impacts arising from vegetation loss, increased erosion and sedimentation, and fugitive dust deposition caused by increased traffic levels, would occur in Nine Mile Canyon because much of the existing road occurs on State and private lands.

4.8.2.3 Invasive and Noxious Plants

Impacts to WTP Project Area invasive and noxious plants under the No Action Alternative would be similar in nature to those discussed under the Proposed Action; however, comparatively, the magnitude and intensity of impacts related to the spread of invasive and noxious weeds would be much less under the No Action Alternative as less development would occur within the WTP Project Area, and drilling would occur on a shorter, less intense schedule. Implementation of the No Action Alternative would increase traffic above current levels and thus would likely increase the spread of non-native plants and noxious weeds on State and private lands within the WTP Project Area, as well as on Federal lands that provide access to proposed development sites on these lands. However, interim reclamation efforts could somewhat reduce the spread of invasive and noxious plants within the WTP Project Area.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.8.3 Alternative C – Transportation Impact Reduction Alternative

General impacts common to Utah GAP vegetation communities under Alternative C would be similar in nature to those discussed under the Proposed Action with the following noted exceptions:

- Impacts related to intensity of development would be less under Alternative C due to transportation restrictions imposed on the number of rigs allowed to operate within the WTP Project Area at any one time. Of the six rigs, only two could operate during the winter season (November 1 – May 15), and the remaining four rigs would operate on a seasonal basis.
- Impacts related to intensity of development would further be constrained under Alternative C by limits on new annual surface disturbance (approximately 280 acres per year), total unreclaimed surface disturbance allowed at any given time (approximately 2,310 acres), and maximum long-term disturbance (approximately 1,995 acres).
- Following interim reclamation efforts, fragmentation of vegetative communities would be less than under the Proposed Action because 62 percent of proposed pipelines would be buried and 38 percent would be laid on the surface.
- Construction of the Trail Canyon alternative access route would result in an additional 14 acres of surface disturbance in the pinyon-juniper, sagebrush, and pinyon vegetation communities.
- Administrative access only to proposed well locations within the Jack Canyon and Desolation Canyon WSAs and the road to Horse Bench would reduce vehicle traffic in these areas, and subsequently could reduce traffic-related soil loss, sediment yield, and resulting loss or changes in vegetative cover (Foltz 2009, Groom et. al. 2007).

- Impacts to vegetation resources under Alternative C would be reduced as compared to the Proposed Action based on implementation of BMPs listed in **Table 2.6-7** and mitigation measures listed in **Table 2.6-8**.

Impacts that are specific to particular vegetation communities under implementation of Alternative C are discussed in the sections below.

4.8.3.1 WTP Project Area Vegetation

Impacts to WTP Project Area upland vegetation under Alternative C would be similar in nature to those discussed under the Proposed Action; however, comparatively, the intensity of development affecting vegetation loss and degradation would be less under Alternative C. Specifically, this would be due to a longer drilling schedule, restriction of administrative and public travel within the WTP Project Area, and construction of the Trail Canyon alternative access route, as described below.

Transportation Restrictions and Requirements

As compared to the Proposed Action, implementation of transportation restrictions and strategies under Alternative C would reduce annual erosion, sedimentation, and fugitive dust deposition in the WTP Project Area, which could reduce loss of vegetation productivity and viability. Conversely, under Alternative C, BBC and other operators would be required to construct a new route through Trail Canyon. Construction of this road would disturb approximately 14 acres of vegetation and would result in indirect impacts to vegetation associated with traffic and road construction.

Drilling Schedule

Implementation of a 15-year drilling schedule under Alternative C, as compared to an 8-year drilling schedule under the Proposed Action, would reduce average annual direct vegetation loss, erosion, sedimentation, and fugitive dust deposition.

Implementation of Alternative C would result in the initial, direct loss of approximately 3,640 acres, which is comparable to that described under the Proposed Action. **Table 4.8-3** lists surface disturbance acreage estimates for each of the respective Utah GAP vegetative communities that would be directly impacted under Alternative C. Almost identical to the magnitude and distribution of vegetation loss shown under the Proposed Action in **Table 4.8-1**, surface disturbance under Alternative C would be greatest in the pinyon-juniper and sagebrush communities, while no direct disturbance would occur in aspen, lowland riparian, mountain fir, or spruce-fir communities.

Table 4.8-3 Approximate Surface Disturbances By Utah GAP Vegetation Cover Type Under the Transportation Impact Reduction Alternative (Alternative C)

Utah GAP Vegetation Cover Type	Surface Disturbance	
	Short-term (acres)	Long-term (acres)
Aspen	0	0
Dry Meadow	34	19

Table 4.8-3 Approximate Surface Disturbances By Utah GAP Vegetation Cover Type Under the Transportation Impact Reduction Alternative (Alternative C)		
Utah GAP Vegetation Cover Type	Surface Disturbance	
	Short-term (acres)	Long-term (acres)
Grassland	5	0
Juniper	43	72
Lowland Riparian	0	0
Mountain Fir	0	0
Pinyon	146	76
Pinyon-Juniper	1,833	965
Ponderosa Pine/Mountain Shrub	61	29
Sagebrush	879	456
Sagebrush/Perennial Grass	208	109
Salt Desert Scrub	163	85
Spruce-Fir	0	0

4.8.3.2 Riparian and Wetland Areas

Impacts to riparian and wetland areas in the WTP Project Area under Alternative C would be similar in nature to those discussed under the Proposed Action; however, comparatively, the intensity of development affecting riparian and wetland loss and degradation would be less under Alternative C. Specifically, this would result from implementation of a longer drilling schedule (15 years) and travel restrictions on selected roads within the WTP Project Area. Under Alternative C, the annual quantity of sedimentation caused by increased erosion, and the annual quantity of fugitive dust caused by increased traffic and development, near riparian and wetland areas would be less than under the Proposed Action because fewer wells would be drilled per year and transportation would be restricted in selected, sensitive areas. In addition, the loss of riparian and wetland vegetation productivity, decreased functioning condition, and potential for contamination caused by construction, drilling, and completion activities would be expected to be lower under Alternative C as compared to the Proposed Action, based on implementation of BMPs discussed in **Table 2.6-7** and mitigation measures listed in **Table 2.6-8**, which include use of closed-loop drilling in sensitive areas. In addition, implementation of the Long-Term Monitoring Plan for Water Resources (**Appendix Q**) under Alternative C would provide water quality data in the WTP Project Area, which would be used to guide mitigation measures. As such, impacts such as loss of riparian and wetland vegetation productivity and decreased functioning condition caused by development activities would be expected to be lower under Alternative C as compared to the Proposed Action.

4.8.3.3 Invasive and Noxious Plants

Impacts resulting from the spread of invasive and noxious weeds under Alternative C would be similar in nature to those discussed under the Proposed Action; however,

comparatively, the intensity of development affecting the spread of invasive and noxious weeds would be less under Alternative C due to a longer drilling schedule (i.e., 15 years as compared to 8 years), transportation restrictions within the WTP Project Area, and annual surface disturbance restrictions. As compared to the Proposed Action, fewer wells would be drilled per year under Alternative C to comply with surface disturbance thresholds, thus driving the 15-year drilling schedule. This would limit the amount of surface disturbance present at any one time, which would thereby reduce the potential for invasive and noxious weed invasion in disturbed areas from levels expected under the Proposed Action. Furthermore, transportation restrictions would reduce the potential for inadvertent transport of weed seeds from known infestations on restricted roads. However, the longer development season would also perpetuate the construction phase of the project, thereby increasing the length of time where new surface disturbance could contribute to weed infestations.

Although implementation of Alternative C would likely increase the spread of invasive and noxious weeds by increasing traffic from current levels within the WTP Project Area, given the lower overall intensity of development, impacts to native vegetation caused by the spread of noxious weeds would likely be less under Alternative C as compared to the Proposed Action. Weed infestations under Alternative C would be reduced assuming mitigation measures (**Table 2.6-8**) that include provisions to implement an Authorized Pesticide Use and Weed Control Plan and annual monitoring are successfully implemented.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.8.4 Alternative D – Conservation Alternative

General impacts common to Utah GAP vegetation communities resulting under Alternative D would be similar in nature to those discussed under the Proposed Action with the following noted exceptions:

- Impacts related to the magnitude of vegetation loss (e.g., acres of surface disturbance) due to direct vegetation loss, increased erosion, sediment yield, and potential for exposure to hazardous substances in the event of a spill would be less under Alternative D.
- Impacts related to the intensity of development would be less under Alternative D due to a longer drilling schedule, transportation restrictions, seasonal restrictions, and surface disturbance restrictions imposed by the BLM.
- Impacts related to intensity of development would further be constrained under Alternative D by limits on new annual surface disturbance (approximately 180 acres per year), total unreclaimed surface disturbance allowed at any given time (approximately 1,440 acres), and maximum long-term disturbance (approximately 1,237 acres).
- Impacts to vegetation resources under Alternative D would be reduced as compared to the Proposed Action based on implementation of BMPs listed in **Table 2.6-7** and mitigation measures listed in **Table 2.6-8**.

Impacts that are specific to particular vegetation communities under implementation of Alternative D are discussed in the sections below.

4.8.4.1 WTP Project Area Vegetation

Impacts to WTP Project Area upland vegetation under Alternative D would be similar in nature to those discussed under the Proposed Action; however, comparatively, the magnitude and intensity of development affecting vegetation loss and degradation would be less under Alternative D. Specifically, the reduction in magnitude of development would result from a reduced number of total wells, and thus a reduced total surface disturbance. The reduction in intensity of development would result from a longer drilling schedule, restricted administrative and public access within the WTP Project Area, and conformance with the BMPs described in **Table 2.6-7** and mitigation measures described in **Table 2.6-8**. Reductions in transportation related impacts are discussed below:

Transportation and Land Use Restrictions

As compared to the Proposed Action, Alternative includes the following land use and transportation restrictions:

- No leasing of unleased non-WSA lands with wilderness characteristics; and, NSO on Federal lands within Jack Canyon and Desolation Canyon WSAs; on Federal lands within Desolation Canyon NHL; unleased Federal lands within the potential Nine Mile Canyon and Desolation Canyon ACECs; and Federal lands with canyon bottoms.
- Under Alternative D, Horse Bench, Jack Canyon, Jack Ridge, and Cedar Ridge roads would be gated. Use of these roads would be limited to those with administrative access.

Prohibiting leasing and eventual development within sensitive areas would eliminate surface dusturance and vegetation loss from oil and gas development in these areas. Preventing surface disturbance and vegetation loss would also result in lower erosion, sedimentation, and fugitive dust deposition, which could reduce loss of adjacent vegetation productivity and viability. Gating of Horse Bench, Jack Canyon, Jack Ridge, and Cedar Ridge roads would reduce vehicle traffic in these areas and subsequently could reduce traffic-related soil loss, sediment yield, and resulting loss or changes in vegetative cover (Foltz 2009, Groom et. al. 2007).

Drilling Schedule

Implementation of a 21-year drilling schedule under Alternative D, as compared to an 8-year drilling schedule under the Proposed Action, would reduce average annual direct vegetation loss, erosion, sedimentation, and fugitive dust deposition caused by traffic and construction within the WTP Project Area.

Implementation of Alternative D would result in the initial, direct loss of approximately 2,510 acres, which is approximately 30 percent less than disturbance under the Proposed Action. **Table 4.8-4** lists surface disturbance acreage estimates for each of the respective Utah GAP vegetative communities that would be directly impacted under Alternative D. Similar to vegetation loss discussed for the Proposed Action in **Table 4.8-**

1, surface disturbance under the Conservation Alternative would be greatest in the pinyon-juniper and sagebrush communities, while no direct disturbance would occur in aspen, lowland riparian, mountain fir, or spruce-fir communities.

Table 4.8-4 Approximate Surface Disturbances By Utah GAP Vegetation Cover Type Under the Conservation Alternative (Alternative D)

Utah GAP Vegetation Cover Type	Surface Disturbance	
	Short-term (acres)	Long-term (acres)
Aspen	0	0
Dry Meadow	31	18
Grassland	5	0
Juniper	67	32
Lowland Riparian	0	0
Mountain Fir	0	0
Pinyon	142	73
Pinyon-Juniper	1129	582
Ponderosa Pine/Mountain Shrub	59	27
Sagebrush	636	325
Sagebrush/Perennial Grass	203	105
Salt Desert Scrub	108	55
Spruce-Fir	0	0

4.8.4.2 Riparian and Wetland Areas

Impacts to riparian and wetland areas in the WTP Project Area under Alternative D would be similar in nature to those discussed under the Proposed Action; however, comparatively, the magnitude and intensity of development affecting riparian and wetland loss and degradation would be less under Alternative D, as fewer wells would be drilled per year, transportation would be restricted in select sensitive areas, and BLM NSO stipulations would not be waived. In addition, conformance with BMPs outlined in **Table 2.6-7**, mitigation measures listed in **Table 2.6-8**, which include the use of closed-loop drilling in sensitive areas could reduce the annual quantity of sedimentation caused by erosion and the annual quantity of fugitive dust caused by increased traffic and development near riparian areas. As such, it would be expected that adverse impacts to riparian and wetland areas caused by construction, drilling, and completion activities would be reduced under Alternative D as compared to the Proposed Action.

4.8.4.3 Invasive and Noxious Plants

Impacts resulting from the spread of invasive and noxious weeds under Alternative D would be similar in nature to those discussed under the Proposed Action; however, comparatively, the magnitude and intensity of development affecting the spread of invasive and noxious weeds would be less under Alternative D due to decreased total surface disturbance necessary for well development as the BLM NSO stipulation would not be waived, a longer drilling schedule (i.e., 21 years as compared to 8 years), transportation restrictions, and maximum annual new disturbance restrictions. The 21-year development phase would limit the amount of surface disturbance present at any one time, which would thereby reduce the potential for invasive and noxious weed

invasion in disturbed areas from levels expected under the Proposed Action. However, the longer development phase would also perpetuate the construction phase of the project, thereby increasing the length of time where new surface disturbance could contribute to weed infestations. Weed infestations under Alternative D would be reduced assuming mitigation measures (**Table 2.6-8**) that include provisions to implement an Authorized Pesticide Use and Weed Control Plan and annual monitoring are successfully implemented.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.8.5 Alternative E – Agency Preferred Alternative

General impacts common to Utah GAP vegetation communities resulting under Alternative E would be similar in nature to those discussed under the Proposed Action with the following noted exceptions:

- Impacts related to intensity of development may be slightly less under Alternative E due to the maximum annual surface disturbance threshold, which could indirectly drive a slightly longer drilling schedule (i.e., 9 years).
- Impacts related to intensity of development would also be less under Alternative E due to transportation-related restrictions.
- Following interim reclamation efforts, fragmentation of vegetative communities would be less than under the Proposed Action because 62 percent of proposed pipelines would be buried and 38 percent would be laid on the surface.
- Impacts to vegetation resources under Alternative E would be reduced based on implementation of BMPs listed in **Table 2.6-7** and mitigation measures listed in **Table 2.6-8**.

Impacts that are specific to particular vegetation communities under implementation of Alternative E are discussed in the sections below.

4.8.5.1 WTP Project Area Vegetation

Impacts to WTP Project Area Upland Vegetation under Alternative E would be similar in nature to those discussed under the Proposed Action; however, comparatively, the intensity of development affecting vegetation loss and degradation would be slightly less under Alternative E due to a slightly longer drilling schedule, annual disturbance limits, and transportation-related restrictions within the WTP Project Area. These reductions are described below:

Drilling Schedule

Alternative E would be conducted on a 9-year drilling schedule, as compared to an 8-year drilling schedule under the Proposed Action. The maximum annual new surface disturbance threshold described below would drive this extended drilling schedule.

Disturbance Thresholds

Under Alternative E, there would be no restrictions on the number of drill rigs operating within the WTP Project Area; however, intensity of development would be limited by the maximum annual new surface disturbance threshold of approximately 540 acres. This restriction would slightly reduce average annual direct vegetation loss, erosion and sedimentation, and fugitive dust deposition caused by traffic and development within the WTP Project Area; however, this restriction would increase the drilling schedule by 1 year.

Transportation and Land Use Restrictions

Implementation of the following transportation and land use restrictions under Alternative E would result in less fugitive dust, which would decrease potential dust-related impacts on vegetation productivity and viability when compared to the Proposed Action:

- NSO by new well pads or other facilities on Federal lands within Jack Canyon and Desolation Canyon WSAs; NSO on Federal lands within the Desolation Canyon NHL; NSO on Federal lands within canyon bottoms; and NSO on unleased Federal lands within the Nine Mile Canyon ACEC.
- Gate roads longer than 2 miles after drilling and completion activities are completed in sensitive resource areas; and
- Gate all new roads that provide access into the WSAs.

Implementation of Alternative E would result in the initial, direct loss of approximately 3,399 acres. **Table 4.8-5** lists surface disturbance acreage estimates for each of the respective Utah GAP vegetative communities and shows those communities directly impacted by vegetation removal due to implementation of Alternative E. Similar to the Proposed Action, surface disturbance under Alternative E would be greatest in the pinyon-juniper and sagebrush communities, while no direct disturbance would occur in aspen, lowland riparian, mountain fir, or spruce-fir communities.

Table 4.8-5 Approximate Surface Disturbances By Utah GAP Vegetation Cover Type Under the Agency Preferred Alternative (Alternative E)

Utah GAP Vegetation Cover Type	Surface Disturbance	
	Short-term (acres)	Long-term (acres)
Aspen	0	0
Dry Meadow	34	19
Grassland	5	0
Juniper	99	50
Lowland Riparian	0	0
Mountain Fir	0	0
Pinyon	144	74
Pinyon-Juniper	1704	897
Ponderosa Pine/Mountain Shrub	61	29
Sagebrush	820	423
Sagebrush/Perennial Grass	204	107

Table 4.8-5 Approximate Surface Disturbances By Utah GAP Vegetation Cover Type Under the Agency Preferred Alternative (Alternative E)		
Utah GAP Vegetation Cover Type	Surface Disturbance	
	Short-term (acres)	Long-term (acres)
Salt Desert Scrub	161	83
Spruce-Fir	0	0

4.8.5.2 Riparian and Wetland Areas

Impacts to riparian and wetland areas in the WTP Project Area under Alternative E would be similar in nature to those discussed under the Proposed Action; however, comparatively, intensity of development affecting riparian and wetland vegetation loss and degradation would be slightly less under Alternative E. Specifically, this would be driven by limits on maximum annual allowable surface disturbance, which in turn could lengthen the drilling schedule. Furthermore, administrative and public travel, and proposed development activities would be limited by conformance with BMP standards in **Table 2.6-7,** mitigation measures listed in **Table 2.6-8**, which include the use of closed-loop drilling in sensitive areas. These restrictive measures could reduce the annual quantity of sedimentation caused by increased erosion, the annual quantity of fugitive dust deposition caused by increased traffic and development, and the potential for exposure to hazardous substances in the event of a spill. In addition, implementation of the Long-Term Monitoring Plan for Water Resources (**Appendix Q**) under Alternative E would provide water quality data in the WTP Project Area, which would be used to guide mitigation measures. As such, impacts such as loss of riparian and wetland vegetation productivity and decreased functioning condition caused by development activities would be expected to be lower under Alternative E as compared to the Proposed Action.

4.8.5.3 Invasive and Noxious Plants

Impacts resulting from the spread of invasive and noxious weeds under Alternative E would be similar in nature to those discussed under the Proposed Action; however, comparatively, the intensity of development affecting the spread of invasive and noxious weeds would be slightly less under Alternative E due to a longer drilling schedule, transportation restrictions, and surface disturbance restrictions. Using a 9-year drilling schedule, on average, slightly fewer wells would be drilled per year under Alternative E as compared to the Proposed Action, and required reclamation activities would occur throughout the LOP to satisfy maximum allowable surface disturbance restrictions. This could reduce the potential for spread of noxious weeds by limiting new surface disturbance and by initiating reclamation within disturbed areas. In addition, limited transportation access under Alternative E could reduce spread of some noxious weed infestations throughout the WTP Project Area by restricting administrative and public access from or into weed infested areas. In addition, impacts to invasive and noxious weeds would further be reduced assuming mitigation measures (**Table 2.6-8**) that include provisions to implement an Authorized Pesticide Use and Weed Control Plan and annual monitoring are successfully implemented.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.9 WILDLIFE AND FISHERIES

4.9.1 Alternative A – Proposed Action

4.9.1.1 General Wildlife

The Proposed Action would result in the disturbance of approximately 3,656 acres of wildlife habitat in a variety of vegetative communities. However, impacts to wildlife species would go beyond this direct habitat loss. Surface disturbance, visual, and noise-related impacts associated with natural gas development would increase functional habitat loss and habitat fragmentation, and would reduce habitat availability and habitat suitability for a variety of common wildlife species. Visual impacts on wildlife could result in displacement from areas where human activity is visible, and could consequently result in increased levels of distress in individual animals. Displacement of wildlife could also occur as a result of human-induced changes in ambient noise levels, such as loud volumes from project-related equipment (e.g., drill rigs), changes or variations in tonal noise, and low frequency noise emanating from project-related equipment (e.g., compressor stations).

Other impacts to general wildlife species would include a potential for mortality caused by equipment or vehicles on construction sites, and an increase in the potential for wildlife and vehicle collisions due to increases in traffic. Increased access and human presence (e.g., at well sites and temporary working housing locations) within the WTP Project Area has the potential to increase displacement, poaching and harassment of wildlife, as well as increase hunter access and success.

Construction, drilling, and completion may result in localized displacement from affected habitats during the entire development period of wells, roads, or pipelines (generally a period of weeks); however, production activities could result in displacement only during well visits (generally hours). If displaced, individual animals could move into less suitable habitats, increasing levels of intra- and inter-specific competition. An increased level of competition could lead to decreased physical conditions, lowered breeding success rates, mortality, and general distress.

In addition, as discussed in **Section 4.8**, implementation of the Proposed Action could lead to the introduction and/or spread of noxious and invasive weeds. Weed invasions would decrease both quantity and quality of wildlife habitats in the WTP Project Area.

Overall, the severity of negative impacts to general wildlife species under the Proposed Action would depend on the seasonal and daily timing of construction, drilling, completion, and production activities, the site-specific topography and vegetation, the sensitivity of the species to human disturbance, and the availability and proximity of suitable habitat within and outside the WTP Project Area. However, the Proposed Action is expected to have a minor to moderate impact on the more common or “general” wildlife species in the WTP Project Area due to the following:

- Many of the "general" wildlife species discussed in **Section 3.9.1** are habitat generalists, meaning they are not tightly restricted to specific habitat types (e.g., cottontail rabbits, coyotes, ravens, rodents, and snakes), and therefore, are not as heavily affected by habitat loss as those species that are obligates to specific vegetative communities.
- Many of the applicant-committed measures in **Table 2.2-6** would directly or indirectly reduce potential impacts to general wildlife species.

Wildlife Mitigation Plan

Under the Proposed Action, BBC and other operators are proposing to implement a Wildlife Mitigation Plan on public, private, and State lands. The goal of BBC's Wildlife Mitigation Plan, described in detail in **Appendix B**, is to improve habitats for sage-grouse, mule deer, elk, and raptors, in an effort to offset the effects of winter drilling and other impacts of the project. In brief, BBC's Wildlife Mitigation Plan commits to:

- Fund and implement road realignment measures designed to reduce traffic-related impacts in sage-grouse wintering habitats;
- Implement habitat improvement and connectivity projects that are designed to convert existing pinyon-juniper habitats into sagebrush in order to benefit sage-grouse and other wildlife species;
- Implement off-site wet meadow and sage-grouse summer range enhancement projects;
- Manage grazing rights on both public and private lands such that grazing management is used as a valuable tool in vegetation manipulation and habitat mitigation (the goal of the grazing program would be to develop the range site to its full potential while keeping succession at its desired seral stage); and
- Fund an ongoing, annual monitoring project whereby basic information on various mitigation projects, as well as limited information on wildlife populations and use areas, would be collected for use by the WTPMOC in planning future mitigation projects.

The mitigation plan specifically commits to an approximate 4:1 acre mitigation ratio based on total potential long-term surface disturbance under the Proposed Action. Thus, for the approximately 1,864 acres of long-term disturbance under the Proposed Action, BBC is committed to offset that habitat loss by directly or indirectly improving approximately 7,456 acres of habitat (i.e., 1,864 acres X 4 = 7,456 acres). Much of the mitigation would be implemented as straight-forward (direct) 4:1 acre habitat enhancement projects. However, many of the above-described measures go beyond acreage-defined habitat enhancement or mitigation.

Like activities associated with natural gas development and other public land uses, implementation of the Wildlife Mitigation Plan would result in both positive and negative impacts on wildlife species and habitats, and potentially on other public land uses and resources. The potential impacts of the Wildlife Mitigation Plan, both positive and negative, are discussed in the following sections. As appropriate, additional information is provided within the species-specific impact analysis discussions.

The proposed road realignments would benefit sage-grouse by re-aligning existing roads that currently bisect the two largest sage-grouse core winter use areas. These roads would be reconstructed away from the sagebrush parks and placed in pinyon-juniper woodlands and on the edges of sagebrush parks. In some cases (i.e., where the road is moved into pinyon-juniper woodlands), the realignments would create both visual and acoustical screening from traffic. However, the primary advantage of moving the existing roads would be to create a greater distance between the roads and core sage-grouse winter use areas. In addition to the benefit sage-grouse would derive from this project, mule deer, elk, and other wildlife species would also benefit from the screening of traffic, which could reduce related displacement. However, such vegetative screening could also reduce visibility of drivers and lead to a greater likelihood of wildlife being struck by vehicles. The proposed road realignments would also result in new disturbance in pinyon-juniper woodlands and could reduce relative habitat value for the species that occur there, such as the ferruginous hawk, red-tailed hawk, gray vireo, ash-throated flycatcher, and pinyon jay. Areas where proposed road realignments would be implemented are illustrated on **Figure 2.2-1** in sage-grouse core winter use areas.

Similarly, while the conversion of pinyon-juniper habitats into sagebrush habitats would have a substantial beneficial effect on sage-grouse and mule deer, the proposed mitigation would reduce habitat availability for species that occur within or use pinyon-juniper habitat. As discussed in **Section 3.8**, there are approximately 51,000 acres of pinyon-juniper habitat and 23,000 acres of sagebrush habitat within the WTP Project Area. Thus, the positive effects of creating or improving sagebrush habitat (which is a declining vegetative community in the west and provides key habitat for a number of wildlife species) would generally outweigh the potential negative impacts of habitat loss in the more widespread pinyon-juniper community. Initial areas proposed for pinyon-juniper treatment on Peter's Point Mesa are illustrated in **Figure 2.2-1**.

Sage-grouse use of limited wet meadow habitats, pond margins, and spring areas indicate a preference for this habitat type during brood rearing (Klebenow 1969, Connelly & Markham 1983, Connelly et al. 1988). Therefore, proposed mitigation designed to increase these habitats would be beneficial to sage-grouse brood survival by increasing forbs and habitat for invertebrates. Under the Wildlife Mitigation Plan, wet meadow enhancement would involve locating spring sources and if topography allows, re-contouring the spring sources to distribute the water over as much surface area as possible creating a sub-irrigated meadow. These areas would be attractive to big game and livestock, and might require fencing to protect the values for sage-grouse. However, in order to avoid adverse impacts to livestock that use the affected springs, water from affected springs would also be piped to a trough or stock watering pond. Creation of troughs or stock watering ponds would also benefit other wildlife species by providing water sources not previously available. Negative impacts resulting from wet meadow enhancements would include a potential but minor reduction in flow within streams in Dry Canyon, Harmon Canyon, Cottonwood Canyon, and Prickly Pear Canyon. These canyons have long stretches of channel that exhibit intermittent seasonal flows that are fed by discharge from springs.

Summer range improvements would involve sagebrush removal in sage-grouse summer range using mechanical treatments with the goal of replacing that existing sagebrush with newer, younger, more vigorous sagebrush stands of similar percent land cover, type, and mosaic patterns. Increased grass and forb production resulting from these treatments would benefit sage-grouse broods as well as mule deer. Small mammal

populations could increase from these types of summer range treatments as a result of increases in forage, thereby providing increased prey base for raptors.

The goal of the proposed grazing mitigation would be to develop range conditions within the Stone Cabin Allotment to their full potential while keeping succession at its desired seral stage. Specifically, the Wildlife Mitigation Plan includes a commitment to implement one year of non-use, in addition to the one year of non-use already committed to by BBC for previous mitigation projects, for a total of two years of temporary non-use on the Stone Cabin Allotment. The temporary non-use and associated range improvement projects (see **Appendix B**) would result in healthier vegetative communities and increased forage production in the Stone Cabin Allotment. The primary beneficiaries of this mitigation measure would be big game species. However, sage-grouse could also benefit from increased herbaceous cover and increased forb and insect production for pre-nesting hens and broods, later in the spring. Raptors and other carnivorous species could also benefit from increased small mammal populations in association with increased herbaceous cover and seed production.

The mitigation commitment to contribute funds to ongoing UDWR monitoring projects would benefit wildlife species and habitats within the WTP Project Area by contributing to the UDWR's (and BLM's) knowledgebase regarding wildlife population numbers and trends. As stated in the Wildlife Mitigation Plan, these data would in part be used to help make decisions regarding future mitigation projects in the WTP Project Area; the data gathered would help facilitate an adaptive management approach for the Wildlife Mitigation Plan.

4.9.1.2 Big Game

Many of the surface-disturbing activities, habitat loss, fragmentation, and displacement impacts associated with the Proposed Action would be similar among big game species and could result in the following:

- Decreased habitat values and reduced habitat use within and/or near disturbed areas due to direct habitat loss and fragmentation of habitat;
- Decreased reproductive success and nutritional conditions from increased energy expenditure as a physical response to disturbance;
- Increased stress from intra- and inter-specific competition for resources due to increased animal densities in adjoining or unsuitable habitats;
- Increased potential for collisions between vehicles and big game; and
- Increased harassment and/or poaching of big game species.

The above-mentioned impacts would be of most concern in crucial winter ranges where winter drilling is proposed. Winter drilling conflicts with seasonal closure requirements, and existing lease stipulations that require seasonal closures in crucial winter range.

Species-specific impacts to big game species found within the WTP Project Area are discussed in detail below.

Mule Deer

Surface disturbances associated with the Proposed Action would result in the direct loss and fragmentation of various UDWR-identified crucial and substantial mule deer habitats. Direct loss of each specific mule deer habitat type is summarized below in **Table 4.9-1**.

Table 4.9-1 Approximate Surfaces Disturbances to UDWR Mule Deer Habitats within the WTP Project Area under the Proposed Action

UDWR-identified Habitat Values	Existing Acreage within the WTP Project Area[1]	Short-term Disturbance (acres)	Long-term Disturbance (acres) (After Interim Reclamation)	Long-term Habitat Loss as a Percentage of Total Available Habitat
Winter Habitat				
Crucial	73,600	2,466	1,315	1.8
Substantial	47,115	918	516	1.1
Additional Habitat Types				
Crucial Spring/Fall	4,804	47	17	0.4
Crucial Summer (Fawning Habitat)	8,634	30	11	0.1

[1]Minor discrepancies due to rounding

Implementation of the Proposed Action would result in the initial, direct loss of approximately 3,656 acres of wildlife habitats, of which approximately 2,466 acres would occur on crucial winter mule deer habitat. During the winter, increased impacts from construction, drilling, and completion activities in crucial winter mule deer habitat could potentially displace deer into other areas of unsuitable habitat, or prevent access to winter foraging areas or sufficient water. Displacement from disturbed habitats could result in reduced habitat use by mule deer within disturbed areas, increased animal densities in adjoining habitats, and increased stress from intra- and inter-specific competition for resources.

Furthermore, habitat loss and displacement would not be limited to actual areas of vegetation removed by surface-disturbing activities. Studies have shown that mule deer will generally avoid human-related activities, and therefore, the amount of suitable habitat loss will be greater than the acreage that is eventually developed (i.e., habitat fragmentation) (D'Eon and Serrouya 2005; Sawyer et al. 2006). For example, Sawyer et al. (2006) found that mule deer were displaced from areas of development on winter range. This study also found that deer were most likely to occur in areas previously predicted as having a low-probability of occurrence up to 3.7 km (2.3 miles) away from development (Sawyer et al. 2006). Although the Sawyer study identified immediate changes on habitat selection, Easterly et al. (1991) found some evidence that mule deer acclimated to human activity associated with construction and production of oil fields. Studies conducted in Wyoming (WGFD 2007) have shown that mule deer will frequently be displaced from or will avoid surface-disturbing activities and infrastructure (e.g., roads, pipelines, and well pads) associated with oil and gas development by a distance of up to approximately 200 meters (656 feet).

As discussed in **Section 3.9.2.1**, a baseline habitat fragmentation model (see **Appendix I**) was conducted to estimate the amount of existing habitat fragmentation that has occurred as a result of existing surface disturbance and infrastructure within the WTP Project Area. Based on the modeling exercise, approximately 17,345 acres of mule deer crucial winter range have already been fragmented by existing surface disturbance. The Proposed Action would increase the extent of fragmented crucial winter range by 16,842 acres. This would result in total, post-development fragmentation of 34,187 acres of mule deer crucial winter range within the WTP Project Area.

Disturbance from human activity could also reduce the relative habitat values for deer within the WTP Project Area, especially during periods of heavy snow cover and cold temperatures (Nicholson et al. 1997). Mule deer typically experience higher levels of physiological stress during the winter, due to higher energy requirements necessary for survival and reproduction (UDWR 1997). Disturbances in crucial winter range could prevent access to areas of sufficient amounts of forage during the winter months. Additionally, roads and well pad development have been identified as bottlenecks during migration, causing disruption of established migratory routes (Sawyer et al. 2005). Lack of suitable forage and access to routes can lead to increased stress and poor nutrition, which is the leading cause of mortality in neo-natal fawns (Pojor and Bowden 2004).

The results of displacement could include reduced use of habitats near disturbances and potential overcrowding of habitats into which the animals were displaced. Overcrowding could cause an increase in competition for forage and space, increase stress levels, and decrease the health of individual deer. Forage competition has been documented between mule deer and other ungulates, such as elk, sheep, and cattle (Beck and Peek 2005; Gill 1999; Packard 1947; Sandoval et al. 2005; Tortenson et al. 2006). As forage competition between mule deer and elk increase, mule deer are more likely to be impacted to a greater extent due to their limited diet (Sandoval et al. 2005). Additionally, higher concentrations of mule deer on smaller areas of landscape can lead to a reduction in forage supply and daily forage intake (Gill 1999). As a result, there could be a decrease in reproductive success and a potential increase for winter mortality.

New roads and increased traffic on new and existing roads could result in increased levels of deer and vehicle collisions, potentially resulting in direct mortality of individuals. Increased access into the WTP Project Area could lead to increases in recreational activities such as OHV use, which could result in increased levels of poaching and/or harassment.

The above-described potential impacts could lead to adverse effects on the Range Creek subunit, which is already below its population objective. However, as previously discussed, the Proposed Action also includes a Wildlife Mitigation Plan that would be fully developed and implemented in consultation with the UDWR, the BLM, and other applicable wildlife agencies and organizations (i.e., the WTPMOC - see **Section 2.2.2.2** and **Appendix B**).

In addition to the benefits discussed in the General Wildlife section, BBC's Wildlife Mitigation Plan commits to funding an ongoing, annual monitoring project whereby basic information on various mitigation projects, as well as limited information on wildlife populations and use areas, would be collected for use in planning for future mitigation projects. Furthermore, as BBC and other operators are proposing year-round drilling, an integral component of their wildlife mitigation plan includes a commitment to annual

coordination with the BLM and UDWR in order to identify winter (November 1 – May 15) drilling locations that would have the least impact on big game species. Provided the Wildlife Mitigation Plan is successfully implemented, potential impacts to wintering mule deer could be partially mitigated.

Elk

Similar to impacts to mule deer, surface disturbances associated with the Proposed Action would result in the direct loss and fragmentation of various UDWR-identified crucial and substantial elk habitats. Direct loss of each specific elk habitat type is summarized below in **Table 4.9-2**.

Table 4.9-2 Approximate Surface Disturbances to UDWR Elk Habitats within the WTP Project Area under the Proposed Action

UDWR-identified Habitat Values	Existing Acreage within the WTP Project Area[1]	Short-term Disturbance (acres)	Long-term Disturbance (acres) (After Interim Reclamation)	Long-term Habitat Loss as a Percentage of Total Available Habitat
Winter Habitat				
Crucial	80,139	2,909	1,564	2.0
Substantial	24,545	295	163	0.7
Additional Habitat Types				
Crucial Summer	10,120	0.1	0	0.0
Substantial Year-long	22,984	257	131	0.6

[1]Minor discrepancies due to rounding

Implementation of the Proposed Action would result in the initial, direct loss of approximately 3,656 acres of wildlife habitats, of which 2,910 acres would occur on crucial winter elk habitat. During the winter, increased impacts from construction, drilling, and completion activities in crucial winter elk habitat could potentially displace elk into other areas of unsuitable habitat or prevent access to winter foraging areas or sufficient water. Surface-disturbing activities could result in reduced habitat use by elk within disturbed areas, increased animal densities in adjoining habitats, and increased stress from intra- and inter-specific competition for resources.

Elk responses to disturbances have been well documented. For example, Van Dyke and Klein (1996) found that elk compensated for site-specific disturbances by shifts in use of habitats, centers of activity, and habitat use. Recent studies conducted in Wyoming (WGFD 2007) have shown that elk will frequently be displaced from or will avoid surface-disturbing activities and infrastructure (e.g., roads, pipelines, and well pads) associated with oil and gas development by a distance of 0.5 and 1.2 miles. As discussed in **Section 3.9.2.1**, a baseline habitat fragmentation model (see **Appendix I**) was conducted to estimate the amount of existing habitat fragmentation that has occurred as a result of existing surface disturbance and infrastructure within the WTP Project Area. Based on the modeling exercise, approximately 54,046 acres of elk crucial winter range within the WTP Project Area have already been fragmented by existing development. The Proposed Action would increase the extent of fragmented crucial

winter range by 20,058 acres. This would result in total, post-development fragmentation of 74,104 acres of elk crucial winter range within the WTP Project Area.

Fragmentation impacts would likely be more pronounced on topographically-restricted migratory corridors, such as along mesa tops or in drainage bottoms. Fragmentation in these areas could deter or preclude the use of these migration corridors by elk, if individuals become displaced or isolated due to increased human activity.

If displaced, elk could move to areas of less suitable habitat, which could lead to decreased reproductive success, increased stress, and competition for forage. Reductions in elk calving rates have been found to be directly linked to human-induced disturbances during calving season (Shively et al. 2005). However, rates were found to return to pre-disturbance levels if the disturbance was removed (Shively et al. 2005). Competition between elk and other ungulates would increase as higher numbers of individuals are displaced to smaller habitats (Packard 1947; Sandoval et al. 2005).

New roads and increased traffic on new and existing roads could result in increased levels of elk and vehicle collisions, resulting in direct mortality of individuals. Edge and Marcum (1991) found a lower level of elk use near roads with higher traffic levels than roads with lower traffic levels. This was pronounced during calving season and near any roads located on ridge tops or within drainage basins (Edge and Marcum 1991). Increased access into the WTP Project Area could lead to increases in recreational activities such as OHV use, which could result in increased levels of poaching and/or harassment. Wisdom et al. (2004) found OHV activities to have a substantial effect on elk behavior caused by increased energy expenditure and displacement from foraging habitat.

Currently, elk population levels in the Range Creek subunit are nearly double the population objective set by the UDWR. Additionally, studies suggest elk ranges do not change after construction activities have been conducted and may not be impacted during construction periods (Van Dyke and Klein 1996; Walter et al. 2006). Therefore, although implementation of the Proposed Action could lead to adverse effects on individual elk, it is doubtful that the Proposed Action would lead to adverse effects on a herd-unit basis. Furthermore, as previously discussed, BBC and other operators' Proposed Action also includes a Wildlife Mitigation Plan that would be fully developed and implemented in consultation with the UDWR, the BLM, and other applicable wildlife agencies and organizations (i.e., the WTPMOC – see **Section 2.2.2.2** and **Appendix B**).

In addition to the benefits discussed under the General Wildlife section, BBC's Wildlife Mitigation Plan commits to funding an ongoing, annual monitoring project whereby basic information on various mitigation projects, as well as limited information on wildlife populations and use areas, would be collected for use in planning for future mitigation projects. Furthermore, as BBC and other operators are proposing year-round drilling, an integral component of their Wildlife Mitigation Plan would includes a commitment to annual coordination with the BLM and UDWR in order to identify winter drilling locations that would have the least impact on big game species. Provided this element of the Wildlife Mitigation Plan is successfully implemented, potential impacts to wintering elk could be partially mitigated or offset.

Rocky Mountain Bighorn Sheep

Like mule deer and elk, surface disturbances associated with the Proposed Action would result in the direct loss and fragmentation of UDWR-identified crucial and substantial Rocky Mountain bighorn sheep habitats. Direct loss of each specific habitat type is summarized in **Table 4.9-3**.

Table 4.9-3 Approximate Surface Disturbances to UDWR Rocky Mountain Bighorn Sheep Habitats within the WTP Project Area under the Proposed Action

UDWR-identified Habitat Values	Existing Acreage within the WTP Project Area[1]	Short-term Disturbance (acres)	Long-term Disturbance (acres) (After Interim Reclamation)	Long-term Habitat Loss as a Percentage of Total Available Habitat
Year-long Habitat				
Crucial	69,339	1,154	609	0.9
Substantial	64,566	2,284	1,239	1.9

[1]Minor discrepancies due to rounding

Implementation of the Proposed Action would result in the direct loss of approximately 1,154 acres of year-long crucial and approximately 2,284 acres of substantial Rocky Mountain bighorn sheep habitat. Direct loss of existing habitat could lead to avoidance of areas surrounding the initial disturbance. This loss of habitat could displace bighorn sheep to other, less suitable habitats, potentially leading to a lack of nutritional forage. As more bighorn sheep utilize a smaller landscape, carrying capacity would decline and mortality would potentially increase (Holl et al. 2004). McKinney et al. (2006) identified nutritional status and predation as two main factors affecting demographic patterns in desert bighorn sheep. These are also likely important to Rocky Mountain bighorn sheep populations. Additionally, Jack Canyon has been identified as a lambing area utilized from mid-March through the end of June. Construction, drilling or completion disturbances in this area during the lambing period could decrease reproductive success of Rocky Mountain bighorn sheep using the WTP Project Area.

Although bighorn sheep may be displaced during periods of construction, studies have shown that bighorn sheep exhibit a strong fidelity to home ranges, even during periods of disturbance (DeCesare and Pletscher 2006; Jansen et al. 2006). Oehler et al. (2005) found that the size of annual home range, composition of diet, and ratios of young to adult females did not differ between female sheep inhabiting mined and unmined areas. Since bighorn sheep have shown habituation to disturbances associated within mining (Jansen et al. 2006; Oehler et al. 2005), some habituation to well development and road construction would likely occur under the Proposed Action.

New roads and increased traffic on new and existing roads could result in increased levels of vehicle collisions with bighorn sheep, potentially resulting in direct mortality of individual bighorn. Bighorn sheep may congregate on roads treated with a salt-mix application during the winter, increasing the likelihood of vehicle collisions (Bertwistle 1999). Furthermore, increased access into the WTP Project Area could lead to increases in recreational activities such as OHV use, which could result in increased

levels of poaching and/or harassment. These traffic and road-related impacts are of particular concern in Nine Mile and Cottonwood Canyons, as Rocky Mountain bighorn sheep continue to expand their range northward. Although collisions could potentially impact bighorn sheep, it is not clear if displacement would occur due to the construction of new roads. Research in Rocky Mountain National Park suggested high levels of human disturbance may be affecting sheep behavior to a point where the sheep are more susceptible to disease and predation (National Park Service [NPS] 2004). However, it is important to note that traffic volumes within the WTP Project Area would not likely be as high as those in Rocky Mountain National Park. Conversely to the NPS study (2004), Bertwistle (1999) documented that bighorn sheep are not disturbed by traffic volumes and may become de-sensitized to traffic volumes.

The Range Creek subunit of Rocky Mountain bighorn sheep is approaching its population objective level. Since studies have shown evidence of habituation to human-induced disturbances (Bertwistle 1999; Jansen et al. 2006; Oheler et al. 2005), it is doubtful that the Proposed Action would lead to adverse effects on a herd-unit basis.

4.9.1.3 Birds

Raptors

Implementation of the Proposed Action could affect breeding, nesting, and wintering raptors, depending on the location of proposed wells, access roads, pipelines, worker housing, and other surface-disturbing actions relative to occupied territories, active or inactive nest sites, wintering areas, and the seasonal or daily timing of Proposed Action activities.

Surface-disturbing activities or areas with concentrated human activity in close proximity to an active raptor nest could lead to nest failure or nest abandonment, thereby affecting the breeding pair and their annual productivity. Studies have shown that human activity and disturbances cause changes in virtually all aspects of raptor breeding activity (Steidl and Anthony 1996). Since many raptors can alternate between nest sites within a breeding territory, any surface facilities where ongoing traffic or human presence occurs could prevent inactive nests from being used in the future. Steidl and Anthony (1996) suggest that the greatest energetic costs from disturbance occur in nestlings, potentially decreasing overall reproductive success. Reduced reproductive success could continue throughout the LOP, particularly where inactive nests are located near heavy traffic roads or areas with intense human activity. Although human activity has been shown to adversely impact breeding raptors, some evidence of raptor habituation to human-induced disturbances has also been documented (Andersen et al. 1989; Rodriguez-Estrella et al. 1998; Steidl and Anthony 1996). For example, Ritchie (1991) documented raptors nesting on oil field equipment in Northern Alaska.

In addition to reducing suitable nesting habitat, surface disturbances associated with the Proposed Action would result in the direct loss of approximately 3,656 acres of habitat for raptor prey species such as small mammals, songbirds, and reptiles. Rodriguez-Estrella et al. (1998) identify loss or fragmentation of habitat for prey species as a contribution to overall loss of raptor populations.

Construction, drilling, and completion activities could also result in avoidance or displacement from affected areas due to visual disturbances on the landscape, noise

from equipment use or other human activity, and increased vehicle traffic. Displacement could lead to increased use of adjacent habitats, which could consequently lead to increased inter- and intra-specific competition for resources.

Upland Game Birds

Potential impacts to the greater sage-grouse are discussed in **Section 4.10.** Since impacts to the blue grouse and chukar would be similar in nature, these species are grouped together for impact analysis under the Proposed Action. Direct loss of each specific habitat type is summarized below in **Table 4.9-4**.

Table 4.9-4 Approximate Surface Disturbances to UDWR Upland Game Bird Habitats within the WTP Project Area under the Proposed Action

UDWR-identified Habitat Values	Existing Acreage within the WTP Project Area[1]	Short-term Disturbance (acres)	Long-term Disturbance (acres) (After Interim Reclamation)	Long-term Habitat Loss as a Percentage of Total Available Habitat
Blue Grouse Habitat				
Crucial Year-long	36,245	882	486	1.3
Chukar Habitat				
Crucial Winter	43,639	969	499	1.1
Crucial Year-long	1,011	0	0	0.0

[1]Minor discrepancies due to rounding

Potential impacts to upland game birds would include the removal of potential nesting and foraging habitats. Construction, drilling, and completion activities that take place during the spring or summer months could lead to decreased reproductive success, nest abandonment, or direct impacts to nest sites. Increased construction of roads and vehicle traffic within the WTP Project Area could also lead to increased potential for vehicle collisions with upland game birds. Increased access and human presence within the WTP Project Area has the potential to increase poaching and harassment of upland game birds, as well as increase hunter access and success. Other potential impacts to individual birds would include increased potential for contact with petroleum-based products in reserve pits and water management facilities, which could lead to project-related mortality.

Visual and auditory impacts related to construction, drilling, and completion activities could also lead to displacement from suitable foraging and nesting habitats (Endrulat et al. 2005). Displaced game birds could move to areas of less suitable habitat where levels of competition for resources may be higher.

Migratory Birds

Impacts to migratory birds in the WTP Project Area under the Proposed Action would be similar for all migratory bird species, but would vary depending on the affected habitat types (i.e., loss of Utah GAP vegetation communities) and species' sensitivities to disturbance. For the purposes of impact analysis in this EIS, impacts to migratory birds within the WTP Project Area are discussed together. Proposed surface disturbance

estimates for Utah GAP vegetative communities, which provide habitats for migratory birds, are summarized in **Section 4.8.1**. In addition, although implementation of the Proposed Action could affect all migratory bird species within the WTP Project Area, impacts would likely have the greatest effect on UPIF Priority Species due to their smaller population sizes and limited distribution.

Implementation of the Proposed Action and associated impacts would depend on seasonal timing of construction, drilling, and completion activities. During the fall or winter months, many of the migratory bird species would have left the WTP Project Area for southern wintering grounds. Surface disturbances, visual, and noise-related (e.g., changes in volume, tone, or frequency of ambient noise) impacts during this time would not impact most individual birds or nesting locations. However, the Proposed Action could result in reproductive failure of breeding adults, nest abandonment, and direct impacts to nest sites if activities are conducted during the spring and summer months.

Fragmentation of habitat and associated edge avoidance by migratory birds has been documented as leading to lower levels of productivity in the area (Renfrew et al. 2005). Associated noise and increased human presence could cause displacement from foraging or nesting habitats. If displaced birds move to less suitable habitats, an increase in competition, deteriorated physical condition, increase in competition levels, and decrease in reproductive success could occur. Increased roads and vehicle traffic levels could lead to increased vehicle collisions with migratory birds. Additional impacts to individual migratory birds could include contact with petroleum-based products in reserve pits and water management facilities, which could lead to increased levels of mortality.

4.9.1.4 Fisheries

Direct and indirect impacts on fish and fish habitats could result from implementation of the Proposed Action. Total average annual water use for drilling, completion, and dust suppression under the Proposed Action would be approximately 228 acre-feet per year (75 percent from surface water sources and 25 percent from new water supply wells) and 407 acre-feet per year during peak development (75 percent from surface water sources and 25 percent from new water supply wells). Depletion of surface water from Nine Mile Creek, Dry Creek, and Cottonwood Creek would result in a reduction of water flow within and downstream of the WTP Project Area, which could lead to habitat loss and/or degradation for aquatic species. For example, depletion of surface water from Nine Mile Creek would reduce total flow of Nine Mile Creek by 1.15 percent annually over the development period. Likewise, if new water supply wells within the Douglas Aquifer are considered to be tributary to these systems, depletions from these wells would also result in a reduction of water flow within and downstream of the WTP Project Area, which could lead to habitat loss and/or habitat degradation for aquatic species.

Additionally, fish habitats would be affected by increased erosion and sediment deposition that could be yielded into waterways through drainages or surface water runoff via well pads, pipelines, or roads. Similarly, condensate could potentially be yielded to waterways, and subsequently to the Green River system, if any pipeline or wellhead spills were to occur during a storm event. Erosion leading to sediment loading into streams has been identified as resulting in lower fish species density (Gorman and Karr 1978; Ross et al. 2001). Additionally, increased levels in disturbances such as sediment deposition and spills, can lead to a reduction in invertebrate species richness

and thereby a reduction in prey availability for many fish species (Robinson and Minshall 1986). Therefore, increased annual erosion and sediment deposition within the WTP Project Area could potentially lower fish species density and decrease invertebrate prey species for fish. Surface-disturbing activities and subsequent erosion under the Proposed Action could increase sediment loading to Nine Mile Creek by about 0.46 percent in the short-term and about 0.16 percent in the long-term. This increased sediment loading could lead to slightly higher temperatures in Nine Mile Creek, which could have an adverse effect on fisheries and other aquatic species. Conservatively assuming that all sediment delivered to Nine Mile Creek is eventually transported to the Green River, the Proposed Action would increase sediment loading to the Green River by about 0.011 percent in the short-term and 0.0039 percent in the long-term (see **Section 4.5**).

Under the Proposed Action, implementation of the dust suppression plan (**Appendix R**) on Nine Mile Canyon Road, in between Harmon and Cottonwood Canyons (and on portions of Harmon, Gate, and Cottonwood Canyon Roads), would substantially reduce fugitive dust from industrial traffic, and therefore would reduce sediment deposition to aquatic habitats within these canyons. Although topical application of lignin sulfonates or soluble polymers on these canyon roads would reduce fugitive dust, these dust suppressants could negatively affect water quality and fish within and downstream, of the WTP Project Area. High levels of lignin sulfonates in water increase biological oxygen demand, which can reduce biological activity. Environmental impacts on water resources are discussed in detail in **Section 4.5**.

Although fish populations would be impacted by various individual disturbance events, some applicant-committed measures listed in **Table 2.2-6** would reduce potential impacts to fish species caused by increased erosion and sediment deposition. These measures include provisions for preventing sediment loading and hydrocarbon spills into waterways within the WTP Project Area.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible Effects

Displacement of wildlife from the WTP Project Area could be considered irreversible in that changes to migration patterns or behaviors may preclude use of an area for an extended period of time beyond the life of the project.

Irretrievable Effects

The Proposed Action would result in the loss of foraging, breeding, and cover habitats for wildlife in the WTP Project Area.

The Proposed Action would result in the loss of crucial winter habitats for big game.

Changes in water quality could lead to habitat degradation and decreased reproductive success for fish.

4.9.2 Alternative B – No Action Alternative

General impacts common to all wildlife species resulting from implementation of the No Action Alternative would be similar in nature to those discussed under the Proposed Action with the following noted exceptions:

- The magnitude of known and potential habitat disturbance due to direct habitat loss, increased erosion, sediment yield, and potential for exposures to hazardous substances in the event of a spill would be less under the No Action Alternative because development of new gas wells would only occur on State of Utah and private surfaces; and
- The intensity of development and associated impacts would be less under the No Action Alternative because development would occur on a shorter, less intense drilling schedule with substantially less surface disturbance (e.g., due to fewer wells drilled and fewer temporary worker housing locations) in comparison to the Proposed Action.

4.9.2.1 General Wildlife

Impacts to general wildlife species under the No Action Alternative would be similar in nature to those discussed under the Proposed Action; however, comparatively, the magnitude and intensity of impacts related to habitat loss, degradation, and fragmentation would be less under the No Action Alternative. Implementation of the No Action Alternative would result in an initial loss of approximately 626 acres of wildlife habitat associated with the construction, drilling, and completion of wells, along with the construction of roads, pipelines, related facilities, and infrastructure. These construction activities would all reduce habitat availability for a variety of common wildlife species.

Overall, the severity of impacts to general wildlife species under the No Action Alternative would depend on the seasonal and daily timing of construction, drilling, and completion activities, the site-specific topography and vegetation, the sensitivity of the species to human disturbance, and the availability and proximity of suitable habitat within and outside the WTP Project Area.

4.9.2.2 Big Game

Impacts to big game species would be similar in nature to those discussed under the Proposed Action; however, comparatively, the magnitude and intensity of impacts related to habitat loss, degradation, and fragmentation would be less under the No Action Alternative. Species-specific impacts to big game found within the WTP Project Area are discussed in detail below.

Mule Deer

Surface disturbances associated with the No Action Alternative would result in the direct loss and fragmentation of various UDWR-identified crucial and substantial mule deer habitats. Direct loss of each specific habitat type is summarized below in **Table 4.9-5**.

Table 4.9-5 Approximate Surface Disturbances to Mule Deer Habitats within the WTP Project Area under the No Action Alternative				
UDWR-identified Habitat Values	**Existing Acreage within the WTP Project Area[1]**	**Short-term Disturbance (acres)**	**Long-term Disturbance (acres) (After Interim Reclamation)**	**Long-term Habitat Loss as a Percentage of Total Available Habitat**
Winter Habitat				
Crucial	73,600	433	223	0.3
Substantial	47,115	70	29	0.1
Additional Habitat Types				
Crucial Spring/Fall	4,804	47	17	0.4
Crucial Summer	8,634	17	7	0.8

[1]Minor discrepancies exist due to rounding.

The No Action Alternative could potentially lead to adverse effects on individual mule deer; however, given the small percentage of total impacted deer habitats within the WTP Project Area, mule deer in the Range Creek subunit would not likely be affected on a herd-unit level basis.

Elk

Similar to impacts to mule deer, surface disturbance associated with the No Action Alternative would result in the direct loss and fragmentation of various UDWR-identified crucial and substantial elk habitats. Direct loss of each specific habitat type is summarized below in **Table 4.9-6**.

Table 4.9-6 Approximate Surface Disturbances to Elk Habitats within the WTP Project Area under the No Action Alternative				
UDWR-identified Habitat Values	**Existing Acreage within the WTP Project Area[1]**	**Short-term Disturbance (acres)**	**Long-term Disturbance (acres) (After Interim Reclamation)**	**Long-term Habitat Loss as a Percentage of Total Available Habitat**
Winter Habitat				
Crucial	80,139	482	241	0.3
Substantial	24,545	0	0	0.0
Additional Habitat Types				
Crucial Summer	10,120	0.1	0	0.0
Substantial Year-long	22,984	85	34	0.1

[1]Minor discrepancies exist due to rounding.

The No Action Alternative could potentially lead to adverse effects on individual elk; however, given the small percentage of total impacted elk habitats within the WTP Project Area, elk in the Range Creek subunit would not likely be affected on a herd-unit level basis.

Rocky Mountain Bighorn Sheep

Like mule deer and elk, surface disturbances associated with the No Action Alternative would result in the direct loss and fragmentation of UDWR-identified crucial and substantial Rocky Mountain bighorn sheep habitats. Direct loss of each specific habitat type is summarized below in **Table 4.9-7**.

Table 4.9-7 Approximate Surface Disturbances to UDWR Rocky Mountain Bighorn Sheep Habitats within the WTP Project Area under the No Action Alternative

UDWR-identified Habitat Values	Existing Acreage within the WTP Project Area[1]	Short-term Disturbance (acres)	Long-term Disturbance (acres) (After Interim Reclamation)	Long-term Habitat Loss as a Percentage of Total Available Habitat
Year-long Habitat				
Crucial	69,339	198	92	0.1
Substantial	64,566	369	183	0.3

[1]Minor discrepancies exist due to rounding.

The Range Creek subunit of Rocky Mountain bighorn sheep is approaching its population objective level set by the UDWR. Studies have shown evidence of habituation to human-induced disturbances (Bertwistle 1999; Jansen et al. 2006; Oehler et al. 2005). As such, given the small percentage of total impacted Rocky Mountain bighorn sheep habitats within the WTP Project Area, Rocky Mountain bighorn sheep would not likely be affected on a herd-unit level basis.

4.9.2.3 Birds

Raptors

Impacts to raptors under the No Action Alternative would be similar in nature to those discussed under the Proposed Action; however, comparatively, the magnitude and intensity of impacts related to habitat loss, fragmentation, and degradation would be substantially less under the No Action Alternative.

Upland Game Birds

Impacts to upland game birds under the No Action Alternative would be similar in nature to those discussed under the Proposed Action; however, comparatively, the magnitude and intensity of impacts related to habitat loss and degradation to upland game birds would be less under the No Action Alternative. Potential impacts to the greater sage-grouse are discussed in **Section 4.10**. Since impacts to the blue grouse and chukar would be similar in nature, these species are grouped together for impact analysis under the No Action Alternative. Direct loss of each specific habitat type is summarized below in **Table 4.9-8**.

Table 4.9-8 Approximate Surface Disturbances to UDWR Upland Game Bird Habitats within the WTP Project Area under the No Action Alternative			
UDWR-identified Habitat Values	**Existing Acreage within the WTP Project Area[1]**	**Short-term Disturbance (acres)**	**Long-term Disturbance (acres) (After Interim Reclamation)**
Blue Grouse Habitat			
Crucial Year-long	36,245	145	73
Chukar Habitat			
Crucial Winter	43,639	167	79
Crucial Year-long	1,011	0	0

[1]Minor discrepancies existing due to rounding.

Under the No Action Alternative, surface disturbance to nesting and breeding habitats could affect individual upland game birds inhabiting the WTP Project Area. However, these impacts would likely be less than under the Proposed Action, given the small percentage of upland game bird habitats that would be affected by surface disturbance activities.

Migratory Birds

Impacts to migratory birds under the No Action Alternative would be similar in nature to those discussed under the Proposed Action; however, comparatively, the magnitude and intensity of impacts related to habitat loss and degradation to migratory birds would be substantially less under the No Action Alternative. Impacts would be greatest on UPIF Priority, due to their smaller population sizes and limited distribution.

4.9.2.4 Fisheries

Impacts to fisheries under the No Action Alternative would be similar in nature to those discussed under the Proposed Action with the following noted exceptions:

- Impacts related to water depletion would be less under the No Action Alternative because less water would be used for well development and dust suppression. Total annual water used for drilling, completion, and dust suppression under the No Action Alternative would be approximately 141 acre-feet per year (75 percent from surface water sources and 25 percent from new water supply wells).
- Impacts related to depletion of surface water from Nine Mile Creek, Dry Creek, and Cottonwood Creek would be less under the No Action Alternative. For example, depletion of surface water from Nine Mile Creek would reduce total flow from Nine Mile Creek by approximately 0.71 percent annually over the approximately 2-year development period.
- Impacts related to increased annual sediment loading would be less under the No Action Alternative. As discussed in **Section 4.5.2.1**, the No Action Alternative would increase sediment loading to Nine Mile Creek by about 0.086 percent in the short-term (about 0.028 percent in the long-term), and could increase

sediment loading to the Green River by about 0.002 percent in the short-term (about 0.0007 percent in the long-term).

Overall, the magnitude and intensity of impacts related to habitat loss and degradation to fisheries would likely be substantially less under the No Action Alternative as compared to the Proposed Action.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects under the No Action Alternative would be the same as under the Proposed Action.

4.9.3 Alternative C – Transportation Reduction Alternative

Impacts to wildlife under Alternative C would be similar in nature to those discussed under the Proposed Action with the following noted exceptions:

- Impacts related to intensity of development and season of development would be less under Alternative C than under the Proposed Action due to restrictions imposed on the number of rigs allowed to operate within the WTP Project Area at any one time. Of the allowable six rigs, only two would operate year-round, including during the winter season (November 1 - May 15), and the remaining four rigs would operate on a seasonal basis, excluding the winter season. Under this drilling scenario for Alternative C, the development phase of the project would occur over 15 years (in comparison to an 8-year development phase under the Proposed Action);
- Impacts related to intensity of development would be further constrained by limits on new annual surface disturbance (approximately 280 acres per year), total unreclaimed surface disturbance allowed at any given time (approximately 2,250 acres), and maximum long-term disturbance (approximately 1,839 acres);
- Impacts related to winter drilling would be less under Alternative C because of the special protection measures described in **Section 2.4.1.2** for high-country watersheds and wildlife;
- Seasonal and/or year-round gating of select roads would reduce traffic-related impacts and human-related impacts (such as harassment of wildlife, poaching, and hunter access and success) on wildlife species;
- Alternative C includes the Agency Wildlife Mitigation Plan (**Appendix E**), which outlines proposed mitigation for natural gas full field development in the WTP Project Area. The agencies' mitigation plan emphasizes the importance of offsetting, to the extent reasonable, the effects of the full field development in its entirety. As applies to this section of the EIS, the agencies' plan gives priority to compensation for potential effects to deer, raptors, elk, and sage-grouse;
- Alternative C includes numerous BMPs and mitigating measures in **Table 2.6-7** and **Table 2.6-8**, respectively, that would directly or indirectly serve to eliminate, avoid, reduce, or partially mitigate impacts to wildlife resources.
- Alternative C also includes the Long-Term Monitoring Plan for Water Resources (**Appendix Q**). The overall objective of the monitoring plan is to document

changes in water quality and quantity that could potentially occur to WTP Project Area streams and their tributaries, the Green River, groundwater, and springs over the life of the project. These data would be used to guide mitigation measures for water resources, which would indirectly reduce impacts to fish and other wildlife species related to increased sedimentation and changes in water quality.

4.9.3.1 General Wildlife

Impacts to general wildlife species under Alternative C would be similar in nature to those discussed under the Proposed Action; however, comparatively, the intensity of habitat loss, degradation, and fragmentation would be less under Alternative C. Implementation of Alternative C would result in a loss of approximately 3,640 acres of wildlife habitats associated with the construction, drilling, and completion of wells, along with the construction of roads, pipelines, related facilities, and infrastructure. These construction activities would all reduce habitat availability for a variety of common wildlife species. The short-term reduction in habitat is expected to have a minor to moderate impact on general wildlife species because 1) many of the "general" wildlife species are habitat generalists, 2) surface disturbance thresholds would limit the total disturbance at any one time, and 3) many of the BMPs and mitigating measures in **Table 2.6-7** and **Table 2.6-8** would afford some protection to general wildlife species or reduce the intensity of potential impacts. Year-round gating of Horse Bench, and seasonal gating of select existing roads during the winter season would reduce potential traffic-related impacts and human-related impacts (such as harassment of wildlife, poaching, and hunter access and success) on wildlife species.

Overall, the severity of impacts to general wildlife species under Alternative C would depend on the seasonal and daily timing of construction, drilling, and completion activities, the site-specific topography and vegetation, the sensitivity of the species to human disturbance, and the availability and proximity of suitable habitat within and outside the WTP Project Area.

Agency Wildlife Mitigation Plan

The Price Field Office in coordination with the UDWR has developed a Wildlife Mitigation Plan, which outlines proposed mitigation for natural gas full field development in the WTP Project Area (see **Appendix E**). The Agency Wildlife Mitigation Plan, which is a modified version of BBC's Wildlife Mitigation Plan, emphasizes the importance of offsetting, to the extent reasonable, the effects of the full field development in its entirety. The agencies' plan gives priority to compensating for potential effects to greater sage-grouse, mule deer, elk, and raptors.

The Agency Wildlife Mitigation Plan would require mitigation at a 4:1 acre-for-acre ratio based on total potential long-term surface disturbance. This ratio generally serves as the limitation on the extent to which operators would be required to mitigate. Under the Agency Wildlife Mitigation Plan, 30 percent of the total potential long-term surface disturbance (approximately 552 acres under Alternative C) would be mitigated at a 4:1 ratio (for a total of approximately 2,208 acres) during the first 3 years following a decision to authorize the full field development project. As part of this initial effort, the following measures would be implemented:

- Habitat improvement and connectivity as described in the operators' plan. This would be implemented at a 4:1 ratio as indicated above;
- Wet meadow/summer range enhancement as described in the operators' plan. Up to six projects would be implemented; and
- The operators would contribute to UDWR for monitoring greater sage-grouse, whether through continued telemetry study or other, more aggressive means of monitoring, if necessary, including experimental designs.

The Agency Wildlife Mitigation Plan would also establish an oversight committee to be led by the BLM, in coordination with UDWR, and other agencies. The WTPMOC would evaluate the implementation and effectiveness of mitigation measures, provide direction on effective means of mitigating planned development activities, and develop adaptive strategies and projects to mitigate beyond the initial 30 percent commitment. The WTPMOC would complete evaluations and make determinations on on-going and planned mitigation activities on an annual basis, in advance of considerations for winter activities (as is outlined under Alternative C), and prepare a report on its findings.

Adaptive strategies beyond the initial mitigation effort could include a broad menu of mitigation options. The relative value of the various options would be determined by the WTPMOC such that their value can be applied toward the operators' 4:1 mitigation requirement.

Mitigation options which would be considered by the WTPMOC for implementation of the plan include, but are not limited to, the following actions:

- Additional habitat improvement and connectivity projects. A variety of methods could be used, targeting a range of vegetative communities and habitats, including wet meadow/summer range;
- Continued or more aggressive monitoring of greater sage-grouse, including experimental designs;
- Conversions of grazing allotments around Nine Mile Canyon from domestic sheep to cattle (this could provide for the reintroduction of bighorn sheep into Nine Mile Canyon and would help mitigate the loss of bighorn sheep habitats);
- The purchase of conservation easements on private lands; and
- Management of private lands for the benefit of wildlife.

The WTPMOC would recognize, within the 4:1 parameter, mitigation activities on Federal, State, and private lands, including those which build upon or complement past commitments by operators to mitigate activities authorized under previous analyses and associated decisions.

Like activities associated with natural gas development and other public land uses, implementation of the Agency Wildlife Mitigation Plan would result in both positive and negative impacts on wildlife species and habitats, and potentially other public land uses and resources. The potential impacts of the Agency Wildlife Mitigation Plan, both positive and negative, are discussed in the following sections. As appropriate, additional information is provided within the species-specific impact analysis discussions.

The conversion of pinyon-juniper habitats into sagebrush habitats would have a substantial beneficial effect on sage-grouse and mule deer. However, the proposed mitigation would reduce habitat availability for species that occur within or use pinyon-juniper habitat. As discussed in **Section 3.8**, there are approximately 51,000 acres of pinyon-juniper habitat and 23,000 acres of sagebrush habitat within the WTP Project Area. Thus, the positive effects of creating or improving sagebrush habitat (which is a declining vegetative community in the west and provides key habitat for a number of wildlife species) would generally outweigh the potential negative impacts of habitat loss in the more widespread pinyon-juniper community. Initial areas proposed for pinyon-juniper treatment are illustrated in **Figure 2.2-1**.

Sage-grouse use of limited wet meadow habitats, pond margins, and spring areas indicate a preference for this habitat type during brood rearing (Klebenow 1969, Connelly & Markham 1983, Connelly et al. 1988). Therefore, proposed mitigation designed to increase these habitats would be beneficial to sage-grouse brood survival by increasing forbs and habitat for invertebrates. Under the Wildlife Mitigation Plan, wet meadow enhancement would involve locating spring sources and if topography allows, re-contouring the spring sources to distribute the water over as much surface area as possible creating a sub-irrigated meadow. These areas would be attractive to big game and livestock and might require fencing to protect the values for sage-grouse. However, in order to avoid adverse impacts to livestock that use the affected springs, water from affected springs would also be piped to a trough or stock watering pond. Creation of troughs or stock watering ponds would also benefit other wildlife species by providing water sources not previously available. Negative impacts resulting from wet meadow enhancements would include a potential but minor reduction in flow within streams in Dry, Harmon, Cottonwood, and Prickly Pear Canyons, which have long stretches of channel that exhibit intermittent seasonal flows that are fed by discharge from springs.

Summer range improvements would involve sagebrush removal in sage-grouse summer range using mechanical treatments with the goal of replacing the existing sagebrush with newer, younger, more vigorous sagebrush stands of similar percent land cover, type, and mosaic patterns. Increased grass and forb production resulting from these treatments would benefit sage-grouse broods as well as mule deer. Small mammal populations could increase from these types of summer range treatments as a result of increases in forage, thereby providing increased prey base for raptors. In turn, however, the proposed summer range improvements would remove or reduce some mature sagebrush, which would reduce habitat for sagebrush obligate species such as the sagebrush lizard, sage sparrow, sage thrasher, and Brewer's sparrow.

Mitigation that would require the operators to contribute funds to UDWR monitoring projects would benefit wildlife species and habitats within the WTP Project Area by contributing to the UDWR's (and BLM's) knowledgebase regarding wildlife population numbers and trends. These data would in part be used to help the WTPMOC make decisions regarding future mitigation projects in the WTP Project Area; the data gathered would help facilitate an adaptive management approach for the Wildlife Mitigation Plan.

The purchase of conservation easements on private lands and management of private lands for the benefit of wildlife would result in a positive impact on wildlife species. Specific beneficial effects would be highly dependent upon the characteristics (e.g., vegetation community, topography, and level of existing disturbance) and locations of the private lands selected for conservation easements and wildlife management

activities the management activities implemented, and the species targeted for wildlife management.

4.9.3.2 Big Game

Impacts to big game species would be similar in nature to those discussed under the Proposed Action; however, comparatively, the intensity of impacts related to habitat loss, degradation, and fragmentation would be less under Alternative C. Species-specific impacts to big game species found within the WTP Project Area are discussed in detail below. Surface disturbances specific to the construction of the proposed Trail Canyon route are listed separately from those that would occur within the WTP Project Area.

Mule Deer

Surface disturbances associated with Alternative C would result in the direct loss and fragmentation of UDWR-identified crucial and substantial mule deer habitats. Direct loss of each specific habitat type is summarized below in **Table 4.9-9**.

Table 4.9-9 Approximate Disturbances to UDWR Mule Deer Habitats within the WTP Project Area under Alternative C

UDWR-identified Habitat Values	Existing Acreage within the WTP Project Area[1]	Short-term Disturbance (acres)	Long-term Disturbance (acres) (After Interim Reclamation)	Long-term Habitat Loss as a Percentage of Total Available Habitat
Winter Habitat				
Crucial	73,600	2,441	1,272	1.7
Substantial	47,115	928	498	1.1
Substantial[2]	N/A	12	9	N/A
Additional Habitat Types				
Crucial Spring/Fall	4,804	51	19	0.4
Crucial Spring/Fall[2]	N/A	2	2	N/A
Crucial Summer (Fawning Habitat)	8,634	30	11	0.1

[1]Minor discrepancies existing due to rounding.
[2]Disturbances within this habitat would occur outside of the WTP Project Area during construction of the proposed Trail Canyon alternative access route.

Implementation of Alternative C would result in the direct loss of approximately 3,640 acres of wildlife habitats, of which approximately 2,441 acres would occur on crucial winter mule deer habitat. During the winter, construction, drilling, and completion activities in crucial winter mule deer habitat could potentially displace deer into other areas of unsuitable habitat or prevent access to winter foraging areas or sufficient water. In addition, habitat loss and fragmentation resulting from these disturbances could result in reduced habitat use by mule deer within disturbed areas, increased animal densities in adjoining habitats, and increased stress from intra- and inter-specific competition for resources. However, based on the special protective measures provided in **Section 2.4.1.2** (e.g., restrictions that would limit project-related vehicle traffic within the dawn and dusk hours when mule deer are most active, as well as snow removal requirements

that would improve animal movement during the WTP Project Area), potential impacts to mule deer related to winter drilling in crucial winter range would be reduced as compared to the Proposed Action. Also important to note is that under the drilling scenario for Alternative C, the development phase of the project would occur over 15 years (in comparison to an 8-year development phase under the Proposed Action). This increase in the development phase period would decrease the intensity of surface-disturbing activities and related effects on mule deer. Thus while, surface disturbance would be nearly equal under the Proposed Action and Alternative C, implementation of surface-disturbing activities would not be as temporally concentrated under Alternative C.

Furthermore, many of the alternative-specific components of Alternative C, in particular those that limit traffic and those that reduce the number of rigs allowed to operate at any one time, would reduce potential traffic-related impacts to mule deer. For example, year-round gating of new roads that longer than 2 miles; all new roads that provide access to proposed wells within the Jack Canyon and Desolation Canyon WSAs, and the road to Horse Bench, as well as seasonal gating of Prickly Pear, Harmon, and Cottonwood Canyons could reduce potential road and traffic-related impacts, and harassment of wildlife and poaching of mule deer (NM Department of Fish and Game 2005; WGFD 2007; USFS 2009).

The above-described potential impacts could lead to adverse effects on the Range Creek and Anthro subunits, which are below their population objectives. However, Alternative C also includes an Agency Wildlife Mitigation Plan (**Appendix E**) that would be fully developed and implemented in consultation with the UDWR, the BLM, and other applicable wildlife agencies and organizations. Benefits of the Agency Wildlife Mitigation Plan on mule deer would be similar to those described for the BBC Wildlife Mitigation Plan as discussed under the Proposed Action. Furthermore, provided the objectives of the Agency Wildlife Mitigation Plan are successfully met, habitat loss impacts to mule deer from Alternative C could be partially mitigated.

Based on the above information, implementation of Alternative C would not likely lead to adverse effects to mule deer on a herd unit basis.

Elk

Similar to impacts to mule deer, surface disturbances associated with Alternative C would result in the direct loss and fragmentation of UDWR-identified crucial and substantial elk habitats. Direct loss of each specific habitat type is summarized in **Table 4.9-10**.

Table 4.9-10 Approximate Surface Disturbances to UDWR Elk Habitat within the WTP Project Area under Alternative C

UDWR-identified Habitat Values	Existing Acreage within the WTP Project Area[1]	Short-term Disturbance (acres)	Long-term Disturbance (acres) (After Interim Reclamation)	Long-term Habitat Loss as a Percentage of Total Available Habitat
Winter Habitat				
Crucial	80,139	2,868	1,503	1.9
Substantial	24,545	287	142	0.6

Table 4.9-10 Approximate Surface Disturbances to UDWR Elk Habitat within the WTP Project Area under Alternative C				
UDWR-identified Habitat Values	**Existing Acreage within the WTP Project Area[1]**	**Short-term Disturbance (acres)**	**Long-term Disturbance (acres) (After Interim Reclamation)**	**Long-term Habitat Loss as a Percentage of Total Available Habitat**
Additional Habitat Types				
Crucial Summer	10,120	0.1	0	0.0
Substantial Year-long	22,984	295	154	0.7
Substantial Year-long[2]	N/A	14	10	N/A

[1]Minor discrepancies existing due to rounding.
[2]Disturbances within this habitat would occur outside of the WTP Project Area during construction of the proposed Trail Canyon alternative access route.

Implementation of Alternative C would result in the direct loss of approximately 3,640 acres of wildlife habitats, of which approximately 2,868 acres would occur on crucial winter elk habitat. During the winter, construction, drilling, and completion activities in crucial winter elk habitat could potentially displace elk into other areas of unsuitable habitat or prevent access to winter foraging areas or sufficient water. In addition, habitat loss and fragmentation resulting from these disturbances could result in reduced habitat use by elk within disturbed areas, increased animal densities in adjoining habitats, and increased stress from intra- and inter-specific competition for resources. However, based on the special protective measures provided in **Section 2.4.1.2** (e.g., restrictions that would limit project-related vehicle traffic within the dawn and dusk hours when elk are most active, as well as snow removal requirements that would improve animal movement during the WTP Project Area), potential impacts to elk related to winter drilling in crucial winter range would be reduced or avoided. Also important to note is that under the drilling scenario for Alternative C, the development phase of the project would occur over 15 years (in comparison to an 8-year development phase under the Proposed Action). This increase in the development phase would decrease the intensity of surface-disturbing activities and related effects on elk. Thus while, surface disturbance would be nearly equal under the Proposed Action and Alternative C, implementation of surface-disturbing activities would not be as temporally concentrated under Alternative C.

Furthermore, many of the alternative-specific components of Alternative C, in particular those that limit traffic and those that reduce the number of rigs allowed to operate at any one time, would reduce potential traffic-related impacts to elk. For example, year-round gating of new roads that longer than 2 miles; all new roads that provide access to proposed wells within the Jack Canyon and Desolation Canyon WSAs, and the road to Horse Bench, as well as seasonal gating of Prickly Pear, Harmon, and Cottonwood Canyons could reduce potential traffic-related impacts such as displacement, and harassment of wildlife and poaching of elk (Claire and Forest 2009; NM Department of Fish and Game 2005; WGFD 2007; USFS 2009).

Additionally, if the objectives of Agency Wildlife Mitigation (**Appendix E**) are successfully met, habitat loss impacts to elk from Alternative C could be largely mitigated. Benefits of

the Agency Wildlife Mitigation Plan on elk would be similar to those described in the BBC Wildlife Mitigation Plan as discussed under the Proposed Action.

Based on the above information, and given that elk population levels in the Range Creek and Anthro subunits currently exceed their population objectives set by the UDWR, implementation of Alternative C would not likely lead to adverse effects to elk on a herd unit basis.

Rocky Mountain Bighorn Sheep

Like mule deer and elk, surface disturbances associated with Alternative C would result in the direct loss and fragmentation of UDWR-identified crucial and substantial Rocky Mountain bighorn sheep habitats. Direct loss of each specific habitat type is summarized in **Table 4.9-11**.

Table 4.9-11 Approximate Surface Disturbances to UDWR Rocky Mountain Bighorn Sheep Habitats within the WTP Project Area under Alternative C

UDWR-identified Habitat Values	Existing Acreage within the WTP Project Area[1]	Short-term Disturbance (acres)	Long-term Disturbance (acres) (After Interim Reclamation)	Long-term Habitat Loss as a Percentage of Total Available Habitat
Year-long Habitat				
Crucial	69,339	1,178	609	0.9
Crucial[2]	N/A	9	7	N/A
Substantial	64,566	2,243	1,176	1.8
Substantial[2]	N/A	5	4	N/A

[1]Minor discrepancies existing due to rounding.
[2]Disturbances within this habitat would occur outside of the WTP Project Area during construction of the proposed Trail Canyon alternative access route.

The Range Creek subunit of Rocky Mountain bighorn sheep is approaching population objective levels set by the UDWR. Many of the alternative-specific components of Alternative C, in particular those that limit traffic along select roads within the WTP Project Area and those that reduce the number of rigs allowed to operate at any one time, would reduce potential traffic-related impacts to Rocky Mountain bighorn sheep. Furthermore, as provided for in **Table 2.6-8**, construction, drilling or completion activities would be limited within lambing areas during the lambing period (mid-March through the end of June). Therefore, it is unlikely that Alternative C would lead to adverse effects on Rocky Mountain bighorn sheep on a herd unit basis.

4.9.3.3 Birds

Raptors

Habitat loss impacts to raptors under Alternative C would be similar in nature to those discussed under the Proposed Action; however, comparatively, the intensity of habitat loss would be less under Alternative C because of the reduced intensity of development

(i.e., 15-year development phase under Alternative C), as well as the surface disturbance thresholds. Under Alternative C, direct impacts to occupied raptor nests would be avoided based on the BLM requirements for site-specific raptor nest surveys, along with the enforcement of spatial and seasonal stipulations during the breeding season (see **Table 2.6-8**).

Upland Game Birds

Impacts to upland game birds under Alternative C would be similar in nature to those discussed under the Proposed Action; however, comparatively, the intensity of impacts related to habitat loss and degradation to upland game birds would be less under Alternative C. Potential impacts to the greater sage-grouse are discussed in **Section 4.10**. Since impacts to the blue grouse and chukar would be similar in nature, these species are grouped together for impact analysis under Alternative C. Direct loss of each specific habitat type is summarized below in **Table 4.9-12**.

Table 4.9-12 Approximate Surface Disturbances to UDWR Upland Game Bird Habitats within the WTP Project Area under Alternative C

UDWR-identified Habitat Values	Existing Acreage within the WTP Project Area[1]	Short-term Disturbance (acres)	Long-term Disturbance (acres) (After Interim Reclamation)
Blue Grouse Habitat			
Crucial Year-long	36,245	865	458
Chukar Habitat			
Crucial Winter	43,639	973	500
Crucial Year-long	1,011	0	0

[1]Minor discrepancies existing due to rounding.

Under Alternative C, potential impacts to upland game birds would include the removal of potential nesting and foraging habitats. The magnitude of surface disturbance would be nearly identical to those under the Proposed Action, given the small percentage of upland game bird habitats that would be affected by surface-disturbing activities.

Mitigating measures outlined in **Table 2.6-8**, which would require the operators to install bird scare devices or implement other protective measures around reserve pits and water management facilities, would reduce or eliminate impacts to upland game birds from contact with reserve pits and water management facilities. In addition, because of the extent of available habitat within and surrounding the WTP Project Area, Alternative C would not likely cause impacts to upland game birds on a population-level basis.

Visual and auditory impacts related to construction, drilling, and completion activities could also lead to displacement from suitable foraging and nesting habitats (Endrulat et al. 2005). Displaced game birds could move to areas of less suitable habitat where levels of competition for resources may be higher.

Also important to note is that under the drilling scenario for Alternative C, the development phase of the project would occur over 15 years (in comparison to an 8-year development phase under the Proposed Action). This increase in the development

phase period would decrease the annual intensity of surface disturbance activities and related effects on wildlife, including upland game birds and their habitats. Thus while, surface disturbance would be nearly equal under the Proposed Action and Alternative C, implementation of surface-disturbing activities would not be as temporally concentrated under Alternative C.

Migratory Birds

Impacts to migratory birds under Alternative C would be similar in nature to those discussed under the Proposed Action; however, comparatively, the intensity of impacts related to habitat loss and degradation to migratory birds would be less under Alternative C. Impacts to migratory birds would vary depending on habitat types (i.e., loss of Utah GAP vegetation communities) and species' sensitivities to disturbance. For the purposes of impact analysis in this EIS, impacts to migratory birds within the WTP Project Area are discussed together; however, proposed surface disturbances estimates for Utah GAP vegetative communities under Alternative C, which provide habitats for migratory birds, are summarized in **Section 4.8.3**.

Alternative C impacts would have the greatest potential effect on UPIF Priority Species, due to their smaller population sizes and limited distribution. However, environmental protection and mitigation measures for 100-year floodplains, springs, and riparian areas in **Table 2.6-8** would serve to minimize impacts to several important migratory bird habitats. Additionally, other mitigation measures in **Table 2.6-8** that would require the operators to install bird scare devices or implement other protective measures around reserve pits and water management facilities, would reduce or eliminate potential impacts to migratory birds from contact with reserve pits and water management facilities.

4.9.3.4 Fisheries

Impacts to fisheries under Alternative C would be similar in nature to those discussed under the Proposed Action with the following noted exceptions:

- Impacts related to water depletion would be less under Alternative C because as the development phase would be spread out over a 15-year period, less water would be used for well development and dust suppression on an annual basis (in comparison to the Proposed Action). Total average annual water use for drilling, completion, and dust suppression under Alternative C would be approximately 129 acre-feet per year (75 percent from surface water sources and 25 percent from new water supply wells) and would be approximately 145 acre-feet per year (75 percent from surface water sources and 25 percent from new water supply wells) during peak development.
- Impacts related to depletion of surface water from Nine Mile Creek, Dry Creek, and Cottonwood Creek would be less under Alternative C. For example, depletion of surface water from Nine Mile Creek would reduce total flow from Nine Mile Creek by approximately 0.65 percent annually over the development period.
- Short-term impacts related to increased annual sediment loading would be greater under Alternative C as compared to the Proposed Action; this increase in annual sediment loading is driven by the requirement for BBC and other

operators to reroute or improve primary roads. As discussed in **Section 4.5.3.1**, Alternative C would increase sediment loading to Nine Mile Creek by about 0.52 percent in the short-term (about 0.16 percent in the long-term), and could increase sediment loading to the Green River by about 0.013 percent in the short-term (about 0.004 percent in the long-term). However, BMPs and mitigation measures in **Table 2.6-7** and **Table 2.6-8**, transportation restrictions in portions of the WTP Project Area, and adherence with surface disturbance thresholds would reduce annual sediment loading within the WTP Project Area such that erosion estimates would likely be similar to those under the Proposed Action.

- Alternative C would include several measures related to protection of 100-year floodplains, springs, and riparian areas, which would indirectly serve to protect aquatic habitat (see **Table 2.6-7** and **Table 2.6-8**, and **Appendix Q**).

Overall, the intensity of impacts related to habitat loss and degradation to fisheries would be less under Alternative C as compared to the Proposed Action. Although fish habitats could likely be impacted by various individual disturbance events, many of the BMPs and mitigation measures in **Table 2.6-7** and **Table 2.6-8** would reduce impacts to fish species and habitats caused by reducing erosion and sediment deposition. These measures include provisions for preventing sediment loading and hydrocarbon spills into waterways within the WTP Project Area.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects under Alternative C would be the same as under the Proposed Action.

4.9.4 Alternative D – Conservation Alternative

Impacts to wildlife under Alternative D would be similar in nature to those discussed under the Proposed Action with the following noted exceptions:

- The magnitude of direct surface disturbance and habitat loss, potential for erosion and sediment yield to drainages, and potential for exposure of drainages to hazardous substances in the event of a spill would be substantially less under Alternative D because of NSO requirements within canyon bottoms, Jack Canyon WSA, Desolation Canyon WSA, and because many of the proposed wells would be directionally drilled from multi-well pads;
- Impacts related to the intensity of development would be less under Alternative D because of the longer drilling schedule (21 years), seasonal restrictions (i.e., adherence to seasonal closures within crucial winter range and high-country watersheds), and transportation restrictions that would limit project-related and/or public access within sensitive areas;
- Impacts related to intensity of development would be further constrained by limits on new annual surface disturbance (approximately 180 acres per year), total unreclaimed surface disturbance allowed at any given time (approximately 1,440), and maximum long-term disturbance (approximately 1,237 acres); and finally;

- Allowing administrative access only on the Cedar Ridge, Horse Bench, Jack Ridge, and Jack Canyon roads would reduce potential traffic-related impacts and human-related impacts (such as harassment of wildlife, poaching, and hunter access and success) on wildlife species;
- Impacts to wildlife, such as direct habitat loss, increased displacement and harassment, related to the construction and use of temporary worker housing locations, would be eliminated under Alternative D because no temporary worker housing locations would be constructed; and
- Alternative D includes numerous BMPs and mitigating measures within **Table 2.6-7** and **Table 2.6-8** that would directly or indirectly serve to eliminate, avoid, reduce, or partially mitigate impacts to wildlife resources.

4.9.4.1 General Wildlife

Impacts to general wildlife species under Alternative D would be similar in nature to those discussed under the Proposed Action; however, comparatively, the magnitude and intensity of habitat loss, degradation, and fragmentation would be substantially less under Alternative D. Implementation of Alternative D would result in a loss of approximately 2,510 acres of wildlife habitat associated with the construction, drilling, and completion of wells, along with the construction of roads, pipelines, related facilities, and infrastructure. These construction activities would all reduce habitat availability for a variety of common wildlife species. The short-term reduction in habitat is expected to have a minor to moderate impact on general wildlife species because 1) many of the "general" wildlife species are habitat generalists, 2) surface disturbance thresholds would limit the total disturbance at any one time, and 3) many of the BMPs and mitigating measures in **Table 2.6-7** and **Table 2.6-8** would afford some protection to general wildlife species or reduce the intensity of potential impacts. As previously stated gating of the Cedar Ridge, Jack Canyon, Horse Bench, and Jack Ridge, roads would reduce potential traffic-related impacts and human-related impacts (such as harassment of wildlife, poaching, and hunter access and success) on wildlife species in areas currently accessed by these roads.

Overall, the severity of impacts to general wildlife species under Alternative D would depend on the seasonal and daily timing of construction, drilling, and completion activities, the site-specific topography and vegetation, the sensitivity of the species to human disturbance, and the availability and proximity of suitable habitat within and outside the WTP Project Area.

4.9.4.2 Big Game

Impacts to big game species would be similar in nature to those discussed under the Proposed Action; however, comparatively, the magnitude and intensity of impacts would be less under Alternative D. Species-specific impacts to big game species found within the WTP Project Area are discussed in detail below.

Mule Deer

Surface disturbances associated with Alternative D would result in the direct loss and fragmentation of UDWR-identified crucial and substantial mule deer habitats. Direct loss of each specific habitat type is summarized below in **Table 4.9-13**.

Table 4.9-13 Approximate Surface Disturbances to UDWR Mule Deer Habitats within the WTP Project Area under Alternative D				
UDWR-identified Habitat Values	**Existing Acreage within the WTP Project Area[1]**	**Short-term Disturbance (acres)**	**Long-term Disturbance (acres) (After Interim Reclamation)**	**Long-term Habitat Loss as a Percentage of Total Available Habitat**
Winter Habitat				
Crucial	73,600	1,902	985	1.3
Substantial	47,115	401	205	0.4
Additional Habitat Types				
Crucial Spring/Fall	4,804	49	18	0.4
Crucial Summer (Fawning Habitat)	8,634	30	11	0.1

[1]Minor discrepancies existing due to rounding.

Implementation of Alternative D would result in the direct short-term loss of approximately 2,510 acres of wildlife habitats, of which approximately 1,902 acres would occur on mule deer crucial winter habitat. The proposed surface-disturbing activities would also increase habitat fragmentation within the WTP Project Area. Based on the habitat fragmentation modeling exercise, Alternative D would increase the extent of fragmented crucial winter range by 12,951 acres. This would result in total, post-development fragmentation of 30,296 acres of mule deer crucial winter range within the WTP Project Area.

Year-round gating of the Cedar Ridge, Jack Canyon, Horse Bench and Jack Canyon roads would reduce potential traffic-related impacts (such as deer-vehicle collisions, and displacement from habitats near roads) and human-related impacts (such as harassment of wildlife, poaching, and hunter access and success) on mule deer in areas currently accessed by these roads (NM Department of Fish and Game 2005; WGFD 2007; USFS 2009).

Aside from direct habitat loss and fragmentation, there would be limited impacts to mule deer within crucial winter range because the BLM would not authorize a waiver or exception to seasonal stipulations in crucial mule deer winter range. Under Alternative D, winter drilling would be prohibited. Based on this seasonal restriction and given the small percentage of directly impacted deer habitats within the WTP Project Area, mule deer in the Range Creek subunit would not likely be affected on a herd unit level basis under Alternative D.

Elk

Surface disturbances associated with Alternative D would result in the direct loss and fragmentation of UDWR-identified crucial and substantial elk habitats. Direct loss of each specific habitat type is summarized below in **Table 4.9-14**.

Table 4.9-14 Approximate Surface Disturbances to UDWR Elk Habitats within the WTP Project Area under Alternative D				
UDWR-identified Habitat Values	**Existing Acreage within the WTP Project Area[1]**	**Short-term Disturbance (acres)**	**Long-term Disturbance (acres) (After Interim Reclamation)**	**Long-term Habitat Loss as a Percentage of Total Available Habitat**
Winter Habitat				
Crucial	80,139	2,133	1,107	1.4
Substantial	24,545	74	37	0.2
Additional Habitat Types				
Crucial Summer	10,120	0.1	0	0.0
Substantial Year-long	22,984	174	74	0.3

[1]Minor discrepancies existing due to rounding.

Implementation of Alternative D would result in the direct loss of approximately 2,510 acres of wildlife habitats, of which approximately 2,133 acres would occur on crucial winter elk habitat. The proposed surface disturbing activities would also increase habitat fragmentation within the WTP Project Area. Based on the habitat fragmentation modeling exercise, Alternative D would increase the extent of fragmented crucial winter range by 15,460 acres. This would result in total, post-development fragmentation of 69,505 acres of elk crucial winter range within the WTP Project Area.

Year-round gating of the Cedar Ridge, Jack Canyon, Horse Bench, and Jack Ridge roads could reduce potential traffic-related impacts (such as elk-vehicle collisions and displacement from roaded areas) and human-related impacts (such as harassment of wildlife, poaching, and hunter access and success) on elk as compared to the Proposed Action (Claire and Forest 2009; NM Department of Fish and Game 2005; WGFD 2007; USFS 2009).

Aside from direct habitat loss and fragmentation, there would be limited impacts to elk within crucial winter range because the BLM would not authorize a waiver or exception to seasonal stipulations in crucial elk winter range. Under Alternative D, winter drilling would be prohibited. Based on this seasonal restriction and given the small percentage of directly impacted elk habitats within the WTP Project Area (approximately 1.6 percent), elk in the Range Creek subunit, which are nearly double their population objective set by the UDWR, would not likely be affected on a herd unit level basis under Alternative D.

Rocky Mountain Bighorn Sheep

Like mule deer and elk, surface disturbances associated with Alternative D would result in the direct loss and fragmentation of UDWR-identified crucial and substantial Rocky Mountain bighorn sheep habitats. Direct loss of each specific habitat type is summarized below in **Table 4.9-15**.

Table 4.9-15 Approximate Surface Disturbances to UDWR Rocky Mountain Bighorn Sheep Habitats within the WTP Project Area under Alternative D				
UDWR-identified Habitat Values	**Existing Acreage within the WTP Project Area[1]**	**Short-term Disturbance (acres)**	**Long-term Disturbance (acres) (After Interim Reclamation)**	**Long-term Habitat Loss as a Percentage of Total Available Habitat**
Year-long Habitat				
Crucial	69,339	695	348	0.5
Substantial	64,566	1,658	858	1.3

[1]Minor discrepancies existing due to rounding.

Many of the components of Alternative D, in particular NSO in sensitive areas, those that limit traffic along select roads within the WTP Project Area, and those that reduce the number of rigs allowed to operate at any one time, would reduce potential impacts to Rocky Mountain bighorn sheep. NSO restrictions within Jack Canyon would prevent surface-disturbing activities within or near known lambing areas for bighorn sheep. This restriction would be strengthened or complemented by measures included in **Table 2.6-8**, under which construction, drilling or completion activities would be limited within lambing areas during the lambing period (mid-March through the end of June). Based on this information, and given the small percentage of total impacted Rocky Mountain bighorn sheep habitats within the WTP Project Area, Rocky Mountain bighorn sheep in the Range Creek subunit would not likely be affected on a herd unit basis under Alternative D.

4.9.4.3 Birds

Raptors

Impacts to raptors under Alternative D would be similar in nature to those discussed under the Proposed Action; however, comparatively, the magnitude and intensity of impacts would be less under Alternative D because of the conservation-minded components of Alternative D. For example, prohibiting the leasing of unleased lands with wilderness characteristics and adherence to NSO limitations (within WSAs, unleased lands within potential ACECs, and canyon bottoms) could protect large expanses of suitable raptor nesting and foraging habitats. In addition, the potential for vehicle collisions with carrion-feeding raptors in the winter would be less under Alternative D as no winter drilling would occur, and consequently less traffic would occur on crucial winter mule deer or crucial winter elk ranges.

Direct impacts to occupied raptor nests would be avoided based on the BLM requirements for site-specific raptor nest surveys, along with the enforcement of spatial and seasonal stipulations during the breeding season (see **Table 2.6-8**).

Upland Game Birds

Impacts to upland game birds under Alternative D would be similar in nature to those discussed under the Proposed Action; however, comparatively, the magnitude and intensity of impacts related to habitat loss and degradation to upland game birds would be less under Alternative D. Potential impacts to the greater sage-grouse are discussed

in **Section 4.10**. Since impacts to the blue grouse and chukar would be similar in nature, these species are grouped together for impact analysis under Alternative D. Direct loss of each specific habitat type is summarized below in **Table 4.9-16**.

Table 4.9-16 Approximate Surface Disturbances to UDWR Upland Game Bird Habitats within the WTP Project Area under Alternative D

UDWR-identified Habitat Values	Existing Acreage within the WTP Project Area[1]	Short-term Disturbance (acres)	Long-term Disturbance (acres) (After Interim Reclamation)
Blue Grouse Habitat			
Crucial Year-long	36,245	805	415
Chukar Habitat			
Crucial Winter	43,639	652	330
Crucial Year-long	1,011	0	0

[1]Minor discrepancies existing due to rounding.

Under Alternative D, small percentages of upland game bird habitats would be affected by surface-disturbing activities. Furthermore, under the drilling scenario for Alternative D, the development phase of the project would occur over 21 years (in comparison to an 8-year development phase under the Proposed Action). This increase in the development phase period would decrease the annual intensity of surface disturbance activities and related effects on wildlife, including upland game birds and their habitats.

NSO requirements within the WSAs, unleased lands within potential ACECs, and canyon bottoms would also provide protection to upland game habitats by limiting surface disturbance within these areas.

Visual and auditory impacts related to construction, drilling, and completion activities could also lead to displacement from suitable foraging and nesting habitats (Endrulat et al. 2005). Displaced game birds could move to areas of less suitable habitat where levels of competition for resources may be higher.

Mitigating measures outlined in **Table 2.6-8**, which would require the operators to install bird scare devices or implement other protective measures around reserve pits and water management facilities, could reduce or eliminate impacts to upland game birds related to contact with produced water in reserve pits and water management facilities.

Migratory Birds

Impacts to migratory birds under Alternative D would be similar in nature to those discussed under the Proposed Action; however, comparatively, the magnitude and intensity of impacts would be less under Alternative D. Impacts to migratory birds in the WTP Project Area under Alternative D would vary depending on the habitat types (i.e., loss of Utah GAP vegetation communities) and species' sensitivities to disturbance. For the purposes of impact analysis in this EIS, impacts to migratory birds within the WTP Project Area are discussed together. Proposed surface disturbance estimates for Utah GAP vegetative communities, which provide habitats for migratory birds, are summarized in **Section 4.8.4**.

Alternative D provides some protection to migratory bird habitats within the WTP Project Area. For example, NSO requirements and leasing restrictions would decrease disturbance and fragmentation within important migratory bird habitats found within WSAs, unleased lands within non-WSA lands with wilderness characteristics, unleased lands within potential ACECs, and canyon bottoms. In addition, mitigation measures listed in **Tables 2.6-8** for 100-year floodplains, springs, and riparian areas would minimize habitat degradation and impacts to water quality that can be caused by erosion and sediment deposition. These measures would indirectly protect migratory bird habitats that occur within 100-year floodplains and riparian areas.

Alternative D impacts would have the greatest effect on UPIF Priority Species, due to their smaller population sizes and limited distributions. However, mitigation measures outlined in **Table 2.6-8**, which would require operators to install bird scare devices or implement other protective measures around reserve pits and water management facilities, could reduce or eliminate impacts to migratory birds related to contact with produced water in reserve pits and water management facilities.

4.9.4.4 Fisheries

Impacts to fisheries under Alternative D would be similar in nature to those discussed under the Proposed Action with the following noted exceptions:

- The magnitude of direct surface disturbance within 100-year floodplains and riparian habitats, erosion and sediment yield, and potential for hazardous substance spills near or within drainages (i.e., fish habitats) would be substantially less under Alternative D because of NSO requirements within canyon bottoms.
- Impacts related to water depletion would be less under Alternative D because as the development phase would be spread out over a 21-year period, less water would be used for well development and dust suppression on an annual basis (in comparison to the Proposed Action). Total average annual water use for drilling, completion, and dust suppression under Alternative D would be approximately 68 acre-feet per year (75 percent from surface water sources and 25 percent from new water supply wells) and would be 98 acre-feet per year (75 percent from surface water sources and 25 percent from new water supply wells) during peak development.
- Impacts related to depletion of surface water from Nine Mile Creek, Dry Creek, and Cottonwood Creek would be less under Alternative D. For example, depletion of surface water from Nine Mile Creek would reduce total flow from Nine Mile Creek by approximately 0.35 percent annually over the development period.
- Impacts related to increased annual sediment loading would be less under Alternative D. As discussed in **Section 4.5.4.1**, Alternative D would increase sediment loading to Nine Mile Creek by about 0.36 percent in the short-term (about 0.13 percent in the long-term), and would increase sediment loading to the Green River by about 0.009 percent in the short-term (about 0.0033 percent in the long-term).

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects under Alternative D would be the same as under the Proposed Action.

4.9.5 Alternative E – Agency Preferred Alternative

In general, impacts to wildlife resulting under Alternative E would be similar in nature to those discussed under the Proposed Action with the following noted exceptions:

- Impacts related to intensity of development would be further constrained by limits on new annual surface disturbance (approximately 540 acres per year), total unreclaimed surface disturbance allowed at any given time (approximately 2,310 acres), and maximum long-term disturbance (approximately 1,750 acres);
- Impacts related to winter drilling and development near naturally occurring springs, 100-year floodplains, and riparian areas would be lessened under Alternative E because of the special protection measures described in **Section 2.6.1.4** for high-country watersheds and wildlife;
- Gating of roads (i.e., closing roads to the general public) would reduce potential traffic-related impacts and human-related impacts (such as harassment of wildlife, poaching, and hunter access and success) on wildlife species;
- Alternative E includes the Agency Wildlife Mitigation Plan (**Appendix E**), which outlines proposed mitigation for natural gas full field development in the WTP Project Area. The agencies' mitigation plan emphasizes the importance of offsetting, to the extent reasonable, the effects of the full field development in its entirety. As applies to this section of the EIS, the agencies' plan gives priority to compensation for potential effects to deer, raptors, elk; and sage-grouse;
- Alternative E includes numerous BMPs and mitigating measures within **Table 2.6-7** and **Table 2.6-8** that would directly or indirectly serve to eliminate, avoid, reduce, or partially mitigate impacts to wildlife resources.
- Alternative E also includes the Long-Term Monitoring Plan for Water Resources (**Appendix Q**). The overall objective of the monitoring plan is to document changes in water quality and quantity that could potentially occur to WTP Project Area streams and their tributaries, the Green River, groundwater, and springs over the life of the project. These data would be used to guide mitigation measures for water resources, which would indirectly reduce impacts to fish and other wildlife species related to increased sedimentation and changes in water quality.

4.9.5.1 General Wildlife

Impacts to wildlife under Alternative E would be similar in nature to those discussed under the Proposed Action. However, comparatively, the intensity of habitat loss, degradation, and fragmentation would be slightly less under Alternative E. Implementation of Alternative E would result in a short-term loss of approximately 3,399 acres of wildlife habitat associated with the construction, drilling, and completion of wells, along with the construction of roads, pipelines, related facilities, and infrastructure. These construction activities would reduce habitat availability for a variety of common

wildlife species. This short-term reduction in habitat is expected to have a minor to moderate impact on general wildlife species because many of the "general" wildlife species are habitat generalists, because interim reclamation requirements would restore habitat components of disturbed areas, and because many of the BMPs and mitigating measures in **Table 2.6-7** and **Table 2.6-8** would afford some protection to general wildlife species or reduce the intensity of potential impacts.

Overall, the severity of impacts to general wildlife species under Alternative E would depend on the seasonal and daily timing of construction, drilling, and completion activities, the site-specific topography and vegetation, the sensitivity of the species to human disturbance, and the availability and proximity of suitable habitat within and outside the WTP Project Area.

Agency Wildlife Mitigation Plan

The Price Field Office in coordination with the UDWR has developed a Wildlife Mitigation Plan, which outlines proposed mitigation for natural gas full field development in the WTP Project Area (see **Appendix E**). The Agency Wildlife Mitigation Plan, which is a modified version of BBC's Wildlife Mitigation Plan, emphasizes the importance of offsetting, to the extent reasonable, the effects of the full field development in its entirety. The agencies' plan gives priority to compensating for potential effects to greater sage-grouse, mule deer, elk, and raptors.

The Agency Wildlife Mitigation Plan would require mitigation at a 4:1 acre ratio based on total potential long-term surface disturbance. This ratio generally serves as the limitation on the extent to which operators would be required to mitigate. Under the Agency Wildlife Mitigation Plan, 30 percent of the total potential long-term surface disturbance (approximately 503 acres under Alternative E) would be mitigated at a 4:1 ratio (for a total of approximately 2,014 acres) during the first 3 years following a decision to authorize the full field development project. Delay in completion of the Mitigation Plan would reduce the beneficial effect of the mitigation during construction activities. As part of this initial effort, the following measures would be implemented:

- Habitat improvement and connectivity as described in the operators' plan. This would be implemented at a 4:1 ratio as indicated above.
- Wet meadow/summer range enhancement as described in the operators' plan. Up to six projects would be implemented.
- The operators would contribute to UDWR for monitoring greater sage-grouse, whether through continued telemetry study or other, more aggressive means of monitoring, if necessary, including experimental designs.

The Agency Wildlife Mitigation Plan would also establish an oversight committee to be led by the BLM, in coordination with UDWR, and other agencies. The WTPMOC would evaluate the implementation and effectiveness of mitigation measures, provide direction on effective means of mitigating planned development activities, and develop adaptive strategies and projects to mitigate beyond the initial 30 percent commitment. The WTPMOC would complete evaluations and make determinations on on-going and planned mitigation activities on an annual basis, in advance of considerations for winter activities (as is outlined under Alternative E), and prepare a report on its findings.

Adaptive strategies beyond the initial mitigation effort could include a broad menu of mitigation options. The relative value of the various options would be determined by the WTPMOC such that their value can be applied toward the operators' 4:1 mitigation requirement.

Mitigation options which would be considered by the WTPMOC for implementation of the plan include, but are not limited to, the following actions:

- Additional habitat improvement and connectivity projects. A variety of methods could be used, targeting a range of vegetative communities and habitats, including wet meadow/summer range.
- Continued or more aggressive monitoring of greater sage-grouse, including experimental designs.
- Conversions of grazing allotments around Nine Mile Canyon from domestic sheep to cattle (this could provide for the reintroduction of bighorn sheep into Nine Mile Canyon and would help mitigate the loss of bighorn sheep habitats).
- The purchase of conservation easements on private lands.
- Management of private lands for the benefit of wildlife.

The WTPMOC would recognize, within the 4:1 parameter, mitigation activities on Federal, State, and private lands, including those which build upon or complement past commitments by operators to mitigate activities authorized under previous analyses and associated decisions. However, credit for previous project mitigation would not be allowed within the 4:1 parameter.

Like activities associated with natural gas development and other public land uses, implementation of the Agency Wildlife Mitigation Plan would result in both positive and negative impacts on wildlife species and habitats, and potentially other public land uses and resources. The potential impacts of the Agency Wildlife Mitigation Plan, both positive and negative, are discussed in the following sections. As appropriate, additional information is provided within the species-specific impact analysis discussions.

The conversion of pinyon-juniper habitats into sagebrush habitats would have a substantial beneficial effect on sage-grouse and mule deer. However, the proposed mitigation would reduce habitat availability for species that occur within or use pinyon-juniper habitat. As discussed in **Section 3.8**, there are approximately 51,000 acres of pinyon-juniper habitat and 23,000 acres of sagebrush habitat within the WTP Project Area. Thus, the positive effects of creating or improving sagebrush habitat (which is a declining vegetative community in the west and provides key habitat for a number of wildlife species) would generally outweigh the potential negative impacts of habitat loss in the more widespread pinyon-juniper community. Initial areas proposed for pinyon-juniper treatment are illustrated in **Figure 2.2-1**.

Sage-grouse use of limited wet meadow habitats, pond margins, and spring areas indicate a preference for this habitat type during brood rearing (Klebenow 1969, Connelly & Markham 1983, Connelly et al. 1988). Therefore, proposed mitigation designed to increase these habitats would be beneficial to sage-grouse brood survival by increasing forbs and habitat for invertebrates. Under the Wildlife Mitigation Plan, wet meadow enhancement would involve locating spring sources and if topography allows,

re-contouring the spring sources to distribute the water over as much surface area as possible creating a sub-irrigated meadow. These areas would be attractive to big game and livestock and might require fencing to protect the values for sage-grouse. However, in order to avoid adverse impacts to livestock that use the affected springs, water from affected springs would also be piped to a trough or stock watering pond. Creation of troughs or stock watering ponds would also benefit other wildlife species by providing water sources not previously available. Negative impacts resulting from wet meadow enhancements would include a potential but minor reduction in flow within streams in Dry, Harmon, Cottonwood, and Prickly Pear Canyons, which have long stretches of channel that exhibit intermittent seasonal flows that are fed by discharge from springs.

Summer range improvements would involve sagebrush removal in sage-grouse summer range using mechanical treatments with the goal of replacing that existing sagebrush with newer, younger, more vigorous sagebrush stands of similar percent land cover, type, and mosaic patterns. Increased grass and forb production resulting from these treatments would benefit sage-grouse broods as well as mule deer. Small mammal populations could increase from these types of summer range treatments as a result of increases in forage, thereby providing increased prey base for raptors. In turn however, the proposed summer range improvements would remove or reduce some mature sagebrush, which would reduce habitat for sagebrush obligate species such as the sagebrush lizard, sage sparrow, sage thrasher, and Brewer's sparrow.

Mitigation that would require the operators to contribute funds to UDWR monitoring projects would benefit wildlife species and habitats within the WTP Project Area by contributing to the UDWR's (and BLM's) knowledgebase regarding wildlife population numbers and trends. These data would in part be used to help the WTPMOC make decisions regarding future mitigation projects in the WTP Project Area. The data gathered would help facilitate an adaptive management approach for the Wildlife Mitigation Plan.

The purchase of conservation easements on private lands and management of private lands for the benefit of wildlife would result in a positive impact on wildlife species. Specific beneficial effects would be highly dependent upon the characteristics (e.g., vegetation community, topography, and level of existing disturbance) and locations of the private lands selected for conservation easements and wildlife management activities, the management activities implemented, and the species targeted for wildlife management.

4.9.5.2 Big Game

Impacts to big game species would be similar in nature to those discussed under the Proposed Action; however, comparatively, the intensity of impacts related to habitat loss, degradation, and fragmentation would be slightly less under Alternative E. Species-specific impacts to big game species found within the WTP Project Area are discussed in detail below.

Mule Deer

Surface disturbances associated with Alternative E would result in the direct loss and fragmentation of UDWR-identified crucial and substantial mule deer habitats. Direct loss of each specific habitat type is summarized below in **Table 4.9-17**.

Table 4.9-17 Approximate Disturbances to UDWR Mule Deer Habitats within the WTP Project Area under Alternative E				
UDWR-identified Habitat Values	**Existing Acreage within the WTP Project Area[1]**	**Short-term Disturbance (acres)**	**Long-term Disturbance (acres) (After Interim Reclamation)**	**Long-term Habitat Loss as a Percentage of Total Available Habitat**
Winter Habitat				
Crucial	73,600	2,449	1,277	1.7
Substantial	47,115	702	376	0.8
Additional Habitat Types				
Crucial Spring/Fall	4,804	50	18	0.4
Crucial Summer (Fawning Habitat)	8,634	30	10	0.1

[1]Minor discrepancies existing due to rounding.

Implementation of Alternative E would result in the initial, direct loss of approximately 3,399 acres of wildlife habitat, of which approximately 2,449 acres would occur on crucial winter mule deer habitat. During the winter, construction, drilling, and completion activities in crucial winter mule deer habitat could potentially displace deer into other areas of unsuitable habitat or prevent access to winter foraging areas or sufficient water. In addition, habitat loss and fragmentation resulting from these disturbances could result in reduced habitat use by mule deer within disturbed areas, increased animal densities in adjoining habitats, and increased stress from intra- and inter-specific competition for resources. However, based on the special protective measures provided in **Section 2.6.1.4** (e.g., restrictions that would limit project-related vehicle traffic within the dawn and dusk hours during daylight savings time when mule deer are most active, as well as snow removal requirements that would improve animal movement during the WTP Project Area), potential impacts to mule deer related to winter drilling in crucial winter range would be reduced or avoided. Also important to note is that under the drilling scenario for Alternative E, the development phase of the project would occur over 9 years (in comparison to an 8-year development phase under the Proposed Action). This slight increase in the development phase period would help decrease the intensity of annual surface disturbance activities and related effects on mule deer. Thus while, surface disturbance would be nearly equal under the Proposed Action and Alternative E, implementation of surface disturbing activities would not be as temporally concentrated under Alternative E.

Furthermore, many of the alternative-specific components of Alternative E, in particular those that limit traffic along select roads within the WTP Project Area, would reduce potential traffic-related impacts to mule deer.

The above-described potential impacts could lead to adverse effects on the Range Creek subunit, which is below population objectives. However, Alternative E also includes an Agency Wildlife Mitigation Plan (**Appendix E**) that would be fully developed and implemented in consultation with the UDWR, the BLM, and other applicable wildlife agencies and organizations. Benefits of the Agency Wildlife Mitigation Plan on mule deer would be similar to those described for BBC's Wildlife Mitigation Plan as discussed

under the Proposed Action. Provided the objectives of the Agency Wildlife Mitigation Plan are successfully met, habitat loss impacts to mule deer from Alternative E could be largely mitigated.

Elk

Surface disturbances associated with Alternative E would result in the direct loss and fragmentation of UDWR-identified crucial and substantial elk habitats. Direct loss of each specific habitat type is summarized in **Table 4.9-18**.

Table 4.9-18 Approximate Surface Disturbances to UDWR Elk Habitats within the WTP Project Area under Alternative E

UDWR-identified Habitat Values	Existing Acreage within the WTP Project Area[1]	Short-term Disturbance (acres)	Long-term Disturbance (acres) (After Interim Reclamation)	Long-term Habitat Loss as a Percentage of Total Available Habitat
Winter Habitat				
Crucial	80,139	2,838	1,490	1.9
Substantial	24,545	196	104	0.4
Additional Habitat Types				
Crucial Summer	10,120	0	0	0.0
Substantial Year-long	22,984	197	87	0.4

[1]Minor discrepancies exist due to rounding.

Implementation of Alternative E would result in the initial, direct loss of approximately 3,399 acres of wildlife habitat, of which approximately 2,838 acres would occur on crucial winter elk habitat. During the winter, construction, drilling, and completion activities in crucial winter elk habitat could potentially displace elk into other areas of unsuitable habitat or prevent access to winter foraging areas or sufficient water. In addition, habitat loss and fragmentation resulting from these disturbances could result in reduced habitat use by elk within disturbed areas, increased animal densities in adjoining habitats, and increased stress from intra- and inter-specific competition for resources. However, based on the special protective measures provided in **Section 2.6.1.4** (e.g., restrictions that would limit project-related vehicle traffic within the dawn and dusk hours during daylight savings time when elk are most active, as well as snow removal requirements that would improve animal movement during the WTP Project Area), potential impacts to elk related to winter drilling in crucial winter range would be reduced or avoided. Also important to note is that under the drilling scenario for Alternative E, the development phase of the project would occur over 9 years (in comparison to an 8-year development phase under the Proposed Action). This slight increase in the development phase would help decrease the intensity of annual surface disturbance activities and related effects on elk. Thus while, surface disturbance would be nearly equal under the Proposed Action and Alternative E, implementation of surface disturbing activities would not be as temporally concentrated under Alternative E.

Furthermore, many of the alternative-specific components of Alternative E, in particular those that limit traffic along select roads within the WTP Project Area, would reduce potential traffic-related impacts to elk.

Additionally, if the objectives of Agency Wildlife Mitigation Plan (**Appendix E**) are successfully met, habitat loss impacts to elk from the Alternative E could be largely mitigated. Benefits of the Agency Wildlife Mitigation Plan on elk would be similar to those described for BBC's Wildlife Mitigation Plan as discussed under the Proposed Action.

Based on the above information, and given that elk population levels in the Range Creek subunit are nearly double its population objective set by the UDWR, implementation of Alternative E would not likely lead to adverse effects to elk on a herd unit basis.

Rocky Mountain Bighorn Sheep

Like mule deer and elk, surface disturbances associated with Alternative E would result in the direct loss and fragmentation of UDWR-identified crucial and substantial Rocky Mountain bighorn sheep habitats. Direct loss of each specific habitat type is summarized in **Table 4.9-19**.

Table 4.9-19 Approximate Surface Disturbances to UDWR Rocky Mountain Bighorn Sheep Habitats within the WTP Project Area under Alternative E

UDWR-identified Habitat Values	Existing Acreage within the WTP Project Area[1]	Short-term Disturbance (acres)	Long-term Disturbance (acres) (After Interim Reclamation)	Long-term Habitat Loss as a Percentage of Total Available Habitat
Year-long Habitat				
Crucial	69,339	966	497	0.7
Substantial	64,566	2,236	1,171	1.8

[1]Minor discrepancies due to rounding.

The Range Creek subunit of Rocky Mountain bighorn sheep is approaching its population objective level set by the UDWR. Many of the alternative-specific components of Alternative E, in particular those that limit traffic along select roads within the WTP Project Area, would reduce potential traffic-related impacts to Rocky Mountain bighorn sheep. Because of directional drilling requirements under Alternative E, there would be less surface disturbance within Jack Canyon, which is the primary lambing area for bighorn sheep in the WTP Project Area. Furthermore, as provided for in **Table 2.6-8**, under Alternative E, construction, drilling or completion activities would be limited within lambing areas during the lambing period (mid-March through the end of June). Therefore, it is unlikely that Alternative E would lead to adverse effects on Rocky Mountain bighorn sheep on a herd unit basis.

4.9.5.3 Birds

Raptors

Habitat loss impacts to raptors under Alternative E would be similar in nature to those discussed under the Proposed Action; however, comparatively, the intensity of habitat

loss would be slightly less under Alternative E because of the reduced intensity of development (i.e., 9-year development phase under Alternative E), as well as adherence to surface disturbance thresholds. Under Alternative E, direct impacts to occupied raptor nests would be avoided based on the BLM requirements for site-specific raptor nest surveys, along with the enforcement of spatial and seasonal stipulations during the breeding season (see **Table 2.6-8**).

Upland Game Birds

Impacts to upland game birds under Alternative E would be similar in nature to those discussed under the Proposed Action; however, comparatively, the intensity of impacts related to habitat loss and degradation to upland game birds would be slightly less under Alternative E. Potential impacts to the greater sage-grouse are discussed in **Section 4.10**. Since impacts to the blue grouse and chukar would be similar in nature, these species are grouped together for impact analysis under Alternative E. Direct loss of each specific habitat type is summarized below in **Table 4.9-20**.

Table 4.9-20 Approximate Surface Disturbances to UDWR Upland Game Bird Habitats within the WTP Project Area under Alternative E

UDWR-identified Habitat Values	Existing Acreage within the WTP Project Area[1]	Short-term Disturbance (acres)	Long-term Disturbance (acres) (After Interim Reclamation)
Blue Grouse Habitat			
Crucial Year-long	36,245	842	445
Chukar Habitat			
Crucial Winter	43,639	958	493
Crucial Year-long	1,011	0	0

[1]Minor discrepancies exist due to rounding.

Under Alternative E, potential impacts to upland game birds would include the removal of potential nesting and foraging habitats. The magnitude of surface disturbance would be nearly identical to those under the Proposed Action, in that approximately 1.2 percent of upland game bird habitats would be affected in the long-term by surface-disturbing activities.

Mitigating measures outlined in **Table 2.6-8**, which would require the operators to install bird scare devices or implement other protective measures around reserve pits and water management facilities, would reduce or eliminate impacts to upland game birds related to contact with reserve pits and water management facilities. In addition, because of the extent of available habitat within and surrounding the WTP Project Area, Alternative E would not likely cause impacts to upland game birds on a population-level basis.

Visual and auditory impacts related to construction, drilling, and completion activities could also lead to displacement from suitable foraging and nesting habitats (Endrulat et al. 2005). Displaced game birds could move to areas of less suitable habitat where levels of competition for resources may be higher.

Also important to note is that under the drilling scenario for Alternative E, the development phase of the project would occur over 9 years (in comparison to an 8-year development phase under the Proposed Action). This slight increase in the development phase period would decrease the annual intensity of surface disturbance activities and related effects on wildlife, including upland game birds and their habitats. Thus while, surface disturbance would be nearly equal under the Proposed Action and Alternative E, implementation of surface-disturbing activities would not be as temporally concentrated under Alternative E.

Migratory Birds

Impacts to migratory birds under Alternative E would be similar in nature to those discussed under the Proposed Action; however, comparatively, the intensity of impacts related to habitat loss and degradation to migratory birds would be slightly less under Alternative E. Impacts to migratory birds in the WTP Project Area under Alternative E would be similar for all migratory bird species, but would vary depending on habitat types (i.e., loss of Utah GAP vegetation communities) and species' sensitivities to disturbance. For the purposes of impact analysis in this EIS, impacts to migratory birds within the WTP Project Area are discussed together; however, proposed surface disturbances estimates for Utah GAP vegetative communities under Alternative E, which provide habitats for migratory birds, are summarized in **Section 4.8.5**.

Alternative E impacts would have the greatest potential effect on UPIF Priority Species, due to their smaller population sizes and limited distribution. However, mitigation measures listed in **Table 2.6-8** for 100-year floodplains, springs, and riparian areas would serve to minimize impacts to several important migratory bird habitats. Additionally, other mitigation measures in **Table 2.6-8** that would require the operators to install bird scare devices or implement other protective measures around reserve pits and water management facilities, would reduce or eliminate potential impacts to migratory birds related to contact with reserve pits and water management facilities.

4.9.5.4 Fisheries

Impacts to fisheries under Alternative E would be similar in nature to those discussed under the Proposed Action with the following noted exceptions:

- Impacts related to water depletion would be slightly less under Alternative E because as the development phase would potentially be spread out over a 9-year period, and thus less water would be used for well development and dust suppression on an annual basis (in comparison to the Proposed Action). Total average annual water use for drilling, completion, and dust suppression under Alternative E would be approximately 199 acre-feet per year (75 percent from surface water sources and 25 percent from new water supply wells) and would be approximately 285 acre-feet per year (75 percent from surface water sources and 25 percent from new water supply wells) during peak development.
- Impacts related to depletion of surface water from Nine Mile Creek, Dry Creek, and Cottonwood Creek would be less under Alternative E. For example, depletion of surface water from Nine Mile Creek would reduce total flow from Nine Mile Creek by approximately 1.01 percent annually over the development period.

- Short-term impacts related to increased annual sediment loading would be greater under Alternative E as compared to the Proposed Action; this increase in annual sediment loading is driven by the requirement for BBC and other operators to reroute or improve primary roads. As discussed in **Section 4.5.5.1**, Alternative E would increase sediment loading to Nine Mile Creek by about 0.48 percent in the short-term (about 0.15 percent in the long-term), and would increase sediment loading to the Green River by 0.0119 percent in the short-term (about 0.0038 percent in the long-term). However, BMPs and mitigating measures in **Table 2.6-7** and **Table 2.6-8**, transportation restrictions in portions of the WTP Project Area, and adherence with surface disturbance thresholds would reduce annual sediment loading within the WTP Project Area such that erosion estimates would likely be similar to those under the Proposed Action.
- Alternative E would include several measures related to protection of 100-year floodplains, springs, and riparian areas, which would indirectly serve to protect aquatic habitat (see **Table 2.6-7** and **Table 2.6-8**, and **Appendix Q**).

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects under Alternative E would be the same as under the Proposed Action.

4.10 THREATENED, ENDANGERED, CANDIDATE, BLM SENSITIVE, AND OTHERWISE SPECIAL STATUS SPECIES

4.10.1 Introduction

Section 7(a) of the ESA requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened, and with respect to its critical habitat, if any has been designated. Regulations that implement this interagency cooperation provision of the ESA are codified at 50 CFR 402. Section 7(a)(2) requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to adversely affect or jeopardize the continued existence of a Federally-listed species or result in the adverse modification or destruction of its critical habitat. If a Federal action "*may affect, is likely to adversely affect*" a Federally-listed species or its designated critical habitat, the responsible Federal agency must enter into formal consultation with the USFWS. Candidate species are also managed by USFWS to prevent a future listing as threatened or endangered.

While Section 7(a) of the ESA provides opportunities for Federal agencies to exercise a degree of control over impacts related to energy development on Federally-listed wildlife and plant species, Section 9 of the ESA provides additional protective measures for Federally-listed endangered plant species. Specifically, Section 9 makes it unlawful to remove and reduce to possession, maliciously damage, or destroy any listed endangered plant species from areas under Federal jurisdiction or to remove, cut, dig up, damage, or destroy any such species in knowing violation of any law or regulation of any State or in the courses of any violation of a State criminal trespass law. This legal protection of Federally-listed endangered plant species may be extended to threatened plant species through regulation (USFWS 1990b). In compliance with Sections 7(a) and 9 of the ESA, the sections below describe Federally-threatened, endangered, and

candidate wildlife and plant species that may be affected by proposed natural gas development within the WTP Project Area.

BLM sensitive species are also managed to prevent a future Federal listing as threatened or endangered. BLM sensitive and otherwise special status (e.g., bald and golden eagles) species that may be affected by proposed natural gas development within the WTP Project Area are also discussed in the sections below.

4.10.2 Alternative A – Proposed Action

4.10.2.1 Threatened, Endangered, and Candidate Species

Mexican Spotted Owl

Implementation of the Proposed Action could affect MSOs that potentially nest or hunt within the WTP Project Area due to a loss of foraging habitat, potential displacement from nesting and hunting areas, and potential exposure to hazardous substances associated with produced water.

The Proposed Action would result in a short-term loss of approximately 3,656 acres of potential foraging habitat for the MSO in the WTP Project Area, of which approximately 553 acres would occur within USFWS-designated critical habitat for the MSO. Because it is not known if one habitat cover type is more beneficial than another in regards to MSO prey species, all 3,656 acres of habitat loss under the Proposed Action could be considered a potential loss of MSO foraging habitat; however, habitat losses within USFWS-designated critical habitat would be considered to be most important. A decrease in prey base habitats and consequently, prey availability could result in increased energy expenditure and time spent away from nest sites. Decreases in prey availability and abundance could also influence prey delivery rates by adult MSO to nestlings, nest attendance, trip duration, and time spent at the nest site (Delaney et al. 1999).

Removal of habitat and increased fragmentation of the landscape could result in indirect genetic effects on owl populations within the WTP Project Area. For example, Barrowclough et al. (2006) found restricted gene flow among isolated populations in fragmented habitats. This could lead to a decrease in population levels due to decreased levels of successful breeding. Additionally, it has been suggested that increased levels of fragmentation may increase competition and hybridization with the barred owl (*Strix varia*), potentially leading to a decrease in MSO populations (USFWS 1995b).

Potential displacement of nesting and hunting MSOs could occur as a result of increased noise levels (e.g., increased volumes and changes in ambient noise levels from construction, drilling, and production equipment, changes in ambient tones or tonal noises, and repetitive low frequency noise emanating from production equipment such as compressor stations) and artificial lighting associated with project-related activities such as drilling and use of temporary working housing within the WTP Project Area. Displacement from preferred nesting and hunting areas could force MSOs to travel further distances and thereby expend additional energy, causing greater physical stress. Displacement could also cause MSOs to move into less suitable habitats with greater predation or higher inter- and intra-specific competition for resources. Swarthout and

Steidl (2003) found that, although changes were relatively small, even hiking through canyons could lead to declines in important activities such as prey delivery for nesting MSOs. Construction, drilling, and completion activities, and compressor stations and engines would increase noise levels and artificial lighting within the WTP Project Area, which could further limit use of potential nesting and hunting habitats. Increased levels of background noise (e.g., at compressor stations) could lower levels of prey delivery to nest locations (Delaney et al. 1999). Increased lighting (e.g., at drill rigs) near MSO habitat could impact owls through visual disruption and disorientation (Longcore and Rich 2004).

Under the Proposed Action, three water management facilities with open ponds would be constructed for produced water disposal. The open nature of water management facilities could potentially attract MSO within the WTP Project Area, and could lead to exposure to hazardous substances associated with produced water.

Applicant-committed measures (**Table 2.2-6**) could also reduce the aforementioned potential impacts to MSOs and their USFWS-designated critical habitat within the WTP Project Area. As discussed in **Table 2.2-6**, all proposed compressor stations would be located at least ½-mile from the edge of canyon rims to lessen noise-related impacts to MSO habitat from compressor engines. **Table 2.2-6** also includes a voluntary commitment by the operator to conduct MSO inventories in accordance with USFWS survey guidelines.

However, based on the potential for displacement of nesting or hunting MSO, and modification and/or loss of USFWS-designated critical habitat, the Proposed Action "***may affect, is likely to adversely affect***" the MSO and its USFWS-designated critical habitat within the WTP Project Area.

Southwestern Willow Flycatcher

According to Utah GAP vegetation cover data analysis, no lowland riparian vegetation occurs within the WTP Project Area. However, given the scale of Utah GAP vegetation mapping (1:119,000), pockets of riparian vegetation not identified by GAP data could possibly exist along Nine Mile Creek, and along the lower portion of Dry Creek, Harmon Creek, Cottonwood Creek, and along other area drainages. Although SWWF have not been documented within the WTP Project Area, these possible pockets of riparian areas could provide potential nesting and foraging habitats for the species. Therefore, this species could be impacted by implementation of the Proposed Action.

Specifically, the Proposed Action could cause direct loss or fragmentation of pockets of riparian habitat during the construction, drilling, and completion of wells, and during the construction of roads, well pads, compressor stations, and other project facilities. In addition, activities that increase levels of erosion and sedimentation (e.g., increased traffic) to area drainages could degrade water quality, which could reduce the proper functioning level of riparian habitats or modify stream flow. Furthermore, construction activities and increased traffic could introduce or spread invasive and noxious plant species within riparian habitats near or adjacent to disturbed areas. Increased habitat loss or degradation of riparian ecosystems caused by reductions in water flow, modification of streams, and potential invasion by exotic species could reduce overall habitat suitability for SWWF within the WTP Project Area.

The loss or modification of habitat is recognized as the primary cause of population decline for the SWWF (USFWS 2002a). Fragmentation of potential SWWF habitat reduces the chance of an individual finding suitable habitat. Searching for increasingly isolated patches of habitat leaves individuals vulnerable to mortality from competition, starvation, and predation, and can result in delayed breeding or loss of breeding opportunities (Finch and Stoleson 2000). Fragmentation of habitat can also increase the potential for brood parasitism by the brown-headed cowbird (*Molothrus ater*) (USFWS 2002a).

Although implementation of the Proposed Action could impact SWWF through potential habitat loss, some studies refute such adverse impacts based upon observed SWWF responses to surface disturbance in other areas. For instance, nesting has been observed in invasive species stands such as Russian olive (*Elaeagnus angustifolia*) and tamarisk (Sogge et al. 2003; Stoleson and Finch 2001). Additionally, Sogge et al. (1997) suggested some level of habituation to low levels of human disturbance.

Overall, degradation of potential habitat by weed species and sediment deposition, fragmentation, and direct habitat loss of riparian pocket areas under the Proposed Action could affect the potential for individual SWWF to use habitats within the WTP Project Area. Based on this information, the Proposed Action "***may affect, is likely to adversely affect***" the SWWF within the WTP Project Area.

Western Yellow-billed Cuckoo

As discussed under the SWWF analysis, pockets of riparian habitat not identified by GAP data could exist along Nine Mile Creek, and along the lower portion of Dry Creek, Harmon Creek, Cottonwood Creek, and along other area drainages. These riparian areas, which may serve as potential nesting and foraging habitats for the WYBC, could be impacted by implementation of the Proposed Action.

The Proposed Action could potentially cause direct loss or fragmentation of pockets of riparian habitat during the construction of roads, well pads, compressor stations, and other project facilities. In addition, activities that increase levels of erosion and sedimentation (e.g., increased traffic) to area drainages could degrade water quality, which could reduce the proper functioning level of riparian habitats. Furthermore, construction activities and increased traffic would likely introduce or spread invasive and noxious plant species within riparian habitats near or adjacent to disturbed areas. The presence of exotic plant species has been documented as decreasing the habitat suitability of native riparian habitats for the WYBC (Wiggins 2005). Increased habitat loss or degradation of riparian ecosystems through reductions in water flow, modification of streams, and the potential for invasion by exotic species could reduce overall habitat suitability for WYBC within the WTP Project Area. As the species has been documented near the WTP Project Area, WYBC could be directly and indirectly affected due to a loss of primary nesting, foraging, and breeding habitat, which is the primary cause of population decline for the species (Wiggins 2005). Fragmentation of habitat would also reduce the chance of an individual WYBC finding suitable habitat. Small, isolated populations become vulnerable to increased predation and parasitism that occur in fragmented habitats, and thus increase the risk for local extirpations (Wiggins 2005).

Overall, degradation of suitable habitat by weed species and sediment deposition, fragmentation, and direct habitat loss of riparian areas under implementation of the

Proposed Action could affect the potential for individual WYBC to use habitats within the WTP Project Area. Based on this information, the Proposed Action may affect, and is likely to contribute to a trend toward federal listing of the WYBC within the WTP Project Area.

Greater Sage-grouse

Oil and gas development can cause sage-grouse populations to decline; however, the specific reasons for declines are still unknown (Braun et al. 2002; Connelly et al. 2000). Some potential impacts of development to sage-grouse include: 1) direct habitat loss from well pad, road, and pipeline construction, 2) avoidance and displacement due to increased human activity and habitat fragmentation, and 3) potential for poaching due to increased access and human presence (such as at well sites and temporary worker housing locations) in the WTP Project Area. Braun et al. (2002) maintains that oil and gas development may have negative short-term (site construction, drilling, and completion), and long-term (road development) effects.

Although sagebrush habitats exist throughout much of the WTP Project Area, not all sagebrush habitats in the area are utilized by sage-grouse. Sage-grouse are a sagebrush obligate species, and rely almost exclusively on contiguous sagebrush ecosystems for leks, nesting sites, feeding sites, brood-rearing sites, protection, and wintering grounds. Although approximately 34,000 acres of sagebrush habitats occur within the WTP Project Area, these habitats are not contiguous. Sage-grouse crucial brooding areas and crucial winter habitat are concentrated primarily on mesa tops (Prickly Pear, Flat Iron, and Peter's Point Mesas) and on the southwestern portion of Horse Bench. Because surface-disturbing activities would occur within these areas, sage-grouse could be impacted by direct loss of crucial brooding and crucial winter habitats. Direct loss of specific sage-grouse habitat types are summarized below in **Table 4.10-1.**

Table 4.10-1 Approximate Surface Disturbances to UDWR Greater Sage-grouse Habitats within the WTP Project Area under the Proposed Action

UDWR-identified Habitat Values	Existing Acreage within the WTP Project Area[1]	Short-term Disturbance (acres)[2]	Long-term Disturbance (acres)[2]	Percentage of Long-term Habitat Lost
Crucial Winter	47,628	1,539	841	1.8
Crucial Brooding	38,033	981	530	1.4

[1]Minor discrepancies exist due to rounding.
[2]Disturbance acreages for wildlife habitat do not include cross country pipelines; therefore, habitat disturbance acreage totals do not add up to the total amount of disturbance.

Numerous studies have determined that sage-grouse are affected by human activity (Braun 1986; Lyon and Anderson 2003; Remington and Braun 1991). These studies have determined that hens nested farther away from leks in areas where human disturbance occurred, and that nesting initiation rates were also lower. In addition, it was also determined that male attendance at leks was lower when human activity occurred within 2 miles. One lek has been identified by the UDWR in the southwestern portion of the WTP Project Area, on Prickly Pear Mesa approximately 3.4 miles from the nearest proposed development. This lek could potentially be affected by project-related activities

occurring during the strutting season. However, given the distance of the lek from proposed development, realized impacts would be minimal.

Numerous citations have linked oil and gas development to declines in sage-grouse populations. For example, Holloran (2005), Doherty et al. (2008), Walker et al. (2007), Lyon and Anderson (2003), and Crompton and Mitchell (2005) have linked population reductions in response to oil and gas development. Sage-grouse exhibit fidelity to traditional winter use areas and surface disturbance and human activity in these areas may cause sage-grouse to displace to less adjacent habitats, which may not have the desired vegetative cover and/or may leave the species more susceptible to predation. Walker et al. (2007) specified sage-grouse avoidance of oil and gas development specific to winter ranges. Studies have documented sage-grouse avoidance of traditional winter habitat where energy development occurs (Doherty et. al. 2008; Copeland et. al 2009).

Another potential impact to sage-grouse from the Proposed Action includes displacement from or abandonment of crucial brooding habitat, crucial wintering habitat, and core winter use areas due to increased noise associated with traffic and construction, drilling, and completion activities, and compression. Lyon and Anderson (2003) determined that traffic disturbance of 1 to 12 vehicles per day during the breeding season may reduce nest-initiation rates and increase distances from leks during lek-site selection. In addition, Ingelfinger (2001) determined that sagebrush obligate bird densities were reduced within 100 meters (328 feet) of roads, regardless of traffic volumes. Project-related noise (e.g., increased volumes or types of noise from construction, drilling, and production equipment, changes in ambient tones or tonal noises, and repetitive low frequency noise emanating from production equipment such as compressor stations) would affect sage-grouse during the period those activities take place. Sage-grouse could be temporarily displaced by noise and other human activities until activities are completed. Under the Proposed Action, development in sage-grouse use areas could temporarily displace sage-grouse due to increased traffic and noise levels.

The relationship between sagebrush and sage-grouse is closest during the winter when birds switch from a diet of insects, forbs, and sagebrush to one composed of more than 96 percent sagebrush (Connelly et al. 2004). Thus, impacts to winter habitats could have a disproportionate effect on regional population size and persistence (Naugle et al. 2006). During winters with heavy snowfall and cold temperatures, birds could move onto more rugged land as they search for sagebrush above the snow and for protection from high winds (Connelly et al. 2004). Impacts due to winter drilling within the WTP Project Area could affect sage-grouse wintering on top of the mesas, which could cause avoidance and displacement of sage-grouse into sub-optimal habitats, thus potentially causing a decline in their winter survival.

The above-described potential impacts may affect individual sage-grouse and could lead to a downward trend of sage-grouse populations within the WTP Project Area, but would not likely cause a trend towards Federal listing. However, the Proposed Action also includes a Wildlife Mitigation Plan that would be fully developed and implemented in consultation with the UDWR, the BLM, and other applicable wildlife agencies and organizations (i.e., the WTPMOC - see **Section 2.2.2.2** and **Appendix B**). The goal of BBC's Wildlife Mitigation Plan is to improve habitats for sage-grouse, mule deer, elk, and raptors in an effort to offset the effects of winter drilling and other impacts of the project.

If the objectives of this plan are successfully met, habitat loss impacts to sage-grouse from the Proposed Action could be largely mitigated or offset as a result of BBC's commitments to implement and/or fund wildlife habitat enhancement projects. The mitigation plan specifically commits to an approximate 4:1 acre mitigation ratio based on total potential long-term surface disturbance under the Proposed Action. Thus, for the approximately 1,864 acres of long-term disturbance under the Proposed Action, BBC is committed to offset that habitat loss by directly or indirectly improving approximately 7,456 of habitat (i.e., 1,864 acres x 4 = 7,456 acres). Much of the mitigation would be implemented as straight-forward (direct) 4:1 acre habitat enhancement projects. However, many of the measures committed to by BBC include measures that go beyond acreage-defined habitat enhancement or mitigation and would benefit sage-grouse and sage-grouse habitats. The mitigation measures that would specifically target sage-grouse include the following commitments to:

- Fund and implement road realignment measures designed to reduce traffic-related impacts in sage-grouse wintering habitats;
- Implement habitat improvement and connectivity projects that are designed to convert existing pinyon-juniper habitats into sagebrush in order to benefit sage-grouse and other wildlife species;
- Implement off-site wet meadow and sage-grouse summer range enhancement projects; and
- Fund an ongoing, annual monitoring project whereby basic information on various mitigation projects, as well as limited information on wildlife populations and use areas, would be collected for use by the WTPMOC in planning future mitigation projects.

The proposed road realignments would benefit sage-grouse by re-aligning existing roads that currently bisect the two largest sage-grouse core winter use areas. These roads would be reconstructed away from the sagebrush parks and placed in pinyon-juniper woodlands and on the edges of sagebrush parks. In some cases (i.e., where the road is moved into pinyon-juniper woodlands), the realignments would create both visual and acoustical screening from traffic. However, the primary advantage of moving the existing roads would be to create a greater distance between the roads and sage-grouse core winter use areas, thus reducing disturbance to sage-grouse from vehicles. Areas where proposed road realignments would be implemented are illustrated on **Figure 2.2-1** in sage-grouse core winter use areas.

The conversion of pinyon-juniper habitats into sagebrush habitats would have a substantial beneficial effect on sage-grouse by creating or improving sagebrush habitat. Initial areas proposed for pinyon-juniper treatment on Peter's Point Mesa are illustrated in **Figure 2.2-1**.

Sage-grouse use of limited wet meadow habitats, pond margins, and spring areas indicate a preference for this habitat type during brood rearing (Klebenow 1969, Connelly & Markham 1983, Connelly et al. 1988). Therefore, proposed mitigation designed to increase these habitats would be beneficial to sage-grouse brood survival by increasing forbs and habitat for invertebrates. Under BBC's Wildlife Mitigation Plan, wet meadow enhancement would involve locating spring sources and if topography

allows, re-contouring the spring sources to distribute the water over as much surface area as possible creating a sub-irrigated meadow.

Summer range improvements would involve sagebrush removal in sage-grouse summer range using mechanical treatments with the goal of replacing the existing sagebrush with newer, younger, more vigorous sagebrush stands of similar percent land cover, type, and mosaic patterns. Increased grass and forb production resulting from these treatments would benefit sage-grouse broods.

Provided these elements of BBC's Wildlife Mitigation Plan (**Appendix B**) are successfully implemented, development activities and subsequent impacts to sage-grouse and sage-grouse habitats within the WTP Project Area could be partially mitigated. Furthermore, existing fragmentation of sage-grouse habitat could be counteracted by the efforts to improve and enlarge sagebrush parks within the WTP Project Area.

Based on the information above, implementation of the Proposed Action may impact individual sage-grouse and could lead to a downward trend of sage-grouse populations within the Project Area, but would not likely cause a trend towards Federal listing.

Colorado River Fish Species

Impact analysis for the bonytail, Colorado pikeminnow, humpback chub, and razorback sucker (collectively known as the Colorado River fish) are discussed together within this EIS, based on their similarity of affected habitat within the Green River and potential impacts under the Proposed Action.

No surface disturbance would occur within USFWS-designated critical habitat for the Colorado River fish located in the Green River, which flows through Desolation Canyon along the eastern boundary of the WTP Project Area. However, Colorado River fish present in the Green River would be impacted as a result of the Proposed Action by activities that deplete water, increase erosion and sedimentation (to Nine Mile Creek and the Green River), and increase the potential for exposure to hazardous substances in the case of an accidental spill.

The Colorado River fish are affected by activities that deplete or degrade the flow of downstream waters into the Upper Colorado River Basin (USFWS 1987). In addition to reducing the quantity of water with sufficient quality in a specific location, water depletions can also reduce a river's ability to create and maintain the physical habitat (areas inhabited by, or potentially inhabitable by, special status fish for use in spawning, nursery, feeding, and rearing, or access to these habitats) and the biological environment (food supply, predation, and competition). Water depletions can also contribute to alterations in flow regimes that favor non-native fish that compete with native fish species for resources.

On January 22, 1988, a Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (Recovery Program) was initiated in order to address depletion (and other) impacts to the Colorado River fish. Any water depletions from tributary waters within the Colorado River drainage are considered to "*jeopardize the continued existence*" of these fish under this Recovery Program. A Section 7 agreement was implemented on October 15, 1993, by Recovery Program participants in

order to further define and clarify objectives of the recovery process as stated in the Recovery Program. Incorporated into this agreement was the Recovery Implementation Program Recovery Action Plan (RIPRAP). The RIPRAP identified actions currently believed to be required to most expeditiously recover the Colorado River fish. Included in the RIPRAP was the requirement that a one-time depletion fee would be paid to help support the Recovery Program for all non-historical water depletions from the Upper Colorado River Basin. These depletion fees[1] were intended to be a Reasonable and Prudent Alternative to avoid jeopardy to the endangered Colorado River fish by depletions to the Upper Colorado River Basin. In 1995, USFWS eliminated these water depletion fees for water depletions from the Upper Colorado River Basin of 100 acre-feet per year or less (USFWS 1995c). However, as depletions would be greater than 100 acre-feet per year, BBC and other operators would be responsible for paying depletion fees associated with the Proposed Action.

Implementation of the Proposed Action would result in water depletion to the Upper Colorado River Basin. As discussed **Section 2.2.7**, it is estimated that total average annual water use for drilling, completion, and dust suppression under the Proposed Action would be approximately 228 acre-feet per year (75 percent from surface water sources and 25 percent from new water supply wells) and 407 acre-feet per year during peak development (75 percent from surface water sources and 25 percent from new water supply wells). As such, Section 7 consultation with USFWS[2] would be required based on water depletion to the Upper Colorado River Basin, and a one-time depletion fee would be required because water use would exceed 100 acre-feet/year under the Proposed Action.

Depletion of surface water from Nine Mile Creek, Dry Creek, and Cottonwood Creek would result in a reduction of water flow within and downstream of the WTP Project Area. Reduction of water flow could lead to habitat loss and/or degradation to the Colorado River fish. For example, depletion of surface water from Nine Mile Creek would reduce total water flow of Nine Mile Creek by 1.15 percent annually over the development period. Likewise, if new water supply wells within the Douglas Aquifer are considered to be tributary to these systems, depletions from these wells would also result in a reduction of water flow within and downstream of the WTP Project Area, which could lead to habitat loss and/or degradation for the Colorado River fish.

Implementation of the Proposed Action could also degrade USFWS-designated critical habitat for Colorado River fish in the Green River by increasing erosion, sediment yield, and the potential for exposure to hazardous substances in the case of an accidental spill. However, impacts related to accidental spills of hazardous substances would be minimized due to compliance with SPCC regulations. Surface-disturbing activities and subsequent erosion under the Proposed Action could increase sediment loading to Nine Mile Creek by about 0.46 percent in the short-term and about 0.16 percent in the long-term. This increased sediment loading could lead to slightly higher temperatures in Nine Mile Creek, which could have an adverse effect on fisheries and other aquatic species. Sediment could potentially be yielded to several perennial streams (i.e., Cottonwood Creek, Dry Canyon, Jack Canyon, and Nine Mile Creek), riparian habitats, and small, ephemeral drainages (i.e., Harmon Canyon and Stone Cabin Draw) within the WTP

[1] As of October 1, 2007 the rate is $17.79 per acre foot (USFWS 2007b).

[2] The USFWS is a Cooperating Agency on the WTP EIS. Section 7 Consultation between the Price Field Office and USFWS is ongoing for the WTP project.

Project Area. Conservatively assuming that all sediment delivered to Nine Mile Creek is eventually transported to the Green River, the Proposed Action would increase sediment loading to the Green River by about 0.011 percent in the short-term and about 0.0039 percent in the long-term (see **Section 4.5**).

Under the Proposed Action, implementation of the dust suppression plan (**Appendix R**) on Nine Mile Canyon Road, in between Harmon and Cottonwood Canyons (and on portions of Harmon, Gate, and Cottonwood Canyon Roads), would substantially reduce fugitive dust from industrial traffic, and therefore would reduce sediment deposition to aquatic habitats within these canyons. Although topical application of lignin sulfonates or soluble polymers on these canyon roads would reduce fugitive dust, these dust suppressants could negatively affect water quality and the Colorado River fish. High levels of lignin sulfonates in water increase biological oxygen demand, which can reduce biological activity. Environmental impacts on water resources are discussed in detail in **Section 4.5**.

Based upon potential depletion of the Green River and the potential for sedimentation to and contamination of the Green River, the Proposed Action **"*may affect, is likely to adversely affect*"** the Colorado River fish and their USFWS-designated critical habitats.

Uinta Basin Hookless Cactus

Implementation of the Proposed Action could potentially impact known Uinta Basin hookless cactus populations located on Federal lands in the northeastern portion of the WTP Project Area, south of Horse Bench. Potential direct and indirect impacts to the Uinta Basin hookless cactus may include the following:

- Increased potential for exploitation by cactus dealers and hobbyists;
- Removal or fragmentation of habitat for construction of well pads, roads, pipelines, and facilities;
- Trampling or modification of habitat by project machinery and OHVs;
- Encroachment and invasion of habitat by invasive and noxious weeds; and
- Cacti loss or habitat degradation due to increased sediment deposition from changes to surface water runoff;
- Increased potential for fugitive dust deposition on cactus individuals located adjacent to roadways and ROWs; and
- Potential loss of pollinators and fragmentation of pollinator habitat.

Analyses for each of these potential impacts are discussed in the paragraphs below.

The Uinta Basin hookless cactus is a highly desired species among cactus collectors because of its prized flowers (USFWS 1990b). A rare and highly endemic species, this cactus has been, and will continue to be, a particular prize among collectors, thus causing it to be threatened by unregulated commercial trade of specimens from wild populations (USFWS 1990b). Illegal collection of the Uinta Basin hookless cactus is an ongoing threat to the conservation and recovery of the species on Utah BLM lands (BLM 2006c). For example, an estimated 50 to 70 percent of a single Uinta Basin hookless cactus population in the Myton Bench area of the Diamond Mountain planning area was

illegally collected in the recent past (BLM 2006c). Anecdotal evidence suggests that collectors for the European cactus market conduct a great deal of the illegal collection on Utah BLM lands and other areas. In one example that supports this assertion, the BLM was provided with a European magazine that advertised the location of Utah BLM lands where the Uinta Basin hookless cactus could be found (BLM 2006c). However, the primary threat as determined by the USFWS is oil and gas development and the associated habitat loss and fragmentation.

Some land uses associated with project development under the Proposed Action could contribute to the illegal collection of Uinta Basin hookless cactus. These land uses include new road construction, upgrades to existing roads, and the resulting potential for increased OHV use within the WTP Project Area. Implementation of the Proposed Action would require the construction and improvement of approximately 200 miles of access roads on the BLM, State, and private lands. Increased access to the WTP Project Area via proposed and existing roads could result in increased recreational visitation and OHV use by the general public. If roads provide access to occupied Uinta Basin hookless cactus habitats (e.g., along proposed road improvements to Horse Bench), the potential for illegal collection could increase. With regards to recreational vehicles, according to USFWS, OHV use on Uinta Basin hookless cactus habitat is typically minimal, but is expected to increase with the increasing popularity and availability of improved OHVs (USFWS 1990b). Therefore, while improved road access on Horse Bench could potentially increase loss of cacti by increasing access for OHV use, this is not likely to occur given that 1) onsite clearances, as required by the BLM and UDOGM during the general permitting process, would be conducted prior to upgrading Horse Bench and 2) extreme, topographical features on either side of Horse Bench could provide some protection to Uinta Basin hookless cactus populations.

In addition to exploitation of cacti, direct removal and/or fragmentation of potential Uinta Basin hookless cactus habitat could occur during construction activities or recreational activities that excavate or trample vegetation. This would be detrimental to cacti located on coarse gravelly, river alluvium above the present floodplain of the Green River and its major tributaries (USFWS 1990b). However, direct loss or fragmentation of cactus populations due to construction activities would not be expected to occur under the Proposed Action because onsite clearances, as required by the BLM and UDOGM during the general permitting process, would be conducted to prevent incidental take prior to beginning surface disturbances.

Another concern for Uinta Basin hookless cactus population viability, related to increased surface disturbance within the WTP Project Area, would be the introduction and spread of invasive and noxious weed species. Weed species compete with native plants and can result in a deterioration of ecological conditions (Gelbard and Belnap 2003). Weed infestations can also interfere with reclamation potential in disturbed areas and can encroach upon undisturbed areas, including suitable and occupied Uinta Basin hookless cactus habitats. Because implementation of the Proposed Action would likely increase the transport, introduction, and spread of invasive and noxious weeds along area roadways, Uinta Basin hookless cactus suitable and occupied habitats could be affected by encroachment and competition from noxious weeds. Reducing cactus loss and habitat degradation caused by noxious weeds can be difficult because Uinta Basin hookless cactus may be vulnerable to various herbicides typically used in the control of noxious weeds (USFWS 1990b).

Other potential impacts to Uinta Basin hookless cactus populations under the Proposed Action could include increased potential for cactus loss or decreased productivity caused by changes in surface water flow regimes that degrade cactus habitats. Surface disturbances associated with the construction of well pads, access roads, pipelines, and other project facilities, would lead to increased soil erosion and sedimentation. As such, during storm events, stormwater runoff could potentially contain heavier concentrations of sediment that could flow onto Uinta Basin hookless cactus suitable and occupied habitats, if habitats are on the down-slope aspect of nearby disturbed areas. In addition, soil compaction from heavy project-related machinery and vehicles could alter surface water runoff patterns. This could increase sediment deposition in areas not previously affected by water runoff.

Changes to surface water flow regimes are important to impact analyses of development because the Uinta Basin hookless cactus is not tolerant of heavy sedimentation (Specht 2007). For example, the VFO documented the loss of a portion of one cactus population that was located on a down-slope aspect of Glen Bench Road in the Book Cliffs planning area. Anecdotal evidence suggests that this population was destroyed by burial under heavy sediment deposition due to surface water runoff from the unpaved Glen Bench Road; heavy sediment deposition buried and killed this population because deposition exceeded natural swelling and shrinking abilities of the cacti (Specht 2007). The VFO has also observed other populations in the Pariette Wetlands where natural sediment deposition (i.e., sedimentation not caused by natural gas development or other anthropogenic causes) caused loss of cacti or modified suitable habitat for the Uinta Basin hookless cactus (Specht 2007). However, per onsite clearances required by the BLM and UDOGM as part of the general permitting process and applicant-committed measures listed in **Table 2.2-6** that limit erosion potential, impacts resulting from changes to surface water flow (and thus increased sediment deposition) would not likely impact Uinta Basin hookless cactus populations located in the WTP Project Area.

Increased traffic levels within the WTP Project Area could cause increased deposition of fugitive dust on individual Uinta Basin hookless cactus located adjacent to roadways and ROWs. Dust settling on cactus may alter or limit the plant's ability to photosynthesize and/or reproduce until the dust is removed via precipitation or wind. Although dust commonly occurs within the WTP Project Area, increased traffic levels and surface disturbance would increase the presence of fugitive dust, which could decrease productivity of the Uinta Basin hookless cactus along roads and ROWs within the WTP Project Area. The use of water for dust suppression on major WTP Project Area roads (**Table 2.2-6**) could reduce fugitive dust and dust-related impacts on the Uinta Basin hookless cactus and its habitat.

Impacts from development may include the loss of pollinators in the area. Fragmentation of pollinator habitat has been shown to reduce the viability of pollinator populations and reproductive success (Murren 2002). Additional studies have suggested that pollination may be reduced because of reduced pollinator activity in disturbed and fragmented habitat (Moody-Weis and Heywood 2001; Donaldson et al. 2002).

Overall, given that the majority of well pads and roads would not occur near known occupied habitats (with the exception of road upgrades to Horse Bench), the extreme topography on either side of Horse Bench, applicant-committed measures (**Table 2.2-6**) that limit erosion potential, and that site-specific clearances would be conducted during

the onsite process as part of the general permitting process prior to initiating surface disturbance, the above-mentioned potential impacts would not likely threaten Uinta Basin hookless cactus populations or their suitable habitat within the WTP Project Area. Additionally, implementation of the Proposed Action would not challenge objectives of the USFWS Recovery Plan for the Uinta Basin hookless cactus (USFWS 1990b) to protect and preserve Uinta Basin hookless cactus habitat and their known population groups (e.g., Green River population in Utah). However, as the conservation measures for this species would not be implemented, the Proposed Action "***may affect, is likely to adversely affect***" the Uinta Basin hookless cactus or its suitable habitat within the WTP Project Area.

4.10.2.2 BLM Sensitive and Otherwise Special Status Species

Impacts to BLM sensitive and otherwise special status species would be comparable to those discussed for vegetation in **Section 4.8** and for wildlife in **Section 4.9**; however, given their ongoing habitat losses, sensitivity to disturbance, and declining population numbers, BLM sensitive or otherwise special status species would be more sensitive to project-related impacts than other more common species. For example, potential impacts to the burrowing owl, ferruginous hawk, golden eagle, northern goshawk, peregrine falcon, and Swainson's hawk would be similar to the potential impacts described for general raptor species (see **Section 4.9.1.3**). Given the similarity of impacts on BLM sensitive species to impacts on other species previously discussed, only those special status species of particular interest or sensitivity in the WTP Project Area are carried forward for individual impact analyses. It is anticipated that for any of the BLM sensitive or otherwise special status species not individually discussed (i.e., not specifically called out) in this section, the Proposed Action would have negligible or no impacts on those species, and would not likely cause a loss of viability or cause a trend towards Federal listing of those species.

Bald Eagle

As discussed in **Section 3.10**, bald eagle nests have not been documented in the WTP Project Area. Therefore, direct and indirect impacts to bald eagle nests or nesting activity are not anticipated as a result of the Proposed Action. However, potential impacts from the Proposed Action that may affect wintering bald eagles that roost in Desolation Canyon and forage within the WTP Project Area include:

- Direct habitat loss in foraging areas and/or habitat degradation to roosting areas due to construction activities;
- Temporary habitat loss due to changes in vegetation structure;
- Temporary displacement caused by increased human activity, traffic, and noise levels/types; and
- Increased potential for collisions with vehicles when foraging on carrion.

Implementation of the Proposed Action would result in the direct, initial short-term loss of approximately 3,656 acres of prey habitat during the construction of roads, pipelines, well pads, and ancillary facilities. Loss of prey habitat could decrease prey abundance, which has been shown to cause eagles to shift their geographic foraging patterns. These shifts in foraging patterns may force eagles to travel farther and thereby expend

additional energy, causing greater physical stress (Brown 1993). Additionally, any degradation of stream habitat and associated fisheries would lower the availability of aquatic prey for foraging eagles. Other effects on bald eagles could include direct habitat loss and temporary habitat loss associated with surface disturbance and changes/losses in vegetation structure from project development.

Wintering bald eagles congregate at established sites for purposes of feeding and sheltering in close proximity to sufficient food sources. Human activities near or within communal roost sites may prevent eagles from feeding or taking shelter, especially if other undisturbed, suitable sites are not available. Disruptive activities in the flight path between important roosting and foraging areas may interfere with feeding, and activities that permanently alter these habitats may eliminate essential elements for feeding and sheltering eagles within an area (USFWS 2006b). Some studies have shown that sensitivity of bald eagles to human activity may lead to nest or roost abandonment during periods of drilling or construction (Steidel and Anthony 1996; Steidel and Anthony 2000). However, other studies have shown evidence of bald eagle habituation to human-induced disturbances (Parson 1994; Steidl and Anthony 1996).

With implementation of the Proposed Action, drilling and construction activities would continue through the winter months, thus increasing human presence, traffic, and associated noise levels (e.g., increased volumes from construction, drilling, and production equipment, changes in ambient tones or tonal noises, and repetitive low frequency noise emanating from production equipment such as compressor stations). Wintering eagles are likely to search for prey in the WTP Project Area from early November through late March. Development activities could result in short-term displacement and increased stress levels in roosting and foraging bald eagles during these months. In addition, increased levels of traffic associated with construction activities on proposed and existing roads would increase the potential for mortality of eagles foraging on roadside carrion (Stinson et al. 2001). However, this potential impact would not likely be realized considering that little development has been proposed near bald eagle roosting and foraging habitats identified along Desolation Canyon.

Graham's Beardtongue

Implementation of the Proposed Action could potentially impact Graham's beardtongue populations located on Federal lands near the northeastern portion of the WTP Project Area, south of Horse Bench. Similar to other plants, the Proposed Action could result in the direct loss of populations or suitable habitat, or degradation to suitable and occupied habitats via increased erosion, sedimentation, pollinator loss and pollinator habitat fragmentation, and fugitive dust deposition. Other land uses associated with the Proposed Action that could contribute to the degradation of Graham's beardtongue habitat include new road construction, upgrades to existing roads, and the resulting potential for increased OHV use within the WTP Project Area. However, these impacts would not likely occur based on applicant-committed measures (**Table 2.2-6**) that limit erosion potential and include use of dust suppressants to limit fugitive dust, and that onsite clearances would be conducted as required by the BLM and UDOGM as part of the general permitting process. If Graham's beardtongue populations are identified during the onsite process, ROWs and facilities would be relocated, as directed by the AO. However, as conservation measures for this species would not be implemented, the Proposed Action could affect individual Graham's beardtongue in the WTP Project Area, and may result in a trend towards Federal listing.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible Effects

Displacement of special status wildlife resources from the WTP Project Area could be considered irreversible in that changes to migration patterns or behaviors may preclude use of an area for an extended period of time beyond the life of the project.

Irretrievable Effects

The Proposed Action would result in the loss of foraging, breeding, and cover habitats for special status species in the WTP Project Area.

The Proposed Action would result in the loss of crucial brooding areas, crucial winter habitat, and core winter use areas for sage-grouse.

Water depletion and changes in water quality as a result of the Proposed Action could lead to habitat degradation and decreased reproductive success for the Colorado River fish.

The Proposed Action would result in the loss and fragmentation of habitat for special status plant and wildlife species in the WTP Project Area.

4.10.3 Alternative B – No Action Alternative

Impacts common to all special status species under the No Action Alternative would be comparable to those discussed under the Proposed Action with the following noted exceptions:

- The magnitude of known and potential habitat disturbance due to direct habitat loss, increased erosion, sediment yield, and potential for exposures to hazardous substances in the event of a spill would be less under the No Action Alternative because development of new gas wells would only occur on State of Utah and private surface;
- The intensity of development and associated impacts would be less under the No Action Alternative because development would occur on a shorter, less intense drilling schedule with substantially less surface disturbance (e.g., due to fewer wells drilled and fewer temporary worker housing locations) in comparison to the Proposed Action; and
- Direct impacts to populations of or habitats for special status species could potentially be greater as development would be concentrated on State and private lands. On private lands, the potential for protection of special status species may be difficult or impossible to enforce.

4.10.3.1 Threatened, Endangered, and Candidate Species

Mexican Spotted Owl

Impacts to MSOs under the No Action Alternative would be similar in nature to those discussed under the Proposed Action; however, comparatively, the magnitude and intensity of habitat loss and degradation would be less under the No Action Alternative. Implementation of the No Action Alternative would result in the short-term loss of less than approximately 626 acres of prey habitat within the WTP Project Area, or an 83 percent reduction in prey habitat losses compared to those expected under the Proposed Action. Furthermore, direct habitat loss within USFWS-designated critical habitat for MSO, which is thought to be most suitable for MSO use, would be less than 1 acre under the No Action Alternative, or a 98 percent reduction in habitat loss compared to that expected under the Proposed Action. In addition, because drilling would be completed in 2 years (6 years shorter than the Proposed Action), temporary displacement of MSOs from nesting, roosting, and foraging areas would occur over a shorter duration under the No Action Alternative as compared to the Proposed Action.

However, based on the potential for displacement of nesting or hunting MSO, and modification and/or loss (albeit less than 1 acre) of USFWS-designated critical habitat, the No Action Alternative "***may affect, is likely to adversely affect***" the MSO and its USFWS-designated critical habitat within the WTP Project Area.

Southwestern Willow Flycatcher and Western Yellow-billed Cuckoo

Impact analyses for the SWWF and WYBC are discussed collectively in this section, given their similarity of preferred habitat (i.e., riparian areas) within the WTP Project Area, and similar impact potential to these species under the No Action Alternative.

Impacts to the SWWF and WYBC under the No Action Alternative would be comparable to those discussed under the Proposed Action; however, comparatively, the magnitude and intensity of potential habitat loss and degradation would be substantially less under the No Action Alternative. Implementation of the No Action Alternative would result in a smaller direct loss or fragmentation of pockets of riparian habitat potentially found on State and private lands. In addition, the introduction or spread of invasive and noxious weed species would be less under the No Action Alternative due to less surface disturbance, lower traffic levels, and consequently, lesser potential for weed seed dispersal. Furthermore, because drilling would be completed in 2 years (6 years shorter than the Proposed Action), potential displacement of SWWF or WYBC from nesting and foraging areas would occur over a shorter duration under the No Action Alternative as compared to the Proposed Action.

Overall, degradation of suitable habitat by weed species and sediment deposition, fragmentation, and direct loss of pockets of riparian areas under the No Action Alternative could affect the potential for individual SWWF or WYBC to use habitats within the WTP Project Area. Therefore, the No Action Alternative "***may affect, is likely to adversely affect***" the SWWF, and may affect and is likely to contribute to a trend toward federal listing of the WYBC.

Greater Sage-grouse

Impacts to the greater sage-grouse under the No Action Alternative would be similar in nature to those discussed under the Proposed Action; however, comparatively, the magnitude and intensity of habitat loss and degradation would be substantially less under the No Action Alternative. Direct loss of specific sage-grouse habitat types are summarized below in **Table 4.10-2.**

Table 4.10-2 Approximate Surface Disturbances to UDWR Greater Sage-grouse Habitats within the WTP Project Area under the No Action Alternative

UDWR-identified Habitat Values	Existing Acreage within the WTP Project Area[1]	Short-term Disturbance (acres)[2]	Long-term Disturbance (acres)[2]	Percentage of Long-term Habitat Lost
Crucial Winter	47,628	172	95	0.2
Crucial Brooding	38,033	130	78	0.2

[1]Minor discrepancies exist due to rounding.
[2]Disturbance acreages for wildlife habitat do not include cross country pipelines; therefore, habitat disturbance acreage totals do not add up to the total amount of disturbance.

Based on the information above, implementation of the No Action Alternative could lead in a downward trend of sage-grouse populations within the WTP Project Area, but would not lead in a trend towards Federal listing of the species.

Colorado River Fish Species

Impacts to Colorado River fish under the No Action Alternative would be similar in nature to those discussed under the Proposed Action with noted exceptions listed below:

- Impacts related to water depletion would be less under the No Action Alternative because less water would be used for well development and dust suppression. Total annual water used for drilling, completion, and dust suppression under the No Action Alternative would be approximately 141 acre-feet per year (75 percent from surface water sources and 25 percent from new water supply wells).
- Impacts related to depletion of surface water from Nine Mile Creek, Dry Creek, and Cottonwood Creek would be less under the No Action Alternative. For example, depletion of surface water from Nine Mile Creek would reduce total flow from Nine Mile Creek by approximately 0.71 percent annually over the development period.
- Impacts related to increased annual sediment loading would be less under the No Action Alternative. As discussed in **Section 4.5.2.1**, the No Action Alternative would increase sediment loading to Nine Mile Creek by about 0.086 percent in the short-term (about 0.028 percent in the long-term), and could increase sediment loading to the Green River by about 0.002 percent in the short-term (about 0.0007 percent in the long-term).

Section 7 consultation with USFWS[3] would be required based on water depletion to the Upper Colorado River Basin, and a one-time depletion fee[4] would be required because

[3] The USFWS is a Cooperating Agency on the WTP EIS. Section 7 Consultation between the Price Field Office and USFWS is ongoing for the WTP project.
[4] As of October 1, 2007 the rate is $17.79 per acre foot (USFWS 2007b).

water use would exceed 100 acre-feet/year under the No Action Alternative.

Based upon potential depletion of the Green River and the potential for sedimentation to and contamination of the Green River, the No Action Alternative **"*may affect, is likely to adversely affect*"** the Colorado River fish and their USFWS-designated critical habitats.

Uinta Basin Hookless Cactus

Impacts to the Uinta Basin hookless cactus under the No Action Alternative would be similar in nature to those discussed under the Proposed Action; however, comparatively, the magnitude and intensity of suitable habitat loss and degradation would be less under the No Action Alternative as less development would occur within the WTP Project Area. In addition, impacts to the Uinta Basin hookless cactus would be less under the No Action Alternative because the majority of State and private lands within the WTP Project Area are not located in close proximity to known Uinta Basin hookless cactus populations or within the eastern portion of the WTP Project Area where gravelly, alluvial soils are most likely to occur.

Overall, given that the majority of well pads and roads would not occur near known occupied habitats (with the exception of upgrades to Horse Bench), the extreme topography on either side of Horse Bench, and that site-specific clearances would be conducted during the onsite process as part of the general permitting process prior to initiating surface disturbance, the above-mentioned potential impacts would not likely threaten Uinta Basin hookless cactus populations or their suitable habitat within the WTP Project Area. Additionally, implementation of the No Action Alternative would not challenge objectives of the USFWS Recovery Plan for the Uinta Basin hookless cactus (USFWS 1990b) to protect and preserve Uinta Basin hookless cactus habitat and their known population groups (e.g., Green River population in Utah). However, as the conservation measures for this species would not be implemented, the No Action Alternative "***may affect, is likely to adversely affect***" the Uinta Basin hookless cactus and its suitable habitat within the WTP Project Area.

4.10.3.2 BLM Sensitive and Otherwise Special Status Species

Impacts to BLM sensitive and otherwise special status species would be comparable to those discussed for vegetation in **Section 4.8** and for wildlife in **Section 4.9**; however, given their ongoing habitat losses, sensitivity to disturbance, and declining population numbers, BLM sensitive and otherwise special status species would be more sensitive to project-related impacts than other more common species. For example, potential impacts to the burrowing owl, ferruginous hawk, golden eagle, northern goshawk, peregrine falcon, and Swainson's hawk would be comparable to the potential impacts described for general raptor species. Given the similarity of impacts on BLM sensitive species to impacts on other species previously discussed in **Section 4.9**, only those special status species of particular interest or sensitivity in the WTP Project Area are carried forward for individual impact analyses. It is anticipated for that for any of the BLM sensitive or otherwise special status species not individually discussed (i.e., not specifically called out) in this section, the No Action Alternative would have negligible or no impacts on those species, and would not likely cause a loss of viability or lead to a trend towards Federal listing of these species.

Bald Eagle

Impacts to bald eagles under the No Action Alternative would be similar in nature to those discussed under the Proposed Action; however, comparatively, the magnitude and intensity of habitat loss and degradation would be substantially less under the No Action Alternative. Implementation of the No Action Alternative would result in a loss of approximately 626 acres of prey habitat, or an 83 percent reduction in prey habitat losses compared to those under the Proposed Action. In addition, because drilling would be completed in 2 years (6 years shorter than the Proposed Action), temporary displacement of bald eagles from communal roosting sites and foraging areas would occur over a shorter duration under the No Action Alternative as compared to the Proposed Action.

The No Action Alternative would not likely result in a loss of roosting or foraging habitats, or temporary displacement from these areas because no surface disturbance would occur within bald eagle roosting and foraging habitats identified along Desolation Canyon on State and private lands.

Graham's Beardtongue

Impacts to Graham's beardtongue under the No Action Alternative would be similar in nature to those discussed under the Proposed Action; however, comparatively, the magnitude and intensity of suitable habitat loss and degradation would be less under the No Action Alternative as less development would occur within the WTP Project Area.

The No Action Alternative could result in the direct loss of populations or suitable habitat, or in degradation of occupied and suitable habitats via increased erosion, sedimentation, pollinator loss or pollinator habitat fragmentation, and fugitive dust deposition. However, these impacts would not likely occur as onsite clearances required by the BLM and UDOGM would be conducted as part of the general permitting process. If Graham's beardtongue populations are identified during the onsite process, ROWs and facilities would be relocated, as directed by the AO. However, as conservation measures for this species would not be implemented, the Proposed Action could affect individual Graham's beardtongue in the WTP Project Area, and may result in a trend towards Federal listing.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects under the No Action Alternative would be the same as under the Proposed Action.

4.10.4 Alternative C – Transportation Impact Reduction Alternative

Impacts common to all special status species under Alternative C would be similar in nature to those discussed under the Proposed Action with the following noted exceptions:

- Impacts related to intensity of development and season of development would be less than under the Proposed Action due to restrictions imposed on the number of rigs allowed to operate within the WTP Project Area at any one time. Of the allowable six rigs, only two would operate year-round, including during the winter

season (November 1 – May 15), and the remaining four rigs would operate on a seasonal basis, excluding the winter season. Under this drilling scenario for Alternative C, the development phase of the project would occur over 15 years (in comparison to an 8-year development phase under the Proposed Action);

- Impacts related to intensity of development would be further constrained by limits on new annual surface disturbance (approximately 280 acres per year), total unreclaimed surface disturbance allowed at any given time (approximately 2,250 acres), and maximum long-term disturbance (approximately 1,839 acres);
- Impacts related to winter drilling and development near naturally-occurring springs, 100-year floodplains, and riparian areas would be lessened under Alternative C because of the special protection measures described in **Section 2.4.1.2** for high-country watersheds and wildlife (which would directly or indirectly protect some of the threatened, endangered, candidate, BLM sensitive, and otherwise special status species discussed in this section of the EIS);
- Alternative C includes the Agency Wildlife Mitigation Plan, which outlines proposed mitigation for natural gas full field development in the WTP Project Area (see **Section 2.4.1.3** and **Appendix E**). The agencies' mitigation plan emphasizes the importance of offsetting, to the extent reasonable, the effects of the full field development in its entirety. As it applies to this section of the EIS, the agencies' plan gives priority to compensation for potential effects to sage-grouse (and indirectly to other species);
- Alternative C includes numerous BMPs and mitigating measures within **Table 2.6-7** and **Table 2.6-8**, respectively, that would directly or indirectly serve to eliminate, avoid, reduce, or partially mitigate direct and indirect impacts to threatened, endangered, candidate, BLM sensitive, and otherwise special status species; and
- Alternative C also includes the Long-Term Monitoring Plan for Water Resources (**Appendix Q**). The overall objective of the monitoring plan is to document changes in water quality and quantity that could potentially occur to WTP Project Area streams and their tributaries, the Green River, groundwater, and springs over the life of the project. These data would be used to guide mitigation measures for water resources, which would indirectly reduce impacts to special status species related to increased sedimentation and changes in water quality.

4.10.4.1 Threatened, Endangered, and Candidate Species

Mexican Spotted Owl

Under Alternative C, surface disturbance impacts to MSO, similar in nature to those discussed under the Proposed Action, would include disturbances to potential foraging habitat in the WTP Project Area and to approximately 545 acres of USFWS-designated critical habitat. However, comparatively, impacts related to intensity of development would be less under Alternative C. For example, transportation limitations restricting the number of rigs allowed to operate at any one time would decrease human activity within the WTP Project Area, and therefore, could decrease temporary displacement from foraging and roosting sites throughout the LOP. However, as use of airstrips would be required, avoidance by MSO of areas near the active airstrips could occur due to increased noise levels from project-related aircraft, and increased lighting along the

runways. These potential effects would be minimized by avoiding use of aircrafts within 1,000 feet of occupied nests during the breeding season, by down-shielding lighting at construction areas and project-related facilities, and by using white (preferable) or red strobe lights at night at airstrips, as outlined in **Table 2.6-8**.

Although the magnitude of surface disturbance within the WTP Project Area under Alternative C would be similar to that under the Proposed Action, the construction of a new route through Trail Canyon would result in the additional direct removal of approximately 9 acres of "fair" and "good" MSO habitats. Construction of this alternative access route could also result in MSO avoidance of, or displacement from, these habitats, as well as from other "fair" and "good" habitats located within ½ mile of the Trail Canyon route.

Mitigation measures within **Table 2.6-8** would reduce or eliminate the aforementioned potential impacts to MSOs that use "fair" and "good" habitats or USFWS-designated critical habitat within the WTP Project Area or associated with the Trail Canyon route. For example, potential impacts to nesting MSO would be minimized based on USFWS requirements for site-specific MSO nest surveys in "fair" and "good" habitats, along with the enforcement of spatial and seasonal stipulations during the breeding season.

Despite the above-listed measures, based on the potential for displacement of nesting or hunting MSO and modification and/or loss of "fair" and "good" habitats and USFWS-designated critical habitat, Alternative C "***may affect, is likely to adversely affect***" the MSO and its USFWS-designated critical habitat.

Southwestern Willow Flycatcher and Western Yellow-billed Cuckoo

Impacts to SWWF and WYBC under Alternative C would be similar in nature to those discussed under the Proposed Action; however, comparatively, impacts related to intensity of development would be less under Alternative C. Temporary displacement of SWWF or WYBC from nesting or foraging areas would be less as compared to the Proposed Action because drilling would be completed on a 15-year drilling schedule, instead of an 8-year schedule. However, since the total estimated surface disturbance under Alternative C is almost identical to that proposed under the Proposed Action, implementation of Alternative C would likely result in a comparable, direct loss or fragmentation of pockets of riparian habitat. However, potential infestations of invasive and noxious weeds in disturbed areas would likely be less under Alternative C because of surface disturbance thresholds.

Overall, degradation of suitable habitat by weed species and sediment deposition, fragmentation, and direct habitat loss of riparian areas under Alternative C could affect the potential for individual SWWF or WYBC to use habitats within the WTP Project Area. However, based on mitigating measures developed to monitor and minimize impacts to surface water, 100-year floodplains, springs, and riparian habitats (see **Table 2.6-8** and **Appendix Q**), impacts to potential SWWF or WYBC habitats would be reduced or minimized, and it is not likely that SWWF or WYBC would be impacted at the population level. Therefore, Alternative C "***may affect, is not likely to adversely affect***" the SWWF, and may affect but is not likely to contribute to a trend toward federal listing of the WYBC within the WTP Project Area.

Greater Sage-grouse

Impacts to the greater sage-grouse under Alternative C would be similar in nature to those discussed under the Proposed Action; however, comparatively, impacts related to the intensity of development would be less under Alternative C. Direct loss of specific sage-grouse habitat types are summarized below in **Table 4.10-3.**

Table 4.10-3 Approximate Surface Disturbances to UDWR Greater Sage-grouse Habitats within the WTP Project Area under Alternative C

UDWR-identified Habitat Values	Existing Acreage within the WTP Project Area[1]	Short-term Disturbance (acres)[2]	Long-term Disturbance (acres)[2]	Percentage of Long-term Habitat Lost
Crucial Winter	47,628	1,526	816	1.7
Crucial Brooding	38,033	987	429	1.2

[1]Minor discrepancies exist due to rounding.
[2]Disturbance acreages for wildlife habitat do not include cross country pipelines; therefore, habitat disturbance acreage totals do not add up to the total amount of disturbance.

As discussed in **Section 2.4.1.2**, Alternative C includes several additional special protective measures for sage-grouse:

- Disturbance would be minimized in and around core winter use areas through strategic planning for optimal realignment of existing roads and placement of new roads, well pads and other infrastructure, thereby reducing habitat fragmentation (see **Figure 2.4-1**). Strategic planning would include cooperation with the UDWR to determine appropriate locations for road realignments and other surface activities so as to minimize impacts on sage-grouse.
- No surface disturbance would be authorized in sage-grouse core winter use areas until the operator submits a site-specific, engineered plan of development for proposed roads, wells, pipelines, and/or other project features that would be constructed within those areas.
- No winter development (i.e., construction, drilling, or completion activities) would be allowed in sage-grouse core winter use areas on Prickly Pear Bench and in the Peters Point area (see **Figure 2.4-1**).
- Development (i.e., construction, drilling, and completion activities) would be precluded within two miles of known leks between March 15 and July 15. In addition, regardless of season, development would be prohibited within ½ mile of known leks.
- Upgrades to or use of the Interplanetary airstrip for project-related activities would be prohibited.

These special protective measures would reduce noise and visual impacts to important sage-grouse habitats within the WTP Project Area.

Gating of select roads and the subsequent reduction in public access and human presence in the WTP Project Area under Alternative C would help reduce the potential for poaching of sage-grouse and vehicle-related disturbance in brooding and wintering habitats. Road closures and traffic limitations are effective management tools that have

been used by the BLM to reduce traffic related effects on sage-grouse populations and habitats (Braun 2006; http://www.blm.gov/co/st/en/BLM_Information/newsroom/2006/sageroadclosures.html).

Furthermore, Alternative C also includes an Agency Wildlife Mitigation Plan (see **Section 2.4.1.3** and **Appendix E**) that would be fully developed and implemented in consultation with the UDWR, the BLM, and other applicable wildlife agencies and organizations. Provided the objectives of the Agency Wildlife Mitigation Plan are successfully met, habitat loss impacts to sage-grouse from Alternative C could be largely mitigated as a result of requirements to implement and/or fund wildlife habitat enhancement projects. Specific benefits to sage-grouse under the Agency Wildlife Mitigation Plan are discussed below.

The conversion of pinyon-juniper habitats into sagebrush habitats would have a substantial beneficial effect on sage-grouse by creating or improving sagebrush habitat within the WTP Project Area. Initial areas proposed for pinyon-juniper treatment are illustrated in **Figure 2.2-1**.

Proposed mitigation designed to increase wet meadow habitats, pond margins, and spring areas would be beneficial to sage-grouse brood survival by increasing forbs and habitat for invertebrates. Under the Wildlife Mitigation Plan, wet meadow enhancement would involve locating spring sources and if topography allows, re-contouring the spring sources to distribute the water over as much surface area as possible creating a sub-irrigated meadow.

Summer range improvements would involve sagebrush removal in sage-grouse summer range using mechanical treatments with the goal of replacing that existing sagebrush with newer, younger, more vigorous sagebrush stands of similar percent land cover, type, and mosaic patterns. Increased grass and forb production resulting from these treatments would benefit sage-grouse broods.

Mitigation that would require the operators to contribute funds to UDWR monitoring projects would benefit sage-grouse within the WTP Project Area by contributing to the UDWR's (and BLM's) knowledgebase regarding sage-grouse population numbers and trends. These data would in part be used to help the WTPMOC make decisions regarding future mitigation projects in the WTP Project Area; the data gathered would help facilitate an adaptive management approach for the Wildlife Mitigation Plan.

Based on the information above, implementation of Alternative C may impact individual sage-grouse and could lead to a downward trend of sage-grouse populations within the Project Area, but would not likely cause a trend towards Federal listing.

Colorado River Fish Species

Impacts to Colorado River fish under Alternative C would be similar in nature to those discussed under the Proposed Action with the following noted exceptions:

- Impacts related to water depletion would be less under Alternative C because as the development phase would be spread out over a 15-year period, less water would be used for well development and dust suppression on an annual basis (in comparison to the Proposed Action). Total average annual water use for drilling,

completion, and dust suppression under Alternative C would be approximately 129 acre-feet per year (75 percent from surface water sources and 25 percent from new water supply wells) and would be approximately 145 acre-feet per year (75 percent from surface water sources and 25 percent from new water supply wells) during peak development.

- Impacts related to depletion of surface water from Nine Mile Creek, Dry Creek, and Cottonwood Creek would be less under Alternative C. For example, depletion of surface water from Nine Mile Creek would reduce total flow from Nine Mile Creek by approximately 0.65 percent annually over the development period.
- Impacts related to increased annual sediment loading would be greater under Alternative C as compared to the Proposed Action; this increase in annual sediment loading is driven by the requirement for BBC and other operators to reroute or improve primary roads. As discussed in **Section 4.5.3.1**, Alternative C would increase sediment loading to Nine Mile Creek by about 0.52 percent in the short-term (about 0.16 percent in the long-term), and could increase sediment loading to the Green River by about 0.013 percent in the short-term (about 0.004 percent in the long-term). However, BMPs and mitigation measures in **Table 2.6-7** and **Table 2.6-8**, transportation restrictions in portions of the WTP Project Area, and adherence with surface disturbance limitations (i.e., improved interim reclamation efforts) would reduce annual sediment loading within the WTP Project Area such that erosion estimates would likely be similar to those under the Proposed Action.
- Alternative C would include several BMPs and mitigation measures related to protection of 100-year floodplains, springs, and riparian areas, which would indirectly serve to protect habitat of the Colorado River fish (see **Table 2.6-7** and **Table 2.6-8**, and **Appendix Q**).

Section 7 consultation with USFWS[5] would be required based on water depletion to the Upper Colorado River Basin, and a one-time depletion fee[6] would be required because water use would exceed 100 acre-feet/year under Alternative C. BMPs and mitigation measures developed to monitor and minimize impacts to surface water, 100-year floodplains, springs, and riparian habitats (see **Table 2.6-7** and **Table 2.6-8**, and **Appendix Q**), would reduce potential impacts to habitats for the endangered Colorado River fish.

Although the abovementioned mitigation measures could limit adverse impacts to perennial streams, riparian areas, and area drainages, based upon potential depletion of the Green River and the potential for sedimentation to and contamination of the Green River, Alternative C **"*may affect, is likely to adversely affect*"** the Colorado River fish and their USFWS-designated critical habitats.

Uinta Basin Hookless Cactus

Impacts to the Uinta Basin hookless cactus under Alternative C would be similar in nature to those discussed under the Proposed Action; however, comparatively, impacts

[5] The USFWS is a Cooperating Agency on the WTP EIS. Section 7 Consultation between the Price Field Office and USFWS is ongoing for the WTP project.
[6] As of October 1, 2007 the rate is $17.79 per acre foot (USFWS 2007b).

related to the annual intensity of development would be less under Alternative C based on an extended drilling schedule. In addition, measures to reduce transportation impacts and restrict the number of drill rigs, implementation of a Long-Term Monitoring Plan for Water Resources, and implementation of USFWS and BLM Conservation Measures for the Uinta Basin hookless cactus (refer to **Table 2.6-8**) could reduce or eliminate direct and indirect impacts to the species related to the implementation of Alternative C. As such, Alternative C would reduce the potential for exploitation by cactus dealers and hobbyists, removal or fragmentation of habitat for construction activities, trampling, or modification of habitat by project machinery and OHVs. In addition, Alternative C would reduce encroachment of habitat by invasive weeds, dust deposition and dust-related impacts on the cactus, pollinator loss and pollinator habitat fragmentation, and cacti loss or degradation of habitat due to increased sediment deposition. The rationale for each of these statements follows:

- Transportation Restrictions: Gating of Horse Bench Road (limited to administrative access only) could reduce the potential for exploitation by cactus dealers and hobbyists; would reduce traffic and therefore fugitive dust along Horse Bench; and could reduce potential cacti loss, habitat degradation, and impacts to pollinator and pollinator habitat caused by improved access for OHV use along access roads (BLM 2006d).
- Rig Number Restrictions: Seasonal rig restrictions would reduce the intensity of development throughout the year and thus could reduce effects from transportation such as increased erosion and sediment deposition near disturbed areas. In turn, this could also reduce impacts related to sediment deposition associated with changes to surface water runoff, and reduce impacts to cacti caused by invasive and noxious weeds.
- Dust Abatement Techniques: Use of water on major WTP Project Area roads could reduce impacts related to increased sediment deposition.
- Sediment Deposition: Implementation of the Long-Term Monitoring Plan for Water Resources (**Appendix Q**) under Alternative C would provide water quality data in the WTP Project Area. These data would then guide mitigation measures to reduce runoff and erosion, thus reducing the potential for sedimentation-related impacts on the cactus.
- USFWS Conservation Measures: Implementation of USFWS Conservation Measures for the Uinta Basin hookless cactus (refer to **Table 2.6-8**) could reduce impacts related to the direct removal or fragmentation of suitable and occupied habitats.

Given that the majority of well pads and roads would not occur near known occupied habitats (with the exception of road upgrades to Horse Bench), the extreme topography on either side of Horse Bench, BMPs (**Table 2.6-7**) that limit erosion potential, and implementation of USFWS and BLM Conservation Measures (**Table 2.6-8**), the above-mentioned potential impacts would not likely threaten Uinta Basin hookless cactus populations or their suitable habitat within the WTP Project Area. Additionally, implementation of the Proposed Action would not challenge objectives of the USFWS Recovery Plan for the Uinta Basin hookless cactus (USFWS 1990b) to protect and preserve Uinta Basin hookless cactus habitat and their known population groups (e.g., Green River population in Utah). These potential impacts would be of most concern on private lands where the USFWS and BLM Conservation Measures for the Uinta Basin

hookless cactus (refer to **Table 2.6-8**) may be difficult or impossible to enforce. However, on Federal or State surfaces, it is assumed that these conservation measures would be enforced, and therefore, direct impacts to the Uinta Basin hookless cactus would be reduced or eliminated. As such, Alternative C "***may affect, is not likely to adversely affect***" the Uinta Basin hookless cactus and its suitable habitat within the WTP Project Area.

4.10.4.2 BLM Sensitive and Otherwise Special Status Species

Impacts to BLM sensitive and otherwise special status species would be similar in nature to those discussed for vegetation in **Section 4.8** and for wildlife in **Section 4.9**; however, given their ongoing habitat losses, sensitivity to disturbance, and declining population numbers, BLM sensitive and otherwise special status species would be more sensitive to project-related impacts than other more common species. Given the similarity of impacts on BLM sensitive species to impacts on other species previously discussed, only those special status species of particular interest or sensitivity in the WTP Project Area are carried forward for individual impact analyses. It is anticipated for that for any of the BLM sensitive or otherwise special status species not individually discussed (i.e., not specifically called out) in this section, Alternative C would have negligible or no impacts on those species, and would not likely cause a loss of viability or lead to a trend towards Federal listing of those species.

Bald Eagle

Impacts to bald eagles under Alternative C would be similar in nature to those discussed under the Proposed Action; however, comparatively, impacts related to intensity of development would be less under Alternative C. For example, transportation limitations restricting the number of rigs allowed to operate in the winter could decrease temporary displacement from foraging and winter roosting sites, and could decrease the potential for vehicle collisions with carrion-feeding eagles. Similarly, year-round and seasonal gating of select roads and subsequent reductions in traffic and public access to certain portions of the WTP Project Area would reduce the potential for bald eagle displacement due to vehicle or human presence. However, as use of airstrips could be higher under Alternative C, avoidance by eagles of areas near the airstrips could occur due to increased noise levels from project-related aircraft, and thus could somewhat counteract or offset the beneficial effects of transportation restrictions. This impact could be minimized by locating airstrips at least 1,000 feet from bald eagle winter roosting sites, as presented in **Table 2.6-8**.

Prey base habitat loss impacts could also be mitigated or offset under Alternative C, which includes an Agency Wildlife Mitigation Plan (see **Section 2.4.1.3** and **Appendix E**) that would be fully developed and implemented in consultation with the UDWR, the BLM, and other applicable wildlife agencies and organizations. The mitigation plan specifically requires a 4:1 acre mitigation ratio based on total potential long-term surface disturbance under Alternative C. Thus, for the approximately 1,839 acres of long-term disturbance under Alternative C, the operators would be required to offset that habitat loss by directly or indirectly improving 7,356 acres of habitat. This mitigation requirement could mitigate or offset habitat and prey base losses that occur as a result of surface-disturbing activities.

Overall, Alternative C would not likely result in a loss of roosting or foraging habitats, or temporary displacement from these areas, based on the discussion above and given that no surface disturbance would occur within bald eagle roosting and foraging habitats identified along Desolation Canyon. In addition, mitigating measures to remove carrion from roadways, as listed in **Table 2.6-8**, would further minimize the potential for vehicle collisions with carrion-feeding bald eagles within the WTP Project Area. Furthermore, as stated above, many of the habitat related impacts would be minimized or avoided based on other mitigating measures in **Table 2.6-8** and the Agency Wildlife Mitigation Plan (see **Section 2.4.1.3** and **Appendix E**).

Graham's Beardtongue

Impacts to Graham's beardtongue under Alternative C would be similar in nature to those discussed under the Proposed Action; however, comparatively, impacts related to the intensity of development would be less under Alternative C based on an extended drilling schedule. In addition, measures to reduce transportation impacts (e.g., gating of Horse Bench Road), restrict the number of drill rigs, reduce the amount of fugitive dust, and implement USFWS and BLM Conservation Measures for the Graham's beardtongue (refer to **Table 2.6-8**) could reduce or eliminate direct and indirect impacts to the species under Alternative C. Gating of Horse Bench Road would substantially reduce OHV use of the area and potential OHV impacts on Graham's beardtongue habitat and populations (BLM 2006d). Seasonal rig restrictions would reduce the intensity of development throughout the year and thus could reduce effects from transportation such as increased erosion and sediment deposition near disturbed areas. In turn, this could also reduce impacts related to sediment deposition associated with changes to surface water runoff, and reduce impacts to the Graham's beardtongue caused by invasive and noxious weeds. Use of water to suppress dust on major WTP Project Area roads and the implementation of the Long-Term Monitoring Plan for Water Resources could reduce impacts related to fugitive dust and increased sediment deposition.

Implementation of USFWS Conservation Measures for the Graham's beardtongue (refer to **Table 2.6-8**) could reduce impacts related to the direct removal or fragmentation of suitable and occupied habitats. These potential impacts would be of most concern on private lands where the USFWS Conservation Measures for the Graham's beardtongue (refer to **Table 2.6-8**) may be difficult or impossible to enforce. However, on Federal or State surfaces, it is assumed that these conservation measures would be enforced, and therefore, direct impacts to the Graham's beardtongue would be reduced or eliminated.

Given the factors discussed above, that the majority of well pads and roads would not occur near known populations of Graham's beardtongue (with the exception of road upgrades to Horse Bench), BMPs (**Table 2.6-7**) that limit erosion potential, and that the USFWS Conservation Measures (**Table 2.6-8**) would be implemented, Alternative C could impact individual Graham's beardtongue in the WTP Project Area, but would not likely result in a trend towards Federal listing.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects under Alternative C would be the same as under the Proposed Action.

4.10.5 Alternative D – Conservation Alternative

General impacts common to special status species resulting from implementation of Alternative D would be similar in nature to those discussed under the Proposed Action with the following noted exceptions:

- The magnitude of direct surface disturbance and habitat loss, potential for erosion and sediment yield to drainages, and potential for exposure of drainages to hazardous substances in the event of a spill would be substantially less under Alternative D because of NSO requirements within canyon bottoms, Jack Canyon WSA, Desolation Canyon WSA, and because many of the proposed wells would be directionally drilled from multi-well pads;
- Impacts related to the intensity of development would be less under Alternative D because of the longer drilling schedule (21 years), seasonal restrictions (i.e., adherence to seasonal closures within crucial winter range and high-country watersheds), and transportation restrictions that would limit project-related and/or public access within sensitive areas;
- Impacts related to intensity of development would be further constrained by limits on new annual surface disturbance (approximately 180 acres per year), total unreclaimed surface disturbance allowed at any given time (approximately 1,440 acres), and maximum long-term disturbance (approximately 1,237 acres);
- Impacts to special status species, such as direct habitat loss, increased displacement and harassment, related to the construction and use of temporary worker housing locations, would be eliminated under Alternative D because no temporary worker housing locations would be constructed; and
- Alternative D includes numerous BMPs and mitigating measures within **Table 2.6-7** and **Table 2.6-8**, respectively, that would directly or indirectly serve to eliminate, avoid, reduce, or partially mitigate impacts to threatened, endangered, candidate, BLM sensitive, and otherwise special status species.

Species-specific impacts from implementation of Alternative D are discussed in the sections below.

4.10.5.1 Threatened, Endangered, and Candidate Species

Mexican Spotted Owl

Impacts to MSO under Alternative D would be similar in nature to those discussed under the Proposed Action; however, comparatively, impacts related to magnitude and intensity of development would be less under Alternative D. Implementation of Alternative D would result in the short-term loss of approximately 2,510 acres of prey habitat within the WTP Project Area during the construction of roads, pipelines, well pads, and ancillary facilities, or a 31 percent reduction in surface disturbance as compared to the Proposed Action. Furthermore, direct habitat loss within USFWS-designated critical habitat for MSO would be limited to approximately 546 acres. Impacts related to development intensity would be somewhat less under Alternative D because drilling would occur on a 21-year schedule (13 years longer than the Proposed Action). Furthermore, NSO restrictions within canyons under Alternative D would reduce

construction activities within canyons, and would therefore, reduce related noise and visual impacts within canyon habitats.

Mitigating measures within **Table 2.6-8** would further reduce or eliminate potential impacts to MSOs and their USFWS-designated critical habitat within the WTP Project Area. For example, potential impacts to nesting MSO would be minimized based on USFWS requirements for site-specific MSO nest surveys in "fair" and "good" habitats, along with the enforcement of spatial and seasonal stipulations during the breeding season.

Despite the above-listed measures, based on the potential for displacement of nesting or hunting MSO, and modification and/or loss of USFWS-designated critical habitat, Alternative D "***may affect, is likely to adversely affect***" the MSO and its USFWS-designated critical habitat.

Southwestern Willow Flycatcher and Western Yellow-billed Cuckoo

Impacts to SWWF and WYBC under Alternative D would be comparable to those discussed under the Proposed Action; however, impacts related to magnitude and intensity of development would be less under Alternative D. The potential for displacement of SWWF and WYBC from nesting and foraging areas would be less as compared to the Proposed Action because drilling would be completed on a 21-year drilling schedule, instead of an 8-year schedule because the level of development would be substantially reduced, and because surface disturbance would largely be prohibited in sensitive areas (e.g., canyon bottoms) under Alternative D.

Overall, degradation of suitable habitat by weed species, sediment deposition, fragmentation, and direct habitat loss of pockets of riparian areas under Alternative D could affect the potential for individual SWWF or WYBC to use habitats within the WTP Project Area. However, based on mitigation measures developed to minimize impacts to surface water, 100-year floodplains, springs, and riparian habitats (see **Table 2.6-8**), impacts to potential SWWF or WYBC habitats would be reduced or minimized, and it is not likely that SWWF or WYBC would be impacted at the population level. Therefore, Alternative D "***may affect, is not likely to adversely affect***" SWWF, and may affect but is not likely to contribute to a trend toward federal listing of the WYBC within the WTP Project Area.

Greater Sage-grouse

As compared to the Proposed Action, impacts related to the type, magnitude, and intensity of development would be substantially less under Alternative D given the reduced intensity of development, reduced surface disturbance within sage-grouse habitats, and prohibition of winter drilling. Direct loss of specific sage-grouse habitat types are summarized below in **Table 4.10-4.**

Table 4.10-4 Approximate Surface Disturbances to UDWR Greater Sage-grouse Habitats within the WTP Project Area under Alternative D				
UDWR-identified Habitat Values	**Existing Acreage within the WTP Project Area[1]**	**Short-term Disturbance (acres)[2]**	**Long-term Disturbance (acres)[2]**	**Percentage of Long-term Habitat Lost**
Crucial Winter	47,628	1,063	565	1.2
Crucial Brooding	38,033	799	429	1.1

[1]Minor discrepancies exist due to rounding.
[2]Disturbance acreages for wildlife habitat do not include cross country pipelines; therefore, habitat disturbance acreage totals do not add up to the total amount of disturbance.

Gating of the road onto Cedar Ridge, Cedar Ridge, and Jack Ridge would limit motorized access into areas of crucial brooding and winter habitat for the sage grouse. Reductions in public access and human presence in these habitats would help reduce the potential for poaching of sage-grouse and vehicle-related disturbance in brooding and wintering habitats. Road closures and traffic limitations are effective management tools that have been used by the BLM to reduce traffic related effects on sage-grouse populations and habitats (Braun 2006; http://www.blm.gov/co/st/en/BLM_Information/newsroom/2006/sageroadclosures.html).

Upgrades to or use of the Interplanetary airstrip for project-related activities would be prohibited under Alternative D, which would eliminate aircraft-related impacts to sage-grouse wintering habitat near the airstrip. However, the use of other airstrips and associated increased noise from aircrafts could displace sage-grouse from brooding areas. But these impacts would not affect sage-grouse during the winter since winter drilling would not occur within the WTP Project Area under Alternative D.

No surface occupancy restrictions, transportation restrictions, and surface disturbance thresholds could also indirectly reduce potential impacts to sage-grouse under Alternative D. Specifically, gating Horse Bench, Jack Ridge, and Cedar Ridge roads would reduce public access and human presence in crucial sage-grouse winter and brooding habitats, thus reducing the potential displacement and/or poaching in those areas.

Based on the information above, implementation of Alternative D may impact individual sage-grouse and could lead to a downward trend of sage-grouse populations within the Project Area, but would not likely cause a trend towards Federal listing.

Colorado River Fish Species

Impacts to Colorado River fish under Alternative D would be similar in nature to those discussed under the Proposed Action with the following noted exceptions:

- Impacts related to water depletion would be less under Alternative D because as the development phase would be spread out over a 21-year period, less water would be used for well development and dust suppression on an annual basis (in comparison to the Proposed Action). Total average annual water use for drilling,

completion, and dust suppression under Alternative D would be approximately 68 acre-feet per year (75 percent from surface water sources and 25 percent from new water supply wells) and would be 98 acre-feet per year (75 percent from surface water sources and 25 percent from new water supply wells) during peak development.

- Impacts related to depletion of surface water from Nine Mile Creek, Dry Creek, and Cottonwood Creek would be less under Alternative D. For example, depletion of surface water from Nine Mile Creek would reduce total flow from Nine Mile Creek by approximately 0.35 percent annually over the development period.
- Impacts related to increased annual sediment loading would be less under Alternative D. As discussed in **Section 4.5.4.1**, Alternative D would increase sediment loading to Nine Mile Creek by about 0.36 percent in the short-term (about 0.13 percent in the long-term), and would increase sediment loading to the Green River by about 0.009 percent in the short-term (about 0.0033 percent in the long-term).

Alternative D outlines two additional strategies that would reduce impacts to Colorado River fish by directly or indirectly limiting activities that could potentially degrade surface water features within the WTP Project Area, and in their USFWS-designated critical habitats:

- No leasing of unleased lands with wilderness characteristics; and, NSO by new well pads or other facilities on Federal lands within WSAs, unleased lands within the potential Nine Mile Canyon and Desolation Canyon ACECs, or canyon bottoms.
- Strict adherence to existing lease and land use plan stipulations (e.g., no surface disturbance within 330 feet of all perennial streams on either side from the centerline (or its 100-year floodplain, whichever is greater), within 660 feet of natural springs (flowing or not), or on slopes greater than 30 percent, unless it is determined that it would cause a greater impact to pursue other alternatives).

Despite the conservation strategies discussed above, Section 7 consultation with USFWS[7] would be required based on water depletion to the Upper Colorado River Basin; however, a one-time depletion fee[8] would not be required because water use would not exceed 100 acre-feet/year under Alternative D.

BMPs and mitigation measures developed to minimize impacts to surface water, 100-year floodplains, springs, and riparian habitats (see **Table 2.6-7** and **Table 2.6-8**), would reduce potential impacts to habitats for the Colorado River fish. However, based upon potential depletion of the Green River and the potential for sedimentation to and contamination of the Green River, Alternative D ***"may affect, is likely to adversely affect"*** the Colorado River fish and their USFWS-designated critical habitats.

[7] The USFWS is a Cooperating Agency on the WTP EIS. Section 7 Consultation between the Price Field Office and USFWS is ongoing for the WTP project.

[8] As of October 1, 2007 the rate is $17.79 per acre foot (USFWS 2007b).

Uinta Basin Hookless Cactus

Impacts to the Uinta Basin hookless cactus under Alternative D would be similar in nature to those discussed under the Proposed Action; however, comparatively, impacts related to the magnitude and intensity of development would be substantially less under Alternative D as less overall surface disturbance would occur throughout the WTP Project Area and drilling would occur on an extended drilling schedule. In addition, measures to reduce transportation impacts, manage surface disturbance thresholds, restrict surface occupancy within sensitive areas, and implement USFWS Conservation Measures for the Uinta Basin hookless cactus (refer to **Table 2.6-8**) could reduce or eliminate direct impacts to the species related to the implementation of Alternative D. As such, implementation of Alternative D would reduce the potential for exploitation by cactus dealers and hobbyists, removal or fragmentation of habitat due to construction, trampling of vegetation by vehicles or machinery, encroachment of habitat by invasive and noxious weeds, dust deposition and dust-related impacts on the cactus, pollinator loss and pollinator habitat fragmentation; and cacti loss or habitat degradation due to increased sediment deposition. The rationale for each of these statements follows:

- Transportation Access Restrictions: Gating of Horse Bench Road (limited to administrative access only) could reduce the potential for exploitation by cactus dealers and hobbyists; would reduce traffic and therefore fugitive dust along Horse Bench; and could reduce potential cacti loss, habitat degradation, and impacts to pollinator and pollinator habitat caused by improved access for OHV use along access roads (BLM 2006d).
- Surface Disturbance Restrictions: Surface disturbance restrictions could reduce impacts to cacti caused by loss of pollinators, pollinator habitat fragmentation, and invasive and noxious weed infestations. These surface disturbance thresholds (specifically, 180 new annual acres, 1,440 total unreclaimed acres, and 1,237 maximum long-term acres under Alternative D) could reduce the potential for weed encroachment or invasion of Uinta Basin hookless cactus occupied and suitable habitats. Furthermore, interim reclamation efforts could reduce the potential for cacti loss or habitat degradation caused by increased erosion and sediment deposition, and surface water runoff near construction areas.
- Surface Occupancy and leasing Restrictions: Leasing and surface occupancy restrictions within WSAs, unleased lands with wilderness characteristics, and unleased lands within potential ACECs could reduce impacts to WTP Project Area lands that either contain known Uinta Basin hookless cactus populations or are most likely to contain gravelly, alluvial soils in the eastern portion of the WTP Project Area. This could reduce potential loss of populations due to excavation activities or trampling by machinery, habitat removal, and/or fragmentation of occupied habitats. Furthermore, surface occupancy restrictions in these areas could reduce potential cacti loss or habitat degradation caused by increased erosion and sediment deposition levels near disturbed areas.
- USFWS Conservation Measures: Implementation of USFWS Conservation Measures for the Uinta Basin hookless cactus (refer to **Table 2.6-8**) could reduce impacts related to the direct removal or fragmentation of suitable and occupied habitats. These potential impacts would be of most concern on private lands where the USFWS Conservation Measures for the Uinta Basin hookless cactus

(refer to **Table 2.6-8**) may be difficult or impossible to enforce. However, on Federal or State surfaces, it is assumed that these conservation measures would be enforced, and therefore, direct impacts to the Uinta Basin hookless cactus would be reduced or eliminated.

Given the factors discussed above, that the majority of well pads and roads would not occur near known populations of Uinta Basin hookless cactus (with the exception of road upgrades to Horse Bench), BMPs (**Table 2.6-7**) that limit erosion potential, and that the USFWS Conservation Measures (**Table 2.6-8**) would be implemented, Alternative D "***may affect, is not likely to adversely affect***" the Uinta Basin hookless cactus or its suitable habitat within the WTP Project Area.

4.10.5.2 BLM Sensitive and Otherwise Special Status Species

Impacts to BLM sensitive and otherwise special status species would be similar in nature to those discussed for vegetation in **Section 4.8** and for wildlife in **Section 4.9**; however, given their ongoing habitat losses, sensitivity to disturbance, and declining population numbers, BLM sensitive and otherwise special status species would be more sensitive to project-related impacts than other more common species. Given the similarity of impacts on BLM sensitive species to impacts on other species previously discussed, only those special status species of particular interest or sensitivity in the WTP Project Area are carried forward for individual impact analyses. It is anticipated for that for any of the BLM sensitive or otherwise special status species not individually discussed (i.e., not specifically called out) in this section, Alternative D would have negligible or no impacts on those species, and would not likely cause a loss of viability or lead to a trend towards Federal listing of those species.

Bald Eagle

Impacts to bald eagles under Alternative D would be similar in nature to those discussed under the Proposed Action; however, comparatively, impacts related to magnitude and intensity of development would be less under Alternative D, given the reduced total surface disturbance, reduced intensity of development, and prohibition of winter drilling. Implementation of Alternative D would result in a loss of approximately 2,510 acres of prey habitat during the construction of roads pipelines, well pads, and ancillary facilities, or a 31 percent reduction in surface disturbance as compared to the Proposed Action. Impacts related to intensity of development would be less under Alternative D because drilling would occur on a 21-year schedule (13 years longer than the Proposed Action). However, potential impacts would occur over a much longer duration under Alternative D.

In addition, seasonal (i.e., no winter drilling) and transportation limitations could decrease temporary displacement from foraging and roosting sites due to noise and visual impacts associated with traffic, and could decrease the potential for vehicle collisions with carrion-feeding eagles. Year-round gating of the Cedar Ridge, Jack Canyon, Horse Bench, and Jack Ridge roads, and subsequent reductions in traffic and public access to certain portions of the Project Area accessed by these roads would reduce the potential for bald eagle-vehicle collisions as well as reducing potential for bald eagle displacement due to vehicle or human presence.

Avoidance by eagles of areas near the airstrips could occur due to increased noise levels from project-related aircraft, and thus could somewhat counteract or offset the beneficial effects of transportation restrictions. This impact could be minimized by locating airstrips at least 1,000 feet from bald eagle winter roosting sites, as presented in **Table 2.6-8**.

Overall, Alternative D would not likely result in a loss of roosting or foraging habitats, or temporary displacement from these areas, based on the discussion above and given that no surface disturbance would occur within bald eagle roosting and foraging habitats identified along Desolation Canyon. In addition, mitigating measures to remove carrion from roadways, as listed in **Table 2.6-8**, would further minimize the potential for vehicle collisions with carrion-feeding bald eagles within the WTP Project Area. Furthermore, many of the other habitat-related impacts would be minimized or avoided based on other mitigating measures in **Table 2.6-8.**

Graham's Beardtongue

Impacts to Graham's beardtongue under Alternative D would be similar in nature to those discussed under the Proposed Action; however, comparatively, impacts related to the magnitude and intensity of development would be substantially less under Alternative D as less overall surface disturbance would occur throughout the WTP Project Area and drilling would occur on an extended drilling schedule. In addition, measures to reduce transportation impacts, manage surface disturbance thresholds, restrict surface occupancy within sensitive areas, and implement USFWS Conservation Measures for the Graham's beardtongue (refer to **Table 2.6-8**) could reduce or eliminate direct and indirect impacts to the species related to the implementation of Alternative D.

Surface occupancy restrictions and transportation restrictions (including the gating of Horse Bench Road) would substantially reduce potential impacts related to increased OHV use and general access by the public (BLM 2006d). Surface disturbance restrictions could reduce impacts to the Graham's beardtongue caused by loss of pollinators, pollinator habitat fragmentation, and invasive and noxious weed infestations. Interim reclamation could also reduce impacts related to the encroachment of invasive and noxious weeds on suitable or occupied Graham's beardtongue habitats. In addition, implementation of USFWS Conservation Measures for the Graham's beardtongue (refer to **Table 2.6-8**) could reduce impacts related to the direct removal or fragmentation of suitable and occupied habitats. These potential impacts would be of most concern on private lands where the USFWS Conservation Measures for the Graham's beardtongue (refer to **Table 2.6-8**) may be difficult or impossible to enforce. However, on Federal or State surfaces, it is assumed that these conservation measures would be enforced, and therefore, direct impacts to the Graham's beardtongue would be reduced or eliminated.

Given the factors discussed above, that the majority of well pads and roads would not occur near known populations of Graham's beardtongue (with the exception of road upgrades to Horse Bench), BMPs (**Table 2.6-7**) that limit erosion potential, and that the USFWS Conservation Measures (**Table 2.6-8**) would be implemented, Alternative D could impact individual Graham's beardtongue in the WTP Project Area, but would not likely result in a trend towards Federal listing.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects under Alternative D would be the same as under the Proposed Action.

4.10.6 Alternative E – Agency Preferred Alternative

Impacts common to all special status species under Alternative E would be similar in nature to those discussed under the Proposed Action with the following noted exceptions:

- Impacts related to intensity of development would be further constrained by limits on new annual surface disturbance (approximately 540 acres per year), total unreclaimed surface disturbance allowed at any given time (approximately 2,310 acres), and maximum long-term disturbance (approximately 1,750 acres);
- Impacts related to winter drilling and development near naturally occurring springs, 100-year floodplains, and riparian areas would be lessened under Alternative E because of the special protection measures described in **Section 2.6.1.4** for high-country watersheds and wildlife (which would directly or indirectly protect some of the threatened, endangered, candidate, BLM sensitive, and otherwise special status species discussed in this section of the EIS);
- Alternative E includes the Agency Wildlife Mitigation Plan, which outlines proposed mitigation for natural gas full field development in the WTP Project Area (see **Section 2.6.1.5** and **Appendix E**). The agencies' mitigation plan emphasizes the importance of offsetting, to the extent reasonable, the effects of the full field development in its entirety. As applies to this section of the EIS, the agencies' plan gives priority to compensating for potential effects to threatened, endangered, candidate, and otherwise special status species discussed; and
- Alternative E also includes numerous BMPs and mitigating measures within **Table 2.6-7** and **Table 2.6-8**, respectively, that would directly or indirectly serve to eliminate, avoid, reduce, or partially mitigate impacts to wildlife resources.
- Alternative E also includes the Long-Term Monitoring Plan for Water Resources (**Appendix Q**). The overall objective of the monitoring plan is to document changes in water quality and quantity that could potentially occur to WTP Project Area streams and their tributaries, the Green River, groundwater, and springs over the life of the project. These data would be used to guide mitigation measures for water resources, which would indirectly reduce impacts to special status species related to increased sedimentation and changes in water quality.

4.10.6.1 Threatened, Endangered, and Candidate Species

Mexican Spotted Owl

Under Alternative E, surface disturbance impacts to MSO, similar in nature to those discussed under the Proposed Action, would include disturbances to potential foraging habitat in the WTP Project Area and to approximately 441 acres of USFWS-designated critical habitat. However, comparatively, impacts related to the intensity of development would likely be slightly less under Alternative E. For example, transportation limitations that gate new roads longer than 2 miles in sensitive resource areas or gate access to

WSAs would decrease anticipated traffic levels in or near USFWS-designated MSO critical habitat, thereby decreasing the potential for displacement of MSO from foraging and roosting sites. Furthermore, the intensity of development would also be less under Alternative E based on surface disturbance thresholds. Reduced drilling intensity and NSO in the canyon bottoms and the Nine Mile ACEC would further reduce the potential for displacement or other visual and auditory impacts on MSO as compared to the Proposed Action.

Mitigating measures within **Table 2.6-8** would also reduce or eliminate potential impacts to MSOs and their USFWS-designated critical habitat within the WTP Project Area. For example, potential impacts to nesting MSO would be minimized based on USFWS requirements for site-specific MSO nest surveys in "fair" and "good" habitats, along with the enforcement of spatial and seasonal stipulations during the breeding season.

Despite the above-listed measures, based on the potential for displacement of nesting or hunting MSO, and modification and/or loss of USFWS-designated critical habitat, Alternative E "***may affect, is likely to adversely affect***" the MSO and its USFWS-designated critical habitat.

Southwestern Willow Flycatcher and Western Yellow-billed Cuckoo

Impacts to SWWF and WYBC under Alternative E would be similar in nature to those discussed under the Proposed Action; however, comparatively, impacts related to intensity of development would be less under Alternative E. Alternative E would result in less direct loss or fragmentation of pockets of riparian habitat because of NSO requirements in canyon bottoms and the Nine Mile ACEC. However, the potential for infestation by invasive and noxious weeds in disturbed areas could be lessened under Alternative E due to surface disturbance thresholds.

Overall, degradation of suitable habitat by weed species and sediment deposition, fragmentation, and direct habitat loss of pockets of riparian areas under implementation of Alternative E could affect the potential for individual SWWF or WYBC to use habitats within the WTP Project Area. However, based on mitigation measures developed to monitor and minimize impacts to surface water, 100-year floodplains, springs, and riparian habitats (see **Table 2.6-8** and **Appendix Q**), impacts to potential SWWF or WYBC habitats would be reduced or minimized, and it is not likely that SWWF or WYBC would be impacted at the population level. Therefore, Alternative E "***may affect, is not likely to adversely affect***" the SWWF, and may affect but is not likely to contribute to a trend toward federal listing of the WYBC within the WTP Project Area.

Greater Sage-grouse

Impacts to the greater sage-grouse under Alternative E would be similar in nature to those discussed under the Proposed Action; however, comparatively, impacts related to the intensity of development would be less under Alternative E. Direct loss of specific sage-grouse habitat types are summarized below in **Table 4.10-5.**

Table 4.10-5 Approximate Surface Disturbances to UDWR Greater Sage-grouse Habitats within the WTP Project Area under Alternative E

UDWR-identified Habitat Values	Existing Acreage within the WTP Project Area[1]	Short-term Disturbance (acres)[2]	Long-term Disturbance (acres)[2]	Percentage of Long-term Habitat Lost
Crucial Winter	47,628	1,458	780	1.6
Crucial Brooding	38,033	922	495	1.3

[1]Minor discrepancies due to rounding
[2]Disturbance acreages for wildlife habitat do not include cross country pipelines; therefore, habitat disturbance acreage totals do not add up to the total amount of disturbance.

As discussed in **Section 2.6.1.4**, Alternative E includes special protective measures for sage-grouse:

- Disturbance would be minimized in and around core winter use areas through strategic planning for optimal realignment of existing roads and placement of new roads, well pads and other infrastructure, thereby reducing habitat fragmentation (see **Figure 2.6-1**). Strategic planning would include cooperation with the UDWR to determine appropriate locations for road realignments and other surface activities so as to minimize impacts on sage-grouse.
- No surface disturbance would be authorized in sage-grouse core winter use areas until the operator submits a site-specific, engineered plan of development for proposed roads, wells, pipelines, and/or other project features that would be constructed within those areas.
- No winter development (i.e., construction, drilling, or completion activities) would be allowed in sage-grouse core winter use areas on Prickly Pear Bench and in the Peters Point area (see **Figure 2.6-1**).
- Development (i.e., construction, drilling, and completion activities) would be precluded within two miles of known leks between March 15 and July 15. In addition, regardless of season, development would be prohibited within ½ mile of known leks.
- Upgrades to or use of the Interplanetary airstrip for project-related activities would be prohibited.

These special protective measures would reduce noise and visual impacts to important sage-grouse habitats within the WTP Project Area.

In addition, road gating under Alternative E, discussed in **Section 2.6**, would reduce public access to areas utilized by sage-grouse. This reduction in public access and human presence in the WTP Project Area would reduce the potential for poaching of sage-grouse.

Furthermore, Alternative E also includes an Agency Wildlife Mitigation Plan that would be fully developed and implemented in consultation with the UDWR, the BLM, and other applicable wildlife agencies and organizations (see **Section 2.6.1.5** and **Appendix E**). Provided the objectives of the Agency Wildlife Mitigation Plan are successfully met, habitat loss impacts to sage-grouse from Alternative E could be largely mitigated.

Specific benefits to sage-grouse under the Agency Wildlife Mitigation Plan are discussed below.

The conversion of pinyon-juniper habitats into sagebrush habitats would have a substantial beneficial effect on sage-grouse by creating or improving sagebrush habitat within the WTP Project Area. Initial areas proposed for pinyon-juniper treatment are illustrated in **Figure 2.2-1**.

Proposed mitigation designed to increase wet meadow habitats, pond margins, and spring areas would be beneficial to sage-grouse brood survival by increasing forbs and habitat for invertebrates. Under the Wildlife Mitigation Plan, wet meadow enhancement would involve locating spring sources and if topography allows, re-contouring the spring sources to distribute the water over as much surface area as possible creating a sub-irrigated meadow.

Summer range improvements would involve sagebrush removal in sage-grouse summer range using mechanical treatments with the goal of replacing that existing sagebrush with newer, younger, more vigorous sagebrush stands of similar percent land cover, type, and mosaic patterns. Increased grass and forb production resulting from these treatments would benefit sage-grouse broods.

Mitigation that would require the operators to contribute funds to UDWR monitoring projects would benefit sage-grouse within the WTP Project Area by contributing to the UDWR (and BLM's) knowledgebase regarding sage-grouse population numbers and trends. These data would in part be used to help the WTPMOC make decisions regarding future mitigation projects in the WTP Project Area; the data gathered would help facilitate an adaptive management approach for the Wildlife Mitigation Plan.

Based on the information above, implementation of Alternative E may impact individual sage-grouse and could lead to a downward trend of sage-grouse populations within the Project Area, but would not likely cause a trend towards Federal listing.

Colorado River Fish Species

Impacts to Colorado River fish under Alternative E would be similar in nature to those discussed under the Proposed Action with the following exceptions:

- Impacts related to water depletion would be slightly less under Alternative E because as the development phase would potentially be spread out over a 9-year period, and thus less water would be used for well development and dust suppression on an annual basis (in comparison to the Proposed Action). Total average annual water use for drilling, completion, and dust suppression under Alternative E would be approximately 199 acre-feet per year (75 percent from surface water sources and 25 percent from new water supply wells) and would be approximately 285 acre-feet per year (75 percent from surface water sources and 25 percent from new water supply wells) during peak development.
- Impacts related to depletion of surface water from Nine Mile Creek, Dry Creek, and Cottonwood Creek would be less under Alternative E. For example, depletion of surface water from Nine Mile Creek would reduce total flow from

Nine Mile Creek by approximately 1.01 percent annually over the development period.

- Impacts related to increased annual sediment loading would be greater under Alternative E as compared to the Proposed Action; this increase in annual sediment loading is driven by the requirement for BBC and other operators to reroute or improve primary roads. As discussed in **Section 4.5.5.1**, Alternative E would increase sediment loading to Nine Mile Creek by about 0.48 percent in the short-term (about 0.15 percent in the long-term), and would increase sediment loading to the Green River by 0.0119 percent in the short-term (about 0.0038 percent in the long-term). However, BMPs and mitigation measures in **Table 2.6-7** and **Table 2.6-8**, transportation restrictions in portions of the WTP Project Area, and adherence with surface disturbance limitations (i.e., improved interim reclamation efforts) would reduce annual sediment loading within the WTP Project Area such that erosion estimates would likely be similar to those under the Proposed Action.
- Alternative E would include several measures related to protection of 100-year floodplains, springs, and riparian areas, which would indirectly serve to protect habitat of the endangered Colorado River fish (see **Table 2.6-7** and **Table 2.6-8**, and **Appendix Q**).

Section 7 consultation with USFWS[9] would be required based on water depletion to the Upper Colorado River Basin, and a one-time depletion fee[10] would be required because water use would exceed 100 acre-feet/year under Alternative E. Mitigation measures developed to monitor and minimize impacts to surface water, 100-year floodplains, springs, and riparian habitats (see **Table 2.6-7** and **Table 2.6-8**, and **Appendix Q**), as well as NSO in canyon bottoms, would reduce potential impacts to habitats for the endangered Colorado River fish.

Although the abovementioned mitigation measures could limit adverse impacts to perennial streams, riparian areas, and area drainages, based upon potential depletion of the Green River and the potential for sedimentation to and contamination of the Green River, Alternative E **"*may affect, is likely to adversely affect*"** the Colorado River fish and their USFWS-designated critical habitats.

Uinta Basin Hookless Cactus

Impacts to the Uinta Basin hookless cactus under Alternative E would be similar in nature to those discussed under the Proposed Action; however, comparatively, impacts related to annual intensity of development would be slightly less under Alternative E as the drilling schedule would be extended by one year. In addition, measures to reduce transportation impacts, implementation of surface disturbance thresholds, implementation of the Long-Term Monitoring Plan for Water Resources, use of dust abatement techniques, and implementation of USFWS and BLM Conservation Measures for the Uinta Basin hookless cactus (refer to **Table 2.6-8**) could reduce or eliminate direct and indirect impacts to the species related to the implementation of Alternative E. As such, implementation of Alternative E would reduce the potential for exploitation by

[9] The USFWS is a Cooperating Agency on the WTP EIS. Section 7 Consultation between the Price Field Office and USFWS is ongoing for the WTP project.
[10] As of October 1, 2007 the rate is $17.79 per acre foot (USFWS 2007b).

cactus dealers and hobbyists, removal or fragmentation of habitat due to construction, trampling of vegetation by vehicles or machinery, encroachment of habitat by invasive and noxious weeds, dust deposition and dust related impacts on the cactus, pollinator loss and pollinator habitat fragmentation, and cacti loss or habitat degradation due to increased sediment deposition. The rationale for each of these statements follows:

- Transportation Access Restriction: Gating access new roads longer than 2 miles in sensitive resource areas and on all new roads that provide access into WSAs (i.e., closed to the general public) could reduce potential for exploitation by cactus dealers and hobbyists, would reduce traffic and therefore fugitive dust, and could reduce potential cacti loss or habitat degradation due to increased OHV use along access roads.
- Surface Disturbance Restrictions: Surface disturbance restrictions could reduce impacts to cacti populations caused by loss of pollinators, pollinator habitat fragmentation, and invasive and noxious weed infestations. These surface disturbance thresholds (specifically, 540 new annual acres, 2,310 total unreclaimed acres, and 1,750 maximum long-term acres under Alternative E) could reduce the potential for weed encroachment or invasion of Uinta Basin hookless cactus occupied and suitable habitats. Furthermore, interim reclamation efforts could reduce the potential for cacti loss or habitat degradation caused by increased erosion and sediment deposition, and surface water runoff near construction areas.
- Dust Abatement Techniques: Use of water on major WTP Project Area roads could reduce impacts related to increased sediment deposition.
- Sediment Deposition: Implementation of the Long-Term Monitoring Plan for Water Resources (**Appendix Q**) under Alternative E would provide water quality data in the WTP Project Area. This data would then guide mitigation measures to reduce runoff and erosion, reducing the potential for sedimentation related impacts on the cactus.
- USFWS Conservation Measures: Implementation of USFWS and BLM Conservation Measures for the Uinta Basin hookless cactus (refer to **Table 2.6-8**) could reduce impacts related to the direct removal or fragmentation of suitable and occupied habitats. These potential impacts would be of most concern on private lands where the USFWS and BLM Conservation Measures for the Uinta Basin hookless cactus may be difficult or impossible to enforce. However, on Federal or State surfaces, it is assumed that these conservation measures would be enforced, and therefore, direct impacts to the Uinta Basin hookless cactus would be reduced or eliminated.

Given the factors discussed above, that the majority of well pads and roads would not occur near known populations of Uinta Basin hookless cactus (with the exception of road upgrades to Horse Bench), BMPs (**Table 2.6-7**) that limit erosion potential, and that the USFWS and BLM Conservation Measures (**Table 2.6-8**) would be implemented, Alternative E "***may affect, is not likely to adversely affect***" the Uinta Basin hookless cactus or its suitable habitat within the WTP Project Area.

4.10.6.2 BLM Sensitive and Otherwise Special Status Species

Impacts to BLM sensitive and otherwise special status species would be similar in nature to those discussed for vegetation in **Section 4.8** and for wildlife in **Section 4.9**; however, given their ongoing habitat losses, sensitivity to disturbance, and declining population numbers, BLM sensitive and otherwise special status species would be more sensitive to project-related impacts than other more common species. Given the similarity of impacts on BLM sensitive species to impacts on other species previously discussed, only those special status species of particular interest or sensitivity in the WTP Project Area are carried forward for individual impact analyses. It is anticipated for that for any of the BLM sensitive or otherwise special status species not individually discussed (i.e., not specifically called out) in this section, Alternative E would have negligible or no impacts on those species, and would not likely cause a loss of viability or lead to a trend towards Federal listing of those species.

Bald Eagle

Impacts to bald eagles under Alternative E would be similar in nature to those discussed under the Proposed Action; however, comparatively, impacts related to intensity of development would be slightly less under Alternative E. For example, transportation limitations that gate new roads longer than 2 miles in sensitive resource areas or gate access to WSAs could decrease traffic levels within and near bald eagle habitats, thereby decreasing potential displacement from foraging and roosting sites. Transportation limitations could also decrease the potential for vehicle collisions with carrion-feeding eagles during the winter. However, as use of airstrips could be higher under Alternative E, avoidance by eagles of areas near the airstrips could occur due to increased noise levels from project-related aircraft, and thus could somewhat counteract or offset the beneficial effects of transportation restrictions. This impact could be minimized by locating airstrips at least 1,000 feet from bald eagle winter roosting sites, as presented in **Table 2.6-8**.

Prey base habitat loss impacts could also be mitigated or offset under Alternative E, which includes an Agency Wildlife Mitigation Plan (see **Section 2.6.1.5** and **Appendix E**) that would be fully developed and implemented in consultation with the UDWR, the BLM, and other applicable wildlife agencies and organizations. The mitigation plan specifically requires a 4:1 acre mitigation ratio based on total potential long-term surface disturbance under Alternative E. Thus, for the approximately 1,678 acres of long-term disturbance under Alternative E, the operators would be required to offset that habitat loss by directly or indirectly improving 6,712 acres of habitat. This mitigation requirement could mitigate or offset habitat and prey base losses that occur as a result of initial surface-disturbing activities.

Overall, Alternative E would not likely result in a loss of roosting or foraging habitats, or temporary displacement from these areas, based on the discussion above and given that no surface disturbance would occur within bald eagle roosting and foraging habitats identified along Desolation Canyon. In addition, mitigating measures to remove carrion from roadways, as listed in **Table 2.6-8**, would further minimize the potential for vehicle collisions with carrion-feeding bald eagles within the WTP Project Area. Furthermore, as stated above, many of the habitat related impacts would be minimized or avoided based on other mitigating measures in **Table 2.6-8** and the Agency Wildlife Mitigation Plan (see **Section 2.6.1.5** and **Appendix E**).

Graham's Beardtongue

Impacts to Graham's beardtongue under Alternative E would be similar in nature to those discussed under the Proposed Action; however, comparatively, impacts related to the intensity of development would be slightly less under Alternative E as the drilling schedule would be extended by one year. In addition, measures to reduce transportation impacts, manage surface disturbance thresholds, and implement USFWS Conservation Measures for the Graham's beardtongue (refer to **Table 2.6-8**) could reduce or eliminate direct impacts to the species related to the implementation of Alternative E.

Transportation restrictions including gated access on new roads longer than 2 miles in sensitive resource areas and on all new roads that provide access into WSAs (i.e., closed to the general public) could reduce potential impacts related to increased OHV use and general access by the public. Surface disturbance restrictions could reduce impacts to beardtongue populations caused by loss of pollinators, pollinator habitat fragmentation, and invasive and noxious weed infestations. Interim reclamation could also reduce impacts related to the encroachment of invasive and noxious weeds on suitable or occupied Graham's beardtongue habitats. Use of water on major WTP Project Area roads could reduce impacts related to increased sediment deposition. In addition, implementation of USFWS Conservation Measures for the Graham's beardtongue (refer to **Table 2.6-8**) could reduce impacts related to the direct removal or fragmentation of suitable and occupied habitats. These potential impacts would be of most concern on private lands where the USFWS Conservation Measures for the Graham's beardtongue (refer to **Table 2.6-8**) may be difficult or impossible to enforce. However, on Federal or State surfaces, it is assumed that these conservation measures would be enforced, and therefore, direct impacts to the Graham's beardtongue would be reduced or eliminated.

Given the factors discussed above, that the majority of well pads and roads would not occur near known populations of Graham's beardtongue (with the exception of road upgrades to Horse Bench), BMPs (**Table 2.6-7**) that limit erosion potential, and that the USFWS Conservation Measures (**Table 2.6-8**) would be implemented, Alternative E could impact individual Graham's beardtongue in the WTP Project Area, but would not likely result in a trend towards Federal listing.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects under Alternative E would be the same as under the Proposed Action.

4.11 RECREATION

4.11.1 Alternative A – Proposed Action

The recreational landscape in the WTP Project Area ranges from rural, with some development on private lands along Nine Mile Canyon, to predominantly undeveloped lands throughout the majority of the WTP Project Area. Both past and ongoing natural gas operations have added an industrial component to the landscape throughout portions of the WTP Project Area. Additional development under the Proposed Action

would add substantially to the industrial landscape. The potential impacts on recreational resources are related to the loss of opportunities and diminishment of experience. Specifically, recreation impacts would include:

- Natural gas development altering the natural setting or character of an area used for recreation;
- Natural gas-related construction, operation, and maintenance activities disrupting recreation as a result of noise (e.g., increased volumes from construction, drilling, and production equipment, changes in ambient tones or tonal noises, and repetitive low frequency noise emanating from production equipment such as compressor stations), dust, traffic, visual intrusions, and increased industrial presence;
- Natural gas development increasing motorized access into previously undeveloped and/or inaccessible areas; and
- Natural gas development activities being inconsistent or incompatible with inventoried recreational opportunities in the WTP Project Area.

4.11.1.1 Impacts to Recreation Management

Recreation Opportunity Spectrum

Under Alternative A, development is proposed within three of the four ROS classifications within the WTP Project Area. Additional development is proposed on State and private lands that are not inventoried under the ROS spectrum.

While there are no well pads or roads proposed on Federal lands within the Nine Mile Canyon corridor, there is a pump station proposed on Federal lands and five well pads and a second pump station proposed on private parcels. Additionally, Nine Mile Canyon Road (CR 53) would be the primary access route to the proposed development on the plateau. Traffic during peak construction is expected to increase by approximately 555 percent (see **Section 4.14.2**) over current levels. The ROS classification in the canyon during construction would remain *RN*; however, the industrial presence, increased social contacts, and increased managerial presence (e.g., signage and detours) would tend to shift the recreational opportunity toward the *Rural* end of the spectrum during the 8-year development phase.

As discussed in **Section 3.11**, *Rural* settings are characterized by a substantially modified natural environment wherein resource modification, development, and use are obvious. Human presence in *Rural* areas is readily evident, and interaction between users is often moderate to high.

During the production phase of the project, the recreational opportunity in Nine Mile Canyon is expected to return to *RN*.

The vast majority of the proposed development (317 well pads and associated facilities) fall within the SPM areas. SPM areas provide a natural appearing environment with subtle evidence of human presence. During the 8-year development phase, improvements to existing roads, new road construction, increased traffic, and increased human activity (and resulting social interactions) would move SPM areas toward the

Rural end of the recreation spectrum. During the production phase, traffic and human interaction would decrease appreciably; however, the sights and sounds of humans associated with the more industrialized setting would result in a long-term shift to a *RN* recreational opportunity.

Within areas currently classified as SPNM, 101 well pads and associated facilities (including approximately 40 miles of new and upgraded roads) are planned under the Proposed Action. The majority of these facilities would be located to the north of the existing Horse Bench Road. A smaller concentration of well pads in SPNM-designated areas would be located in the Peter's Point area (an existing Federal Oil and Gas Unit where limited past development has occurred) within the Jack Canyon WSA and just north of the Jack Canyon WSA (see **Figure 3.11-1**). As with the development proposed within the SPNM areas, during the 8-year development phase, increased traffic and social contact, in addition to road construction and improved access, would move SPNM areas toward the *Rural* end of the recreation spectrum. During the production phase, SPNM areas would shift to *RN* recreational opportunities. However, large undeveloped areas would remain available for SPNM opportunities in the majority of the Jack Canyon WSA.

Approximately 66 well pads and associated facilities, including approximately 22 miles of new and upgraded roads, are proposed within the area classified as *Primitive*. An estimated 646 acres of surface disturbance are expected from this development. However, loss of *Primitive* recreational opportunities would extend beyond the areas of direct disturbance. The majority of these new well pads and facilities would be located south of the existing Horse Bench Road but north of the Desolation Canyon WSA (see **Figure 3.11-1**), while approximately 12 of these well pads are proposed in the eastern portion of the Peter's Point Unit within the Desolation Canyon WSA. During the 8-year development phase, these areas would shift toward the *Rural* end of the recreation spectrum. During the production phase of the project, the areas in the immediate vicinity of the development would shift to *RN* recreation spectrum. The majority of the Desolation Canyon WSA and lands to the north of the WSA would remain undeveloped and available for *Primitive* recreational opportunities.

Recreation Management Areas

Special Recreation Management Areas

As stated in **Section 3.11.2.2**, SRMAs are areas where recreation is a principal management objective. Potential impacts to the two SRMAs within the WTP Project Area as a result of the Proposed Action are discussed below.

Nine Mile Canyon SRCMA

Under the Proposed Action, recreational experiences within the Nine Mile Canyon SRCMA would be affected during both the development and the production phases. Over the LOP, the Nine Mile Canyon Road would be the primary access to development on the plateau. Under the Proposed Action, during peak development, the ADT is expected to increase by approximately 555 percent (see **Section 4.14.2**). Increased traffic, noise, social interaction, and fugitive dust would diminish the quality of a visit to the SRCMA. The impacts would be most apparent when heavy equipment is being transported through the canyon and when construction activities are occurring in the

canyon itself (5 well pads are proposed on private parcels in Nine Mile Canyon) and in the lower reaches of Dry Canyon (11 well pads are proposed within the SRCMA boundary).

Construction of 5 new well pads and 2 pump stations within the canyon itself would also alter the recreational experience within the SRCMA by introducing additional visual and auditory elements into the landscape.

Adherence to the dust suppression plan (**Appendix R**) would substantially reduce dust generated by traffic within the most highly used recreational corridors (Nine Mile Canyon, Harmon Canyon, and Cottonwood Canyon). Additionally, due to safety concerns, certain road segments within Nine Mile, Gate, or the lower reaches of Harmon and Cottonwood Canyons, may be improved with hard surfacing, such as asphalt, chip and seal, or other materials, as approved by the BLM or counties as appropriate. Should BBC and other operators pave road segments, dust impacts would effectively be eliminated. It is acknowledged however that hardening of road surfaces within the WTP Project Area could result in both positive and negative impacts for recreation. For example, decreases in dust and improved road conditions could potentially result in an improved visitor experience in Nine Mile Canyon. On the other hand, hardening of road surfaces may result in an increase in visitation to portions of the WTP Project Area, which could diminish the backcountry character and potentially lead to increases in conflict between recreational users and industry.

The recreational experience in the SRCMA could also be diminished due to the loss of landscape context (resulting from modifications to the natural landscape and increased industrial presence) associated with cultural sites, changes in ambient noise (e.g., increased volumes from construction, drilling, and production equipment, two pump stations, changes in ambient tones or tonal noises, and repetitive low frequency noise emanating from production equipment such as compressor stations), and potential for conflict between industrial and recreational uses. Additional information regarding noise impacts under the Proposed Action can be found in **Section 4.18.1.1.** The loss of landscape context and the increased industrial presence may result in decreased visitation to Nine Mile Canyon.

Desolation Canyon SRMA

No development is planned under the Proposed Action within the Desolation Canyon SRMA. However, three wells along Cedar Ridge could potentially be located within the visual corridor of the river. In addition, a limited number of wells could be developed within the sound corridor of the river. Development within sight or sound of the Green River is not consistent with the Desolation and Gray Canyons of the Green River Management Plan (BLM 1979). It should be noted that all wells that could be located within the visual corridor would be in the middle ground viewing distance (see **Section 4.16.1.4**). The closest development to the river would be approximately 1.5 miles to the west. It is probable that recreational users on the river would experience auditory disturbances caused by development within the Desolation Canyon WSA and WIA (as discussed in **Section 4.18.1.1**). Elevated noise levels along the Green River (ranging from 34 to 41 dBA during drilling and completion operations) would be above the average background levels of 25 dBA at night and the average background levels of 30 to 45 dBA during the day. These noise impacts would vary based upon topography and river flow but could distract from the recreational experience of river users expecting a

more primitive environment. Visitors who hike into the side canyons from the river would, depending on their location within the SRMA, be in closer proximity to development and could be more apt to be impacted by the sights and sounds of development.

Existing motorized access into the Desolation Canyon SRMA is on an unmaintained and particularly hazardous road along Horse Bench. Upgrades to the road along Horse Bench under the Proposed Action would end outside of the SRMA but would allow vehicles to gain easier access to overlooks into Desolation Canyon and, potentially, travel the entire length of this unmaintained route through the SRMA to its intersection with Nine Mile Canyon.

Extensive Recreation Management Area

The majority of the Project Area is managed as an ERMA wherein recreation activities are subject to few restrictions and are managed at the opportunity level, rather than for specific activities and experiences. Management of the ERMA would not change as a result of the Proposed Action.

4.11.1.2 Impacts to Recreational Opportunities

Direct impacts to recreational opportunities would occur with the displacement of existing opportunities by proposed natural gas facilities. Under the Proposed Action, there would be a direct disturbance of approximately 3,656 acres of surface within the WTP Project Area.

Indirect impacts to recreational use would occur if the Proposed Action resulted in a change in the level of visitation to the area or a diminished recreational experience. While it is difficult to predict changes in visitation numbers, it can be assumed that the shift to a more industrialized landscape may result in a reduction in the number of dispersed recreational users (e.g., hikers, campers, mountain bikers, etc.) who would normally be attracted to the more primitive settings currently found within the WTP Project Area. Individuals expecting a primitive environment would likely experience conflicts with increased traffic from project vehicles and more noise and airborne dust than are currently present. Conversely, because the expanded road system would increase motorized access, it could attract additional use to the area.

Short-term impacts to recreation within the WTP Project Area would result from all phases of development. Activities associated with the installation of the proposed wells, including construction of roads, pipelines, compressor stations, and other facilities could temporarily alter the use of some roads for the duration of the 8-year development phase. Construction activities would occur year-round but in isolated areas so visitors would only be directly affected in the particular area of construction. At times, construction activities would impede recreation use of existing roads and would limit access to particular areas when road closure is necessary.

During the 8-year development phase, conflicts between recreational and industrial users in the area would be expected. During peak production and traffic is expected to increase by 555 percent over current levels. Adherence to the dust suppression plan (**Appendix R**) would substantially reduce dust generated by traffic within the most highly used recreational corridors (Nine Mile Canyon, Harmon Canyon, and Cottonwood

Canyon). While visited to a lesser degree by recreational users, dust within other areas of the Project Area, could impact visitors and increase the potential for traffic-related conflicts, congestion, direct interaction, and accidents. Traffic and dust is discussed in detail in **Section 4.14**.

Visual and auditory impacts would also be most evident during the 8-year development phase. The visual character of the surrounding landscape is an important element in the quality of the recreational experience. Traffic, dust, and the proposed physical structures (e.g., well pads, well facilities, roads, pipelines, compressor stations, etc.) would impact the ambiance sought by recreationists. Changes in landscape character associated with the Proposed Action are discussed in detail in **Section 4.16**.

Construction activity would result in increased, but temporary, noise levels throughout the WTP Project Area from blasting, drilling, and heavy equipment use. Construction-related noise could reduce the quality of the recreational experience in general. However, increases in noise level would be short-term, and with the exception of blasting, would be restricted to the immediate vicinity of the work in progress. Noise from blasting would be sporadic and of short duration but would carry for long distances.

Impacts to recreational use would be reduced during the production phase of the project, but would still be expected since the WTP Project Area would be altered by the presence of natural gas facilities and an extensive road system. The opportunity to recreate in a primarily undeveloped landscape would be lost over portions of the WTP Project Area and this impact would continue over the LOP. However, increased access resulting from the construction of an extensive road system (approximately 178 miles of new and improved roads) would open much of the area to recreational use that was previously inaccessible. Potential long-term increases in noise levels (e.g., increased volumes, changes in ambient tones or tonal noises, and repetitive low frequency noise) would result from the operation of gas-powered pumping units, from the operation of the three new compressor stations, and from the increased traffic necessary for production and maintenance.

In general, the quality of the recreational experience would decline in the WTP Project Area. The nature of the experience would change in the immediate areas disturbed by project activities because there would be less opportunity to experience an isolated and natural setting. Recreationists who seek a primitive experience characterized by a high degree of natural integrity and appearance may seek these experiences elsewhere within the WTP Project Area (e.g., the undeveloped portions of the WSAs) or on other public lands in the vicinity of the WTP Project Area.

Potential impacts to specific recreational opportunities and experiences as a result of the Proposed Action are discussed below.

Developed Recreation

As mentioned in **Section 3.11.3**, Daddy Canyon is the only developed recreational facility located within the WTP Project Area. During the 8-year development phase, the sights and sounds of industrial traffic could deter visitors from using the Daddy Canyon facility. During peak construction, traffic on Nine Mile Canyon Road is expected to increase by approximately 555 percent over current levels. Upon completion of construction, project-related trips for operations and maintenance would still result in a

noticeable increase (approximately 245 percent) in traffic beyond current levels. There are no new facilities proposed within sight or sound distance from Daddy Canyon; however, given the unpredictable propagation of sound through the rugged canyons in the area, it is possible that sounds of construction, especially blasting, may be audible at the Daddy Canyon facility. However, because the existing Dry Canyon compressor station is adjacent to Daddy Canyon, any audible disturbance would be in addition to existing oil and gas related noise in the area.

Recreational Off Highway Vehicles

Under the Proposed Action, approximately 178 miles of new and improved roads would be constructed in the WTP Project Area. No gating or seasonal closures are proposed for this alternative. Construction of new roads would occur in many areas that were not previously accessible by motorized vehicle use. The majority of the WTP Project Area is currently designated as open to OHV use. Therefore, new roads and road improvements would increase access and provide more opportunities for OHV use. During the development phase, conflicts would likely occur between OHV users and project-related traffic.

Motorized recreation would continue to be limited to designated roads and trails in the WTP Project Area. Road upgrades within the Jack Canyon and Desolation Canyon WSAs would allow users to access areas where there currently is no motorized access. Road upgrades or reroutes and new road construction in these areas would increase both access and the opportunity to travel off of designated roads and trails. The more primitive OHV experience would be replaced with a more industrial experience. Many existing roads within the Project Area could properly be characterized as primitive and receive very little use. Upgrades to those roads and the construction of new roads would provide a more urban feel to the OHV experience.

Cultural/Heritage Tourism

As discussed in **Section 3.11.3.2**, empirical observations by frequent users of Nine Mile Canyon (e.g., Nine Mile Canyon Coalition) indicate that recreational use of the area for cultural and heritage tourism has experienced steady decline since a surge in oil and gas development began in the WTP Project in 2004. These observations are supported by anecdotal information provided by the Castle Country Regional Information Center in Price, that during the past two years visitor interest and inquiries about visiting the Canyon have declined significantly.

Based on the proposed level of oil gas development it is expected that declines in visitor to Nine Mile Canyon would continue for the LOP. Recreational use could be reduced due to the increased industrial presence and associated impacts (described under “dispersed recreation” above) within Nine Mile Canyon. However, there could also be a moderate increase in cultural and heritage tourism within other areas of the WTP Project Area due to improved accessibility (e.g., Horse Bench and Jack Canyon).

Overall, the experience would be substantially altered by the increased human interaction and industrial presence. There is also the potential for increased vandalism or illegal looting of cultural artifacts as a result of increased public access (e.g., increased OHV use) due to the expanded road system. More details regarding cultural resources can be found in **Section 4.12.**

Primitive and Unconfined Recreation

Opportunities for primitive and unconfined recreation currently exist throughout much of the WTP Project Area, but are especially available within the Jack Canyon and Desolation Canyon WSAs. Recreationists attracted to the unaltered backcountry settings that these areas provide would likely be displaced by the proposed development.

The solitude now experienced on public lands throughout the WTP Project Area would be primarily impaired by natural gas development during the 8-year development phase, as described under "dispersed recreation" above. Recreationists would encounter new wells, roads, and human activity (both visual and auditory) where previously natural appearing landscapes were dominant. Additional information regarding noise impacts are discussed in **Section 4.18.1.1**. Additional information regarding visual impacts is discussed in **Section 4.16.1**.

Motorized access throughout the WTP Project Area, including increased OHV use, would be substantially altered by the development of an extensive road system. The opportunity to recreate in an undeveloped landscape would be lost over large portions of the WTP Project Area and the impact would continue over the LOP.

According to the fragmentation analysis, opportunities for primitive and unconfined recreation could be lost on approximately 1,122 acres of land within the Jack Canyon WSA and 6,370 acres of land within the Desolation Canyon WSA (see **Section 4.17.1.2**).

River Recreation

As previously discussed, under the Proposed Action three wells along Cedar Ridge would be developed within the visual corridor of the Green River and a limited number of wells could be developed within the sound corridor of the river. It should be noted that all wells within the visual corridor would be in the middle ground viewing distance (see **Section 4.16.1.4**). The closest development to the river would be approximately 1.5 miles to the west. It is probable that recreational users on the river would experience auditory disturbances caused by development within the Desolation Canyon WSA and WIA (as discussed in **Section 4.18.1.1**). Elevated noise levels along the Green River (ranging from 34 to 41 dBA during drilling and completion operations) would be above the average background levels of 25 dBA at night and the average background levels of 30 to 45 dBA during the day. These noise impacts would vary based upon topography and river flow but could distract from the recreational experience of river users expecting a more primitive environment. Visitors who hike into the side canyons from the river would, depending on their location within the SRMA, be in closer proximity to development and could be more apt to be impacted by the sights and sounds of development.

As discussed in **Section 3.11.3.4**, recreationists select Desolation Canyon for river trips because it offers a unique wilderness experience. Any development that results in changes in the visual quality of the landscape or results in human related auditory disturbance could affect solitude, tranquility, and naturalness and interfere with an individual's ability to enjoy this wilderness experience. Changes in the visual quality of

the landscape, increased noise, as well as public perceptions of oil and gas development that could occur on the West Tavaputs Plateau in areas adjacent to Desolation Canyon could discourage some recreationists from floating the Green River through Desolation Canyon, especially those seeking remoteness and a primitive and unconfined recreational experience.

Potential impacts to river recreation opportunities and experiences could also occur as a result of increased sedimentation, runoff, turbidity, salinity, and potential for contamination in the Green River.

Hunting and Fishing

As shown in **Table 3.11-2**, seasonal dates for big game hunting occur from mid August through late January. As drilling and completion activities are proposed on a year-round basis under the Proposed Action, development would overlap the big game hunting season. Hunting activities would be affected primarily in the vicinity of well pads that are undergoing drilling and completion activities. The expanded road system would increase ease of access for hunters and would possibly lead to an increase in harvest.

In general, the absolute number of hunters that utilize the WTP Project Area is not expected to change appreciably. However, implementation of the Proposed Action would change the landscape character of the WTP Project Area and could discourage a segment of the hunting population who prefer a more remote backcountry setting. There are an additional 178 miles of new roads proposed under the Proposed Action, which would increase the total linear extent of roads in the WTP Project Area by approximately 84 percent. There is also the potential for illegal hunting activities to increase with increased access provided by the expanded road system. Finally, development and production of natural gas wells in the WTP Project Area could alter migration patterns and impact the absolute number of animals using the area which could, in turn, impact opportunities for or the success of hunting in the WTP Project Area (see **Section 4.9**).

Implementing the Proposed Action could impair game fish habitat and reduce the quality of available fishing opportunities within the Project Area. However, as fishing is not a primary use of waters within the Project Area, these impacts are expected to be negligible.

IRRETRIEVABLE EFFECTS

Loss of recreational opportunities that would last the life of the project would constitute irretrievable effects.

IRREVERSIBLE EFFECTS

While recreational opportunities and experiences may be partially restored at the end of the project, impacts to recreation would be considered irreversible, in that it is usually easier to shift in a Primitive to Urban direction along the ROS spectrum than to move from Urban toward Primitive. Once physical developments or other human modifications are in place it is difficult to remove evidence of them (USFS 1982).

4.11.2 Alternative B – No Action

The No Action Alternative would not generate substantially new or different recreation impacts in the WTP Project Area than those that currently exist. Current types and patterns of recreational use would remain unchanged, with the area providing primarily for cultural/heritage related tourism, hunting, backpacking, hiking, river-based recreation, and OHV use. ROWs may be issued across the BLM lands to grant access to private or State leases, and existing roads within existing ROWs would be upgraded to provide safe travel to private and State leases.

Impacts of the No Action Alternative on recreational resources would be similar in nature to those described under the Proposed Action; however, the magnitude of the impacts would decrease in proportion to the decreased level of development. Specific differences are noted below.

4.11.2.1 Impacts to Recreation Management

Recreation management under the ROS spectrum and defined recreation management areas apply only to BLM-administered lands and would not apply under Alternative B. However, it is important to note that upgrades to the Horse Bench Road to access leases on State lands would make it easier for visitors to access the overlooks to Desolation Canyon within the Desolation Canyon SRMA. The existing road providing access to these overlooks is particularly hazardous and impassible during most times of the year.

4.11.2.2 Impacts to Recreational Opportunities

Under Alternative B, there would be a direct displacement of approximately 626 acres of land from existing uses by natural gas facilities.

Potential impacts to dispersed recreation would be identical in nature to those described under the Proposed Action. A total of 81 wells from 54 well pads are proposed under Alternative B, which is approximately 90 percent less than under the Proposed Action. Potential impacts to dispersed recreation would be reduced in proportion to the decreased level of development.

Developed Recreation

No measurable impacts would be expected for the Daddy Canyon facility as a result of Alternative B.

Recreational Off Highway Vehicles

Under the No Action Alternative, 32 miles of new and improved roads are proposed within the WTP Project Area. Expansion of the road network throughout the WTP Project Area would open a limited amount of area to motorized travel that was previously inaccessible. Opportunities for recreational OHV enjoyment is not expected to increase appreciably.

Cultural/Heritage Tourism

While limited development on private lands within Nine Mile Canyon could impact the visitor experience to the canyon, visitation is not expected to change substantially as a result of Alternative B.

Primitive and Unconfined Recreation

Surface development, under Alternative B, would be substantially reduced (an 84 percent reduction) when compared to the Proposed Action. Most of the WTP Project Area would remain available for primitive and unconfined recreation. There would be no development within the Jack Canyon or Desolation Canyon WSAs. Limited impacts to primitive and unconfined recreational opportunities would be experienced in the immediate vicinity of development activities. Increased traffic, noise, and fugitive dust during the construction period could diminish the recreational experience for some visitors. Improved access along Horse Bench Road would increase the ease of access to overlooks into Desolation Canyon as described under the Proposed Action.

River Recreation

River recreation is not expected to be impacted by Alternative B as there is no development proposed within or in near proximity to the Green River corridor.

Hunting and Fishing

Potential impacts to hunting and fishing within the WTP Project Area as a result of Alternative B are expected to be negligible.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.11.3 Alternative C – Transportation Impact Reduction

The level of proposed development and magnitude of surface-disturbing activities under Alternative C are identical to those under the Proposed Action. The primary differences under Alternative C as compared to the Proposed Action are the extended duration of the construction period (15 years versus 8 years) and the substantial reduction in anticipated traffic. An alternative access route through Trail Canyon would also eliminate industrial traffic between Harmon and Gate Canyons along Nine Mile Road. Additionally, gating of select roads within the WTP Project Area would likely have both beneficial and adverse impacts on recreation.

Under Alternative C, gates would be placed at the mouth of Harmon Canyon, Prickly Pear Canyon, and below the dugways from Cottonwood Canyon to the top of the plateau. Each of these gates would be closed from December 1 to April 15. Gating canyon roads that provide access to the West Tavaputs Plateau during the winter time would limit motorized access on roads that were not constructed for winter use and protect the safety of recreational users.

In addition, if Alternative C were implemented, the BLM would gate the improved Horse Bench and Jack Canyon Roads on a year-round basis. Gating these roads would prevent the public from accessing areas which are presently not passable in most vehicles.

While year-round or seasonal gating of these roads would help reduce traffic related safety issues for public land users and diminish effects to sensitive natural resources, gating could decrease opportunities for motorized recreation.

Other specific differences between Alternative C and the Proposed Action are discussed below.

4.11.3.1 Impacts to Recreation Management

Recreation Opportunity Spectrum

Impacts to the ROS designations would be similar to those described under the Proposed Action with the exception that there would be a substantial reduction in traffic numbers. However, levels are still expected to more than double those currently experienced in the Project Area (from an ADT of 106 to a maximum ADT of approximately 367). Human activity (and the potential for social interaction) would also be less than the Proposed Action, but would increase substantially over current levels.

Recreation Management Areas

Nine Mile Canyon SRCMA

As with the Proposed Action, under Alternative C recreational experiences within the Nine Mile Canyon SRCMA would be affected both during the development and production phases. While the nature of the impacts to the SRCMA would be similar to those described under the Proposed Action, the intensity of potential impacts, which are primarily traffic related, would decrease commensurate with the decrease in anticipated traffic during the development and production phases. Impacts would substantially decrease between Harmon and Gate Canyons as there would be no industrial use of this portion of the Nine Mile Canyon Road. Under Alternative C, production traffic would be reduced by approximately 65 percent as compared to the Proposed Action.

As discussed in **Section 2.1.5.6**, under all alternatives BBC and other operators would be required to adhere to a dust suppression plan (**Appendix R**). Adherence to this plan would substantially reduce dust generated by traffic in Nine Mile, Harmon, and Cottonwood Canyons. Additionally, due to safety concerns, certain road segments within Nine Mile, Gate, or the lower reaches of Harmon and Cottonwood Canyons, may be improved with hard surfacing, such as asphalt, chip and seal, or other materials, as approved by the BLM or counties as appropriate. Should BBC and other operators pave road segments, dust impacts would effectively be eliminated. It is acknowledged however that hardening of road surfaces within the WTP Project Area could result in both positive and negative impacts for recreation. For example, decreases in dust and improved road conditions could potentially result in an improved visitor experience in Nine Mile Canyon. On the other hand, hardening of road surfaces may result in an increase in visitation to portions of the WTP Project Area, which could diminish the

backcountry character and potentially lead to increases in conflict between recreational users and industry.

Desolation Canyon SRMA

Development within sight or sound of the Green River is not consistent with the Desolation and Gray Canyons of the Green River Management Plan (BLM 1979).

No development is planned under Alternative C within the Desolation Canyon SRMA. However, according to the viewshed analysis, three conceptual well locations along Cedar Ridge could be visible from the Green River in the middle ground viewing distance (see **Section 4.16.1.4**). As discussed in **Table 2.6-8**, during the onsite process, these wells would be located outside the viewshed of the Green River unless to do so would preclude the development of valid and existing lease rights.

In addition, a limited number of wells could be developed within the sound corridor of the river. The closest development to the river would be approximately 1.5 miles to the west. It is possible that recreational users on the river could experience auditory disturbances caused by development within the Desolation Canyon WSA and WIA. However, Alternative C includes mitigation measures to reduce noise within 2 miles of the river including the use of hospital grade mufflers on drill and completion rigs within 2 miles of the Green River, which would decrease noise levels by approximately 10 dBA when compared with the Proposed Action. This noise reduction would lower the predicted average day/night noise level at the Green River (L_{dn} dBA) to 24.0 dBA from drilling on Cedar Ridge and 31.0 dBA from drilling activities in the bottom of Jack Canyon. These levels would be above the average background levels of 25 dBA at night and below the average background levels of 30 to 45 dBA during the day. However, under Alternative C, no drilling would occur during within 2 miles of the Green River during the peak recreational use period, which is from May 15 to August 15. Based upon the aforementioned mitigation measures, it is likely that impacts to recreationists on the river within the SRMA would be minimal.

It should be noted that visitors who hike into the side canyons from the river would, depending on their location within the SRMA, be in closer proximity to development and could be more apt to be impacted by the sights and sounds of development.

Motorized access into the Desolation Canyon SRMA is via an unmaintained and particularly hazardous road along Horse Bench. Although Horse Bench would be upgraded, it would also be gated so the general public could not gain access into the SRMA from the improved Horse Bench Road. Year-round gating of the Horse Bench Road could decrease opportunities for motorized recreation.

Extensive Recreation Management Area

Potential impacts to the ERMA would be nearly identical to those described for the Proposed Action.

4.11.3.2 Impacts to Recreational Opportunities

Under Alternative C, the direct displacement of existing land uses, including recreation, due to natural gas development would be nearly identical to the Proposed Action.

Impacts to dispersed recreational use throughout the WTP Project Area are also expected to be similar in nature to those described under the Proposed Action. The intensity of potential impacts would be reduced in proportion to the reduction in anticipated traffic but would extend over a longer period of time because the development phase would be extended from 8 years under the Proposed Action to 15 years under this alternative. Additionally, the gating of select roads within the WTP Project Area would limit recreational use year-round on 103 miles of the 176 miles (or 58 percent) of new roads. As stated previously, available recreation opportunities would remain non-motorized throughout much of the WTP Project Area as a result of gating. Seasonal gating of Prickly Pear, Harmon, and Cottonwood Canyon (below the dugways) from December 1 to April 15 would, in effect, close the entire West Tavaputs Plateau to recreational use during that period. Winter closure would result in a direct loss of motorized recreational opportunities for just over 4 months every year. Year-round closure of the Horse Bench and Jack Canyon roads would reduce opportunities for semi-primitive motorized recreation in these areas.

Developed Recreation

Potential impacts to visitors to the Daddy Canyon facility would be similar in nature to those described for the Proposed Action, but the level of impact would be substantially reduced in proportion to the reduction in traffic expected under Alternative C. However, potential disruptions to visitors during the development phase would be expected over a longer period of time since the development phase would be extended to 15 rather than 8 years.

Recreational Off Highway Vehicles

Although the extent of road expansion under Alternative C is similar to that under the Proposed Action, the increased opportunity for OHV use in the WTP Project Area would be reduced when compared to Alternative A due to the gating of all new roads longer than 2 miles after drilling and completion activities are completed. In addition, all roads that provide access to proposed wells within the Jack Canyon and Desolation Canyon WSAs, and the Horse Bench road would be gated. Gating would close the roads to the general public resulting in limited access to approximately 103 miles of the 176 miles (or 58 percent) of proposed new roads. In addition, approximately 19 miles of existing road (predominantly on Horse Bench) would be closed to the general public. The potential for unauthorized OHV travel in these areas identified under the Proposed Action would, therefore, be reduced.

OHV use of the entire plateau would effectively be closed via the gating of Prickly Pear, Harmon, and Cottonwood Canyons from December 1 through April 15 each year throughout the LOP. Winter closure would result in a direct loss of motorized recreational opportunities for just over 4 months every year. Year-round closure of the Horse Bench and Jack Canyon roads would reduce opportunities for semi-primitive motorized recreation in these areas.

Cultural/Heritage Tourism

With the exception of Nine Mile Canyon, the potential impacts to cultural/heritage tourism throughout the Project Area would be identical in nature to those described under the Proposed Action. Impacts would be reduced proportionately but would extend

over a longer period of time because the development phase would be 7 years longer under Alternative C. Within Nine Mile Canyon, impacts to cultural/heritage tourism would be substantially reduced along the portion of the road between Harmon and Gate Canyons as this segment would not be used by industrial traffic due to use of the Trail Canyon access route.

Primitive and Unconfined Recreation

Potential impacts under Alternative C would be similar in nature to those described for the Proposed Action in terms of a loss in opportunity for primitive recreation throughout much of the WTP Project Area. While development would still occur at the same levels as under the Proposed Action in WSAs, access to these areas would be gated to the general public which would slightly reduce motorized access into these areas. The direct loss of lands available for primitive recreation would be identical to the Proposed Action in these areas.

River Recreation

According to the viewshed analysis, three conceptual well locations along Cedar Ridge could be visible from the Green River. In addition, a limited number of wells could be developed within the sound corridor of the river. It should be noted that all wells within the visual corridor would be in the middle ground viewing distance (see **Section 4.16.1.4**). As discussed in **Table 2.6-8**, during the onsite process, wells would not be located within the viewshed of the Green River unless to do so would preclude the development of valid and existing lease rights.

The closest development to the river would be approximately 1.5 miles to the west. It is possible that recreational users on the river could experience auditory disturbances caused by development within the Desolation Canyon WSA and WIA. However, Alternative C includes mitigation measures to reduce noise within 2 miles of the river including the use of hospital grade mufflers on drill and completion rigs within 2 miles of the Green River, which would decrease noise levels by approximately 10 dBA when compared with the Proposed Action. This noise reduction would lower the predicted average day/night noise level at the Green River (L_{dn} dBA) to 24.0 dBA from drilling on Cedar Ridge and 31.0 dBA from drilling activities in the bottom of Jack Canyon. These levels would be above the average background levels of 25 dBA at night and below the average background levels of 30 to 45 dBA during the day. However, under Alternative C, no drilling would occur during within 2 miles of the Green River during the peak recreational use period, which is from May 15 to August 15

As discussed in **Section 3.11.3.4**, recreationists select Desolation Canyon for river trips because it offers a unique wilderness experience. Any development that results in changes in the visual quality of the landscape or results in human related auditory disturbance could affect solitude, tranquility, and naturalness and interfere with an individual's ability to enjoy this wilderness experience. Changes in the visual quality of the landscape, increased noise, as well as public perceptions of oil and gas development that could occur on the West Tavaputs Plateau in areas adjacent to Desolation Canyon could discourage some recreationists from floating the Green River through Desolation Canyon, especially those seeking remoteness and a primitive and unconfined recreational experience.

Based upon the aforementioned mitigation measures, it is likely that impacts to recreationists within the SRMA could be reduced.

It should be noted that river recreationists who hike into the side canyons from the river would, depending on their location, be in closer proximity to development and could be more apt to be impacted by the sights and sounds of development.

Hunting and Fishing

Potential impacts to hunting and fishing would be similar in nature to those described under the Proposed Action. However, due to road gating under Alternative C, less new area would be open to motorized vehicles, and the Project Area would continue to provide primitive hunting opportunities (in a roaded environment) under this alternative.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.11.4 Alternative D – Conservation Alternative

In general, potential impacts to recreation under Alternative D would be similar in nature to those described under the Proposed Action but the magnitude of the impacts would be reduced in proportion to the reduction in planned development. Additionally, impacts would extend over a longer development period (21 rather than 8 years).

Under Alternative D, gates would be placed on the Cedar Ridge, Jack Canyon, Horse Bench, and Jack Ridge roads, limiting motorized access to these areas year-round. Gating of these roads would increase opportunities for semi-primitive and primitive non-motorized recreation thereby decreasing opportunities for motorized recreation.

Other specific differences between Alternative D and the Proposed Action are noted in the discussion below.

4.11.4.1 Impacts to Recreation Management

Recreation Opportunity Spectrum

While the level of development under Alternative D would be reduced by approximately 30 percent, potential impacts and resulting changes in recreational opportunities under the ROS would be nearly identical since the level of development is still a substantial increase over current conditions. Alternative D would require approximately 127 miles of new road into previously undeveloped areas. The 127 miles of new road would result in increased traffic, social contact, and direct loss of surface to natural gas development. Under this alternative, 243 wells are proposed in areas currently designated as SPM, and 51 wells are proposed in areas designated as SPNM. Within areas currently designated as *Primitive* under the ROS, development would be limited to 20 wells (as compared to 66 under the Proposed Action). An estimated 161 acres of surface disturbance are expected from this development. However, loss of *Primitive* recreational opportunities would extend beyond the areas of direct disturbance.

Gating of the Cedar Ridge, Jack Canyon, Horse Bench, and Jack Ridge, roads would increase opportunities for *Primitive* and SPNM recreational opportunities by restricting or limiting motorized access into these areas. Gating would decrease opportunities for SPM recreation.

Recreation Management Areas

Nine Mile Canyon SRCMA

Potential impacts to the Nine Mile Canyon SRCMA are expected to be similar to those described under the Proposed Action, with the exception that during winter season (November 1 – May 15) activity related to oil and gas development would not occur so impacts would be reduced substantially during this time of year. However, project duration would be extended by 13 years meaning that potential impacts would occur over a longer period of time. During the active drilling season, impacts to the SRCMA would be similar to those described under the Proposed Action, although the intensity of potential impacts, which are primarily traffic related, would decrease commensurate with the decrease in anticipated traffic during the development phase. Impacts during production, which would occur year-round, would also be reduced in proportion to reductions in the amount of traffic.

Adherence to the dust suppression plan (**Appendix R**) would substantially reduce dust generated by traffic within the most highly used recreational corridors (Nine Mile Canyon, Harmon Canyon, and Cottonwood Canyon. Additionally, due to safety concerns, certain road segments within Nine Mile, Gate, or the lower reaches of Harmon and Cottonwood Canyons, may be improved with hard surfacing, such as asphalt, chip and seal, or other materials, as approved by the BLM or counties as appropriate. Should BBC and other operators pave road segments, dust impacts would effectively be eliminated. It is acknowledged however that hardening of road surfaces within the WTP Project Area could result in both positive and negative impacts for recreation. For example, decreases in dust and improved road conditions could potentially result in an improved visitor experience in Nine Mile Canyon. On the other hand, hardening of road surfaces may result in an increase in visitation to portions of the WTP Project Area, which could diminish the backcountry character and potentially lead to increases in conflict between recreational users and industry.

Desolation Canyon SRMA

Under Alternative D, Horse Bench Road would be gated and access to the SRMA would be limited to permitted uses. Gating of the Horse Bench Road would reduce unauthorized motorized recreation in the area.

Under Alternative D no wells would be within sight or sound of the Green River.

Extensive Recreation Management Area

Potential impacts to the ERMA under Alternative D would be similar to those described for the Proposed Action. However, impacts would be reduced in proportion to reductions in the amount of proposed development.

4.11.4.2 Impacts to Recreational Opportunities

In general, potential impacts to dispersed recreation throughout the WTP Project Area are expected to be identical in nature to those described under the Proposed Action. However, impact would be proportionately reduced based on the reduction in proposed development. Additionally, potential impacts would be reduced substantially during the period between November 1 and May 15 each year when drilling activity would not occur within the WTP Project Area. Finally, potential impacts would extend over a longer period of time in proportion to the extended drilling period and LOP.

Developed Recreation

Impacts to the Daddy Canyon facility are expected to be identical in nature to those described under the Proposed Action for the construction period but would be adjusted proportionally to the reduction in anticipated traffic throughout the majority of the year. During the period between November 1 and May 15, impacts are expected to be reduced to near current levels as no drilling would occur during this period. Potential impacts would extend over a longer period of time in proportion to the extended drilling period and LOP.

Recreational Off Highway Vehicles

As with general dispersed recreation, recreational OHV use would be impacted to a far lesser extent during the period between November 1 and May 15 when construction, drilling, or completion activities would not occur. The addition of 127 miles of new access road would expand the opportunity for OHV use in the area. However, gating of roads into Jack Canyon, Horse Bench, Jack Ridge, and Cedar Ridge would reduce opportunities for SPM recreation in these areas.

Cultural/Heritage Tourism

Impacts to cultural/heritage tourism are expected to be identical in nature to those described under the Proposed Action for the construction period but would be adjusted proportionally to the reduction in anticipated traffic. Between November 1 and May 15, impacts are expected to be reduced to near current levels as no drilling would occur during this period. Potential impacts would extend over a longer period of time in proportion to the extended drilling period and LOP.

Primitive and Unconfined Recreation

While the level of development proposed under Alternative D is reduced by 30 percent when compared to the Proposed Action, 558 wells from 348 well pads still represents a substantial amount of development in the WTP Project Area. However, larger tracts of land would remain available for primitive and unconfined recreation because there would be NSO by well pads and facilities within the Jack Canyon and Desolation Canyon WSAs; within the Desolation Canyon NHL; and within canyon bottoms. In addition, there would be leasing restrictions and NSO requirements on unleased Federal lands with wilderness characteristics and unleased lands within the potential Nine Mile Canyon and Desolation Canyon ACECs (as illustrated in Alternative C of the *Supplement to the Draft Price Resource Management Plan and Environmental Impact Statement)*. Gating of

Jack Canyon, Horse Bench, Jack Ridge, and Cedar Ridge roads would increase opportunities for SPNM and Primitive recreation in these areas.

River Recreation

River recreation is not expected to be impacted by Alternative D because there is no development proposed within sight or sound of the Green River. However, gating of Horse Bench and Jack Canyon roads could prevent unauthorized motorized travel into the Desolation and Jack Canyon WSAs and preserve the natural sights and sounds along the river corridor.

Hunting and Fishing

Potential impacts to hunting and fishing are expected to be similar in nature to those described under the Proposed Action for the construction period but would be adjusted proportionally to the reduction in anticipated traffic and level of development throughout the majority of the year. During the period between November 1 and May 15, impacts are expected to be reduced to near current levels as no drilling would occur during this period. The movement of rigs in and out of the area prior to the winter closure could disrupt hunting activities.

Gating of the Cedar Ridge, Jack Canyon, Horse Bench, and Jack Ridge roads would reduce opportunities for hunters and fisherman to access these areas using motorized transportation. Reduced motorized access into these areas because of gating could be construed as a negative impact by hunters and fisherman that prefer OHV or other forms of motorized access to hunting and fishing locations. However, for those hunters and fisherman seeking a more primitive hunting or fishing experience, gating of these roads would be a positive effect.

Impacts would extend over a longer period of time in proportion to the extended drilling period and LOP.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.11.5 Alternative E – Agency Preferred Alternative

The implementation of Alternative E would result in approximately 10 percent less surface disturbance than would implementation of the Proposed Action. When compared with the Proposed Action well pad reductions would primarily occur in the Desolation and Jack Canyon WSAs, Dry Canyon, and within the Nine Mile Canyon ACEC (as designated in PRMP). As each of these areas have higher than average recreational use, the proportional reductions in impacts would likely be greater than the proportion reductions in surface disturbance. In addition, the Agency Preferred Alternative contains numerous mitigation measures above those included in the Proposed Action. Implementation of these mitigation measures would substantially reduce impacts to recreational resources within the WTP Project Area as described in detail in the analysis below.

4.11.5.1 Impacts to Recreation Management

Recreation Opportunity Spectrum

While the level of development under Alternative E would be reduced slightly as compared to the Proposed Action, potential impacts and resulting changes in recreational opportunities under the ROS would be nearly identical since the level of development represents a substantial increase over current conditions. Alternative E would require approximately 168 miles of new road into previously undeveloped areas and would result in increased traffic, social contact, and direct loss of surface to natural gas development. Under this alternative, 294 well pads are proposed in areas currently designated as SPM, and 88 are proposed in areas designated as SPNM. Within areas currently designated as *Primitive* under the ROS, there would be 26 fewer wells developed than under the Proposed Action.

Recreation Management Areas

Special Recreation Management Areas

Potential impacts to the Nine Mile SRCMA and Desolation Canyon SRMA are expected to be similar to those described under Alternative C with a few exceptions. First, under Alternative E, there would be NSO on Federal lands within canyon bottoms, which would eliminate wells from Dry Canyon within the SRCMA. Second, construction of proposed turnouts and interpretation sites at locations identified by the SRCMA management plan and WTP PA could both inform and educate visitors while contributing to a safer visitor experience. Third, the BLM has established criteria for locating pump stations on public lands in Nine Mile Canyon, which would reduce visual and auditory impacts.

Within the Desolation Canyon SRMA, upgrades to the road along Horse Bench would allow vehicles to gain easier access to overlooks into Desolation Canyon and, potentially, travel the entire length of this currently unmaintained route through the SRMA to its intersection with Nine Mile Canyon.

Extensive Recreation Management Area

Potential impacts to the ERMA under the Agency Preferred Alternative would be nearly identical to those described for the Proposed Action.

4.11.5.2 Impacts to Recreational Opportunities

Potential impacts to dispersed recreation under the Agency Preferred Alternative are expected to be identical in nature to those described under the Proposed Action; however, gating of project roads would limit access through the Project Area on 89 miles of the 168 miles of new roads proposed. Available recreation opportunities would, therefore, remain non-motorized throughout much of the WTP Project Area, but within a roaded setting where development occurs. The WTP PA (**Appendix T**) for cultural resources would require dust abatement throughout the revised APE for cultural resources; an area larger in size than the WTP Project Area. The expanded requirements for dust abatement would reduce fugitive dust from vehicle traffic outside and within the WTP Project Area to a greater extent than under the Proposed Action, thereby reducing visibility effects and subsequent detractions from the user's

recreational experience. Expanded use of dust abatement throughout the revised APE and reductions in fugitive dust would also provide for a safer roads for the recreational user. The Agency Preferred Alternative also contains numerous mitigation measures which would apply to the various recreational opportunities described below.

Developed Recreation

Impacts to the Daddy Canyon facility are expected to be nearly identical to those described for the Proposed Action; however, there would be a slight reduction in traffic.

Recreational Off Highway Vehicles

Although the amount of expansion of the road network under Alternative E is nearly identical to that under the Proposed Action, the increased opportunity for OHV use in the WTP Project Area would be reduced when compared to the Proposed Action because roads would be gated. Under the Agency Preferred Alternative, 89 miles of the proposed 168 miles of new roads would be gated to public use.

Cultural/Heritage Tourism

Impacts to cultural/heritage tourism are expected to be reduced under Alternative E for several reasons. First, site interpretation requirements outlined in the WTP PA (**Appendix T**) could both inform and educate visitors while contributing to a safer visitor experience. Other stipulations required in the WTP PA would reduce adverse effects on cultural and historic resources, thereby reducing potential effects to cultural/heritage tourism uses of the Project Area. Second, there would be NSO on Federal lands within canyon bottoms, which would eliminate new wells in Dry Canyon where numerous cultural sites are located. Finally, the BLM has established criteria for locating pump stations on public lands in Nine Mile Canyon, which would reduce visual and auditory impacts. These measures would minimize impacts to the cultural recreational experience in the area.

Primitive and Unconfined Recreation

As there would be limited development in the WSAs (45 percent less surface disturbance than under the Proposed Action) and roads into those areas would be gated, the opportunities for primitive and unconfined recreation in those areas would be preserved to a greater degree than under the Proposed Action. With regard to noise in Primitive Areas, increased use of directional drilling under Alternative E would reduce the number of proposed well pad locations within the WSAs thereby spatially limiting noise impacts.

River Recreation

Potential impacts to river recreation are expected to be similar to those described under Alternative C.

Hunting and Fishing

Potential impacts to hunting and fishing are expected to be identical in nature to those described under the Proposed Action. However, because of the gating of project roads, not as many new areas would become available to motorized travel for hunting access.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.12 CULTURAL RESOURCES

Cultural resources, including archaeological sites and historic structures, are nonrenewable resources. In the context of this cultural resources analysis, direct effects refer to those effects that could occur to known or unknown sites as a result of surface disturbing activities (e.g., excavation, trenching, blading, grading, or blasting). All other potential impacts to cultural resources are considered indirect. The categorization of direct and indirect impacts does not imply any greater or lesser degree of significance, importance, or effect.

Based on the impact analysis contained within the DEIS, the final results of the Dust Study (Appendix G), and comments received during the public comment period (Appendix S), in December of 2008 the BLM determined, in consultation with SHPO and the ACHP, that implementation of the Proposed Action or Alternatives could have an "Adverse Effect" on historic properties within the WTP APE. The initial determination of "Adverse Effect" was limited to the potential for dust generated by industrial traffic to settle on and effect the visual appearance of the rock art panels pursuant to 36 CFR 800.5 (a) (2) (v). However, during development of the WTP PA, the BLM determined with consulting parties that there are also potential "Adverse Effects" to the cultural setting within Nine Mile Canyon and indirect impacts to sites over the entire WTP APE. The BLM revised its "Adverse Effects" determination in a letter to the SHPO, ACHP, and consulting parties dated July 7, 2009. A copy of the revised effects determination letter can be found in **Appendix T- WTP PA**.

An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion on the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.

4.12.1 Alternative A – Proposed Action

4.12.1.1 Direct Impacts

Direct impacts to cultural resources related to the WTP APE include surface disturbance during the construction of well pads, roads, pipelines, ROW maintenance, water facilities, etc. While the locations of proposed well pads, access roads, pipelines, and other surface facilities illustrated on **Figures 2.2-1** – **2.6-1** have not been individually inspected, they have been conceptually identified considering topography, land features, vegetation, and operational constraints. Onsite inspections, including an intensive cultural resource inventory as outlined in the Preconstruction Cultural Resource Identification Plan (see **Appendix N**) of individual well pads, access roads, pipelines,

and other surface facility locations by the BLM and operator personnel would occur during the permitting process for individual wells or ROWs, and site-specific adjustments to location and orientation would be made at that time. As such, the following discussion considers the Proposed Action as it has been conceptually developed with the understanding that site-specific adjustments to location and orientations may be made during the permitting process.

In order to provide a comparison between the types and magnitudes of known cultural resources presented and potentially impacted under each alternative, the following discussion is framed in the context of the alternatives occurring *without* additional cultural resource inventories, avoidance, or other mitigation measures. As such, these should be considered *potential* direct impacts. In practice, however, the Preconstruction Cultural Resource Identification Plan (see **Appendix N**) will serve to mitigate, primarily through avoidance, as many of the direct impacts to the resources as possible.

Known Impacts

Under the Proposed Action, the configuration of well locations, associated access roads and pipelines, and ancillary facilities results in at least 47 potential conflicts with known cultural resources (**Table 4.12-1**). Of these 47 conflicts, 22 of the resources have been previously determined as eligible for inclusion in the NRHP. Eligible properties must either be avoided or impacts to the resource must be otherwise mitigated. Avoidance and other mitigation recommendations are presented in **Appendix N**.

Table 4.12-1 Sites Known to Conflict with the Existing Plan of Development

Site Number	Site Type	Eligibility	Conflict	Avoidable?
42Cb0046	Prehistoric Rock Shelter	Eligible	Pipeline	Unknown
42Cb0052(66)	Prehistoric Rock Shelter & Rock Art	Eligible	Pipeline	Unknown
42Cb0069	Prehistoric Rock Shelter & Rock Art	Eligible	Pipeline	Unknown
42Cb0071	Unknown	Unknown	Well Pad	Unknown
42Cb0132	Rock Art	Eligible	Access/Pipeline	Yes
42Cb0133	Rock Art	Eligible	Access/Pipeline	Unknown
42Cb0243	Prehistoric Artifact Scatter	Unknown	Access/Pipeline	Yes
42Cb0245	Unknown	Unknown	Well Pad	Yes
42Cb0263	Prehistoric Artifact Scatter	Eligible	Compressor	Yes
42Cb1298	Historic Land Use-Ranching	Eligible	Access/Pipeline	Unknown
42Cb1715	Prehistoric Artifact Scatter	Not Eligible	Well Pad/Access/Pipeline	Yes
42Cb1716	Prehistoric Artifact Scatter	Eligible	Pipeline	Yes
42Cb1721	Prehistoric Artifact Scatter	Not Eligible	Access/Pipeline	N/A
42Cb1722	Historic-Miscellaneous	Not Eligible	Well Pad/Access/Pipeline	N/A
42Cb1732	Historic Land Use-	Eligible	Well	Unknown

Table 4.12-1 Sites Known to Conflict with the Existing Plan of Development				
Site Number	**Site Type**	**Eligibility**	**Conflict**	**Avoidable?**
	Ranching		Pad/Access/Pipeline	
42Cb1733	Prehistoric Camp/Historic Land Use-Ranching	Eligible	Access/Pipeline	Yes
42Cb1734	Prehistoric Artifact Scatter	Not Eligible	Access/Pipeline	N/A
42Cb1739	Historic Habitation	Not Eligible	Well Pad	N/A
42Cb1742	Prehistoric Artifact Scatter	Eligible	Well Pad	Unknown
42Cb1743	Prehistoric Artifact Scatter	Eligible	Well Pad	Unknown
42Cb1751	Prehistoric Artifact Scatter	Not Eligible	Access/Pipeline	N/A
42Cb1753	Prehistoric Artifact Scatter	Not Eligible	Well Pad	N/A
42Cb1756	Prehistoric Rock Art	Eligible	Well Pad	Unknown
42Cb1926	Prehistoric Artifact Scatter	Not Eligible	Well Pad	N/A
42Cb1931	Prehistoric Artifact Scatter	Eligible	Access/Pipeline	Yes
42Cb2083	Prehistoric Artifact Scatter	Not Eligible	Access/Pipeline	N/A
42Cb2160	Prehistoric Rock Art	Eligible	Well Pad	Yes
42Cb2193	Historic Land Use-Ranching	Not Eligible	Pipeline	N/A
42Cb2194	Historic Land Use-Ranching	Not Eligible	Pipeline	N/A
42Cb2196	Prehistoric Storage Site	Eligible	Pipeline	Unknown
42Cb2198	Prehistoric Storage Site	Eligible	Pipeline	Unknown
42Cb2199	Prehistoric Rock Shelter	Eligible	Access/Pipeline	Yes
42Cb2201	Prehistoric Artifact Scatter	Not Eligible	Access/Pipeline	N/A
42Cb2223	Prehistoric Artifact Scatter	Eligible	Access/Pipeline	Yes
42Cb2224	Prehistoric Artifact Scatter	Eligible	Access/Pipeline	Yes
42Cb2234	Historic Land Use-Ranching	Not Eligible	Well Pad	N/A
42Cb2474	Prehistoric Artifact Scatter	Not Eligible	Well Pad/ Access/Pipeline	N/A
42Cb2537	Temporary Camp	Eligible	Well Pad	Yes
42Cb2544	Prehistoric Artifact Scatter	Not Eligible	Access	N/A
42Cb2546	Prehistoric Artifact Scatter	Not Eligible	Access	N/A
42Cb2738	Prehistoric Artifact Scatter	Not Eligible	Access	N/A
42Cb2739	Prehistoric Artifact Scatter	Not Eligible	Access	N/A
42Cb2772	Prehistoric Artifact	Not Eligible	Access	N/A

Table 4.12-1 Sites Known to Conflict with the Existing Plan of Development				
Site Number	**Site Type**	**Eligibility**	**Conflict**	**Avoidable?**
	Scatter			
42Cb2773	Prehistoric Artifact Scatter	Not Eligible	Access/Pipeline	N/A
42Cb2780	Prehistoric Artifact Scatter	Not Eligible	Access/Pipeline	N/A
42Cb2781	Storage	Eligible	Access/Pipeline	Unknown

N/A – Not applicable

Potential Direct Impacts

Potential direct impacts to cultural resources may occur in the process of maintaining or upgrading existing roads, or from conditions that make such maintenance necessary. Surface sites are most prone to these types of disturbances. Generally, rock art sites, rock shelters, and standing structures are less likely to be directly impacted by maintenance disturbances even when those features are near or adjacent to roads. Impacts to these sites are more likely to be indirect. The exceptions to this generalization include 42Cb0956, 42Cb0976, 42Cb1711, and 42Cb2168. These four sites include a midden, rock art panel on a detached boulder, a storage site, and a rock shelter, respectively. These sites have a greater potential to be impacted by the Proposed Action due to their positions relative to existing roads when compared with other similar sites in the WTP APE. Site 42Cb0956 recently underwent a test excavation (Patterson 2007b) and it was found that the nature and extent of the cultural deposit at the site is significant and, if not adequately protected, in danger of future impacts from continued road maintenance, potential looting, and water-related erosion impacts.

Regular maintenance and upgrades of existing roads could potentially disturb 43 known cultural resources that are bisected or immediately adjacent to existing roads as shown in **Table 4.12-2**. To various extents, many of these sites were impacted when the original roads were built. However, 26 sites still retain enough integrity to warrant their designations as eligible to listing on the NRHP. Four of the sites (42Cb0245, 42Cb0247, 42Cb0253, and 42Cb0263) have not been evaluated for NRHP eligibility. Until they can be evaluated, they are assumed to be eligible. Because these cultural resources are already impacted by existing roads and cannot effectively be avoided, any additional direct disturbance to the resources would require mitigation for adverse effects (see **Appendix N**).

Table 4.12-2 Known Sites with Potential Conflicts with Existing Road Maintenance and Upgrades			
Site Number	**Site Type**	**Eligibility**	**Conflict**
42Cb0088	Prehistoric Temporary Camp	Eligible	Adjacent to Existing Road
4Cb0090	Prehistoric Artifact Scatter	Eligible	Bisected by Existing Road
42Cb0241	Prehistoric Habitation	Eligible	Adjacent to Existing Road
42Cb0242	Prehistoric Habitation	Eligible	Adjacent to Existing Road
42Cb0245	Prehistoric Artifact Scatter	Unknown	Bisected By Existing Road
42Cb0247	Prehistoric Artifact Scatter	Unknown	Adjacent to Existing Road
42Cb0253	Prehistoric Artifact Scatter	Unknown	Adjacent to Existing Road

Table 4.12-2 Known Sites with Potential Conflicts with Existing Road Maintenance and Upgrades			
Site Number	**Site Type**	**Eligibility**	**Conflict**
42Cb0263	Prehistoric Artifact Scatter	Unknown	Adjacent to Existing Road
42Cb0644	Prehistoric Artifact Scatter	Eligible	Adjacent to Existing Road
42Cb0649	Prehistoric Temporary Camp	Eligible	Adjacent to Existing Road
42Cb0793	Historic Homestead	Eligible	Bisected by Adjacent Road
42Cb0801	Prehistoric Temporary Camp	Eligible	Adjacent to Existing Road
42Cb0815	Prehistoric Artifact Scatter	Eligible	Adjacent to Existing Road
42Cb0913	Prehistoric Habitation	Eligible	Adjacent to Existing Road
42Cb0956	Prehistoric Artifact Scatter	Eligible	Adjacent to Existing Road
42Cb0976	Rock Art on Detached Boulder	Eligible	Adjacent to Existing Road
42Cb1711	Prehistoric Storage	Eligible	Adjacent to Existing Road
42Cb1716	Prehistoric Artifact Scatter	Eligible	Adjacent to Existing Road
42Cb1718	Historic Artifact Scatter	Not Eligible	Adjacent to Existing Road
42Cb1739	Historic Habitation	Eligible	Adjacent to Existing Road
42Cb1741	Prehistoric Artifact Scatter	Eligible	Adjacent to Existing Road
42Cb1753	Prehistoric Artifact Scatter	Not Eligible	Adjacent to Existing Road
42Cb1909	Prehistoric Temporary Camp	Eligible	Bisected by Existing Road (Road is currently closed to gas field traffic)
42Cb1910	Prehistoric Artifact Scatter	Eligible	Adjacent to Existing Road
42Cb1926	Prehistoric Artifact Scatter	Not Eligible	Adjacent to Existing Road
42Cb1927	Prehistoric Artifact Scatter	Eligible	Adjacent to Existing Road
42Cb1930	Prehistoric Artifact Scatter	Eligible	Adjacent to Existing Road
42Cb2045	Prehistoric Artifact Scatter	Unknown	Adjacent to Existing Road
42Cb2055	Historic Land Use-Ranching	Not Eligible	Adjacent to Existing Road
42Cb2076	Prehistoric Artifact Scatter	Not Eligible	Adjacent to Existing Road
42Cb2077	Prehistoric Artifact Scatter	Not Eligible	Adjacent to Existing Road
42Cb2080	Prehistoric Artifact Scatter	Eligible	Adjacent to Existing Road
42Cb2085	Prehistoric Temporary Camp	Eligible	Adjacent to Existing Road
42Cb2163	Prehistoric Rock Shelter and Artifact Scatter	Eligible	Adjacent to Existing Road
42Cb2168	Prehistoric Rock Shelter	Eligible	Immediately Adjacent to Existing Road
42Cb2193	Historic Land Use-Ranching	Not Eligible	Adjacent to Existing Road
42Cb2194	Historic Land Use-Ranching	Not Eligible	Adjacent to Existing Road
42Cb2200	Prehistoric Artifact Scatter	Not Eligible	Adjacent to Existing Road
42Cb2206	Historic Artifact Scatter	Not Eligible	Adjacent to Existing Road
42Cb2209	Historic Land Use	Not Eligible	Bisected by Existing Road
42Cb2212	Historic Artifact Scatter	Not Eligible	Adjacent to Existing Road
42Cb2223	Prehistoric Artifact Scatter	Eligible	Bisected by Existing Road
42Cb2224	Prehistoric Artifact Scatter	Eligible	Bisected by Existing Road

To date, the BLM has documented that past natural gas exploration and production has resulted in direct impacts to two cultural sites (42Cb0956 and 42Cb446) within the WTP APE (Howard 2007; Miller 2007). Both of these sites were disturbed by blading activities. Nature and extent testing was conducted at both sites. These sites have now been identified for avoidance from future road maintenance activities and are being monitored.

Anticipated Direct Impacts to Unknown Cultural Resources

As is discussed in **Section 3.12** and the Class I cultural resources overview (Whitfield et al. 2006, as amended by Patterson 2010), much of the WTP Project Area has received varying degrees and intensities of archaeological and CRM analysis. Previous natural gas exploration and production and associated projects have driven much of the archaeological inventories conducted on the West Tavaputs Plateau. This has resulted in a patchwork of areas that have been intensively surveyed, interspersed with other areas that have not been inventoried for cultural resources. For example, the Horse Bench area of the WTP Project Area has received almost no systematic archeological investigations. According to the Class I cultural resources overview (Whitfield et al. 2006, as amended by Patterson 2010), only 750 acres of the area proposed for surface disturbance under the Proposed Action, has been previously surveyed for cultural resources. However, it should be noted that under the Proposed Action, the majority of the proposed development would occur in areas that have received considerable scrutiny from cultural resource inventories. Linear surveys have been conducted for past ROW authorizations, seismic lines, and individual well pads. In addition, all roads leading up to the West Tavaputs Plateau, the majority of the Nine Mile Canyon road in the WTP APE, and large portions of the major canyon rims, have also been surveyed. Taken collectively, these surveys have resulted in a fairly systematic examination of the WTP APE resulting in sufficient data for identifying culturally sensitive areas. As shown in **Figure 3.12-1**, the previously inventoried areas can be easily construed as representative of large portions of the WTP APE.

Site Density Estimate Parameters

While additional archaeological inventory would be required before each instance of surface disturbance (see **Appendix N**), it is possible to estimate the potential number of archeological sites that may be encountered as a result of disturbances from the Proposed Action. These estimates, however, should be considered an *approximation*. **Table 4.12-3** summarizes these estimates. A description of the site density estimate methodology is provided below. The inventories conducted in the WTP Project Area to date do not meet the assumptions required of general probability theory and statistical inference.

Table 4.12-3 Site Density Estimates for Alternative A

Density Estimate	Estimate Parameters	Site Density (sites/mi^2)	Potential Number of Sites in Alternative A
Density 1	Total # Sites/Total WTP APE	4.66	27*
Density 1a	Total # Sites/Total Inventoried Areas	52.6	479**
Density 1b	Total # Sites/Modified Total of Inventoried Areas	43.3	394**

Table 4.12-3 Site Density Estimates for Alternative A			
Density Estimate	**Estimate Parameters**	**Site Density (sites/mi^2)**	**Potential Number of Sites in Alternative A**
Density 2	Total # Sites on Plateau/Total Inventoried Areas on Plateau	42.7	389
Density 3	Site Density Estimate from Landt 2006 for Sagebrush Flats Area	18.5	94
Density 4	Total # Sites on Plateau/Total Area of Previously Inventoried Areas of Alternative A	39	354

*Not considered in the range estimate because it is known to be too low.
**Site Density represents sites in both canyon and plateau settings
- number
mi^2 – square mile

The Class I literature review (Whitfield et al. 2006, as amended by Paterson) and a block survey (Landt 2006) offers data to estimate a range for the number of potential sites, based on site densities, that may be within the WTP APE. These data can be used to identify areas where new surface disturbances would potentially impact these sites under the Proposed Action. Whitfield et al. (2006:33-37) and Paterson (2010) calculated known site densities for various temporal periods for the entire WTP APE. The site densities were calculated by dividing the known number of sites per period by the total area of the WTP APE. Based on the number of known sites (1,105) and the size of the WTP APE (237 miles^2), the known site density is 4.66 sites per mile^2 (Density 1).

Calculating the site density of known sites using the recorded acreage (n=13,400 acres) inventoried for cultural resources within the WTP APE prior to January 2010, increases the site densities substantially from 4.66 sites/mile^2 to 52.6 sites/mile^2 (Density 1a). This estimate is very high, but is inflated for two reasons. First, the acreage used in the density calculation is underrepresented. Rock art recording programs conducted by the BLM, Brigham Young University (BYU), and amateur archaeological groups rarely have inclusive inventory areas (see **Section 3.12**). Some of the earlier cultural resource inventories and scientific investigations also lacked well-defined inventory areas. Bounding these areas loosely increases the acreage to an estimated 16,349 acres resulting in a site density of 43.3 sites/mile^2 (Density 1b). The second problem with these estimates is that they do not adequately reflect the strong dichotomy in the spatial distribution of the sites between Nine Mile Canyon, its major tributaries, and the upland areas of the West Tavaputs Plateau (see Whitfield et al. 2006: Figure 3). For example, of the 1,105 sites used in the analysis section of the revised Class I literature review, 64 percent (n=710) occur in the major canyons and the remaining 36 percent of the sites (n=395) occur in upland (plateau) settings. Given that the majority of the new surface disturbance would occur outside the canyons, the high site density estimates may overestimate the number of potential direct impacts to unidentified cultural resources. Utilizing only the acreage of cultural resource inventories conducted on the West Tavaputs Plateau, approximately 5,920 acres, and the 395 known sites in upland settings produces a site density of 42.7 sites/mile^2 (Density 2).

The results of a large, intensive cultural resource inventory conducted by MOAC offers an alternative site density that can be used in estimating potential direct impacts to unidentified cultural resources. The inventory of a 2,116 acre area located on Sagebrush Flat and adjoining areas resulted in the identification of 61 previously

recorded (n=23) and newly discovered (n=38) sites (Landt 2006). The site types and affiliations identified in the Sagebrush Flat survey area are similar to those identified in the upland portions of the WTP APE (Landt 2006). The resulting site density from this inventory is 18.5 sites/mile^2 (Density 3).

Finally, a site density can be extracted from the proportion of the known sites already identified within the Proposed Action disturbance areas and the number of acres already inventoried within the proposed disturbance areas. An estimated 750 acres of the Proposed Action disturbance area has been previously inventoried for cultural resources. Within this area, there are 47 known sites. As a proportion, it can be expected that the entire disturbance would have a site density of approximately 39 sites/mile^2 (Density 4) or a total of 219 sites over the entire area of planned disturbance.

Estimated Site Density Ranges

Using the absolute minimum site density, or Density 1, it can be estimated that the acres of new disturbance would potentially impact approximately 27 sites. However, given that the number of known sites that could be directly impacted (n=47) is over 30 percent larger, this estimate is not appropriate for consideration of direct impacts. Utilizing Density 2, the estimated number of sites potentially impacted by the new disturbance areas of the Proposed Action is 389 sites. Density 3 results in an estimated 94 sites potentially impacted by the new disturbance areas under the Proposed Action. The 39 sites/mile^2 calculation listed for Density 4 is remarkably similar to Density 1b. Given these density measures, *the range of potential sites that may occur in the new disturbance areas for the Proposed Action is between 94 and 394.* Furthermore, it can be expected, based on the eligibility trends of the known sites, that at least two-thirds of the sites would be eligible for nomination to the NRHP.

Direct Impacts to Sites without Surface Indications

Direct impacts to cultural resources without surface indications, often referred to as buried sites, are difficult to estimate. MOAC has monitored approximately 26 miles of pipeline and road construction in both the canyon bottoms (i.e., Nine Mile Canyon, Dry Creek Canyon, Cottonwood Canyon) and on the West Tavaputs Plateau (Bond 2006; Bond and Whitfield 2004; Bond and Whitfield 2005; Taylor and Montgomery 2005), as well as the construction of one well pad location deemed to have a high potential for buried sites (Bond and Elkins 2004). During the course of these monitoring projects, three buried sites (42Cb2457, 42Dc1668, and 42Dc1669) have been identified. A fourth site, 42Cb2282, was identified in a trench, but subsequent testing showed the site to be a modern fire pit. While the potential for encountering buried sites is seemingly low, the possibility that buried sites would be disturbed during pipeline, road, or well pad construction does exist. Unless the buried site is detected quickly during surface-disturbing activities, the impact to the site can be considerable. While the limited data make estimating the number of buried sites infeasible, the Preconstruction Cultural Resource Identification Plan presented in **Appendix N** details the parameters for monitoring surface disturbance in areas with a high potential for buried sites. The Preconstruction Plan also identifies the methods, procedures, and actions required should a buried site be identified.

Summary

It is estimated that between 94 and 394 cultural resources, with surface manifestations, occur within the new disturbance areas under the Proposed Action. Each of these sites has the potential to be directly impacted by surface-disturbing activities if they are not identified and documented prior to construction and either avoided or otherwise mitigated. Existing permitting requirements and the guidelines for identification of cultural resources prior to surface disturbance (**Appendix N**) provide measures to ensure the avoidance or mitigation of cultural resources that are found eligible for nomination to the NRHP. Based on the adherence to the guidelines and procedures in **Appendix N**, and the track record of site avoidance in previous gas production within the WTP APE, the potential for direct impacts to cultural resources is relatively low.

4.12.1.2 Indirect Impacts

Anticipated indirect impacts to cultural resources within the WTP APE include dust and associated impacts to rock art; increased visitation; vandalism; OHV use; erosion; and impacts to unidentified TCPs. It should be noted that many of the indirect impacts are not mutually exclusive (e.g., increased visitation results in dust issues) and many of the indirect impacts also have cumulative impacts. Indirect impacts are most likely to occur to cultural resources that are visible from major transportation routes (e.g., Nine Mile, Dry, and Cottonwood Canyon roads). As shown in **Figure 4.12-1** there are approximately 379 cultural resources with rock art panels shown in a scatter plot diagram. Of the 379, cultural resources with rock art panels 252 sites are within 300 horizontal and 300 vertical feet of a major road. There are 178 cultural resources with rock art panels outside the range of the scatter plot diagram.

Indirect Impacts to Rock Art

Indirect impacts to rock art include the negative effects of dust, potential vibration related to increases in traffic, and inadvertent damage and advertent damage (i.e., vandalism) due to increased visitation.

Dust, especially that which contains binding agents such as magnesium chloride, and pollutants, such as those derived from vehicle exhaust, present potential indirect impacts to the rock art in Nine Mile Canyon and its major tributaries. There have been few scientifically based studies directly examining the correlation between particulates and any associated detrimental effects of dust on rock art (**Appendix G**). However, it is clear to the common observer that many rock art panels immediately adjacent to the major roads are obscured, or are becoming obscured, by the accumulation of dust.

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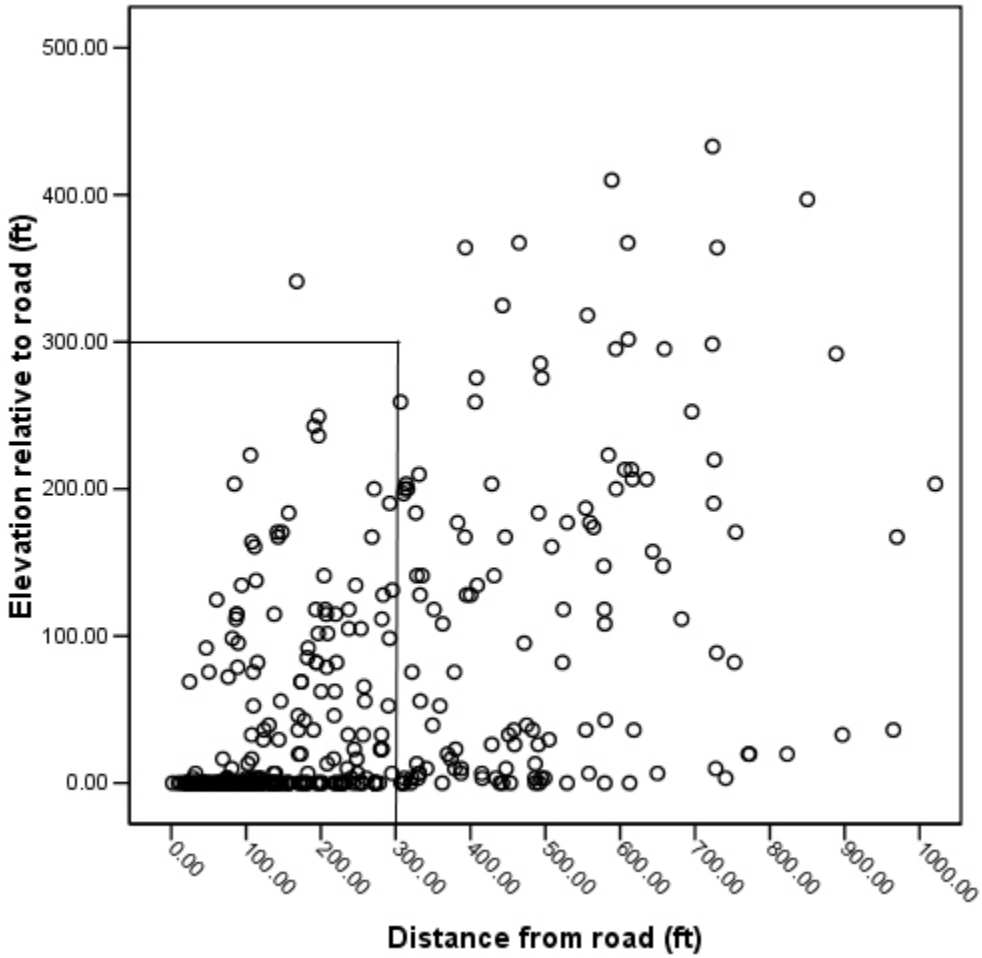
Figure 4.12-1 Scatter Plot of Known Cultural Resources



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To assist in this impact analysis, BBC funded an independent dust study, (**Appendix G**), the results of which show that the accumulation of dust on rock art panels located in proximity to roads experiencing high levels of traffic has had an effect on the visual integrity and may have an effect on the physical integrity of the rock art. Given that dust may have the capacity to damage rock art, the author of the study included the following recommendations.

1) **Dust Abatement.** Research is needed to develop safe dust abatement treatments for the road in Nine Mile canyon.

2) **Baseline Documentation**. Baseline photographic and descriptive documentation of rock-art sites is very important. At present, it is almost impossible to judge if dust has altered the condition of the rock art because there are no detailed baseline studies of the sites to document change over time.

3) **Development of Analytical Methods for Determination of Damage**. It is not possible to determine whether any or all of the rock art sites have been permanently damaged by the deposition of dust, which can include various types of salts. This avenue of research needs to continue, in order to answer the key question of this research: how has the rock art been damaged permanently by the deposition of dust?

4) **Investigation of Possible Deposition of Hydrocarbon Emissions**. A study of the effects of industrial pollutants on rock art is in progress in Burrup, Australia. The results of this study (expected to be completed in 2010) could be applicable to Nine Mile Canyon.

5) **Development of Conservation Treatments**. Systems for removing dust from the affected panels should be developed in the laboratory and eventually tested on site.

6) **Continuing Research on Magnesium Chloride**. Use of magnesium chloride in Nine Mile Canyon has raised a high level of concern. Additional research is needed to understand the origins, migration, deposition, and potential negative impacts of magnesium chloride in Nine Mile Canyon.

While BBC and other operators have not agreed to implement all of the aforementioned recommendations, under the Proposed Action, they have agreed to put into operation a dust suppression plan (See **Section 2.1.5.6**) and discontinue the use of magnesium chloride. According to the dust suppression plan (see **Appendix R**), lignin sulfonate or a soluble polymer, such as TerraLOC, would be used in Nine Mile Canyon between Harmon and Cottonwood Canyons (12 miles), in Harmon Canyon (1 mile), in Gate Canyon (1 mile) and in Cottonwood Canyon (8 miles). Implementation of the dust suppression plan (using lignin sulfonate) has been occurring on the aforementioned road segments since the summer of 2008. Implementation of this plan has substantially reduced the amount of dust generated by increased project-related traffic in these cultural resource sensitive areas. Despite implementation of the dust suppression plan, limited amounts of dust are likely to be generated by project-related traffic when suppressant materials begin to lose their effectiveness; in isolated locations where there are pockets of fine sediments in the road base; and after seasonal storm events. While BBC has committed to maintenance applications of dust suppressants when problems

are identified, efforts may not be totally effective. Therefore, it is possible that in limited circumstances and locations dust may settle on and visually obscure rock art adjacent to the road.

It should also be noted, that dust suppression efforts committed under the Proposed Action would not cover the entire APE. Therefore, implementation of the Proposed Action would result in frequent dust generation on untreated segments of road. Sites that are adjacent to the road located in Nine Mile and Gate Canyon that fall outside of the WTP Project Area would therefore be subjected to greater impacts.

As an alternative to using dust suppression or due to safety concerns, certain road segments within Nine Mile, Gate, or the lower reaches of Harmon and Cottonwood Canyons, may be improved with hard surfacing, such as asphalt, chip and seal, or other materials, as approved by the BLM or counties as appropriate. Should BBC and other operators pave road segments, dust impacts to cultural resources would effectively be eliminated. It is acknowledged however that hardening of road surfaces within the WTP APE could result in both positive and negative impacts. For example, increased visitation to the area may result in unauthorized collection of artifacts or intentional or unintentional damage to sites. Conversely, increased visitation and improved road conditions – especially at popular cultural sites – may result in reduced vandalism-related impacts to cultural sites as vandalism is more likely to occur when less people are present in an area (Spangler et al. 2006).

Vibration, resulting from increased traffic and construction activities, may also have effects on rock art and other associated sites (e.g., sites with standing architecture) that are adjacent to the major roads in Nine Mile Canyon and its tributaries. The major concern with vibration is the potential for collapsed cliff faces, or portions thereof, containing rock art panels or the collapse of standing architecture. Several studies considering the effects of vibration on prehistoric standing structures have been conducted. The results from vibration studies at Chaco Canyon National Park (King et al. 1985) and Hovenweep National Monument (King and Algermissen 1987) conclude that vibration should not exceed 1.0 mm/second peak particle velocity at the base of standing prehistoric structures. The authors of these studies provide minimum distances that various vibration-inducing activities should be kept away from the resource. For automobile traffic, the distance is 30 meters for normal traffic and 65 meters for industrial traffic. The resources at Chaco Canyon, Hovenweep, and Nile Mile Canyon cannot be assumed to be identical and different vibration thresholds can be expected for exposed bedrock and cultural standing structures. There are previous vibration analyses and associated recommendations for the WTP APE. The vibroseis activities of the Stone Cabin 3D seismic project conducted in 2004 maintained a maximum 0.75 inch/second (19 mm/second) peak particle velocity at the vibe source and a 300-foot distance from known resources (BLM 2002c) as detailed in the BLM Handbook 3150-Figure 10. No documented damage to rock art or standing architecture resulted from these vibroseis activities (Patterson and Whitfield 2004). While possible, the potential for traffic-induced vibration resulting in the collapse of a rock art panel or standing architecture is seemingly low.

Improved accessibility and subsequent increased visitation to rock art sites in the Nine Mile Canyon area of the WTP APE as a result of road upgrades and maintenance, is likely to occur under the Proposed Action. Potential effects to rock art directly related to visitation include unintentional and intentional damage (e.g., vandalism) to rock art and

illegal collection of surface artifacts. Increased tourist and recreation traffic would also contribute to vibration and dust.

Cultural Setting

Impacts to the cultural setting could occur from increases in traffic and human activity in the WTP APE, increases in the amount of dust, and increases in oil and gas facilities in canyon bottoms throughout the WTP Prpject Area. Under the Proposed Action, BBC and other operators plan to construct wells on Federal lands in Dry and Jack Canyons; up to four pump stations on Federal, State, and private lands in Nine Mile, Dry, and Cottonwood Canyons; and, five wells on private lands in Nine Mile Canyon. The presence of surface facilities in canyon bottoms would introduce visual and audible elements that could diminish the integrity of the cultural setting.

BBC has committed to a number of measures which could decrease impacts to the setting. Namely, BBC and other operators are currently, and would continue implementing a dust suppression plan between Harmon Canyon and Cottonwood Canyon in Nine Mile Canyon. Use of dust suppressants has substantially reduced the amount of dust generated by industrial traffic. In addition, BBC has also committed to paint all surface facilities (regardless of land ownership), and locate pump stations in areas where they can make use of visual and topographic screening.

Increased Visitation, Vandalism, and Off Highway Vehicle Use

The largest increase in visitation to both Nine Mile Canyon and more remote parts of the WTP APE would result from an increase in field services employment within the WTP APE.

As discussed in **Section 3.11**, empirical observations by frequent users of Nine Mile Canyon (e.g., Nine Mile Canyon Coalition) suggest that recreational use of the area for cultural and heritage tourism has steadily declined since a surge in oil and gas development began in the WTP Project Area in 2004. Based on the proposed level of oil and gas development it is expected that this trend will continue. Although visitation for cultural tourism is expected to decline, recreational use of the WTP Project Area for other activities (e.g., OHV use) may increase as additional roads, which would provide access into areas that are currently inaccessible (e.g., Horse Bench and Jack Canyon), are constructed.

Increased visitation to the area, whether it is recreational or workforce-related, may result in unauthorized collection of artifacts, and damage to sites caused through the use of OHVs in unauthorized areas (e.g., cross-country travel not on an existing road). The opening of currently inaccessible areas may encourage looting of sites, particularly where there is a low or intermittent level of activity. For example, looting activities occurred in Jack Canyon sometime after a well and an access road were established in that area. Looting to sites in Jack Canyon included illegal excavation of rock shelters and the removal of rock art panels (Patterson and Whitfield 2004). The CPAA has conducted research related to unrestricted road access and site vandalism in the Nine Mile Canyon area (Spangler et al. 2006). This study shows that there is some degree of correlation between the distance a site is located from a road and the likelihood that the site has been vandalized. It also shows that less vandalism occurs in areas where access is limited than in places where access is unrestricted. Efforts have also been

made by the CPAA to examine the relationship between the visibility of a site (e.g., from a road) and vandalism (Arnold 2007). Visitation impacts are likely to occur within and outside of the areas of disturbance; however, those resources outside of the areas associated with the Proposed Action are at greatest risk. Because no plans or actions exist that would result in the documentation of sites outside of the Proposed Action, it is probable that undocumented sites could be adversely affected.

Under the Proposed Action, BBC and other operators would be allowed to construct up to three worker housing locations (on top of Prickly Pear, Flat Iron, and Peter's Point). No worker housing would be permitted in the canyon bottoms. Having workers in the WTP project during off-hours may increase potential for inadvertent and advertent impacts to historic properties including defacement, graffiti, removal of artifacts, and illegal excavation. These impacts are more likely to occur in areas adjacent to the worker housing locations.

Nine Mile Canyon National Register Multiple Property Listing

Impacts to sites that have been listed on the National Register under the Nine Mile Canyon Multiple Property Listing (MPL) would be the same as the impacts to eligible sites discussed above.

It is anticipated that site-specific adjustments to location and orientations would be made during the permitting process (as outlined in **Appendix N**), which would result in avoidance of direct impacts to listed properties.

Indirect impacts to listed properties could include dust, potential vibration related to increases in traffic, and inadvertent damage and advertent damage (i.e., vandalism) due to increased visitation.

As part of their Proposed Action, BBC and other operators have included several measures that could potentially mitigate impacts to listed properties including:

- All permanent structures would be painted a flat, non-reflective standard environmental color as determined by the Authorized Officer (AO). Facilities would be painted within six months of being located on site (**Section 2.1.5.1**).
- BBC and other operators would use closed-loop drilling techniques in canyon bottoms (**Section 2.1.2**).
- In locations where drilling occurs within close proximity to surface water or near canyon rims, closed-loop drilling systems would be employed at the discretion of the BLM. (**Section 2.1.1.1**).
- All pump station engines would be fitted with at least residential grade mufflers for noise abatement. In addition, all pumps and generators located in canyon bottoms would be enclosed in acoustically insulated buildings, which would be painted to match the surrounding environment. As feasible, pump stations would also be constructed so as to take advantage of visual and topographic screening (**Section 2.1.5.3**).

Implementation of the aforementioned mitigation measures would reduce the visual and auditory impacts associated with development proximal to listed properties; however, the

cultural setting, feeling, and association could still be altered due to substantial increases in traffic on canyon roads, increased human activity, and the presence of additional surface facilities.

Native American Consultation and Traditional Cultural Properties

As discussed in **Section 6.2.1**, extensive consultation with Tribes resulted in the identification of one TCP by the Uintah and Ouray Ute Indian Tribe, consisting of a prehistoric temporary campsite with culturally modified tree scars, and one TCP claim by the Hopi for Nine Mile Canyon. After consultation with the Hopi, the TCP rim-to-rim claim for Nine Mile Canyon was placed in abeyance because of protections afforded to Nine Mile Canyon through designation of the Nine Mile Canyon ACEC in the Price Field Office Approved RMP (BLM 2008b) and the BLM's decisions to move forward with a MPL. Thus, the Hopi's potential TCP has not been evaluated because it was placed in abeyance. Although the Hopi have decided not to pursue their TCP claim at this time, given that the Tribe reserves the right to renew their claim in the future, impacts to the Nine Mile Canyon TCP are still considered within this section. For the purposes of analysis, as was requested by the Hopi Tribe, the original Nine Mile Canyon Archaeological District (NMCAD) boundary has been used as the Hopi Nine Mile Canyon TCP boundary.

Archaeological site 42Cb1909 contains CMT scars and is considered to be a TCP by the Uintah and Ouray Ute Indian Tribe. As was discussed in **Section 3.12.4**, the site is bisected by an existing road that is currently closed to gas field traffic. Under the Proposed Action, BBC and other operators would continue to use this reroute, which would substantially reduce if not eliminate direct impacts to this TCP. However, increases in traffic and human activity within the vicinity of this archaeological site would introduce visual, atmospheric, or auditory elements that could detract from cultural significance of this area to the Uintah and Ouray Ute Indian Tribe. Increases in OHV use, could also result in additional use of the existing route which bisects the TCP.

As discussed in **Section 3.12.4**, the Hopi TCP claim is based on oral history related to creation and migration stories and the interpretations of clan symbol markings identified on Nine Mile Canyon rock art panels. The Hopi's potential TCP has not been evaluated because it was placed in abeyance. The Hopi CPO has indicated that the legal description of the original proposed National Register Boundary for the NMCAD could be used in the documentation effort of the TCP claim, or until the Hopi CPO can determine a boundary for their claim.

Therefore, under the Proposed Action, BBC and other operators could construct up to 54 well pads within the potential TCP. The majority of these well pads, however, would be located on mesa tops and would not be visible from Nine Mile, Dry, or Cottonwood Canyons. A viewshed analysis conducted from the roads within these canyons revealed that approximately five well pads would be visible in Nine Mile Canyon, 17 well pads in Dry Canyon, and no well pads in the lower portions Cottonwood Canyon. Within Nine Mile, only the well pads proposed within the canyon itself, all of which are located on private land, would be visible.

In addition to well pads, under the Proposed Action, BBC and other operators could construct up to four pump stations within the potential TCP boundary. One pump station would be located on Federal land in Dry Canyon, one located on State land in

Cottonwood Canyon, one located on private land in Nine Mile Canyon, and one located on Federal land in Nine Mile Canyon.

In addition to the placement of new wells and infrastructure within the potential TCP boundary, the Hopi have voiced concerns about the effects of industrial traffic and lack of adequate control measures for dust, which is accumulating on rock art in the Nine Mile Canyon.

Potential impacts to the TCP from the development described above would be similar in nature to the direct and indirect impacts to individual cultural sites discussed in the previous sections (e.g., increased dust, vibration, OHV use, erosion, etc). Implementation of the Proposed Action would introduce visual, atmospheric, or auditory elements that could detract from cultural significance of this area to the Hopi Tribe.

Mitigation measures discussed in the preceding section, including a dust suppression plan, would reduce visual and auditory impacts within the potential TCP boundary; however, the cultural setting, feeling, and association could still be altered due to substantial increases in traffic, increased human activity, and the presence of additional surface facilities; therefore, disrupting their spiritual experience.

As discussed in **Section 3.12.3**, an ethnographic overview is being prepared that will discuss the ethno-historic presence of Hopi clans and other native groups within the WTP APE. This study will address the cultural significance of the rock markings within the WTP APE. This study, however, is not considered part of mitigation for potential impacts to the rock art panels.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible Effects

The Proposed Action could result in the loss or damage of cultural resources.

Irretrievable Effects

There would be no irretrievable effects.

4.12.2 Alternative B – No Action

Under Alternative B, no drilling would occur on Federal land, but drilling would still proceed on State and private lands. Though no drilling would occur on Federal lands, pipeline and access ROWs and maintenance of existing roads on Federal land would still be required.

4.12.2.1 Direct Impacts

As with Alternative A, the Proposed Action, direct impacts would include surface and subsurface disturbance to known and unknown cultural resources.

Known Impacts

Under Alternative B, the configuration of well locations, associated access roads and pipelines, and ancillary facilities results in at least 11 potential conflicts with known cultural resources (**Table 4.12-4**). Of these 11 conflicts, five of the resources have previously been determined to be eligible for inclusion in the NRHP. Eligible properties must either be avoided or impacts to the resource must be mitigated. Avoidance and other mitigation and avoidance recommendations are presented in **Appendix N**.

Table 4.12-4 Sites Known to Conflict with Existing Plan of Development

Site Number	Site Type	Eligibility	Conflict	Avoidable?
42Cb1732	Ranching Land Use	Eligible	Well Pad/Access	Yes
42Cb1742	Prehistoric Artifact Scatter	Eligible	Well Pad	Yes
42Cb1743	Prehistoric Artifact Scatter	Eligible	Well Pad	Yes
42Cb1751	Prehistoric Artifact Scatter	Not Eligible	Access	N/A
42Cb2076	Prehistoric Artifact Scatter	Not Eligible	Access	N/A
42Cb2223	Prehistoric Artifact Scatter	Eligible	Access	Yes
42Cb2224	Prehistoric Artifact Scatter	Eligible	Access	Yes
42Cb2738	Prehistoric Artifact Scatter	Not Eligible	Access	N/A
42Cb2739	Prehistoric Artifact Scatter	Not Eligible	Access	N/A
42Cb2772	Prehistoric Artifact Scatter	Not Eligible	Access	N/A
42Cb2773	Prehistoric Artifact Scatter	Not Eligible	Access/Pipeline	N/A

N/A – Not applicable

Potential direct impacts to cultural resources may occur in the process of maintaining or upgrading existing roads or from conditions that make such maintenance necessary; surface sites are most prone to these types of disturbances. Given that existing roads would be used to access the Project Area and that most of the State and private land is scattered throughout the WTP Project Area, the potential direct impacts to the sites discussed under the Proposed Action apply to Alternative B as well.

Anticipated Direct Impacts to Unknown Cultural Resources

While additional archaeological inventory would be required before each instance of surface disturbance (see **Appendix N**), it is possible to estimate the potential number of archeological sites that may be encountered throughout the disturbances under Alternative B. These estimates, however, should be considered an *approximation*. The inventories conducted in the WTP APE to date do not meet the assumptions required of general probability theory and statistical inference.

Site Density Estimates

Using the site density estimates calculated for the Proposed Action, it is estimated that between 15 and 60 sites are located within the proposed development areas detailed under Alternative B. The results of the site density estimates are given in **Table 4.12-5.**

Table 4.12-5 Site Density Estimates for Alternative B			
Density Estimate	**Estimate Parameters**	**Site Density (sites/mi^2)**	**Potential Number of Sites in Alternative B**
Density 1	Total # Sites/Total WTP Project Area	4.66	5*
Density 1a	Total # Sites/Total Inventoried Areas	52.6	58**
Density 1b	Total # Sites/Modified Total of Inventoried Areas	43.3	48**
Density 2	Total # Sites On Plateau/Total Inventoried Areas on Plateau	42.7	47
Density 3	Site Density Estimate from Landt 2006 for Sagebrush Flats Area	18.5	17
Density 4	Total # Sites on Plateau/Total Area of Previously Inventoried Areas of Alternative B	39	43

*Not considered in the range estimate because it is known to be too low.
**Site density represents sites in both canyon and plateau settings.
- number
mi^2 – square mile

To assess the validity of the estimated range presented above, the site density for State lands within the WTP APE was calculated. In the WTP APE, 1,228 acres (1.92 square miles [mi^2]) of State land have been inventoried for cultural resources and 45 sites have been documented, resulting in a density of 24 sites/mi^2. This site density is consistent with the estimated range of sites presented above.

Direct Impacts to Sites without Surface Indications

The potential for encountering buried sites is presented in detail under the Proposed Action. Given the smaller levels of surface disturbance, the chances of encountering a buried site under Alternative B are greatly reduced compared to the other alternatives, though such a disturbance is still possible.

Summary

It is estimated that between 15 and 60 cultural resources with surface manifestations occur within the disturbance areas for Alternative B. Each of these sites has the potential to be directly impacted by surface-disturbing activities if they are not identified and documented prior to construction and either avoided or otherwise mitigated. Existing permitting requirements and guidelines for identification of cultural resources prior to surface disturbance on State and Federal lands provide measures to ensure the avoidance or other mitigation of cultural resources that are found eligible for nomination to the NRHP. There is a low potential for direct impacts to cultural resources given that the disturbance footprint for Alternative B is relatively small, the number of known and potential sites is minimal, and existing cultural resource identification and mitigation measures are already in practice.

4.12.2.2 Indirect Impacts

While the indirect impacts anticipated under Alternative B are identical to those presented for the Proposed Action, the extent of the impacts would be substantially less under this alternative.

Indirect Impacts to Rock Art

The indirect impacts to rock art in Nine Mile Canyon and its major tributaries are detailed under the Proposed Action. Given the reduction in industrial traffic under Alternative B, it is likely that the potential detrimental effects of dust on rock art would be vastly reduced. Likewise, the level of vibration caused by industrial traffic would also be reduced.

As discussed under the Proposed Action, if certain road segments within the WTP APE were improved with hard surfacing, dust impacts to cultural resources would effectively be eliminated. It is acknowledged however that hardening of road surfaces within the WTP APE could result in both positive and negative impacts on various resources, including cultural resources.

Cultural Setting

Under the No Action Alternative there would be construction of up to five wells on private lands in Nine Mile Canyon and construction of at least one well on State land in Dry Canyon. Construction of wells in canyon bottoms, as well as increased traffic and human activity in the WTP APE would result in increases in visual and auditory impacts that could diminish the integrity of historic properties in the revised APE. Based on the limited amount of development that would occur, when compared with other alternatives, impacts to the cultural setting would be minimal under this alternative.

Increased Visitation, Vandalism, and Off Highway Vehicle Use

With the reduced number of wells, there is less need for additional new roads and improvements to existing roads, though it is assumed that continued maintenance of existing roads would be necessary. The reduction in roads would likely reduce visitation and vandalism in the areas outside of the major canyons, though it would not entirely eliminate it. It is assumed that visitation and vandalism would continue at its present (unknown) level in the upland areas, with the exception of Horse Bench. Horse Bench Road would be improved so that BBC and could access proposed well locations on State leases. Road improvements could increase motorized access into this area, which is currently protected by difficulty of access.

Native American Consultation and Traditional Cultural Properties

It is assumed that the impacts to TCPs would be lessened by the reduction in surface disturbance proposed under Alternative B. Less affected area lowers the probability of impacting these types of cultural properties. Conversely, the reduced footprint would also reduce the number of cultural resource inventories needed to fulfill APD requirements.

Nine Mile Canyon National Register Multiple Property Listing

Impacts to sites that have been listed on the National Register under the Nine Mile Canyon MPL would be the same as the impacts to eligible sites discussed above.

It is anticipated that site-specific adjustments to locations and orientations would be made during the permitting process (as outlined in **Appendix N**), which would result in avoidance of direct impacts to listed properties.

Indirect impacts to listed properties could include dust, potential vibration related to increases in traffic, and inadvertent damage and advertent damage (i.e., vandalism) due to increased visitation; however, based upon the amount of development proposed under Alternative B, impacts would be far less than under the Proposed Action.

Traditional Cultural Properties

Under Alternative B, BBC and other operators could construct up to 18 well pads on State and private lands within the potential TCP boundary. The majority of these well pads would be located on mesa tops and would not be visible from Nine Mile, Dry, or Cottonwood Canyons. A viewshed analysis conducted from the roads within these canyons revealed that approximately five well pads would be visible in Nine Mile Canyon. No well pads would be visible from the road in Dry Canyon or from the lower portions of Cottonwood Canyon. Within Nine Mile Canyon, only the well pads proposed within the canyon itself, all of which are located on private land, would be visible.

Increases in traffic, increases in human activity, and the presence of surface facilities would introduce visual, atmospheric, and auditory elements could detract from cultural significance of this area to the Hopi Tribe. However, given the reductions in the amount of proposed development under Alternative B, these impacts would be substantially less than under the Proposed Action.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.12.3 Alternative C – Transportation Impact Reduction

The primary difference between the Proposed Action and Alternative C is that, under Alternative C, BBC and other operators would be required to construct a new route through Trail Canyon and implement traffic reduction measures. In terms of surface disturbances, Alternative C is nearly identical to the Proposed Action. When comparing the two alternatives, there is little discernible change in the conceptual location of well pads, associated facilities, and pipelines.

4.12.3.1 Direct Impacts

Under Alternative C, the direct impacts would be similar in nature to those described under the Proposed Action. However, construction of a new route through Trail Canyon could result in additional direct impacts to both known and unknown archaeological sites along that route. Compliance with the Cultural Resource Identification Plan (see **Appendix N**) would serve to mitigate these impacts, primarily through avoidance.

4.12.3.2 Indirect Impacts

The indirect impacts anticipated under Alternative C would be similar to those described under the Proposed Action; however, Alternative C, the Transportation Impact Reduction Alternative, contains a number of measures that would minimize indirect impacts. These measures are discussed in detail in the sections below.

Indirect Impacts to Rock Art

Under all alternatives, BBC and other operators would be required to put into operation a dust suppression plan, (see **Section 2.1.5.6**) which would substantially reduce the amount of dust generated by project-related traffic. As discussed in **Table 2.6-8**, the BLM would consider dust suppression efforts effective when (1) no dust is generated above the cab of the vehicle, or (2) there are no hanging dust plumes. A COA to this effect would be added to all APDs. While implementation of the dust suppression plan and compliance with these COAs would mitigate the majority of dust impacts, Alternative C contains numerous other mitigation measures which would reduce the amount of project-related traffic, thereby further reducing the amount of fugitive dust generated in Nine Mile Canyon and elsewhere within the WTP APE. Implementation of these additional measures would also reduce other indirect impacts resulting from increased vibration and visitation. These measures include:

- Produced water from wells on mesas would be transported via pipeline to SWD wells or water management facilities.
- Use of telemetry equipment to facilitate remote monitoring of wells reducing pumper traffic.
- Alternate means of personnel transportation (e.g., use of aerial transportation).

In addition to the above-mentioned measures, construction and use of a new route in Trail Canyon would reduce the total amount of project-related traffic in Nine Mile Canyon by approximately 22 percent. Use of this alternative route would also nearly eliminate project-related traffic in Nine Mile Canyon between Gate and Harmon Canyons. As shown on **Figure 4.12-1** (Scatter Plot of Known Cultural Resources), a high concentration of cultural resources with rock art panels are adjacent to major transportation corridors. Many of these rock art panels are located in Nine Mile Canyon between Gate and Harmon Canyons. Therefore, implementation of Alternative C, and specifically construction and use of a new route through Trail Canyon, would reduce indirect impacts on rock art when compared with the Proposed Action.

Cultural Setting

As discussed in the introduction to this section, in terms of surface disturbances, Alternative C is nearly identical to the Proposed Action. Construction of surface facilities in canyon bottoms increases in traffic and human activity, and dust in Nine Mile Canyon could cause visual and auditory impacts that would diminish the integrity of the cultural setting.

When compared to with the Proposed Action, construction of a route through Trail Canyon, as well as implementation of other traffic reduction measures would reduce the

amount of traffic and dust in Nine Mile Canyon. However, construction of the proposed Trail Canyon route would create new surface disturbance and increase visual impacts.

Increased Visitation, Vandalism, and Off Highway Vehicle Use

In addition to reducing traffic, Alternative C places seasonal and year-round public access restrictions on various portions of the WTP APE. Briefly, these restrictions include: administrative only access to Cottonwood Canyon (near the dugways leading to Sagebrush Flat and Flat Iron Mesa), Harmon Canyon, and Prickly Pear Canyon from December 1 to April 15; gating all new access roads longer than two miles after drilling and completion activities are completed; administrative-only access to Horse Bench; and gating all roads into WSAs including the existing Jack Canyon Road. These restrictions would affect, to varying degrees, indirect impacts associated with visitation, vandalism, and OHV use within the WTP APE.

As discussed in Section **4.12.1.2**, the largest increase in visitation to both Nine Mile Canyon and more remote parts of the WTP APE would result from an increase in field services employment within the WTP APE. The above-mentioned access restrictions would not eliminate the potential for intentional or inadvertent damage to cultural resources on the plateaus and more remote areas within the WTP APE by project workforce.

Cultural resources on the plateaus surrounding Nine Mile Canyon commonly are identified by surface manifestations of artifacts. The seasonal closure of the Cottonwood, Harmon, and Prickly Pear roads would likely not affect potential recreational visitation, vandalism, or OHV impacts on sites with surface indications to any significant degree as access to these areas would still be open for eight months a year. Snow cover on the plateaus is typically sufficient during the time of the access closures to obscure most surface artifacts, and as a result, it is not likely that intentional visitation, and subsequent vandalism, would occur. However, the few standing structures, both historic and prehistoric, and rock shelters that occur on the plateaus would likely receive some benefit in access restrictions during the winter season, particularly as a protective measure when industrial and recreational use of the plateaus is lower in general. The assumptions here are that vandalism is more likely to occur when 1) less people are present in an area, and 2) when the resource is visible from an existing road (Spangler et al. 2006). Access restrictions at times of reduced human activity in the area would decrease the likelihood of vandalism to standing structures and other cultural resources that are not covered by snow. In those years when snow cover is not sufficient to cover the ground for most, or part, of the winter, access restrictions would have a similar effect on visitation to and vandalism of cultural resources with only surface manifestations.

OHV use would also be reduced during the seasonal closures on the plateaus potentially limiting surface disturbance (e.g., wheel ruts) during the wettest portions of the year. In years with sufficient snow cover, OHV use (particularly snow mobiles and similar vehicles) would have minimal effects on surface sites. However, as snow melts and the moisture levels in sediments and soils increase, the potential for significant damage to cultural resources also increases. While responsible use of OHVs during this portion of the year would likely have little effect on resources, cross county travel or travel on minor roads (e.g., two-track roads) or trails may result in displacement of surface artifacts, exposure of subsurface artifacts, or disturbance of surface or near-surface features

associated with either known or unknown archaeological sites. Closure of the plateaus during this period would reduce this type of damage, but not entirely eliminate it.

Closure of proposed roads longer than two miles, roads into WSAs (including Jack Canyon), and the Horse Bench Road would have beneficial effects on cultural resources for several reasons. Given that public access would be limited year-round, the potential for vandalism and unauthorized collecting is significantly decreased. The Horse Bench area and the WSAs are the least known archaeologically. That is, very little baseline data exist. What moderate archaeological work conducted in these areas has indicated is that substantial cultural resources exist, but the full extent and locations of the resources are not known and cannot be adequately monitored for visitation and vandalism. For example, the remoteness of Jack Canyon has resulted in significant vandalism, primarily in the form of looting of nearly all the structural sites identified in the canyon. The closure of access into these sensitive areas could reduce the potential for additional looting.

There are no access restrictions on main roads in Gate Canyon, Dry Canyon, or Cottonwood Canyon, below the dugway, and indirect impacts to cultural resources along these roads are similar to those discussed under the Proposed Action. Access would be restricted in portions of Nine Mile Canyon, as some project-related traffic would be required to use the proposed route in Trail Canyon.

Overall, the access restrictions proposed as part of Alternative C would reduce recreational visitation and the potential for intentional or inadvertent damage to cultural resources on the plateaus and more remote areas within the WTP APE; however, the scale of this reduction is difficult to determine given the seasonal nature of some of the closures, and the lack of knowledge about the cultural resources in the area.

While use of the Trail Canyon route would reduce the volume of traffic in portions of Nine Mile Canyon, it is still expected that during off-hours workers could visit the sites within this area.

Under Alternative C, BBC and other operators could construct up to three worker housing locations on Prickly Pear, Peter's Point, and Flat Iron Mesa. During off-hours, workers could inadvertently or advertently damage sites. It is anticipated that the potential for impacts is greatest in areas immediately adjacent to the worker housing locations. In order to minimize these impacts, under Alternative C, BBC would be required to conduct a Class III survey on 160 acres of land prior to constructing worker housing.

Nine Mile Canyon National Register Multiple Property Listing

Impacts to sites that have been listed on the National Register under the Nine Mile Canyon MPL would be the same as the impacts to eligible sites discussed above.

It is anticipated that site-specific adjustments to locations and orientations would be made during the permitting process (as outlined in **Appendix N**), which would result in avoidance of direct impacts to listed properties.

Indirect impacts to listed properties could include dust, potential vibration related to increases in traffic, and inadvertent damage and advertent damage (i.e., vandalism) due

to increased visitation; however, implementation of traffic reduction measures and rerouting some industrial traffic through Trail Canyon could decrease indirect impacts when compared with the Proposed Action.

Traditional Cultural Properties

Under Alternative C, impacts to the TCP identified by the Uintah and Ouray Ute Indian Tribe would be similar to those described under the Proposed Action. However, under Alternative C, the BLM would likely require reclamation of the existing road that bisects this area thereby reducing recreational impacts to the site.

Under Alternative C, potential impacts to the Nine Mile TCP would be similar in nature to those discussed in the Proposed Action. While implementation of Alternative C, which includes construction and use of a route through Trail Canyon, would reduce the volume of traffic in Nine Mile Canyon when compared with the Proposed Action; the cultural setting, feeling, and association would still be altered due to increases in traffic in portions of the Canyon, increased human activity, and the presence of additional surface facilities. These elements could disrupt the Hopi's spiritual experience.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.12.4 Alternative D – Conservation Alternative

Alternative D would reduce the surface disturbance by approximately 30 percent compared with the Proposed Action. Under Alternative D there would be NSO in WSAs, on unleased lands within the potential Nine Mile Canyon and Desolation Canyon ACECs, and in canyon bottoms (including Dry, Jack, and Nine Mile Canyons). In addition, under Alternative D, there would be no development on unleased lands with wilderness characteristics, and gates would be placed on Jack Canyon, Horse Bench, Jack Ridge, and Cedar Ridge roads. These restrictions under Alternative D would be of importance as these areas have been recognized for having cultural resource value and could potentially have high cultural resource site density, and are currently either inaccessible or difficult to access. Finally, the option for temporarily housing workers in facilities within the WTP APE would also be abandoned.

4.12.4.1 Direct Impacts

As with the other alternatives, the direct impacts under Alternative D are primarily associated with surface-disturbing activities such as well pad, pipeline, and road construction, as well as maintenance and improvements to existing roads. These activities could potentially affect both known and unknown cultural resources.

Known Impacts

Under Alternative D, the configuration of well locations, associated access roads and pipelines, and ancillary facilities results in at least 41 potential conflicts with known cultural resources (**Table 4.12-6**). Of these 41 sites, 25 have been previously recommended as eligible for inclusion to the NRHP and three remain unevaluated. For the purposes of Alternative D, the unevaluated sites should be considered eligible until

they are professionally evaluated. In all, Alternative D, without any modification to surface disturbances, would directly impact 17 eligible cultural resources.

Table 4.12-6 Sites Known to Conflict with Existing Plan of Development-Alternative D

Site Number	Site Type	Eligibility	Conflict	Avoidable?
42Cb0071	Unknown	Unknown	Well Pad	Unknown
42Cb0243	Prehistoric Artifact Scatter	Unknown	Access/Pipeline	Yes
42Cb0245	Unknown	Eligible	Well Pad	Yes
42Cb0263	Prehistoric Artifact Scatter	Eligible	Compressor	Yes
42Cb1298	Historic Land Use-Ranching	Eligible	Access/Pipeline	Unknown
42Cb1715	Prehistoric Artifact Scatter	Not Eligible	Well Pad/Access/Pipeline	Yes
42Cb1716	Prehistoric Artifact Scatter	Eligible	Pipeline	Yes
42Cb1721	Prehistoric Artifact Scatter	Not Eligible	Access/Pipeline	N/A
42Cb1722	Historic-Miscellaneous	Not Eligible	Well Pad/Access/Pipeline	N/A
42Cb1732	Historic Land Use-Ranching	Eligible	Well Pad/Access/Pipeline	Unknown
42Cb1733	Prehistoric Camp/Historic Land Use-Ranching	Eligible	Access/Pipeline	Yes
42Cb1734	Prehistoric Artifact Scatter	Not Eligible	Access/Pipeline	N/A
42Cb1739	Historic Habitation	Not Eligible	Well Pad	N/A
42Cb1742	Prehistoric Artifact Scatter	Eligible	Well Pad	Unknown
42Cb1743	Prehistoric Artifact Scatter	Eligible	Well Pad	Unknown
42Cb1751	Prehistoric Artifact Scatter	Not Eligible	Access/Pipeline	N/A
42Cb1753	Prehistoric Artifact Scatter	Not Eligible	Well Pad	N/A
42Cb1926	Prehistoric Artifact Scatter	Not Eligible	Well Pad	N/A
42Cb1931	Prehistoric Artifact Scatter	Eligible	Access/Pipeline	Yes
42Cb2083	Prehistoric Artifact Scatter	Not Eligible	Access/Pipeline	N/A
42Cb2199	Prehistoric Rock Shelter	Eligible	Access/Pipeline	Yes
42Cb2201	Prehistoric Artifact Scatter	Not Eligible	Access/Pipeline	N/A
42Cb2223	Prehistoric Artifact Scatter	Eligible	Access/Pipeline	Yes
42Cb2224	Prehistoric Artifact Scatter	Eligible	Access/Pipeline	Yes
42Cb2474	Prehistoric Artifact Scatter	Not Eligible	Well Pad/ Access/Pipeline	N/A
42Cb2533	Prehistoric Artifact Scatter	Not Eligible	Pipeline	N/A
42Cb2537	Prehistoric Temporary Camp	Eligible	Well Pad	Yes
42Cb2542	Prehistoric Artifact Scatter	Not Eligible	Well Pad	N/A
42Cb2544	Prehistoric Artifact Scatter	Not Eligible	Well Pad	N/A

Table 4.12-6 Sites Known to Conflict with Existing Plan of Development-Alternative D				
Site Number	**Site Type**	**Eligibility**	**Conflict**	**Avoidable?**
42Cb2546	Prehistoric Artifact Scatter	Not Eligible	Well Pad	N/A
42Cb2550	Prehistoric Artifact Scatter	Not Eligible	Pipeline	N/A
42Cb2736	Corral	Not Eligible	Access	N/A
42Cb2738	Prehistoric Artifact Scatter	Not Eligible	Pipeline/Access	N/A
42Cb2739	Prehistoric Artifact Scatter	Not Eligible	Pipeline/Access	N/A
42Cb2742	Prehistoric Artifact Scatter	Not Eligible	Pipeline/Access	N/A
42Cb2755	Prehistoric Artifact Scatter	Eligible	Well Pad	Yes
42Cb2756	Prehistoric Artifact Scatter	Eligible	Well Pad	Yes
42Cb2757	Prehistoric Artifact Scatter	Not Eligible	Well Pad	N/A
42Cb2772	Prehistoric Artifact Scatter	Not Eligible	Access/Pipeline	N/A
42Cb2773	Prehistoric Artifact Scatter	Not Eligible	Access/Pipeline	N/A
42Cb2780	Prehistoric Artifact Scatter	Not Eligible	Access/Pipeline	N/A

N/A – Not applicable

In addition to new surface disturbances, existing road maintenance and improvements would potentially conflict with at least 41 known cultural resources (**Table 4.12-7**). Of these 41 sites, 25 have been previously recommended as eligible for inclusion on the NRHP and five are unevaluated, but should be treated as eligible properties until they can be professionally evaluated. The majority of these sites have already been impacted during the original construction of the current road system within the WTP APE. Avoidance of these cultural resources is not practical in most instances and other means of mitigation would be required before additional disturbances occurred outside of the existing roadways.

Table 4.12-7 Known Sites with Potential Conflicts with Existing Road Maintenance and Upgrades			
Site Number	**Site Type**	**Eligibility**	**Conflict**
42Cb0088	Prehistoric Temporary Camp	Eligible	Adjacent to Existing Road
4Cb0090	Prehistoric Artifact Scatter	Eligible	Bisected by Existing Road
42Cb0242	Prehistoric Habitation	Eligible	Adjacent to Existing Road
42Cb0245	Prehistoric Artifact Scatter	Unknown	Bisected By Existing Road
42Cb0247	Prehistoric Artifact Scatter	Unknown	Adjacent to Existing Road

Table 4.12-7 Known Sites with Potential Conflicts with Existing Road Maintenance and Upgrades			
Site Number	**Site Type**	**Eligibility**	**Conflict**
42Cb0253	Prehistoric Artifact Scatter	Unknown	Adjacent to Existing Road
42Cb0263	Prehistoric Artifact Scatter	Unknown	Adjacent to Existing Road
42Cb0644	Prehistoric Artifact Scatter	Eligible	Adjacent to Existing Road
42Cb0649	Prehistoric Temporary Camp	Eligible	Adjacent to Existing Road
42Cb0793	Historic Homestead	Eligible	Bisected by Adjacent Road
42Cb0801	Prehistoric Temporary Camp	Eligible	Adjacent to Existing Road
42Cb0815	Prehistoric Artifact Scatter	Eligible	Adjacent to Existing Road
42Cb0913	Prehistoric Habitation	Eligible	Adjacent to Existing Road
42Cb0956	Prehistoric Artifact Scatter	Eligible	Adjacent to Existing Road
42Cb0976	Rock Art on Detached Boulder	Eligible	Adjacent to Existing Road
42Cb1711	Prehistoric Storage	Eligible	Adjacent to Existing Road
42Cb1716	Prehistoric Artifact Scatter	Eligible	Adjacent to Existing Road
42Cb1718	Historic Artifact Scatter	Not Eligible	Adjacent to Existing Road
42Cb1739	Historic Habitation	Eligible	Adjacent to Existing Road
42Cb1741	Prehistoric Artifact Scatter	Eligible	Adjacent to Existing Road
42Cb1753	Prehistoric Artifact Scatter	Not Eligible	Adjacent to Existing Road
42Cb1909	Prehistoric Temporary Camp	Eligible	Bisected by Existing Road (Road is currently closed to gas field traffic)
42Cb1910	Prehistoric Artifact Scatter	Eligible	Adjacent to Existing Road
42Cb1926	Prehistoric Artifact Scatter	Not Eligible	Adjacent to Existing Road
42Cb1927	Prehistoric Artifact Scatter	Eligible	Adjacent to Existing Road
42Cb1930	Prehistoric Artifact Scatter	Eligible	Adjacent to Existing Road
42Cb2045	Prehistoric Artifact Scatter	Unknown	Adjacent to Existing Road
42Cb2055	Historic Land Use-Ranching	Not Eligible	Adjacent to Existing Road
42Cb2076	Prehistoric Artifact Scatter	Not Eligible	Adjacent to Existing Road
42Cb2077	Prehistoric Artifact Scatter	Not Eligible	Adjacent to Existing Road
42Cb2080	Prehistoric Artifact Scatter	Eligible	Adjacent to Existing Road
42Cb2085	Prehistoric Temporary Camp	Eligible	Adjacent to Existing Road
42Cb2168	Prehistoric Rock Shelter	Eligible	Immediately Adjacent to Existing Road
42Cb2193	Historic Land Use-Ranching	Not Eligible	Adjacent to Existing Road
42Cb2194	Historic Land Use-Ranching	Not Eligible	Adjacent to Existing Road
42Cb2200	Prehistoric Artifact Scatter	Not Eligible	Adjacent to Existing Road
42Cb2206	Historic Artifact Scatter	Not Eligible	Adjacent to Existing Road
42Cb2209	Historic Land Use	Not Eligible	Bisected by Existing Road
42Cb2212	Historic Artifact Scatter	Not Eligible	Adjacent to Existing Road
42Cb2223	Prehistoric Artifact Scatter	Eligible	Bisected by Existing Road
42Cb2224	Prehistoric Artifact Scatter	Eligible	Bisected by Existing Road

Anticipated Direct Impacts to Unknown Cultural Resources

While additional archaeological inventory would be required before each instance of surface disturbance (see **Appendix N**), it is possible to estimate the potential number of archeological sites that may be encountered throughout the disturbances in Alternative D. These estimates, however, should be considered an *approximation*. The inventories conducted in the WTP APE to date do not meet the assumptions required of general probability theory and statistical inference.

Site Density Estimates

Using the site density estimates calculated for the Proposed Action, it is estimated that between 65 and 160 sites are located within the proposed development areas detailed for Alternative D as shown in **Figure 2.5-1**. The results of the site density estimates are given in **Table 4.12-8**.

Table 4.12-8 Site Density Estimates for Alternative D

Density Estimate	Estimate Parameters	Site Density (sites/mi^2)	Potential Number of Sites in Alternative D
Density 1	Total # Sites/Total WTP APE	4.66	17*
Density 1a	Total # Sites/Total Inventoried Areas	52.6	195**
Density 1b	Total # Sites/Modified Total of Inventoried Areas	43.3	160
Density 2	Total # Sites On Plateau/Total Inventoried Areas on Plateau	42.7	158
Density 3	Site Density Estimate From Landt 2006 for Sagebrush Flats Area	18.5	68
Density 4	Total # Sites on Plateau/Total Area of Previously Inventoried Areas of Alternative D	39	144

*Not considered in the range estimate because it is known to be too low.
**Site density represents sites in both canyon and plateau settings.
- number
mi^2 – square mile

Direct Impacts to Sites without Surface Indications

The potential for encountering buried sites is presented in detail under the Proposed Action**.** Given the smaller levels of surface disturbance, the chances of encountering buried sites are greatly reduced compared to the other alternatives, though such a disturbance is still possible.

Summary

It is estimated that between 65 and 160 cultural resources with surface manifestations occur within the disturbance areas for Alternative D. Each of these sites has the potential to be directly impacted by surface-disturbing activities if they are not identified and documented prior to construction and either avoided or otherwise mitigated. Existing permitting requirements and the guidelines for identification of cultural resources prior to surface disturbance (**Appendix N**) provide measures to ensure the avoidance or other mitigation of cultural resources that are eligible for nomination to the NRHP. Based on the adherence to the guidelines and procedures in **Appendix N** and the track

record of site avoidance in previous gas production within the WTP APE, the potential for direct impacts to cultural resources is relatively low.

4.12.4.2 Indirect Impacts

While the indirect impacts anticipated under Alternative D are identical to those described under the Proposed Action, the extent of the impacts is slightly different under this alternative. Indirect impacts under Alternative D would be reduced in proportion to reductions in the amount of development when compared to the Proposed Action (approximately 30 percent less). In addition, surface occupancy and access restrictions in sensitive resource areas would be of importance as these areas have been recognized for having cultural resource value and could potentially have high cultural resource site density.

Indirect Impacts to Rock Art

As with all other alternatives, BBC and other operators would be required to put into operation a dust suppression plan, (see **Section 2.1.5.6**) which would substantially reduce the amount of dust generated by project-related traffic. As discussed in **Table 2.6-8**, the BLM would consider dust suppression efforts effective when (1) no dust is generated above the cab of the vehicle, or (2) there are no hanging dust plumes. A COA to this effect would be added to all APDs. While implementation of the dust suppression plan and compliance with these COAs would mitigate the majority of dust impacts, under Alternative D, industrial traffic would also be reduced by about 35 percent when compared with the Proposed Action. Reductions in the amount of traffic would further reduce the amount of fugitive dust generated in Nine Mile Canyon and elsewhere within the WTP APE and reduce potential indirect impacts resulting from increased vibration.

Cultural Setting

Impacts to the cultural setting would be substantially less than those described under the Proposed Action. As previously mentioned, there would no drilling on Federal lands in canyon bottoms within the WTP Project Area. Nonetheless, BBC and other operators would still construct up to five well pads on private lands in Nine Mile Canyon as well as up to three pump stations on State and private lands in Dry, Cottonwood, and Nine Mile Canyon. The presence of additional facilities in these canyons would introduce new visual and auditory elements that could diminish the cultural setting. Phased development and reductions in the number of wells within the WTP APE would also reduce the amount of human activity and traffic in Nine Mile Canyon on a day-to-day basis.

Increased Visitation, Vandalism, and Off Highway Vehicle Use

Under Alternative D, there is approximately a 30 percent reduction amount of proposed development when compared with the Proposed Action. Reductions in the amount of proposed development would result in a proportional reduction in field services employment within the WTP APE. With the reduced number of wells, there would also be less need for additional new roads and improvements to existing roads. The reduction in roads would likely reduce visitation and vandalism in the areas outside of the major canyons, though it would not entirely eliminate it. Gating of Jack Canyon,

Horse Bench, Cedar Ridge, and Jack Ridge roads would further limit public access and reduce inadvertent and advertent damage to historic properties. Jack Canyon and Horse Bench in particular have known important cultural resources. In the case of Jack Canyon, looting activities have been recorded, sometime after a well and access road was constructed into the area. Looting of sites in Jack Canyon included illegal excavation of rock shelters and the removal of rock art panels (Patterson and Whitfield 2004).

Numerous studies have been conducted demonstrating a correlation between OHV use and impacts to archaeological resources including *The Alkali Ridge Cultural Resource Survey and Vandalism Study Southeastern Utah* (Honeycutt and Fetterman 1985); *Site Condition and Vandalism Assessment of Archaeological Sites, Lower and Middle Arch Canyon, San Juan County, Utah* (Spangler 2006), and *Final Report: Baseline Site Condition and Vandalism Assessments of Archaeological Sites in Tenmile Canyon, Grand County, Utah* (Spangler and Yentsch 2008). The Alkali Ridge Study documented "that newly bladed roads are the means of vehicular access used by pot hunters to reach formally inaccessible areas and untouched sites." In addition, Spangler's studies in Arch Canyon and Tenmile Canyon demonstrated that direct and indirect impacts have been precipitated by inappropriate ORV use, and that unrestricted vehicular access has resulted in greater access to archaeological sites, which has facilitated vandalism. Restricting public access on certain roads on the WTP Project, could reduce the potential for vandalism.

In addition, under Alternative D there would be no temporary worker housing locations to reduce the potential for worker-related impacts (e.g., loss or damage) to cultural resources, which could occur during off-hours. Given all of these factors, it is anticipated that indirect impacts to cultural resources under Alternative D would be substantially less than under other development alternatives.

Nine Mile Canyon National Register Multiple Property Listing

Impacts to sites that have been listed on the National Register under the Nine Mile Canyon MPL would be the same as the impacts to eligible sites discussed above.

It is anticipated that site-specific adjustments to locations and orientations would be made during the permitting process (as outlined in **Appendix N**), which would result in avoidance of direct impacts to listed properties.

Indirect impacts to listed properties could include dust, potential vibration related to increases in traffic, and inadvertent and advertent damage (i.e., vandalism) due to increased visitation. Based on reductions in the amount and location of development and traffic proposed under this alternative, it is assumed that impacts to listed properties would be less under the Conservation Alternative than the Proposed Action.

Native American Consultation and Traditional Cultural Properties

Under Alternative D, impacts to the TCP identified by the Uintah and Ouray Ute Indian Tribe would be similar to those described under the Proposed Action. However, given the reductions in the amount of proposed development these impacts would be substantially less than under the Proposed Action.

Under Alternative D, BBC and other operators could construct up to 43 well pads within the boundary of Hopi TCP for the Nine Mile Canyon, which is approximately 20 percent less than what would be constructed under the Proposed Action. The majority of these well pads would be located on mesa tops and would not be visible from Nine Mile, Dry, or Cottonwood Canyons. A viewshed analysis conducted from the roads within these canyons revealed that approximately five well pads would be visible in Nine Mile Canyon, four well pads in Dry Canyon, and no well pads in the lower portions Cottonwood Canyon. Within Nine Mile, only the well pads proposed within the canyon itself, all of which are located on private land, would be visible. Within Dry Canyon all well locations that would be visible would be located on the mesa tops.

In addition to well pads, under the Proposed Action, BBC and other operators could construct up to three pump stations within the proposed TCP. One pump station is proposed on State land in Cottonwood Canyon, one pump station is proposed on private land in Nine Mile Canyon, and one pump station is proposed on Federal lands in Dry Canyon.

Potential impacts to the TCP from the development described above would be similar in nature to those discussed in the Proposed Action. However, reductions in the amount of proposed development under Alternative D would reduce visual and auditory impacts within the potential TCP boundary. Nonetheless, the cultural setting, feeling, and association could still be altered due to substantial increases in traffic, increased human activity, and the presence of additional surface facilities; therefore, disrupting Native American spiritual experiences.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.12.5 Alternative E – Agency Preferred Alternative

The implementation of Alternative E would result in approximately 10 percent less surface disturbance than would the implementation of the Proposed Action. When compared with the Proposed Action well pad reductions would primarily occur in the Desolation and Jack Canyon WSAs, Dry Canyon, and within the Nine Mile Canyon ACEC (as designated in the Price Field Office Approved RMP). As each of these areas have high cultural resource concentrations, the proportional reductions in impacts would likely be greater than the proportional reductions in surface disturbance. In addition, under the Agency Preferred Alternative, BBC and other operators would be required to implement measures included in the WTP PA. Implementation of these mitigation measures would substantially reduce impacts to cultural resources within the WTP APE as described in detail in the analysis below.

4.12.5.1 Direct Impacts

Direct impacts would be similar to those discussed Under the Proposed Action with the following exceptions.

In addition to the direct impacts described for the Proposed Action, additional direct impacts to cultural resources could be caused by the construction of nine to 11 visitor interpretation/enhancement sites. Construction of these sites could result in discovery

and potential damage to unidentified cultural resources. However, direct impacts could largely be avoided by complying within measures outlined in **Appendix N**.

The objective of visitor interpretation/enhancement sites would be to direct people to designated areas, inform and educate visitors of the unique resources in Nine Mile Canyon, and contribute to a safer visitor experience. The priority sites include:

- First Site;
- Owl Panel;
- Cottonwood Complex (i.e., Cottonwood Village, Great Hunt Panel, Big Buffalo);
- Rasmussen Cave;
- Daddy Canyon; and
- Freight and Military Road Remnant (Gate Canyon historic road).

In addition, the BLM has committed to try to obtain easements from willing private landowners for development of an additional two to four sites, including the long neck sheep and balance rock sites.

As stated in **Section 2.6.1.6**, under the Agency Preferred Alternative, and as required by the WTP PA, BBC would be required to conduct a Class II cultural resource inventory where existing survey data is lacking. Class II surveys are designed to measure the probable density, diversity, and distribution of cultural properties in an area. Within individual sample units, survey intensity and methods are the same as those applied to Class III surveys. The Class II survey would be designed by a BLM permitted archaeological consultant specific to the WTP APE. A Class II survey could result in the identification of previously unidentified cultural resources, thereby reducing the potential to directly impact those resources.

4.12.5.2 Indirect Impacts

While the indirect impacts anticipated under Alternative E are very similar in nature to those presented for the Proposed Action, the extent of the impacts would be different under this alternative.

Indirect Impacts to Rock Art

As with all other alternatives, BBC and other operators would be required to put into operation a dust suppression plan, (see **Section 2.1.5.6**) which would substantially reduce the amount of dust generated by project-related traffic. Unlike other alternatives, BBC would be required to apply suppressant materials throughout the entire APE, which extends well beyond the WTP Project boundary (see **Figure 3.12-1**). Requiring dust control throughout the APE would ensure that historic properties in Gate Canyon, and Nine Mile Canyon west of Harmon Canyon would be protected from dust.

Currently, the BLM considers dust suppression efforts effective when (1) no dust is generated above the cab of the vehicle, or (2) there are no hanging dust plumes. However, under the WTP PA, the Nine Mile Canyon Road Cooperative Board has agreed to commission a study to evaluate various dust collection devices and

procedures with the objective of identifying a dust monitoring method that will be quantitative, cost effective, and easy to operate. Implementation of a new dust monitoring program would be required prior to project initiation if this alternative were to be selected. Implementation of a dust monitoring program would provide the BLM, Carbon and Duchesne County, and BBC with a less subjective but equally effective method of evaluating the effectiveness of dust suppression efforts. With dust monitoring data, it is assumed that BBC and the counties would be able to quantitatively identify and resolve dust concerns prior to there being problems.

Even with the application of dust suppressants and the use of dust monitoring devices, as was discussed under the Proposed Action, limited amounts of fugitive dust are likely to be generated by project-related traffic that may settle on and visually obscure rock art adjacent to the road. To monitor the amount of dust accumulating on rock art, BBC and other operators would be required to fund a cultural resource monitoring plan. The intent of the plan is to gather information about a sample of sites and then monitor changes to those sites over time. As part of the monitoring plan, a third-party contractor would collect dust samples to determine if dust, generated by industrial traffic, is still being deposited on sites. If the BLM determines that dust is continuing to accumulate on sites, the BLM would mitigate the impacts by 1) requiring conservation treatments; 2) requiring BBC and other operators to implement additional project-related traffic reduction measures; and/or 3) stopping or limiting approval of new APDs and denying or limiting new ROW applications. Implementation of the cultural resources monitoring plan, and, as needed, application of the aforementioned mitigation measures, would ensure that impacts to historic properties associated with future development would be less than under all other action alternatives and would effectively mitigate the “Adverse Effects” discussed in **Section 4.12.1**.

In addition, to minimizing impacts associated with future development, under the Agency Preferred Alternative, as required by the WTP PA, BBC and other operators would be required to pay for conservation treatments at rock art panels that have been affected by dust from past oil and gas development. As discussed in **Section 4.12.1.2**, the Dust Study (Silver 2008) (**Appendix G**) demonstrated that dust associated with industrial activities in the canyon has settled on and visually obscured rock art panels. However, the dust study was inconclusive regarding whether dust and its constituent elements were physically degrading the rock art. To address this uncertainty, BBC and other operators would fund a study focused on whether dust is causing physical degradation of the rock art.

In addition to being required to implement the measures included in the WTP PA, under Alternative E, like under Alternative C, BBC and other operators would be required to implement traffic reduction measures, thereby further reducing the amount of fugitive dust generated in Nine Mile Canyon and reducing impacts to the cultural setting. These measures include:

- Produced water from wells on mesas would be transported via pipeline to SWD wells or water management facilities with limited exceptions (see **Section 2.6.11.3**).
- Use of telemetry equipment to facilitate remote monitoring of wells reducing pumper traffic

Cultural Setting

As discussed in the introduction to this section, it was determined that implementation of the project could have an "Adverse Effect" on the cultural setting. Impacts to the cultural setting could occur from increases in traffic and human activity in the project, increases in the amount of dust, and increases in oil and gas facilities in canyon bottoms.

Reductions in the number of well pads in canyon bottoms (particularly in Dry Canyon and Jack Canyon) and traffic reduction and expanded dust suppression efforts would decrease the visual and auditory impacts within the canyon bottom setting when compared with the Proposed Action. The construction of five wells in Nine Mile Canyon, all located on private lands, as well as the use of Nine Mile Canyon for industrial traffic would still result in changes from the current setting to a more industrial setting.

As discussed in Section, **2.6.11.3**, under the Agency Preferred Alternative, the BLM has established criteria for locating pump stations on Federal lands in Nine Mile Canyon, which would be the only surface facilities on BLM-administered land in the canyon bottom. Implementation of these measures discussed below, would decrease impacts when compared to the Proposed Action.

- Class I and Class III inventories of the proposed pump station locations and a ½-mile buffer zone would be completed during the permitting phase to determine whether any eligible NRHP properties could be affected. For any pump stations proposed within ½-mile of eligible NRHP properties, appropriate Section 106 consultation would be completed prior to approval of the pump station location. Native American consultation would also be completed prior to approving a pump station location(s).
- A cultural resource specialist would be located on-site during construction of the pump stations to monitor and prevent damage to cultural sites.
- All pump station engines would be fitted with at least hospital grade mufflers for noise abatement. In addition, all pumps and generators would be enclosed in acoustically insulated buildings.
- Pump station design and mitigation measures would be reviewed by a licensed landscape architect.
- Site Specific visual simulations and a detailed visual contrast rating would be completed by a licensed landscape architect to determine whether the proposed pump station is in conformance with VRM Class objectives.
- A landscape architect would ensure during construction of the pump stations that appropriate visual resource mitigation measures are implemented.
- No pump stations would be allowed within "line of sight" of Key Observation Points (KOPs) within Nine Mile Canyon, which includes those sites identified within the BLM Recreation and Cultural Area Management Plan: Nine Mile Canyon Special Recreation and Cultural Management Area (BLM 1995) that could be developed as recreational/interpretive sites.

Increased Visitation, Vandalism, and Off Highway Vehicle Use

Alternative E proposes many of the same access restrictions proposed under Alternative C (i.e., gating all proposed roads longer than two miles and all roads providing access into the WSAs). Thus, indirect impacts would be nearly identical to those described under Alternative C.

As discussed under the Proposed Action, implementation of the project would result in increases in human activity due to the large work force that would be required on a day-to-day basis. To alleviate increased vandalism, under the WTP PA, BBC and other operators would be required to provide cultural resource awareness training to all personnel including direct employees and contractors involved in construction, operation, and maintenance of the project. Education has been shown to lessen illegal activities including defacement, graffiti, removal of artifacts, and illegal excavation. In addition, BBC and other operators would be required to complete a 160 acre Class III cultural resource survey prior to constructing worker housing locations. Identification, avoidance, and monitoring of any eligible properties near worker housing, would minimize impact.

Though it is not necessarily expected, construction of turnouts and/or designated parking locations at well-known sites within the canyon could result in increased recreational visitation. Increased visitation could increase the risk of vandalism (both intentional and unintentional), and unauthorized collection of artifacts and other cultural materials. Although, there is documentation which shows that when sites are interpreted and education is provided visitors have more respect and appreciation for these significant non-renewable resources. Therefore, construction of interpretive sites at selected locations may actually provide long term-protection and reduce the amount of site vandalism.

In addition to monitoring for dust, as part of the cultural resource monitoring plan, a professional archaeologist would also be monitoring sites for other human and naturally caused changes including changes in visitation and vandalism. Forms showing changes in overall site conditions would be submitted to the BLM. When impacts are noted, the BLM would address these impacts on a case-by-case basis as discussed in the cultural resource monitoring plan (**Appendix T**).

Nine Mile Canyon National Register Multiple Property Listing

Impacts to sites that have been listed on the National Register under the Nine Mile Canyon MPL would be the same as the impacts to eligible sites discussed above.

It is anticipated that site-specific adjustments to locations and orientations would be made during the permitting process (as outlined in **Appendix N**), which would result in avoidance of direct impacts to listed properties.

Indirect impacts to listed properties could include dust, potential vibration related to increases in traffic, and inadvertent damage and advertent damage (i.e., vandalism) due to increased visitation. Based on the inclusion of mitigation measures outlined in the WTP PA and discussed above, it is assumed that impacts to listed properties would be less under the Agency Preferred Alternative than under any other action alternative.

Native American Consultation and Traditional Cultural Properties

Under Alternative E, impacts to the TCP identified by the Uintah and Ouray Ute Indian Tribe would be identical to those described under Alternative C.

Under the Agency Preferred Alternative, BBC and other operators could construct up to 43 well pads within the boundary of Hopi TCP for the Nine Mile Canyon, which is approximately 20 percent less than what would be constructed under the Proposed Action. The majority of these well pads, however, would be located on mesa tops and would not be visible from Nine Mile, Dry, or Cottonwood Canyons. A viewshed analysis conducted from the roads within these canyons revealed that approximately five well pads would be visible in Nine Mile Canyon, four well pads in Dry Canyon, and no well pads in the lower portions Cottonwood Canyon. Within Nine Mile, only the well pads proposed within the canyon itself, all of which are located on private land, would be visible. Within Dry Canyon all well locations that would be visible would be located on the mesa tops.

In addition to well pads, under the Agency Preferred Alternative, BBC and other operators could construct up to four pump stations within the proposed TCP. One pump station is proposed on State land in Cottonwood Canyon, another on private land in Nine Mile Canyon. The location of the remaining two pump stations is currently unknown. As discussed in the previous section, under the Agency Preferred Alternative, the BLM has established criteria for locating pump stations on Federal lands in Nine Mile Canyon.

Potential impacts to the TCP from the development described above would be similar in nature to those discussed in the Proposed Action. Namely, implementation of the Agency Preferred Alternative would introduce visual, atmospheric, or auditory elements that could detract from cultural significance of this area to the Hopi Tribe. Mitigation measures discussed in the preceding sections would reduce visual and auditory impacts within the potential TCP boundary. However, the cultural setting, feeling, and association could still be altered due to increases in traffic, increased human activity, and the presence of additional surface facilities; therefore, disrupting Native American spiritual experiences. As required by the WTP PA, government-to-government consultation would continue with Indian Tribes, including the Hopi, regarding historic properties of religious and cultural significance.

4.13 SOCIOECONOMIC RESOURCES

4.13.1 Socioeconomics

The main focus of the socioeconomics section is on potential impacts to employment, population, and income; housing and public facilities and services; and public fiscal conditions. Two narrow areas of economic impact were considered as well because of their historical importance or because of public interest expressed during scoping: 1) impacts to livestock operations where well development would affect grazing permits, and 2) economic impacts that might occur because of effects to recreation and cultural resources within the WTP Project Area. The alternative actions would also potentially affect study area residents' satisfaction with community life. The project may also affect individuals and groups with a special interest in potentially affected resources within the WTP Project Area.

The socioeconomics analysis depends on the findings of other sections, principally the analysis of impacts to Rangeland (see **Section 4.7**); Recreation (see **Section 4.11**) and Cultural Resources (see **Section 4.12**).

4.13.1.1 Direct Project Spending Factors

According to the operators, four aspects that affect project spending are 1) the number of wells being drilled; 2) the number of producing wells; 3) production levels; and 4) added capacity to gather the natural gas. The level of activity that drives the spending for each alternative is found in **Table 2.2-1**, or was extrapolated from a typical well profile, regardless of alternative, and from the field production schedule specific to an alternative.

The primary differences between the alternative actions are 1) the length, pace, and intensity of the development phase, and 2) the intensity of the production-only phase, which is mainly determined by the total number of wells. The production-only phase for each alternative is constant at 20 years.

In addition, Alternative C (Transportation Impact Reduction) and Alternative D (Conservation Alternative) are seasonal in nature because of activity restrictions in parts of the WTP Project Area during parts of the year. This affects the development phase only.

Section 2.1.5.1 describes existing well production, which indicates the possibility of a range of production outcomes under each alternative by well type (i.e., shallow or deep). For this analysis, BBC provided one well profile that was developed from internal working information on existing wells. Under each alternative, this single well profile – which blends characteristics of wells BBC has developed to date – was used to generate the aggregate production schedule for the field as a whole.

Table 4.13-1 shows project spending factors. According to BBC, spending factors would be approximately the same for all of the alternatives. Under some alternatives, project activity will vary due to seasonal restrictions. No quantitative information was developed on seasonal impacts. However, seasonal impacts are discussed qualitatively in the narrative for Alternative C (Transportation Impact Reduction) and Alternative D (Conservation Alternative).

The effect of the project on the socioeconomic study area would depend on whether project spending occurs locally or over a wider geographical area. **Table 4.13-2** shows BBC's estimate of spending distributed geographically. The specific oil and gas activities would change over time depending on the development phase and would affect the overall distribution of project spending. However, the relatively high cost of drilling and infrastructure construction generally determines the trend of the overall distribution.

Table 4.13-1 WTP Project Spending Factors, All Alternatives

	Cost Driver	Cost Factor
Drilling and Completion (total)	Per well drilled	$3,407,837
Materials		$443,866
Services		$2,963,971

Table 4.13-1 WTP Project Spending Factors, All Alternatives		
	Cost Driver	**Cost Factor**
Gathering System Construction (total)	Per MMscf/d added capacity	$430,921
Materials		$200,189
Services		$230,731
Well Operations (total)	Per MMscf/d production	$0.195616
Materials		$0.007825
Services		$0.187791
Gathering System Operations (total)	Per MMscf gas transported	$0.066183
Materials		$0.036401
Services		$0.029782
In-House Professional Services - Operations (total)	Per producing well per year	$11,000
Materials		$11,000
Services		$0
In-House Professional Services – Development (total)	Per active rig month	$9,200
Materials		$9,200
Services		$0

MMscf – million standard cubic feet.
MMscf/d – million standard cubic feet per day.

Table 4.13-2 Geographical Distribution of Spending by Activity, All Alternatives (Percent)					
	Carbon County	**Duchesne County**	**Uintah County**	**Other Utah**	**Other States**
Drilling and Completion	0	74	5	0	21
Gathering System Construction	3	3	3	4	87
Well Operations	#	16	20	5	59
Gathering System Operations	3	3	3	3	88
Drilling Administration[1]	0	0	0	0	100
Operations Administration[1]	0	0	0	0	100

= Non-zero.
[1] Administration costs are incurred at BBC headquarters in Denver, Colorado.

In addition, the distribution of average project spending over time by project phase is very similar from alternative to alternative. **Table 4.13-3** shows the overall distribution of average spending for the development and production-only phases for all of the alternatives.

Table 4.13-3 Geographic Distribution of Average Spending by Project Phase, All Alternatives (Percent)			
	Carbon County	**Duchesne County**	**Uintah County**
Development Phase	1	91	8
Production-Only Phase	2	42	56

4.13.1.2 Economic Impact Model and Region for Analysis

Project spending was analyzed using the IMPLAN economic impact analysis software and data. An IMPLAN "model" was built to represent the area where local direct economic effects would occur and where all the local secondary effects would develop.

The geography of the model is the three counties of the local study area: Carbon, Duchesne, and Uintah Counties in Utah. The IMPLAN software integrates proprietary data about each county into a representation of the area as a single, functional economic unit. The benefit of this approach is that the interaction between counties, like cross-county trade and commuting, are captured together in the economic estimates. The total impact for the region was then apportioned to the individual counties in proportion to the geographic distribution of average project spending by project phase (see **Table 4.13-1**).

According to BBC, direct project effects would also occur elsewhere in the State of Utah and in other parts of the U.S. For some dimensions of the alternatives, the operators would spend the same or more outside the local area as the operators would spend inside the study area. However, the impact of jobs created elsewhere in the State of Utah or in the U.S. economy outside of Utah would be small relative to total employment in those economic regions.

Project impacts to employment and income may be offset overtime to some extent by changes in economic activity in other sectors; these activities (e.g., grazing, hunting, recreation, river rafting) were addressed outside the model to the extent possible. How price changes overtime and changes in the economic value of non-market resources may affect employment and income, and its distribution among sectors of the economy, has not been modeled in a general equilibrium framework.

4.13.1.3 Fiscal Analysis

The analysis also estimates the fiscal effect of the alternatives on the region's principal local governments. These fiscal effects are extrapolated from the economic impacts and from projections of the value of the gas that is produced. Expenditure and revenue estimates indirectly reflect the potential impact of the alternatives on the supply and demand of services. There are many special service districts in the region for which estimates were not made. The analysis also estimates two revenue streams to the State of Utah that would be directly impacted by the alternatives: the severance tax and the mineral lease revenue (revenue from Federal royalties on gas production that is returned to the State). Average and cumulative costs and revenues are calculated over the productive life of the field. The productive life lasts from the first year of drilling through the end of the life of the last producing wells, and varies from alternative to alternative.

4.13.1.4 Accounting for Existing Activity in the WTP Project Area

BBC began drilling in the WTP Project Area in 2002. In 2006, there were four rigs deployed, though they ran less than they would in a normal year under any one of the WTP EIS alternatives. BBC's drilling through 2006 has yielded 63 producing wells. Applying spending factors to these cost drivers leads to estimates of the level of onsite employment, total employment, income, and population that are directly attributable to BBC's existing activity in the WTP Project Area.

If given approval, BBC would increase activity from its current level to the level described under each alternative. This means that by the time an alternative is implemented, if approved, some of the impact described in the following analysis may already be realized in the local economy because of road and pad construction; rigs that are already operating; gas gathering capacity that is already being installed; and the operation of existing producing wells. It is also likely that total employment generated by BBC's existing activity is higher than the employment generated under any alternative late in the LOP when wells are going out of production, field output is low and declining, and production-related spending by BBC is proportionately low and declining.

Table 4.13-4 Estimated Existing Direct Employment in the WTP Project Area

Year	Number of Rigs	Producing Wells	Development-Related Employment	Production-Related Employment	Total On Site Employment
2006	4 (part-time)	63	76	8	84

4.13.1.5 Population and Housing Demand Factors

The population and housing demand impacts are extrapolated from the total employment impact. Population numbers are extrapolated using a ratio of population to employment that is calculated from the data in **Table 3.13-32** and **Table 3.13-33.** The population-to-employment ratio is 1.6 for the three-county region (i.e., population grows by 1.6 persons per job). This factor is used to estimate population for all alternatives.

Housing demand is estimated using the ratio of housing to population calculated from **Table 3.13-12** and **Table 3.13-17**. An overall average housing-to-population ratio of 0.62 (one housing unit per 1.6 persons) is used for all three counties and for all alternatives.

Table 3.13-2 provides the basis for apportioning the population impacts to the cities and communities in the Project Area. Data from **Table 3.13-2** indicate how growth since 2000 has accrued to municipalities in local counties. A set of population allocation factors for all alternatives is presented in **Table 4.13-5**. The same scheme for apportioning population is used for direct and secondary employment, and for employment related to the development and production-only phases of an alternative. Population is only apportioned to the larger municipalities. The factors in Carbon County were adjusted to exclude the Scofield area, which is not within proximity of the WTP Project Area.

Table 4.13-5 WTP Local Population Allocation Factors, All Alternatives

	Share of Population Impact (Percent)
Carbon County	**100**
Helper	13
Price	27
Wellington	10
Other Carbon County	50

Table 4.13-5 WTP Local Population Allocation Factors, All Alternatives	
	Share of Population Impact (Percent)
Duchesne County	**100**
Duchesne	8
Roosevelt	27
Other Duchesne County	65
Uintah County	**100**
Vernal	26
Other Uintah County	74

4.13.2 Alternative A – Proposed Action

Under Alternative A, the largest socioeconomic impact relative to community size would occur in Duchesne County. This follows from BBC's stated plan for contracting and buying materials. The level of impact to each county and to other impact variables stems from spending levels occurring under Alternative A. Spending is principally driven by the total number of wells to be developed and the pace of development.

Figure 4.13-1 illustrates the pattern of annual spending by location under Alternative A. The total development period under Alternative A is 8 years. The project begins with a burst of development activity that declines over a 3-year period to a level that is held more or less the same for the last 5 years of the development phase.

4.13.2.1 Employment, Population, and Income

The employment impact of Alternative A is measured by total employment, which is further divided into direct and secondary employment. Direct employment includes some BBC payroll jobs, but primarily includes BBC contractors in the drilling and field services industries in addition to some employment at BBC's direct material suppliers. Secondary employment is the multiplier effect resulting from additional employment created by BBC contractors' purchases of goods and services, additional employment of suppliers (indirect employment), and household spending due to project-related income (induced employment).

Employment impacts are presented as two averages: the average annual employment level during the development phase (which also would include employment related to the operation of newly drilled wells) and average annual employment during the production-only phase. A third measure of impact identifies the employment peak under Alternative A and how much higher total employment would be at the peak of the development phase compared to average annual employment.

Under Alternative A, average total employment for the development phase would be approximately 1,100 jobs in the local study area, of which 900 are with employers that are located in Duchesne County (**Table 4.13-6**). The impact in Duchesne County would raise employment about 9 percent over the employment level projected for 2010 (**Table 3.13-33**). Impact employment in Duchesne County under Alternative A translates into a potential population increase of 1,600 and an increase of approximately 980 housing units (**Table 4.13-7**). Peak impacts occur in year 1 of development under Alternative A.

Impacts could potentially be 60 percent higher than average in that year and would be at or near the peak level for about 3 years.

Table 4.13-6. WTP Development Phase Employment Impacts, Alternative A

	Carbon	Duchesne	Uintah	Local Study Area
Development (8 years)				
Direct (average annual) Employment	5	439	39	483
Secondary (average annual) Employment	6	554	49	609
Total	**11**	**993**	**87**	**1,091**
Production Only (year 21-28)				
Direct (average annual)	0	16	1	17
Secondary (average annual)	0	8	1	9
Total	**0**	**24**	**2**	**26**

Figure 4.13-1 WTP Project Spending Pattern, Alternative A

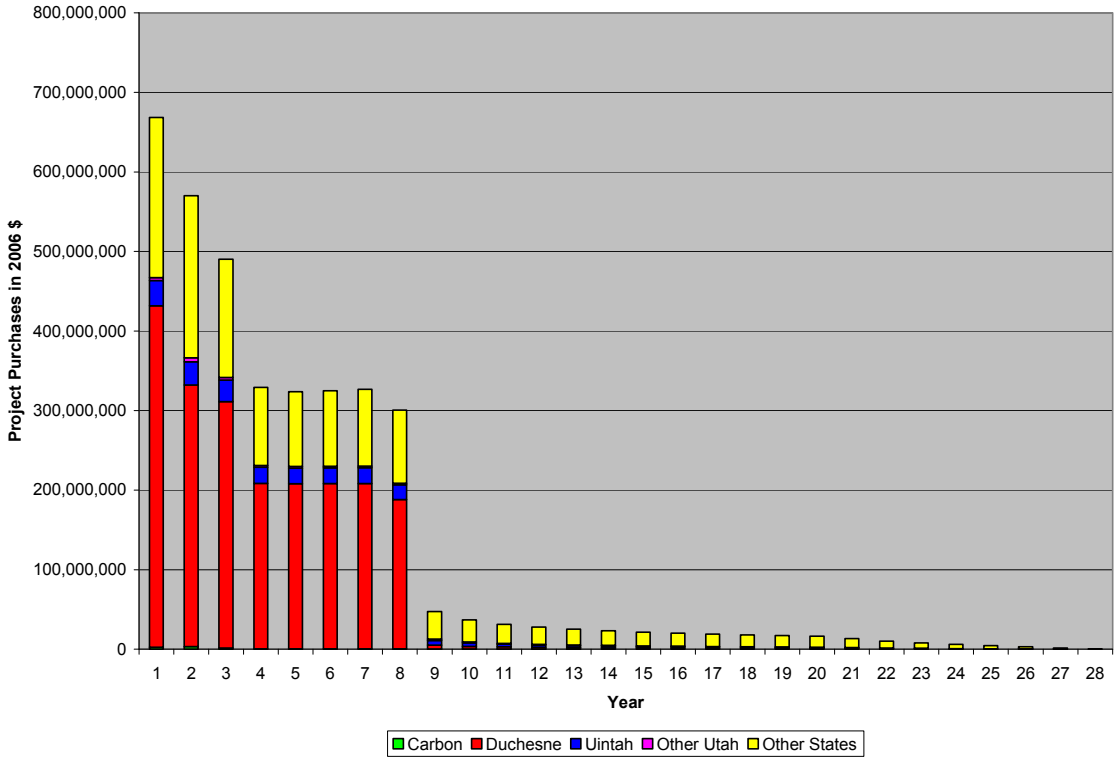

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Table 4.13-7 WTP Annual Average Population and Housing Demand Impact, Alternative A		
	Population	**Housing Demand**
Development		
Carbon County		
Helper	2	1
Price	5	3
Wellington	2	1
Other Carbon County	9	5
Total	**17**	**11**
Duchesne County		
Duchesne	121	75
Roosevelt	426	262
Other Duchesne County	1,038	640
Total	**1,585**	**977**
Uintah County		
Vernal	36	22
Other Uintah County	104	64
Total	**139**	**86**
Production		
Carbon County		
Helper	0	0
Price City	0	0
Wellington	0	0
Other Carbon County	0	0
Total	**0**	**0**
Duchesne County		
Duchesne City	2	1
Roosevelt City	3	2
Other Duchesne County	8	5
Total	**13**	**8**
Uintah County		
Vernal City	0	0
Other Uintah County	1	0
Total	**1**	**1**

Population growth of 7 percent per year or more has created “boomtowns” in the western United States in previous years (Smith et al. 2001). The potential for a high rate of growth under Alternative A creates the possibility of a boom period in Duchesne County and in the cities of Roosevelt and Duchesne during the development phase.

At the same time, other characteristics of Alternative A would potentially offset the possibility of a boom in Duchesne County. First, growth under Alternative A is not projected to be sustained. Growth would likely be high at first (60 percent above average) and would decline to a level at the end of development that is below average. A sustained and very high rate of growth would affect Duchesne County for only part of the development phase (perhaps 3 years) and, after the initial flow of activity, employment, population, and housing demand would ebb.

Second, the declining pattern of economic activity during development indicates that much of the employment created by Alternative A would be short-term. Short-term employment would lead to temporary residency by job-holders instead of permanent immigration. Third, a high proportion of the existing job-holders employed by firms in Duchesne County would temporarily relocate on site within the WTP Project Area.

The temporary workforce housing provided under Alternative A (300 units) would reduce the potential risk of crowding and over-building in Duchesne County and the cities of Roosevelt and Duchesne. Workforce housing would absorb a large share of temporary job-holders on site at any one time, reducing the impact of temporary population and housing demand in Duchesne County (**Table 4.13-7**) during the development phase.

The income impact of Alternative A is measured by total labor income, a major part of personal income that equals the earnings of the self-employed plus businesses' payroll (employee compensation plus employer contributions to benefits and government programs). Total labor income is projected for both the direct and secondary employment impacts of Alternative A.

As shown in **Table 4.13-8**, the total labor income in the WTP Project Area because of Alternative A would average approximately $50 million per year during development (or about $51,000 per job) and approximately $1.1 million per year (or $103,000 per job) during the production-only period. Note that the high estimates of average labor income per job would not be typical of earnings under Alternative A. Higher income for workers in the local gas industry and related establishments raise the average income per job; however, the overall *distribution* of income would likely be concentrated on the lower end of the income spectrum due to work at lower-paid industry jobs and jobs at local trade and service establishments.

Table 4.13-8 WTP Labor Income Impacts (2006 dollars), Alternative A

	Carbon	Duchesne	Uintah	All Local Area
Development (8 years)				
Direct (average annual)	309,765	28,188,634	2,478,122	30,976,521
Secondary (average annual)	189,673	17,260,202	1,517,380	18,967,255
Total	499,438	45,448,836	3,995,502	49,943,776
Cumulative Income During the Development Phase (undiscounted)	3,995,502	363,590,689	31,964,017	399,550,208
Production Only (year 21-28)				
Direct (average annual)	9,165	834,006	73,319	916,490
Secondary (average annual)	2,133	194,086	17,062	213,281
Total	**11,298**	**1,028,092**	**90,382**	**1,129,771**

Many jobs triggered by Alternative A may be held by people who live outside of the county; they may commute in from somewhere relatively close by or "move" to the area temporarily. The outflow of labor earnings due to jobs held by non-residents would be especially high during development and is not adequately reflected in the model. Based on recent data on the percent of jobs in Duchesne County held by "in-commuters" (**Table 3.13-11**), an average of 11 percent of the aggregate labor income impact of Alternative A would "leak" out of the WTP Project Area annually. This average reflects the current economy in the WTP Project Area after 6 or 7 years of growth in the annual rate of well drilling. The labor income leakage estimate is a job market average, including jobs in two general categories with different hiring tendencies. Jobs in the gas industry, including contractors, would draw a very high percentage of new workers from outside the WTP Project Area given prevailing labor market conditions. On the other hand, jobs in the local services and trade sectors would lean toward hiring locally, to the extent that is possible, given the base population and labor market conditions.

Filling the jobs created by Alternative A would add to the number of "out of town workers" employed by the drilling and field development sector. A percentage of those employed under Alternative A would not permanently reside in the tri-county area for a variety of reasons: the industry's requirement for rotational and transient crews; housing availability (scarcity of appropriate type or price); lifestyle preferences (invested elsewhere, "footloose" by choice); or economic expectations (job permanence or job mobility). "Out of town workers" would reduce the amount of household goods and services consumed and housing investment spent locally.

During the production-only phase of Alternative A, the average annual total employment impact is small in Duchesne County (an average of 13 jobs per year) and negligible elsewhere in the local study area (**Table 4.13-7**). Therefore, the field development phase of Alternative A has more meaningful consequences for the economy, communities, and local governments of the study area. Employment would extend beyond the production phase into the field abandonment and reclamation phase for approximately 5-years.

4.13.2.2 Specific Economic Sectors

Grazing

There are three operators in the WTP Project Area currently using the grazing allotments (Green River, Dry Canyon, and Stone Cabin) that would be directly impacted by Alternative A. In **Table 4.7-1**, a reduction of 211 total AUMs of available forage was estimated across the three allotments. Valued at approximately $24 per AUM (see **Table 3.13-13)**, the impact to the potential gross value or "cash receipts" from livestock production would be about $5,064. This approach to valuing the potential reduction of grazing resources is generalized and simplified. Nonetheless, it is a standard approach used to estimate the monetary value of public lands forage.

In **Section 4.7**, the analysis of impacts to herd management addresses the concern that a particular allotment may have other than a proportional or marginal impact on the economics of a livestock operation. The discussion (**Section 4.7.1.1**) covers potential herd management impacts and applicant-committed mitigation measures.

The herd management analysis did not quantify damage or identify specific areas where livestock loss, logistical disruption, or damage to forage would affect the operators disproportionately.

Questions of off-site impact were not analyzed in **Section 4.7**, but the BLM is aware that there could be indirect effects to 20 or 30 livestock operations, among them the BLM permittees, that are located along the Nine Mile Canyon and Gate Canyon roads. The potential impacts to these operators would be related to herd management. No quantification of damage potential is available for this type of impact.

During the scoping process, the BLM sought input about ranching in the WTP Project Area, including grazing, herd management, and transportation related to the WTP. Participating government agencies and the public expressed concern that increased traffic would potentially impact other resources. However, no comment was received related to livestock operation impacts, suggesting that the potentially affected operations expect to adjust to forage and herd management changes under Alternative A.

Recreation and Tourism

The BLM does not currently have an agency-wide program to collect visitor use data that enables the BLM to incorporate statistically valid visitor use monitoring information into planning and management decisions. However, the agency is in the process of developing a program that would provide input for estimating regional socio-economic impacts associated with BLM visitor use and insight into the recreation settings and recreation experiences that BLM visitors want on the public lands.

The EIS (see **Section 3.13.5.2**) does contain general estimates of recreation visitation for the Price Field Office and specific use data for river recreation within Desolation Canyon, which requires a permit. However, without specific visitor use data for Nine Mile Canyon and other locations within the WTP Project Area, recreational and economic impacts can only be discussed qualitatively.

Local recreation and tourism economies can be affected indirectly by oil and gas industry development if lodging is absorbed by workers and visitors are displaced. As noted in **Section 3.13.6.1**, in the Vernal area (Uintah County) and Roosevelt and Duchesne City (Duchesne County) there is an existing stock of approximately 900 motel rooms and 300 commercial RV spaces (some year-round and some seasonal). In addition, there are approximately 600 motel rooms, with some properties also operating campgrounds, in the vicinity of Price, Wellington, and Helper (Carbon County). The cumulative lodging effects due to gas development projected for the BLM's Vernal and Price Field Office areas is considered in Chapter 5. Demand for gas industry lodging is not expected to increase much in the Price area under Alternative A, based on the analysis of WTP project spending, temporary worker housing provisions, and traffic projections.

Direct and indirect impacts to specific tourist sectors are discussed in the proceeding sections.

Cultural and Heritage Tourism

As discussed in **Section 4.11**, empirical observations by frequent users of Nine Mile Canyon (e.g., Nine Mile Canyon Coalition) indicate that recreational use of the area for cultural and heritage tourism has experienced steady decline since a surge in oil and gas development began in the WTP Project in 2004. These observations are supported by anecdotal information provided by the Castle Country Regional Information Center in Price, that during the past 2 years visitor interest and inquiries about visiting the Canyon have declined significantly.

Based on the proposed level of oil gas development, it is expected that declines in visitor to Nine Mile Canyon would continue for the LOP. Reductions in visitors could represent a loss of revenue to cultural tour guides and a loss of revenue for local businesses that serve visitors. There would also be a potential loss in non-market value to visitors discouraged from visiting Nine Mile Canyon, and potentially to all users of the canyon if the cultural recreation experience is diminished.

Table 3.13-15 presented data showing the economic value of direct local spending and non-market economic benefits, which result of recreation use of public lands. As discussed in **Section 3.13.5.2**, a number of studies have been conducted on the importance of historic sites as a tourism and recreational resource. One study (Taylor et al. 1993) concluded that historic site visitors bring more money into an area, generate more economic activity, increase household income, and contribute more to local government revenues than other recreational visitors by about 20 percent. As previously discussed, without an estimate of the total numeric decrease in visitors, calculating potential adverse economic impacts which could occur as a result of implementing of Alternative A would be speculative.

Wilderness Recreation

According to **Section 4.11.1.2**, recreationists attracted to the unaltered backcountry settings in the Jack Canyon WSA and Desolation Canyon WSA would likely be displaced under Alternative A, although portions of both the Jack Canyon and Desolation Canyon WSAs would remain unaltered and would continue to provide primitive and unconfined recreation opportunities. **Table 3.13-14** and **Table 3.13-15** present data showing the potential losses, on a per unit basis, to direct local spending and non-market economic benefits if visitors to Jack Canyon and Desolation Canyon WSAs are displaced. However, without an estimate of the number of displaced visitors, making a quantitative estimate of the potential economic impact due to implementation of Alternative A would be speculative.

River Recreation

Under the Proposed Action there would be no development within the Green River WSR corridor or the Desolation Canyon NHL; however, a limited amount of development could occur within sight and sound of the Green River. As discussed in **Section 3.11.3.4**, recreationists select Desolation Canyon for river trips because it offers a unique wilderness experience. As discussed in **Section 4.11.1.2**, any development that results in changes in the visual quality of the landscape or results in human related auditory disturbance could affect solitude, tranquility, and naturalness, and interfere with an individual's ability to enjoy this wilderness experience. Changes in the visual quality of

the landscape, increased noise, as well as negative a public perception of oil and gas development, could discourage some recreationists from floating the Green River through Desolation Canyon, especially those seeking remoteness and a primitive and unconfined recreational experience. Given the number of applications for river permits each year, and the fact that BLM awards permits on a draw basis, it is not expected that the number of river recreationists would change appreciably.

Any reductions in river recreation could represent a loss of revenue to commercial outfitters and a loss of revenue for local businesses that serve visitors. There would also be a potential loss of economic value to visitors discouraged from visiting Desolation Canyon and potentially to all users of the river if the wilderness experience is diminished.

Section 3.13.5.2 discusses the 2001 study by researchers at Utah State University and provides an estimate of the number of boaters during any one season. In addition, the study estimates total spending per person as well as a more specific spending estimate by residency status and boat type. Given that the number of visitors to Desolation Canyon and the average per person expenditures of boaters are both known, it is possible to calculate the economic value of river recreation. However, estimating the total decrease in boaters which could occur as a result of implementing the Proposed Action would be too speculative.

Hunting

As discussed in **Section 4.11.1.2**, implementation of the Proposed Action would change landscape character of the WTP Project Area and could discourage a segment of the hunting population who prefer a more remote backcountry setting. Although the absolute number of hunters that utilize the WTP Project Area is not expected to change appreciably, any reductions in the number of hunters could represent a loss of revenue to the State of Utah, which is responsible for issuing hunting permits, and a loss of revenue for local businesses that serve hunters. There would also be a potential loss of economic value to individual hunters if the hunting experience is diminished.

OHV Use

The **Section 4.11.1.2** analysis identifies one resource, OHV use, where visitation may increase because of changes to the WTP Project Area. Still, without an estimate of the number of new visitors, making a quantitative estimate of the potential economic impact to the region from this effect would be speculative.

Valuation of Passive (Non-Use) Wilderness Benefits

As discussed in **Section 3.17.2**, past oil and gas activities within the Peter's Point Federal Oil and Gas Unit have previously diminished opportunities for solitude and primitive and unconfined recreation within the Jack and Desolation Canyon WSAs and WIAs. However, the analysis in **Section 4.17** determined that an additional 1,112 acres of the Jack Canyon WSA and an additional 6,370 acres of the Desolation Canyon WSA would be impacted if the Proposed Action were implemented. In terms of non-WSA lands with wilderness characteristics, an additional 28 acres of the Jack Canyon WIA, and an additional 11,471 acres of the Desolation Canyon WIA would also be impacted.

The impairment of lands with wilderness characteristics implies value foregone by the public. A component of the value foregone, as described in **Section 3.13.5.2**, is the "passive use" benefit. This is measured in surveys that elicit what households or individuals would be willing to pay for preservation even if they have never visited and/or do not ever plan to visit the area. No passive use benefit studies of wilderness have been conducted in the WTP Project Area. However, a general monetary estimate of the passive use benefits of wilderness is useful for disclosure purposes in this analysis. Quantification of passive use can be constructed using two broad assumptions. The first is treating Jack Canyon and Desolation Canyon as wilderness, and not just as WSAs or WIAs, which allows the use of values derived from the existing wilderness studies. The second is multiplying by a per acre value from a recent "meta analysis" (Cordell et al. 2005) that incorporated seven out of eight published studies on the passive use benefits of wilderness from 1984 to 1996, including one from Utah (Pope and Jones 1990).

Per **Section 3.13.5.2**, the passive use benefit per acre was $38.50 in 2006 dollars. Using this value, the passive use benefits of wilderness foregone are $730,768 per year for the 18,981 acres in the WTP Project Area. Given adequate time, lands would be expected to regain wilderness characteristics and be available for wilderness consideration on a going-forward basis.

There are other benefits of wilderness besides on site recreation and passive use, which are much less commonly the subject of valuation studies. These benefits include the community jobs and income supported by the local spending of wilderness visitors (discussed above but not evaluated); scientific research, education and management; off-site activities and amenities such as hunting of wilderness-supported game; scenic views and property values; biodiversity conservation; and ecological services like watershed protection and carbon storage (Cordell et al. 2005).

4.13.2.3 Community Facilities and Services

The population and housing demand impacts referenced in this section were previously presented in **Table 3.13-11**.

Carbon County

Housing

Table 3.13-1 showed that Carbon County's population has declined since 2000 and that the county has experienced high net out-migration (**Table 3.13-4**). Given these trends, Carbon County would likely be able to accommodate annual projected housing demand for the development phase of Alternative A, which would average 6 units per year and peak at 18 units in the first year. The housing demand in Carbon County would be highest for housing types that suit shorter residencies since the development activity under Alternative A peaks at the beginning and declines immediately.

Water and Wastewater

Although the Price city water and wastewater system is constrained by peaking capacity (**Section 3.13.6.2**), the growth due to Alternative A would likely not be problematic for these systems, even in the early years of the development phase. Water and

wastewater systems in other parts of Carbon County have capacity and may benefit from the revenue growth that would occur under Alternative A.

Public Safety

Growth in population—which would occur to some extent in Carbon County—could cause a proportionate increase in crime. In addition, index crimes (crimes against persons and property) may increase. A study in Wyoming is currently tracking the rise in index crimes as a potential correlate to a rise in drilling activity in intensive field development (Jacquet 2005).

Law enforcement agencies in Carbon County are staffed for existing conditions, have experience with previous growth and historically higher population levels, and would have access to funding from new revenues generated by gas production under Alternative A. As such, Carbon County law enforcement would likely accommodate or adapt to an increase in the number and type of crimes that could occur under Alternative A.

Carbon County would likely incur costs associated with traffic enforcement on the Nine Mile Canyon Road. Carbon County fire services provide adequate coverage and have effective mutual aid agreements to accommodate growth under Alternative A. New revenue from gas production under Alternative A would potentially fund increases in operating budgets.

Health Care

The acute care capacity at Castleview Hospital in Price would be able to handle growth projected for Carbon County under Alternative A. The facility may benefit from higher utilization rates that generate revenue. Alternative A would not likely have an effect on demand for long-term care beds. The availability of long-term care beds, which the hospital offers, is always a concern in small communities.

Schools

Declining school populations in Carbon County reflect the declining general population (**Table 3.13-21**); although some capacity issues have arisen as population distribution has shifted over time. However, **Section 3.13.6.5** noted recent additions of capacity at three elementary schools, a junior high school, and Carbon High School in Price. In addition, there are plans for a new elementary school in East Carbon. In this context, the projected growth for Price under Alternative A would not likely be a problem for the Carbon County School District, even in the early years of the development phase.

Transportation

Section 4.14.1.1 identifies the Carbon County road in Nine Mile Canyon as a primary road in the WTP Project Area. **Section 4.14.1.1** also describes how the Carbon County Encroachment Ordinance (Carbon County 2005a), which requires operators to share maintenance responsibilities with the county in proportion to their use of the roads, would allow the costs of maintaining roads in Carbon County to be offset by BBC and other operators.

Duchesne County

Housing

In Duchesne County, projected annual housing demand for the development phase of Alternative A would average about 980 units per year and peak at 1,560 units in the first year. This impact would likely be hard to accommodate according to data in **Table 3.13-2**. Duchesne County, as a whole, issued 944 building permits from 2000 to 2005, an average of 175 potential new units per year. Accommodating impacts of Alternative A would be complicated by the likelihood that in-migrants typically seek types of housing that suit shorter period of residency. However, relief for water capacity issues of the past (described in the following section) may spur housing development, positioning Duchesne County to accommodate some additional growth.

Water and Wastewater

Ongoing construction to augment the water supply in Duchesne County would be finished in 2008 and would relieve potable water shortages. As described in **Section 3.13.6.2**, Duchesne City's water infrastructure has the capacity to handle the city's development to build-out. The city is also extending mains in order to serve adjacent subdivisions with wholesale water. The improvements promise to deliver the underlying capacity for housing growth, but may lag what is required to address the projected impacts associated with Alternative A. There is adequate capacity for growth in Roosevelt's wastewater system and outlying subdivisions—which have grown disproportionately—rely on septic systems.

Public Safety

County and municipal law enforcement agencies in Duchesne County would likely be able to accommodate the growth projected under Alternative A, given the community's experience with previous growth. However, law enforcement agencies in Duchesne County are staffed for existing conditions and would potentially be constrained by the adequacy and timeliness of community-based funding (sales tax, residential, and commercial property taxes).

Under these circumstances, accommodating growth in the number of crimes and a potential change in crime severity under Alternative A may pose challenges for management. Challenges to law enforcement management in times of energy growth typically include staff recruitment and housing; and identifying and obtaining financial assistance to fill operating revenue gaps and finance new equipment.

Recent planning efforts indicate that fire protection services in the county may be stretched thin and would face an additional impact from the growth projected under Alternative A, especially in unincorporated areas that have been attracting the majority of new development.

Health Care

Uinta Basin Medical Center in Roosevelt, plus its outlying clinics, would likely be able to accommodate projected growth in Duchesne County under Alternative A.

Schools

Recent construction projects indicate that the Duchesne County School District has anticipated a future growth trend, which may have begun in fall 2004 after several years of declining enrollment. Staffing ratios, another indicator of capacity, remain above average. A high school building replacement was completed in Duchesne City in 2005 and a junior high school replacement project began in Roosevelt in 2005, promising additional space. However, the ability to keep up with enrollment impacts under Alternative A may depend on continued access to State grants and favorable loan terms, which stem in part from State minerals revenue.

Transportation

As noted in **Section 4.14.1.1**, the Duchesne County road in Gate Canyon is a critical county road in the WTP Project Area. Duchesne County, BBC, and other operators have an informal agreement to cooperatively maintain roads in Duchesne County that would be impacted by project-related traffic. In addition, revenue could potentially be allocated to the Duchesne County Transportation Special Service District from the PCIB, which would be used for road maintenance or improvement projects.

Uintah County

Housing

The projected annual housing demand for the development phase of Alternative A would average 74 units per year and would peak at 104 units in the first year. Though relatively small, housing demand under Alternative A may be difficult to accommodate because of very low housing availability (see **Section 3.13.6.1**). Accommodating the impact would be complicated by the likelihood that in-migrants typically seek types of housing that suit shorter periods of residency. Housing demand and the need for more temporary types of units may be accommodated through mobile homes and manufactured housing, which is becoming more common in Uintah County. The recent upward trend in prices for housing also may stimulate supply, though the impact negatively affects affordability.

Water and Wastewater

Water and wastewater capacity would generally be adequate to handle population and housing demand projected for Uintah County under Alternative A. However, growth in excess of project-specific levels would likely pose a problem given current and projected growth needs totaling about $30 million in Vernal and the Ashley Valley.

Public Safety

The law enforcement and fire service agencies of Uintah County are adequately staffed and equipped to handle the level of growth in population and housing projected under Alternative A.

Health Care

The accredited Ashley Valley Medical Center in Vernal would likely be able to accommodate projected growth in Uintah County under Alternative A.

Schools

Despite population growth, fall enrollment has declined in recent years in the Uintah County School District. That trend and the recent completion of a junior high school addition suggest that there would be adequate capacity to accommodate impacts under Alternative A.

Transportation

No roads critical to the WTP Project Area are found in Uintah County.

4.13.2.4 Public Expenditures and Revenues

Simulating complex fiscal changes for the State of Utah and for potentially-affected local governments in the WTP Project Area is beyond the scope of this impact assessment. What the assessment does, however, is to examine the summary data from selected financial statements presented in **Section 3.13.7** and calculates average expenditures per capita for the routine functions of local government. The expenditures are then expanded to approximate the total cost impact in proportion to the population impact for each jurisdiction. This analysis indicates the magnitude of the direct cost of Alternative A to local governments. County road costs attributable to WTP traffic also impact county governments because of their official responsibility for county road maintenance and repair.

Opposite the direct costs are the direct revenues that accrue to State and local governments from Alternative A. These revenues are: the property tax, the severance tax, and Federal mineral lease revenue receipts returned to the State, which then may be partially redistributed to local government. These direct revenue types are projected here by extrapolating from an estimate of the value of gas production under Alternative A.

The Utah Severance Tax on Oil, Gas, and Mining (Utah Code 59-05) is paid to the Utah Tax Commission and promptly remitted to the State treasurer. With the exception of taxes collected on certain Indian lands, severance monies collected are credited to the General Fund, where it is subject to appropriation by the legislative process.

The State of Utah allocates 32.5 percent of mineral lease revenue funds to the Utah PCIF. The PCIF can fund State agencies and/or local sub-divisions of the State for social or economic impacts of mineral development on Federal lands. The board governing the PCIF prefers issuing loans and may make direct grants only when other financing cannot be used, where there is no reasonable repayment method, or for a health or safety emergency.

Forty percent of the State's mineral lease revenue funds are allocated to the Utah Department of Transportation. These are non-project specific funds distributed each quarter using a formula that allocates funds to counties with significant mining activity on

Federal lands. As described in **Table 3.13-31**, Carbon, Duchesne, and Uintah Counties regularly receive these distributions.

The following assessment shows that Duchesne County (including the cities of Duchesne and Roosevelt) would incur perhaps 90 percent or more of the direct costs that would impact local governments under Alternative A because of population change under (see **Table 4.13-9** below). Another portion of direct costs that is not included in that percentage, namely county road maintenance costs entirely due to WTP traffic under Alternative A, would impact Duchesne County and Carbon County. These counties have jurisdiction over roads to be used by the gas industry and its suppliers during development and operations.

The assessment also shows that almost all of the direct property tax benefits of Alternative A accrue to Carbon County and the Carbon County School District (see **Table 4.13-10** below) plus any special services districts that are congruent with the boundaries of Carbon County (special district revenues were not estimated as part of this assessment). Other direct revenues accrue through the severance tax and through the return of Federal mineral lease revenues to the State. A large share of these revenues would likely be distributed to benefit local governments in the WTP Project Area analysis area. However, State impact fund distribution of severance tax and mineral lease revenues is discretionary or involves allocation formulas that may not be directly determined by WTP impact population change and service demand.

As shown in **Table 3.13-29**, the local revenue sources that remain for Duchesne County, and the cities of Duchesne and Roosevelt to offset population-related costs under Alternative A are property taxes; “other taxes” (principally the sales tax); intergovernmental revenue; and “other revenue” (such as government charges for services). These revenue sources respond to community-based growth in residential and commercial development; personal spending; and personal and commercial transactions with local government. Without detailed analysis, it cannot be predicted whether the impact revenue in these categories would offset projected impact costs. What is indicated by the information in **Table 3.13-29** is that the per capita expenditures for FY 2005 in Duchesne County were just offset by per capita revenue, while in the city of Duchesne per capita expenditure exceeded per capita revenue by a large percentage in FY 2005 (although by just 12 percent in FY 2001). In Roosevelt, in FY 2005, per capita expenditure exceeded per capita revenue by 2 percent.

If these relationships hold, Duchesne County may be able to handle additional expenditures under Alternative A without degrading services by utilizing indirect revenues that occur because of Alternative A. Again, this balance excludes the direct costs for county road maintenance caused by industry use in developing the WTP as well as excludes the costs of alleviating overcapacity facilities, should that occur. Given the relationships in **Table 3.13-29**, the city of Roosevelt would likely have to actively manage its costs to stay within budget under Alternative A. The city of Duchesne, a small community, may be especially constrained in its ability to maintain levels of service with available revenues, if growth occurs as projected.

As noted, Duchesne County, BBC and other operators have an informal agreement to cooperatively maintain roads in Duchesne County that would be impacted by project-related traffic.

Public Expenditures

In **Table 4.13-9**, local government cost impact of Alternative A is measured by multiplying the FY 2005 per capita expenditure rate from **Table 3.13-29** by the annual average population impact for the development phase of the WTP (**Table 4.13-9**). These impacts are the additional expenditures caused by the population increase that would occur under Alternative A. **Table 4.13-9** also presents the cumulative amount (undiscounted) of expenditures projected for the development phase under Alternative A.

Table 4.13-9 WTP Local Government Cost Impacts During Development (2006 dollars), Alternative A

Jurisdiction	Annual Average Expenditure Impact	Cumulative Expenditure Impact (8 years of development)
Carbon County	16,809	134,474
Helper	1,591	12,727
Price	3,936	31,492
Wellington	860	6,878
Duchesne County	1,409,030	11,272,239
Duchesne	92,080	736,638
Roosevelt	353,395	2,827,159
Uintah County	107,722	861,776
Vernal	31,168	249,341

In all three counties, a large share of the expenditure impact in **Table 4.13-9** would be due to costs of general government, public safety, and public health. In municipalities, the spending impacts would mostly represent the costs of general government, public safety, streets, and recreation.

School districts are excluded from the table because Utah schools benefit from a budget-supporting foundation program driven directly by enrollment (see **Section 3.13.7**). Utah also supports capital funding in districts with weak tax bases.

Across all jurisdictions, Alternative A would generally stimulate demand for services and impose costs to deliver before generating the offsetting revenues. Even if revenues from the WTP would eventually exceed the costs of service, some local governments and service providers are likely to experience short-term adverse fiscal impacts due to the project. Duchesne County and the cities of Duchesne and Roosevelt would be vulnerable to this kind of fiscal impact because of the magnitude of projected service costs. The local sales tax would be the only direct revenue benefit available to the county and other local governments in Duchesne County.

Public Revenues

The property tax, the severance tax, and mineral lease revenues are three important sources of local and State public revenue that respond directly to Alternative A because they are based on the value of production. The value of production under Alternative A would be an annual average of about $465 million over the 28-year producing life of the

field, and about $13 billion cumulatively (undiscounted). The projection was derived by multiplying annual field production estimates by $6.27, an estimate of the average wellhead price of gas in 2006. The resulting values are expressed in 2006 dollars.

Property Tax

The Utah Property Tax Division values producing gas properties. Thereafter, the centrally assessed taxable value is apportioned to local jurisdictions based on well location. Wells developed under the Proposed Action are almost exclusively in Carbon County. Because only a handful of wells are proposed within Duchesne County, impacts would be negligible.

The State uses dedicated appraisal software to determine taxable valuation based on projected value of production and other statutory factors. For this analysis, instead of simulating the State method, BBC estimated an "effective tax yield" of 1.4 percent of the value of production, reflecting their experience with existing operations in the WTP Project Area. The taxes are paid to Carbon County and the Carbon County School District, which would respectively levy 30 percent and 70 percent of these taxes, based on FY 2004 tax rates. **Table 4.13-10** presents projected property tax payments to Carbon County and the Carbon County School District under Alternative A.

Table 4.13-10 WTP Projected Ad Valorem Property Tax (2006 dollars), Alternative A

	Carbon County Property Tax Revenue	Carbon County School District
Years of Production	28	
Annual Average	1,930,332	4,584,277
Cumulative (undiscounted)	54,049,284	128,359,751

Severance Tax

The Utah severance tax is based on the value of production. The rate for natural gas is 3 percent of value up to and including the first $1.50 per MCF; it is 5 percent of the value received in excess of the first $1.50. The first $50,000 of production per well per year is tax exempt. Given the assumption of a constant $6.27 price (the average well head price of gas in 2006), the effective severance tax rate on BBC production would be 4.5 percent. **Table 4.13-11** is a projection of the severance tax paid by BBC under Alternative A.

Table 4.13-11 WTP Projected Utah Severance Tax on Value of Production (2006 dollars), Alternative A

	Severance Taxes
Years of Production	28
Annual Average	19,637,063
Cumulative (undiscounted)	549,837,754

Mineral Lease Revenues

States receive 50 percent of the revenues associated with minerals located on Federal public lands within their borders. BBC would be expected to pay Federal royalties at the rate of 12.5 percent of production, which comprise approximately 97 percent of the WTP Project Area.

In Utah, more than 70 percent of the State's Federal mineral revenue receipts are appropriated as follows: 32.5 percent to the PCIF, 40 percent to UDOT for distribution to counties and county special service districts, and 5 percent to the Department of Community and Culture for distribution to county special service districts. Mineral lease revenues by State program are shown in **Table 4.13-12**.

Table 4.13-12 WTP Projected Utah Mineral Lease Revenue and Appropriations (2006 dollars), Alternative A

	Mineral Lease Revenue Returned to State of Utah (50% of Federal Royalties)	Appropriation to Utah Permanent Community Impact Fund (32.5% of State Revenue)	Appropriation to Utah Department of Transportation for Special Service Districts (40% of State Revenue)	Appropriation to Utah Department of Community and Culture for Special Service Districts (5% of State Revenue)
Years of Production	28			
Annual Average	28,268,747	9,187,343	11,307,499	1,413,437
Cumulative	791,524,918	257,245,598	316,609,967	39,576,246

% percent

Sales and Use Taxes

Sales and use taxes on purchases of taxable goods in the region would also be collected by jurisdictions in Carbon, Duchesne, and Uintah Counties. All county and municipal jurisdictions in the local study area assess the local option sales tax of 1 percent. The State sales tax is 4.75 percent.

Some purchases made by BBC, plus retail purchases by contractors and the holders of secondary jobs, would generate sales tax revenues. Sales taxes are an important revenue source for Utah local government. There is insufficient information available to estimate the amount of sales and use taxes that would be generated by Alternative A.

4.13.2.5 Community Social Conditions

Counties and Communities

Social well-being in communities is disrupted during boom periods, characterized by extreme growth rates that can double population in a decade or less. Studies in natural-resource driven communities—including in Utah—have found that disruptive social effects may not last once stability is re-established (Smith et al. 2001).

Under Alternative A, growth would surge in the local study area, especially during the first year or two of development. Duchesne County and the city of Roosevelt would see a population influx early in the development phase of up to 2,700 persons over a year or

two, creating one-year population growth rates near the 17 percent range in Duchesne County. The peak would be short-lived and would be followed by a decline as the development phase runs its course over 8 years. Population could then migrate away, assuming no projects fill the gap.

A potential adverse effect to residents of Duchesne County and the city of Roosevelt would be a decline in personal feelings of community satisfaction during the most rapid periods of growth. The disruptive consequences of boom growth "occur...in some places, during some periods of the growth process, and for only some segments of the local population" (Smith et al. 2001). The disruptive consequences, brought on by a relatively large wave of development, are related to perceptions of the friendliness, neighborliness, and trustworthiness of other local residents; security, safety, and risk of victimization by crime; and how satisfying community life is in general (Smith et al. 2001).

As development ends and population falls and then stabilizes during production, community social well-being would likely rebound. A major factor that could alleviate or even mask a decline in social well-being in Duchesne County (Smith et al. 2001) is the recognition (mentioned in **Section 3.13.9.1**) that the community has come to depend more on oil and gas development over the past 20 years.

The potential for disruption of social well-being in Uintah County and the city of Vernal would be small. Population in Uintah County and the city of Vernal would grow by perhaps 170 over the first year or two of Alternative A, an impact of less than 1 percent compared to a projected 2010 population of 27,000. Immigrants to Duchesne County may overflow to areas along Highway 40, perhaps as far as the city of Vernal, but this shift is unlikely to change the potential for social impact.

The potential for an adverse social impact to Carbon County and the city of Price would be negligible because of the very low impact to population under Alternative A. Residents in the cities of Price and Wellington, and other small towns along routes to the WTP Project area may react positively to an economic stimulus that would benefit the local tax base.

A feature that bolsters the local study area against disruption of social well-being is a culturally high level of social integration adaptable to natural resource dependency. This is reinforced by the general understanding that and commitment to "public lands resource extraction ... [as] the mainstay of our employment and tax base" (Carbon County 2005b).

Ute Indian Tribe

The Tribal communities of the local study area are distant from the WTP Project Area; this buffers the community from the direct effects of Alternative A. Development activity in the WTP Project Area could impact traditional life ways associated with important cultural sites, but Tribal consultation would be ongoing to address any potential conflicts (see **Section 6.2.1**).

There are Native American residents along Highway 40 in cities, places, and rural areas of Duchesne and Uintah Counties on and off the Uintah and Ouray Reservation. Development associated with Alternative A would benefit the Tribal and non-Tribal

population alike in these communities and may contribute to general satisfaction with community life.

Tribal communities on the Reservation are homogeneous and familial with high levels of social integration, neighborliness, trust, and general community satisfaction (Duchesne County 2005), all indicators of overall social well-being (Smith et al. 2001). Reservation communities may benefit from the economic opportunities generated by Alternative A, reinforcing personal satisfaction with community life.

Groups with Special Interests

Because of impacts to specific resources, Alternative A would benefit people seeking improved access to motorized recreation (expanded road system) and those with a high priority on economic use of resources (employment and income). Alternative A may adversely affect people who give a high priority to wildlife conservation and those who give a high priority to protecting areas with special designation.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible Effects

Economic benefits from natural gas extraction within the WTP Project would not be available for future generations.

Irretrievable Effects

Implementation of the Proposed Action could adversely affect specific economic sectors (e.g., grazing and recreational tourism).

Social well-being and feelings of community satisfaction could be disrupted in the local study area during the LOP. However, studies in natural resource communities have found that disruptive social effects do not last once stability is re-established (Smith et al. 2001).

4.13.3 Alternative B – No Action

4.13.3.1 Direct Project Effects

Without Federal approval for development in the WTP Project Area, BBC would limit its activity to development on State of Utah and private lands, which amounts to a continuation of existing activity until the non-Federal leases are exhausted. Alternative B limits BBC to 2 years of development activity. The production-only period and field abandonment and final reclamation periods are the same as other alternatives at 20 years and 5 years respectively. The spending pattern that would potentially occur under Alternative B is illustrated in **Figure 4.13-2**.

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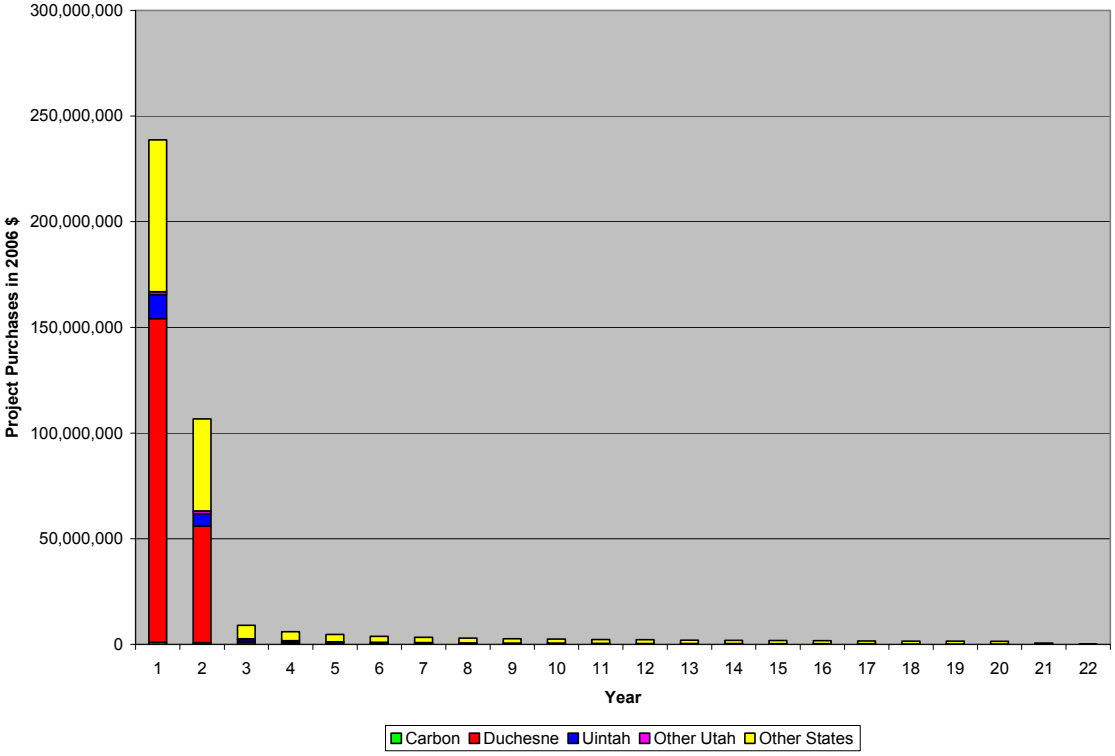
Figure 4.13-2 WTP Project Spending Trend, Alternative B



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4.13.3.2 Employment, Population and Income

Under Alternative B, average total employment for the 2-year development phase is 435 jobs in the local study area, of which 396 are with employers that are located in Duchesne County (**Table 4.13-13**). The impact in Duchesne County would raise employment about 2 percent over the employment level projected for 2010 (**Table 3.13-33**). Peak impacts occur in year 1 of development. The peak would be 50 percent higher than employment in year 2.

The employment impact in Duchesne County under Alternative B translates into a potential population increase of 632 and a housing demand of 390 housing units (**Table 4.13-14**). However, short-term employment and temporary residency by job-holders would override the possibility of permanent immigration. The average direct on site employment under Alternative B is 112 jobs per year. The temporary workforce housing provided under Alternative B (more than 60 units) would absorb this impact, also lowering the temporary population and housing demand in Duchesne County.

The income impact of Alternative B is shown in **Table 4.13-15**. BBC's development activity under Alternative B would generate an average of $19.9 million in labor income per year over 2 years. As noted previously, many jobs triggered by Alternative B may be held by people who live outside of the County, whether they commute in from somewhere relatively close by or "move" to the area temporarily. The outflow of labor earnings from local economies due to jobs held by non-residents would be especially high during development. Alternative B is similar to, but generates somewhat more income than recently occurring drilling activity in the WTP Project Area.

Table 4.13-13 WTP Development Phase Employment Impacts, Alternative B

	Carbon	Duchesne	Uintah	All Local Area
Development (2 years)				
Direct (average annual)	2	176	15	193
Secondary (average annual)	2	220	19	242
Total	**4**	**396**	**35**	**435**
Production Only (year 3-22)				
Direct (average annual)	0	19	2	21
Secondary (average annual)	0	9	1	10
Total	**0**	**28**	**3**	**31**

Table 4.13-14 WTP Annual Average Population and Housing Demand Impact, Alternative B

	Population	Housing Demand
Development		
Carbon County		
Helper	1	1
Price	2	1
Wellington	1	0
Other Carbon County	3	2
Total	**7**	**4**
Duchesne County		
Duchesne	48	30
Roosevelt	170	105

Table 4.13-14 WTP Annual Average Population and Housing Demand Impact, Alternative B		
	Population	**Housing Demand**
Other Duchesne County	414	255
Total	**632**	**390**
Uintah County		
Vernal	14	9
Other Uintah County	41	25
Total	**55**	**34**
Production		
Carbon County		
Helper	0	0
Price	0	0
Wellington	0	0
Other Carbon County	0	0
Total	**0**	**0**
Duchesne County		
Duchesne	3	2
Roosevelt	12	7
Other Duchesne County	29	18
Total	**44**	**27**
Uintah County		
Vernal	1	1
Other Uintah County	3	2
Total	**4**	**2**

Table 4.13-15 WTP Labor Income Impacts (2006 dollars), Alternative B				
	Carbon	**Duchesne**	**Uintah**	**All Local Area**
Development (2 years)				
Direct (average annual)	123,671	11,254,102	989,372	12,367,145
Secondary (average annual)	75,693	6,888029	605,541	7,569,263
Total	**199,364**	**18,142,141**	**1,594,913**	**19,936,408**
Cumulative Income During the Development Phase (undiscounted)	398,728	36,284,263	3,198,825	39,872,816
Production Only (year 3-22)				
Direct (average annual)	1,602	145,749	12,813	160,164
Secondary (average annual)	373	33,918	2,982	37,272
Total	**1,974**	**179,667**	**15,795**	**197,436**

4.13.3.3 Specific Economic Sectors

Grazing

Table 4.7-2 reported an estimated reduction of 21 total AUMs of available forage across three grazing allotments in the WTP Project Area under Alternative B. The impact to the potential “cash receipts” from livestock production would be about $504 at $24 per AUM.

Recreation and Tourism

Visitation to special management areas, dispersed recreation, cultural sites, and roads open to OHV use are not expected to change substantially as a result of Alternative B (see **Section 4.11.1.2**). Therefore, there is no impact to parts of the economy that benefit from recreation and cultural tourism.

Valuation of Passive (Non-Use) Wilderness Benefits

Development would not occur within the Jack Canyon or Desolation Canyon WSAs under Alternative B (**Section 4.11.2**) so economic loss due to impairment of wilderness values would be avoided.

4.13.3.4 Community Facilities and Services

Under Alternative B, impacts to community facilities and services would be negligible in Carbon County and Uintah County. In Duchesne County, adequate capacity would be available to accommodate impacts to community facilities and services under Alternative B.

4.13.3.5 Public Revenues and Expenditures

Public Expenditures

Table 4.13-16 presents the impact to public expenditures of local, general-purpose government under Alternative B. The amounts are the average annual expenditure and the cumulative amount of expenditures (undiscounted) for the development phase of Alternative B. The impact is low and occurs for just 2 years.

Table 4.13-16 WTP Local Government Cost Impacts During Development (2006 dollars), Alternative B

Jurisdiction	Annual Average Expenditure Impact	Cumulative Expenditure Impact (2 years of development)
Carbon County	6,703	13,405
Helper	634	1,269
Price	1,570	3,139
Wellington	343	686
Duchesne County	561,855	1,123,711
Duchesne	36,717	73,434
Roosevelt	140,917	281,835
Uintah County	42,955	85,909
Vernal	12,428	24,856

Public Revenues

Table 4.13-17 reports the value of production under Alternative B at an annual average of about $59.4 million over the 22-year producing life of the field. Cumulatively, the value of production would be about $1.3 billion. Estimates of the property tax benefit to Carbon County and the Carbon County School District under Alternative B are provided in **Table 4.13-18**. The severance tax benefit to the State would be about $2.5 million annually and cumulatively about $56 million. The mineral lease revenues to the State and the subsequent appropriations for the benefit of local government are provided in **Table 4.13-19**. No estimate was made of sales and use taxes that would be generated by Alternative B.

Table 4.13-17 WTP Value of Production (2006 dollars), Alternative B

	Value of Production – Producing Life of Field
Years of Production	22
Annual Average	59,444,091
Cumulative (undiscounted)	1,307,770,000

Table 4.13-18 WTP Projected Ad Valorem Property Tax (2006 dollars), Alternative B

	Carbon County Property Tax Revenue	Carbon County School District
Years of Production	22	
Annual Average	246,592	585,622
Cumulative (undiscounted)	5,425,021	12,883,692

Table 4.13-19 WTP Projected Utah Mineral Lease Revenue and Appropriations (2006 dollars), Alternative B

	Mineral Lease Revenue Returned to State of Utah (50% of Federal Royalties)	Appropriation to Utah Permanent Community Impact Fund (32.5% of State Revenue)	Appropriation to Utah Department of Transportation for Special Service Districts (40% of State Revenue)	Appropriation to Utah Department of Community and Culture for Special Service Districts (5% of State Revenue)
Years of Production	22			
Annual Average	3,611,215	2,347,290	2,888,972	361,122
Cumulative (undiscounted)	79,446,739	51,640,380	63,557,391	7,944,674

% percent

4.13.3.6 Community Social Conditions

Employment and population in most study area communities would experience little change from Alternative B, as indicated in **Table 4.13-13** and **Table 4.13-14**. In Duchesne County, the effect of Alternative B, a 3 percent increase in population in the first year of development followed by a reverse of the trend in the following year, would be hard to distinguish from other economic and demographic activity in the community, where similar amounts of net migration have occurred in both directions from 2000 to 2005 (**Table 3.13-4**). Overall, Alternative B would not affect community social conditions in the local study area. Personal satisfaction would be greater among individuals and

groups with a special interest in wilderness because fewer acres of the Jack Canyon and Desolation Canyon WSAs would be impaired under Alternative B, as compared to Alternative A.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.13.4 Alternative C – Transportation Impact Reduction

4.13.4.1 Direct Project Effects

The generally lower annual spending extended over 15 years of development gives Alternative C the activity trend illustrated in **Figure 4.13-3**. In addition, limitation of winter operations would create seasonality of employment and population that is not shown in the annualized data. Despite a longer duration for the WTP, the seasonal drilling cycle of Alternative C would potentially foster annual migration of members of the workforce. This could offset any incentive that a 15-year project might otherwise create for workers to reside locally.

4.13.4.2 Population, Employment and Income

Under Alternative C, average total employment for the development phase would be 585 jobs in the local study area, of which 532 are with employers that are located in Duchesne County (**Table 4.13-20**). The impact in Duchesne County would raise employment about 5 percent over the current employment level projected for 2010 (**Table 3.13-33**). Impact employment in Duchesne County under Alternative C translates into a potential population increase of 850 and a housing demand impact of 524 housing units (**Table 4.13-21**).

Peak impacts occur in year 2 of development under Alternative C. Impacts in year 2 would potentially be 10 percent to 20 percent higher than average without development in the WTP Project Area. Impacts would be at or near the peak level for about 6 years.

Alternative C would potentially generate a quick surge of employment and population. The economic activity caused by Alternative C would be stable for about 6 years at a level about 5 percent above projections of employment and population for 2010 without WTP development. Total employment on site under Alternative C would average 270 jobs, 213 of those involving drilling. The seasonal limitation on drilling would foster annual migration among drilling job-holders. Use of temporary workforce housing on site would mitigate the effect annual migration might otherwise have on local communities.

Labor income impacts, shown in **Table 4.13-22**, would average $27 million per year over the 15 years of development. Labor income impact would average $730,000 per year during production only. The prevalence of temporarily resident workers who are “in-commuters” would lower the local personal income impact from Alternative C. The outflow of labor earnings from local economies due to jobs held by non-residents would be especially high during development. Cumulative labor income (undiscounted) for the 15-year development phase would be $402 million under Alternative C.

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Figure 4.13-3 WTP Project Spending Trend, Alternative C

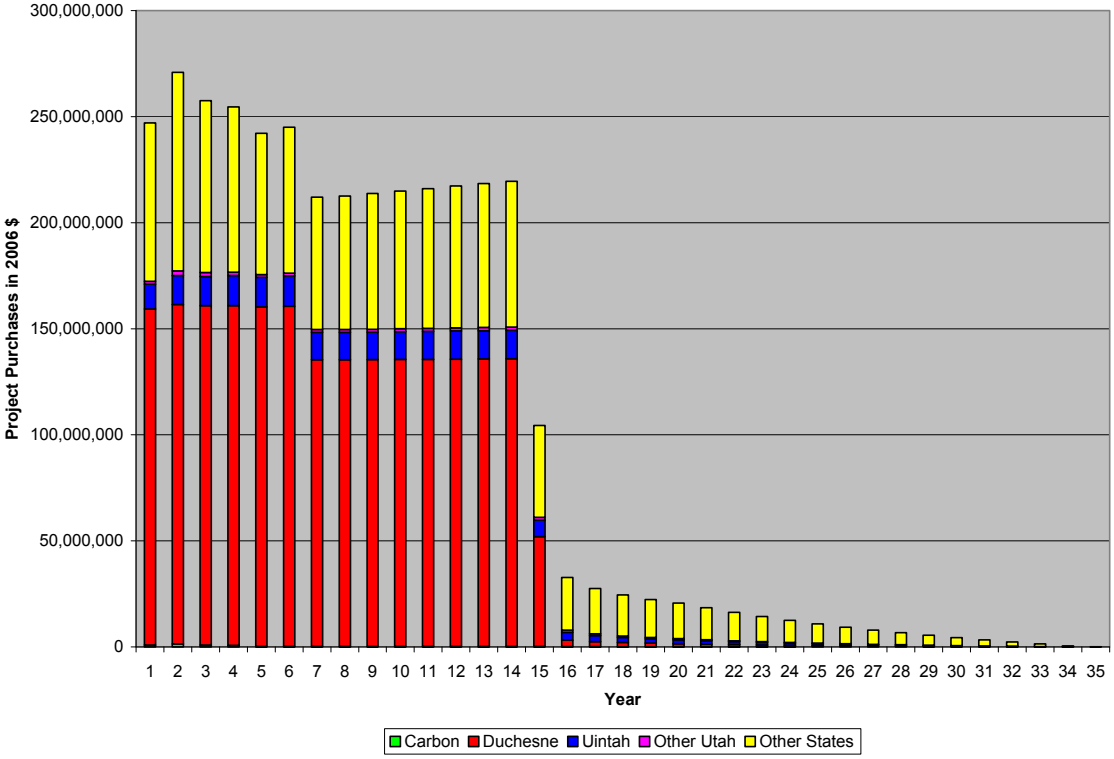

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Table 4.13-20 WTP Development Phase Employment Impacts, Alternative C				
	Carbon	**Duchesne**	**Uintah**	**All Local Area**
Development (15 years)				
Direct (average annual)	3	235	21	259
Secondary (average annual)	3	297	26	326
Total	**6**	**532**	**47**	**585**
Production Only (year 16-35)				
Direct (average annual)	0	11	1	12
Secondary (average annual)	0	5	0	5
Total	**0**	**15**	**1**	**17**

Table 4.13-21 WTP Annual Average Population and Housing Demand Impact, Alternative C		
	Population	**Housing Demand**
Development		
Carbon County		
Helper	1	1
Price	3	2
Wellington	1	1
Other Carbon County	5	3
Total	**9**	**6**
Duchesne County		
Duchesne	65	40
Roosevelt	228	141
Other Duchesne County	557	343
Total	**850**	**524**
Uintah County		
Vernal	19	12
Other Uintah County	56	34
Total	**75**	**46**
Production		
Carbon County		
Helper	0	0
Price	0	0
Wellington	0	0
Other Carbon County	0	0
Total	**0**	**0**
Duchesne County		
Duchesne	2	1
Roosevelt	7	4

Table 4.13-21 WTP Annual Average Population and Housing Demand Impact, Alternative C		
	Population	**Housing Demand**
Other Duchesne County	16	10
Total	**25**	**15**
Uintah County		
Vernal	1	0
Other Uintah County	2	1
Total	**2**	**1**

Table 4.13-22 WTP Labor Income Impacts (2006 dollars) – Alternative C				
	Carbon	**Duchesne**	**Uintah**	**All Local Area**
Development (15 years)				
Direct (average annual)	166,139	15,118,668	1,329,114	16,613,921
Secondary (average annual)	101,744	9,258,732	813,954	10,174,431
Total	267,884	24,377,400	2,143,068	**26,788,352**
Cumulative Income During the Development Phase (undiscounted)	4,018,253	365,661,005	32,146,022	401,825,280
Production Only (years 16-35)				
Direct (average annual)	5,941	540,615	47,527	594,082
Secondary (average annual)	1,383	125,809	11,060	138,252
Total	7,323	666,424	58,587	**732,334**

4.13.4.3 Specific Economic Sectors

Grazing

The loss of potential gross cash receipts from the reduction of AUMs of forage would generally be the same under Alternative C as under Alternative A.

Recreation and Tourism

Economic impacts to recreation and tourism would be similar to those described under the Proposed Action with the following exceptions:

Alternative C contains a number of transportation reduction measures which could reduce the volume of traffic in Nine Mile Canyon (including the use of an alternate access route). Decreases in industrial traffic may encourage continued use of the canyon for cultural and heritage tourism.

Alternative C contains a number of mitigation measures intended to minimize the impacts of development that could occur within sight and sound of the Green River (see **Table 2.6-8**). Implementation of these measures could preserve the wilderness experience.

Under Alternative C, the BLM would adopt a phased development approach, which would lower the average total employment number during the development phase. If average employment numbers are reduced, it is less likely that available lodging would be absorbed by that by oil and gas industry development workers.

Valuation of Passive (Non-Use) Wilderness Benefits

Potential loss of non-use economic value under Alternative C due to impairment of wilderness character would be similar to Alternative A.

4.13.4.4 Community Facilities and Services

In Carbon County and Uintah County, community facilities and services would be less affected under Alternative C than under Alternative A. Lower population and housing demand impacts would enable Duchesne County to better accommodate growth from Alternative C than from Alternative A. However, housing demand would still be of concern in Duchesne County under Alternative C.

4.13.4.5 Public Revenues and Expenditures

Public Expenditures

In **Table 4.13-23**, impacts to a local, general-purpose government are presented for Alternative C. The impact is slightly lower than Alternative A because development has been spread over 15 years instead of 8. Under Alternative C, local governments may avoid some costs included in these projections or incur others because the seasonality of employment during the development phase may discourage full-time local residency.

Table 4.13-23 WTP Local Government Cost Impacts During Development (2006 dollars), Alternative C

Jurisdiction	Annual Average Expenditure Impact	Cumulative Expenditure Impact (15 years of development)
Carbon County	9,016	135,234
Helper	853	12,799
Price	2,111	31,670
Wellington	461	6,917
Duchesne County	755,728	11,335,916
Duchesne City	49,387	740,799
Roosevelt	189,542	2,843,130
Uintah County	57,776	866,645
Vernal	16,717	250,750

Public Revenues

The cumulative value of production under Alternative C is the same as under Alternative A, but the average annual value of production is lower because it is spread out over the 35-year producing life of the field (**Table 4.13-24**).

Table 4.13-24 WTP Value of Production (2006 dollars), Alternative C	
	Value of Production over Life of the Project
Years in Life of Project	35
Annual Average	372,263,714
Cumulative (undiscounted)	13,029,216,750

Table 4.13-25, **Table 4.13-26** and **Table 4.13-27**, respectively present estimates of the property tax benefit to Carbon County and the Carbon County School District under Alternative C, the severance tax benefit to the State, and the mineral lease revenues to the State and the subsequent appropriations to the local government. No estimate was made of sales and use taxes that would be generated by Alternative C.

Table 4.13-25 WTP Projected Ad Valorem Property Tax (2006 dollars), Alternative C		
	Carbon County Property Tax Revenue	**Carbon County School District**
Years of Production	35	
Annual Average	1,544,265	3,667,421
Cumulative (undiscounted)	54,049,284	128,359,751

Table 4.13-26 WTP Projected Utah Severance Tax on Value of Production (2006 dollars), Alternative C	
	Severance Taxes
Years of Production	35
Annual Average	15,713,057
Cumulative (undiscounted)	549,957,004

Table 4.13-27 WTP Projected Utah Mineral Lease Revenue and Appropriations (2006 dollars), Alternative C				
	Mineral Lease Revenue Returned to State of Utah (50% of Federal Royalties)	**Appropriation to Utah Permanent Community Impact Fund (32.5% of State Revenue)**	**Appropriation to Utah Department of Transportation for Special Service Districts (40% of State Revenue)**	**Appropriation to Utah Department of Community and Culture for Special Service Districts (5% of State Revenue)**
Years of Production	35			
Annual Average	22,614,998	14,699,748	18,091,998	2,261,500
Cumulative (undiscounted)	791,524,918	514,491,196	633,219,934	79,152,492

% percent

4.13.4.6 Community Social Conditions

Impacts to community social well-being under Alternative C would resemble Alternative A. However, the potential for disruption under Alternative C would be lower in proportion because of the slower pace of development.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.13.5 Alternative D – Conservation Alternative

4.13.5.1 Direct Project Effects

Compared to Alternative C, Alternative D would further lower annual spending by developing only 558 total wells in the WTP Project and extending the development period to 21 years. **Figure 4.13-4** illustrates the trend in spending under Alternative D.

Exclusion of winter drilling would amplify annual seasonal variation in project spending and employment. The impact on the propensity of the workforce to maintain temporary living arrangements would be greater than Alternative C, though a 21-year assignment would be an incentive for a core of the workforce to reside locally.

There would be NSO within WSAs under Alternative D. The operator, BBC, would not be able to drill approximately 60 wells under Alternative D. These are wells that cannot be drilled directionally and that would have been accessible from sites in WSAs under the Proposed Action (Alternative A).

By not developing approximately 60 wells in WSAs, the operator would potentially forego 154,500 MMscf of natural gas production with a gross sales value of roughly $969 million in undiscounted 2006 dollars. The estimate assumes that the wells foregone in the WSAs would have produced average amounts of gas per well.

4.13.5.2 Population, Employment and Income

Under Alternative D, average total employment for the development phase would be 281 jobs in the local study area, of which 256 are with employers located in Duchesne County (**Table 4.13-28**). The impact in Duchesne County would raise employment about 2 percent over the current employment level projected for 2010 (**Table 3.13-33**).

Table 4.13-28 WTP Development Phase Employment Impacts, Alternative D

	Carbon	Duchesne	Uintah	All Local Area
Development (21 years)				
Direct (average annual)	1	113	10	124
Secondary (average annual)	2	143	12	157
Total	**3**	**256**	**22**	**281**
Production Only (years 22-41)				
Direct (average annual)	0	5	0	5
Secondary (average annual)	0	2	0	2
Total	**0**	**7**	**0**	7

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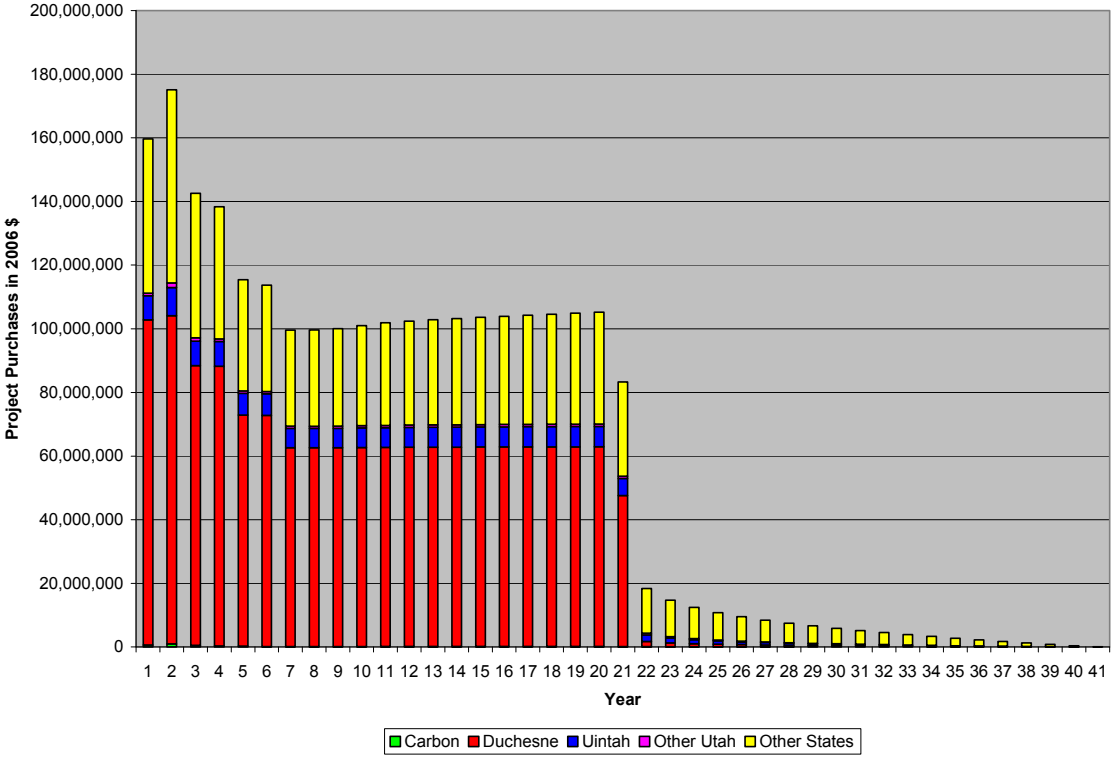
Figure 4.13-4 WTP Project Spending Trend, Alternative D – Conservation Alternative



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Employment impacts in Duchesne County under Alternative D translate into a potential population increase of 408 and a housing demand increase of 252 housing units (**Table 4.13-29**). Peak impacts occur in year 2 of development under Alternative D. Peak impacts would potentially be 50 percent higher than without development under Alternative D. Impacts would be or near the peak level for about 4 years.

Table 4.13-29 WTP Annual Average Population and Housing Demand Impact, Alternative D

	Population	Housing Demand
Development		
Carbon County		
Helper	1	1
Price	1	1
Wellington	0	0
Other Carbon County	2	1
Total	**4**	**3**
Duchesne County		
Duchesne	31	19
Roosevelt	110	68
Other Duchesne County	267	165
Total	**408**	**252**
Uintah County		
Vernal	9	6
Other Uintah County	27	16
Total	**36**	**22**
Production		
Carbon County		
Helper	0	0
Price	0	0
Wellington	0	0
Other Carbon County	0	0
Total	**0**	**0**
Duchesne County		
Duchesne	1	1
Roosevelt	3	2
Other Duchesne County	7	4
Total	**11**	**7**
Uintah County		
Vernal	0	0
Other Uintah County	1	1
Total	**1**	**1**

Like other alternatives, Alternative D would potentially generate a quick surge of employment and population, though the initial impact would be lower than other alternatives. After the initial peak, economic activity would decline and then stabilize for 13 to 15 years at a level somewhat below the average for the development phase.

The full seasonal limitation on drilling would foster annual migration among drilling job-holders. Use of temporary workforce housing on site would mitigate the effect annual migration might otherwise have on local communities.

For Alternative D income impacts (**Table 4.13-30**), the annual average for the development and production only phases are $12.9 million and $317,570, respectively. Cumulative labor income (undiscounted) for the development phase is $270.3 million over 21 years.

Table 4.13-30 WTP Labor Income Impacts (2006 dollars), Alternative D

	Carbon	Duchesne	Uintah	All Local Area
Development (21 years)				
Direct (average annual)	79,822	7,263,808	638,577	7,982,207
Secondary (average annual)	48,884	4,448,463	391,074	4,888,421
Total	**128,706**	**11,712,271**	**1,029,650**	**12,870,628**
Cumulative Income During the Development Phase (undiscounted)	2,702,832	245,957,701	21,622,655	270,283,188
Production Only (years 22-41)				
Direct (average annual)	2,576	234,433	20,610	257,619
Secondary (average annual)	600	54,555	4,796	59,951
Total	**3,176**	**288,989**	**25,406**	**317,570**

4.13.5.3 Specific Economic Sectors

Grazing

Under Alternative D, there would be an estimated reduction of 159 total AUMs of available forage across three grazing allotments in the WTP Project Area. The impact to the potential "cash receipts" from livestock production would be about $3,816 per year, at $24 per AUM.

Recreation and Tourism

Section 4.11.4.2 reports that impacts to uses that bring visitors to the WTP Project Area (e.g., dispersed recreation, cultural sites, roads open to OHV use, and hunting) decrease in proportion to the reduction in development activity. Impacts to parts of the economy that benefit from dispersed recreation and cultural visitation would potentially experience a lower impact than under the Proposed Action. Under Alternative D, there would be no impacts to river recreation, as there would be no development within sight or sound of the river. Therefore, businesses that benefit from river recreation would not be impacted.

Valuation of Passive (Non-Use) Wilderness Benefits

There would be no development within the Jack Canyon or Desolation Canyon WSAs or on unleased lands with wilderness characteristics under Alternative D (see **Section 4.11.4**). However, development is proposed on leased areas in the Desolation Canyon WIA. Therefore, if Alternative D were implemented, approximately 8,260 acres of land with wilderness characteristics would be effectively be lost.

Per **Section 3.13.5.2**, the passive use benefit per acre of wilderness estimated to be $38.50 in 2006 dollars. Using this value, the passive use benefits of wilderness foregone are $318,010 per year for the 8,260 acres in the WTP Project Area. Given adequate time, lands would be expected to regain wilderness characteristics and be available for wilderness consideration on a going-forward basis.

As discussed under the Proposed Action, there are other benefits of wilderness besides on site recreation and passive use, which are much less commonly the subject of valuation studies. These benefits include the community jobs and income supported by the local spending of wilderness visitors (discussed above but not evaluated); scientific research, education and management; off-site activities and amenities such as hunting of wilderness-supported game; scenic views and property values; biodiversity conservation; and ecological services like watershed protection and carbon storage (Cordell et al. 2005).

4.13.5.4 Community Facilities and Services

Impacts to community facilities and services under Alternative D would be low and not likely of concern in Carbon and Uintah Counties. Duchesne County would still potentially experience some difficulty accommodating housing demand impacts under Alternative D. Impacts to other facilities and services would be low enough under Alternative D for Duchesne County to accommodate.

4.13.5.5 Public Expenditures and Revenues

Public Expenditures

Table 4.13-31 presents impacts to general-purpose government for Alternative D. The impacts to local government costs are similar to Alternative C but proportionately lower because annual activity is spread over 21 years instead of 15. Like Alternative C, Alternative D may change public costs, avoiding some but incurring others, because of seasonality and temporary residency status during the development phase.

Table 4.13-31 WTP Local Government Cost Impacts During Development (2006 dollars), Alternative D

Jurisdiction	Annual Average Expenditure Impact	Cumulative Expenditure Impact (20 years of development)
Carbon County	4,330	86,596
Helper	410	8,196
Price	1,014	20,279
Wellington	221	4,429
Duchesne County	362,946	7,258,913
Duchesne	23,718	474,368

Table 4.13-31 WTP Local Government Cost Impacts During Development (2006 dollars), Alternative D		
Jurisdiction	**Annual Average Expenditure Impact**	**Cumulative Expenditure Impact (20 years of development)**
Roosevelt	91,029	1,820,588
Uintah County	27,748	554,953
Vernal	8,028	160,567

Public Revenues

The average annual and cumulative values of production under Alternative D are lower than under all other alternatives except Alternative B. This reflects less extensive development of the field; foregoing the development of specific reserves in WSAs because of NSO constraints; lengthening the producing life of the field to 41 years; and lowering the rate of production from the field because of the less intensive annual drilling pace (**Table 4.13-32**).

Table 4.13-32 WTP Value of Production (2006 dollars), Alternative D	
	Value of Production over Life of the Project
Years of Production	41
Annual Average	219,733,415
Cumulative (undiscounted)	9,009,070,000

Table 4.13-33, **Table 4.13-34**, and **Table 4.13-35** respectively present estimates of the property tax benefit to Carbon County and the Carbon County School District under Alternative D, the severance tax benefit to the State, and the mineral lease revenues to the State and the subsequent appropriations to local governments. No estimate was made of sales and use taxes that would be generated by Alternative D.

Table 4.13-33 WTP Projected Ad Valorem Property Tax (2006 dollars), Alternative D		
	Carbon County Property Tax Revenue	**Carbon County School District**
Years of Production	41	
Annual Average	911,521	2,164,740
Cumulative (undiscounted)	37,372,367	88,754,326

Table 4.13-34 WTP Projected Utah Severance Tax on Value of Production (2006 dollars), Alternative D	
	Severance Taxes (in 2006 dollars)
Years of Production	41
Annual Average	9,275,542
Cumulative (undiscounted)	380,297,228

Table 4.13-35 WTP Projected Utah Mineral Lease Revenue and Appropriations (2006 dollars), Alternative D				
	Mineral Lease Revenue Returned to State of Utah (50% of Federal Royalties)	Appropriation to Utah Permanent Community Impact Fund (32.5% of State Revenue)	Appropriation to Utah Department of Transportation for Special Service Districts (40% of State Revenue)	Appropriation to Utah Department of Community and Culture for Special Service Districts (5% of State Revenue)
Years of Production	41			
Annual Average	13,348,775	8,676,703	10,679,020	1,334,877
Cumulative (undiscounted)	547,299,757	355,744,842	437,839,806	54,729,976

% percent

4.13.5.6 Community Social Conditions

Impacts to community social well-being under Alternative D would resemble Alternative C but would be potentially less disruptive due to the lower population impact and the slower pace of development under Alternative D. Personal satisfaction would be greater under Alternative D for those with a special interest in wilderness as no disturbance would occur in Jack Canyon and Desolation Canyon WSAs and other areas with wilderness values.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.13.6 Alternative E – Agency Preferred Alternative

4.13.6.1 Direct Project Effects

Alternative E closely resembles Alternative A except that development—and with the producing life of the field—would be extended by 1 year in order to place some constraint on development intensity. **Figure 4.13-5** illustrates the trend in spending under Alternative E.

4.13.6.2 Population, Employment and Income

Under Alternative E, average total employment for the development phase is 972 jobs in the local study area, of which 885 are with employers located in Duchesne County (**Table 4.13-36**). The impact in Duchesne County would raise employment about 8 percent over the employment level projected for 2010 (**Table 3.13-33**).

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Figure 4.13-5 WTP Project Spending Trend, Alternative E – Agency Preferred Alternative.

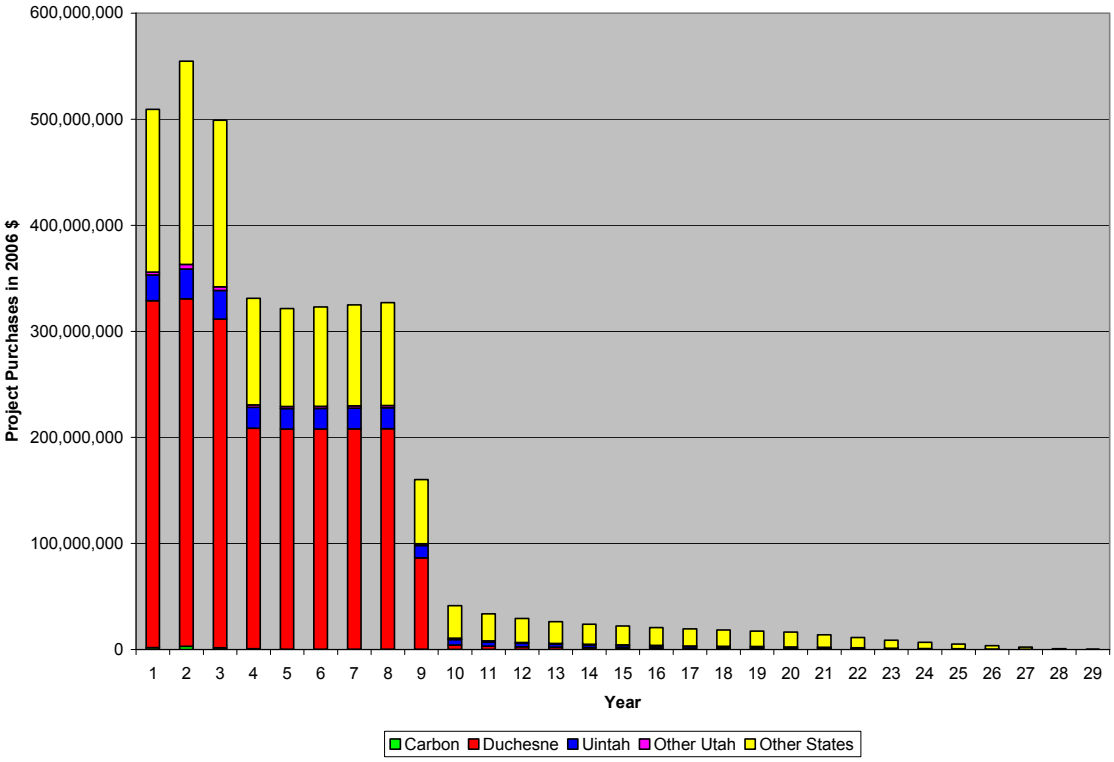

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Table 4.13-36 WTP Development Phase Employment Impacts, Alternative E				
	Carbon	**Duchesne**	**Uintah**	**All Local Area**
Development (9 years)				
Direct (average annual)	4	391	34	430
Secondary (average annual)	5	493	43	542
Total	**10**	**885**	**78**	**972**
Peak Year: Year 2				
Peak as a Multiple of Average Annual Employment during the Development Phase	3.0	1.4	1.3	1.4
Production Only (years 10-29)				
Direct (average annual)	0	9	1	10
Secondary (average annual)	0	4	0	5
Total	**0**	**14**	**1**	**15**

Impact employment in Duchesne County under Alternative E translates into a potential population increase of 1,400 and an increase in housing demand of 870 housing units (**Table 4.13-37**). Peak impacts occur in year 2 of development under Alternative E. Impacts would potentially be 40 percent higher than average in that year and would be at or near the peak level for about 3 years.

Table 4.13-37 WTP Annual Average Population and Housing Demand Impact, Alternative E		
	Population	**Housing Demand**
Development		
Carbon County		
Helper	2	1
Price	4	3
Wellington	1	1
Other Carbon County	8	5
Total	**16**	**10**
Duchesne County		
Duchesne	108	67
Roosevelt	379	234
Other Duchesne County	925	570
Total	**1,412**	**871**
Uintah County		
Vernal	32	20
Other Uintah County	92	57
Total	**124**	**77**
Production		
Carbon County		
Helper	0	0
Price	0	0

Table 4.13-37 WTP Annual Average Population and Housing Demand Impact, Alternative E		
	Population	**Housing Demand**
Wellington	0	0
Other Carbon County	0	0
Total	**0**	**0**
Duchesne County		
Duchesne	2	1
Roosevelt	6	4
Other Duchesne County	14	9
Total	**22**	**14**
Uintah County		
Vernal	0	0
Other Uintah County	1	1
Total	**2**	**1**

Concerns about the disruptive potential of a high rate of population growth in Duchesne County would be the same under Alternative E as under Alternative A described in **Section 4.13.1.2**. Other characteristics of Alternative E would potentially offset the possibility of disruptive social impacts. The offsetting characteristics are 1) the brevity of the growth wave; 2) the immediate decline of population and housing demand to lower levels for the remainder of the development phase; 3) the propensity for the drilling and completion workforce to be temporary instead of permanent residents; and 4) the provision of temporary workforce housing on site.

As shown in **Table 4.13-38**, the income impacts of Alternative E would average $44.5 million in labor income per year during development and would average $665,000 per year during production only. As described in **Section 4.13.6.2**, income would likely be lower than estimated because many jobs would be held by temporary residents who would report the income elsewhere. Cumulative labor income (undiscounted) for the development phase would be $400.5 million over 9 years of development.

Table 4.13-38 WTP Labor Income Impacts (2006 dollars), Alternative E				
	Carbon	**Duchesne**	**Uintah**	**All Local Area**
Development (9 years)				
Direct (average annual)	275,991	25,115,140	2,207,924	27,599,055
Secondary (average annual)	168,996	15,378,635	1,351,968	16,899,599
Total	**444,987**	**40,493,775**	**3,559,892**	**44,498,654**
Cumulative Income During the Development Phase (undiscounted)	4,004,879	364,443,976	32,039,031	400,487,886
Production Only (year 10-29)				
Direct (average annual)	5,320	484,135	42,561	532,017
Secondary (average annual)	1,238	112,665	9,905	123,808
Total	**6,558**	**596,801**	**52,466**	**655,825**

4.13.6.3 Specific Economic Sectors

Grazing

Under Alternative E, there would be an estimated reduction of 197 total AUMs of available forage across three grazing allotments in the WTP Project Area. The impact to the potential "cash receipts" from livestock production would be about $4,728 per year, at $24 per AUM.

Recreation and Tourism

Economic impacts to recreation and tourism would be similar to those described under the Proposed Action with the following exceptions:

Alternative E contains a number of transportation reduction measures which could reduce the volume of traffic in Nine Mile Canyon. In addition, BBC and other operators would be required to construct visitor pullouts, and would be asked to assist with site enhancement projects. Decreases in industrial traffic, turn-outs, and site enhancements may encourage continued use of the canyon for cultural and heritage tourism.

Alternative E contains a number of mitigation measures intended to minimize the impacts of development that could occur within sight and sound of the Green River (see **Table 2.6-8**). Implementation of these measures could preserve the wilderness experience.

As a result of increased directional drilling, fewer well pads would be constructed in the WSAs under Alternative E than under the Proposed Action. Increased use of directional drilling would leave larger portions of the Project Area available wilderness recreation.

Valuation of Passive (Non-Use) Wilderness Benefits

The potential loss of non-use economic value under Alternative E due to impairment of wilderness characteristics would be similar to Alternative A.

4.13.6.4 Community Facilities and Services

Impacts to community facilities and services under Alternative E would be similar to the impacts described under Alternative A.

4.13.6.5 Public Revenues and Expenditures

Public Expenditures

The local government cost impact of Alternative E would be nearly the same as under Alternative A. Projected expenditures under Alternative E are presented in **Table 4.13-39**.

Table 4.13-39 WTP Local Government Cost Impacts During Development (2006 dollars), Alternative E		
Jurisdiction	**Annual Average Expenditure Impact**	**Cumulative Expenditure Impact (9 years of development)**
Carbon County	14,977	134,795
Helper	1,418	12,758
Price	3,507	31,567
Wellington	766	6,894
Duchesne County	1,255,456	11,299,105
Duchesne City	82,044	738,393
Roosevelt	314,877	2,833,897
Uintah County	95,981	863,830
Vernal	27,771	249,936

Public Revenues

The average annual and cumulative value of production for the producing life of the field under Alternative E is presented in (**Table 4.13-40**). The average annual production under Alternative E is slightly lower than under Alternative A because of the additional year to develop the field. However, the cumulative value of production under Alternative A is the same as under Alternative E.

Table 4.13-40 WTP Value of Production (2006 dollars), Alternative E	
	Value of Production over Life of the Project
Years of Production	29
Annual Average	449,283,103
Cumulative (undiscounted)	13,029,216,750

Table 4.13-41, **Table 4.13-42**, and **Table 4.13-43** respectively present estimates of the property tax benefit to Carbon County and the Carbon County School District under Alternative E, the severance tax benefit to the State, and the mineral lease revenues to the State and the subsequent appropriations to local governments. No estimate was made of sales and use taxes that would be generated by Alternative E.

Table 4.13-41 WTP Projected Ad Valorem Property Tax (2006 dollars), Alternative E		
	Carbon County Property Tax Revenue	**Carbon County School District**
Years of Production	29	
Annual Average	1,863,768	4,426,198
Cumulative (undiscounted)	54,049,284	128,359,751

Table 4.13-42 WTP Projected Utah Severance Tax on Value of Production (2006 dollars), Alternative E	
	Severance Taxes
Years of Production	29
Annual Average	15,713,057
Cumulative (undiscounted)	549,927,754

Table 4.13-43 WTP Projected Utah Mineral Lease Revenue and Appropriations (2006 dollars), Alternative E				
	Mineral Lease Revenue Returned to State of Utah (50% of Federal Royalties)	**Appropriation to Utah Permanent Community Impact Fund (32.5% of State Revenue)**	**Appropriation to Utah Department of Transportation for Special Service Districts (40% of State Revenue)**	**Appropriation to Utah Department of Community and Culture for Special Service Districts (5% of State Revenue)**
Years of Production	29			
Annual Average	22,614,998	14,699,748	18,091,998	2,261,500
Cumulative (undiscounted)	791,524,918	514,491,196	633,219,934	79,152,492

% percent

4.13.6.6 Community Social Conditions

Impacts to community social well-being under Alternative E would be exactly as described for Alternative A.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.13.7 Environmental Justice

4.13.7.1 Direct and Indirect Impacts

This section considers the potential direct and indirect environmental justice impacts that would result from the proposed alternatives. For this analysis, applicable environmental justice guidance was applied to determine whether there could be any disproportionately high or adverse human health or environmental impacts on low-income, minority, or Tribal populations within the WTP Project Area as a result of the implementation of any of the alternatives.

4.13.7.2 Alternative A – Proposed Action

Well field development would not be in proximity to any low-income, minority, or Tribal communities. The majority of Native American population centers are dispersed along Highway 40, and in the towns of Duchesne, Ouray, and Roosevelt. While Highway 40 is an access route leading to the WTP Project Area, the populated areas along this highway are not located anywhere near the project boundary. The nearest areas with

low-income, minority, or Tribal populations are located approximately 30 miles to the north of the WTP Project Area boundary. Although there is a small amount of rural development within the WTP Project Area, the residents of this area are not members of low-income, minority, or Tribal communities.

Activities associated with the Proposed Action would not expose these communities to known health risks or environmental hazards. To the extent that an offsite accident could occur (e.g., along Highway 40), the low-income, minority, or Tribal populations living near the WTP Project Area boundary could be affected. However, the potential for an accident of such significant magnitude is extremely low.

Tribal Consultation

Disproportionately high or adverse human health or environmental effects on low-income, minority, or Tribal populations are not anticipated to occur as a result of the Proposed Action. However, activities associated with the Proposed Action have the potential to impact important, traditional Tribal lifeways, and religious and cultural sites.

In these Tribal-sensitive areas, construction, operation, and associated sights and sounds of wells and ancillary facilities could affect the natural character of previously undisturbed areas and transform the landscape into a more industrialized setting. This industrial landscape could decrease opportunities for hunting, gathering of plants, and other materials. Executive Order 12898 directs agencies to consider patterns of subsistence hunting and fishing when an agency action may affect fish or wildlife.

Furthermore, activities associated with the Proposed Action could impact the use of cultural sites for traditional Tribal activities (hunting and plant-gathering activities, and areas where artifacts, rock art, or other significant cultural sites are located). Extensive consultation with Tribes resulted in the identification of one TCP, culturally modified tree scars, and several previously documented archaeological sites (rock art panels) of significance to Tribal communities. No traditional plant-gathering areas were identified during Tribal consultation. Specific concerns expressed by Tribal representatives include the impacts of fugitive dust on rock art panels, the impacts on wildlife habitat, and the impact on traditional plant and mineral resources utilized by indigenous communities in the WTP Project Area (see **Section 4.12**).

In summary, extensive future development could impact traditional lifeways associated with important cultural sites.

4.13.7.3 Low Income Populations

As identified in **Table 3.13-34**, the proportion of low-income populations in communities located near the WTP Project Area (i.e., selected communities in Carbon, Duchesne, and Uintah Counties within the Uintah and Ouray Reservation) is greater than the proportion recorded for the State of Utah (U.S. Census Bureau 2000d). The areas identified as having the highest poverty rates are within the Uintah and Ouray Reservation.

Activities associated with the Proposed Action would not expose these communities to known health risks or environmental hazards. In the unlikely event of any offsite impacts, effects on these populations would be no greater than those experienced by

non-low-income members of the general population. Therefore, no environmental justice impacts are anticipated as a result of the Proposed Action.

On the contrary, low-income communities in proximity to the WTP Project Area would be positively affected by the Proposed Action. Development associated with the Proposed Action would contribute to the local economy by providing employment opportunities, monies to local contractors, and recycled revenues through the local economy. Additional revenues would be generated in the form of State taxes, income taxes, and property taxes. Local workers would be used for much of the project work, and they would likely spend much of their income in local economies.

4.13.7.4 Minority Populations

As identified in **Table 3.13-34**, the proportion of minority and Tribal populations in these selected communities is generally equal to or greater than the proportion recorded for the State of Utah (U.S. Census Bureau 2000d). The areas identified as "minority populations," that is, the percentage of minorities in an area that exceeds 50 percent, are within the Uintah and Ouray Reservation.

Activities associated with the Proposed Action would not expose these communities to known health risks or environmental hazards. In the unlikely event of any offsite impacts, effects on these populations would be no greater than those experienced by non-minority members of the general population. Therefore, no environmental justice impacts are anticipated as a result of the Proposed Action.

Summary

It is anticipated that the Proposed Action would benefit low-income, minority, and Tribal populations by creating job opportunities and stimulating local economic growth via project revenues and increased tourism.

4.13.8 Alternative B – No Action

In general, Environmental Justice impacts under Alternative B would be similar to those described in the Proposed Action.

4.13.8.1 Tribal Consultation

Environmental Justice impacts to Tribal populations under Alternative B would be similar to those described in the Proposed Action. However, because Alternative B involves considerably less development and associated surface disturbance, the potential impacts to important, traditional Tribal lifeways, and religious and cultural sites would be proportionately reduced.

4.13.8.2 Low Income Populations

Environmental Justice impacts to low-income populations under Alternative B would be similar to those described in the Proposed Action. However, because Alternative B involves considerably less development, the potential economic benefits available to low-income populations under the Proposed Action would be proportionately reduced.

4.13.8.3 Minority Populations

Environmental Justice impacts to minority populations under Alternative B would be identical to those described in the Proposed Action.

4.13.9 Alternative C – Transportation Impact Reduction

Environmental Justice impacts under Alternative C would be identical to those described in the Proposed Action.

4.13.9.1 Tribal Consultation

Environmental Justice impacts to Tribal populations under Alternative C would be identical to those described in the Proposed Action.

4.13.9.2 Low Income Populations

Environmental Justice impacts to low-income populations under Alternative C would be identical to those described in the Proposed Action.

4.13.9.3 Minority Populations

Environmental Justice impacts to minority populations under Alternative C would be identical to those described in the Proposed Action.

4.13.10 Alternative D – Conservation Alternative

In general, Environmental Justice impacts under Alternative D would be similar to those described in the Proposed Action.

4.13.10.1 Tribal Consultation

Environmental Justice impacts to Tribal populations under Alternative D would be similar to those described in the Proposed Action. However, because Alternative D involves considerably less development and associated surface disturbance, the potential impacts to important, traditional Tribal lifeways, and religious and cultural sites would be proportionately reduced.

4.13.10.2 Low Income Populations

Environmental Justice impacts to low-income populations under Alternative D would be similar to those described in the Proposed Action. However, because Alternative D involves considerably less development, the potential economic benefits available to low-income populations under the Proposed Action would be proportionately reduced.

4.13.10.3 Minority Populations

Environmental Justice impacts to minority populations under Alternative D would be identical to those described in the Proposed Action.

4.13.11 Alternative E – Agency Preferred Alternative

In general, Environmental Justice impacts under Alternative E would be identical to those described in the Proposed Action.

4.13.11.1 Tribal Consultation

Environmental Justice impacts to Tribal populations under Alternative E would generally be identical to those described under the Proposed Action. However, under Alternative E, turnouts and/or designated parking locations would be constructed at sites frequently visited along the Nine Mile Canyon Backcountry Byway. These locations would present benefits for public safety and recreation. However, there may also be the potential for adverse effects to cultural sites as increased visitation increases the risk of vandalism (both intentional and unintentional), and unauthorized collection of artifacts and other cultural materials.

4.13.11.2 Low Income Populations

Environmental Justice impacts to low-income populations under Alternative E would be identical to those described in the Proposed Action.

4.13.11.3 Minority Populations

Environmental Justice impacts to minority populations under Alternative E would be identical to those described in the Proposed Action.

Identification and Mitigation of Known and Anticipated Impacts

Because no disproportionately high or adverse human health or environmental effects on low-income, minority, or Tribal populations would occur under any of the proposed alternatives, no further mitigation measures would be required. However, with regard to the potential impacts to important and traditional Tribal lifeways and cultural sites, mitigation measures will incorporate avoidance of Tribal-sensitive areas. Tribal consultation is ongoing for areas where conflicts arise between traditional Tribal values and practices and proposed development. See **Section 4.12** for more information on the ongoing Tribal consultation and mitigation measures in place to address Tribal concerns and avoid impacts to significant sites.

4.14 TRANSPORTATION

4.14.1 Transportation

This analysis addresses the impacts of each alternative on the network of roads within the WTP Project Area. Each alternative would result in an increase in industrial traffic as well as construction and/or improvement of new roads.

The number of wells drilled per year is assumed to correlate directly with transportation impacts during the development phase. Likewise, the number of producing wells is assumed to correlate directly with transportation impacts during the production phase.

For comparison purposes, the average daily trips associated with peak-year development and production were contrasted with baseline traffic data contained in **Section 3.14**. Combining estimated peak-year average daily trips with baseline data allows for an assessment of the potential project-related traffic impacts in a base-year context; however, it is anticipated that other variables (e.g., changes in recreational use of the WTP Project Area) could contribute to changes in traffic on the affected roads. These outside variables are not factored into the calculations.

For this transportation assessment annual round trips were converted to AADT by multiplying by two and dividing by 365. This conversion allows comparison with baseline traffic data collected for this EIS. Traffic impacts on Federal and State Highways as well as county roads may be overstated because not all vehicles would leave the WTP Project Area every day.

4.14.1.1 Traffic-Related Impacts

Changes in the level and type of traffic within the WTP Project Area would directly and indirectly impact both the road network and other resources. The primary impacts associated with increased industrial traffic include dust generation, vehicle emissions, road congestion, noise, accelerated deterioration of roads, and increased potential for vehicle accidents. The magnitude (amount) and intensity (duration) of traffic-related impacts would vary with each alternative and is dependant upon the volume of traffic projected.

Under all alternatives, increased traffic would lead to an increase in both fugitive dust and vehicle emissions throughout the WTP Project Area. Fugitive dust and vehicle emissions have the potential to impact cultural resources (e.g., obscuring and deteriorating rock art), detract from visitors' experience in the WTP Project Area, and create a safety hazard for other drivers. Dust impacts are discussed in **Sections 4.3**, Air Quality; **4.16**, Visual Resources; **4.11**, Recreation; and **4.15**, Health and Safety.

Heavy trucks, due to their absolute mass, cause more damage to all types of road surfaces than passenger vehicles or light trucks. Under all alternatives, heavy truck traffic would account for approximately 30 percent of the total number of vehicles during the development phase. Road maintenance needs would increase accordingly. Deterioration of roads also has an impact on the governmental entities that are responsible for road maintenance and traffic management.

Under all alternatives, increased traffic would result in a potential for increased accidents within the WTP Project Area. Although truck traffic is not directly related to the number of accidents, the disparity in size and weight between passenger vehicles and medium to heavy trucks required for construction of oil and gas facilities could result in an increase in accidents that are fatal or cause serious injury.

The WTP Project Area is located in an area used for access to private lands and recreation areas. Conflicts between industrial traffic and other traffic are likely to occur. Conflicting uses would be highest on weekends, holidays, and during hours of high use. As discussed in **Section 2.1.10**, the flow of traffic could be interrupted during inclement weather, rig moves, or when heavy equipment is being transported along steep canyon roads. As discussed in **Section 3.14.3**, bottleneck problems are common occurrences in the WTP Project Area, and particularly in Gate, Nine Mile, Harmon, and Cottonwood

Canyons. Additional traffic could increase road congestion and/or the frequency of closures, which could perpetuate conflicts with other drivers.

4.14.1.2 Construction-Related Impacts

Under all alternatives, BBC and other operators would be required to construct new lease roads and apply for new construction ROWs across public lands on areas that fall outside of their lease boundaries. Overall road density within the Project Area would directly correlate with the number of proposed well pads. Road construction or improvement, including the removal of vegetation and surface disturbance, are a potential source of numerous environmental impacts.

The intensity of surface-disturbing impacts related to the construction or improvement of roads is dependant upon the amount, location, and timing of the proposed development. Negative resource impacts from road construction or improvement are more likely to occur in sensitive areas such as crucial winter big game range, floodplains, riparian corridors, and high country watersheds. Construction and widening of access roads also has the potential to increase soil erosion, which can affect surface water quality and aquatic habitat. New or upgraded roads can reduce visual quality, impact paleo-geologic and cultural resources, and affect wildlife and livestock through increased disturbance and habitat fragmentation. Impacts to each of these resources are addressed in the appropriate resource sections of this EIS.

Changes in the road network would open a substantial amount of previously unroaded land to motorized access. The expanded road system has the potential to increase illegal activity such as poaching, unauthorized woodcutting, and disturbance of cultural sites.

Upon project completion, all roads constructed specifically for the project would be removed with the exception of those roads that the BLM retains for administrative purposes or public use. Roads that are not needed for further use would be blocked, re-contoured, reclaimed, and vegetated consistent with the requirements of the appropriate surface management agency.

4.14.1.3 Existing Road Improvements

As discussed in the *WTP Transportation Plan*, on Federal lands, road construction standards are applied in the design of access roads for oil and gas development or other uses (e.g., recreation and access to private lands and grazing allotments). These standards have proven to be effective in mitigating soil erosion problems related to surface disturbance from construction operations. Actions such as limiting road grades, building proper drainage structures, applying surface materials, avoiding excessive earthwork, and implementing a dust abatement program can mitigate adverse impacts. Appropriate standards are determined by the operator's access needs and public use of the roads. Standards for gradient, width, turnouts, and site-distance make roads safer for use by both the operators and the general public.

As discussed in **Section 3.14.3**, the primary BLM roads in the WTP Project Area include Harmon Canyon, Prickly Pear Canyon, Dry Canyon, Cottonwood Canyon, the dugways from Cottonwood Canyon to Flat Iron Mesa and Peter's Point, Horse Bench, Cedar Ridge, and Jack Canyon. Each of these roads has unique issues. Improvements or

upgrades would be necessary on segments of these roads to meet the BLM standards. The BLM recognizes that due to the rugged topography of the WTP Project Area, and the design of many of these roads, strict compliance with the BLM standards may be difficult. Nonetheless, the extent of transportation-related impacts is evaluated in terms of compliance with the BLM road construction standards.

Like the BLM, both Carbon and Duchesne Counties have road standards and/or specifications intended to mitigate environmental impacts and ensure public safety. These standards are briefly discussed in the *WTP Transportation Plan*. Primary county roads in the WTP Project Area include the roads in Nine Mile and Gate Canyon. In addition to these roads, county road standards would apply to various routes located on State property where Carbon County has obtained permanent easements. Due to the topography of the WTP Project Area and the design of the existing roads, compliance with county standards may also be difficult. Nonetheless, the extent of transportation-related impacts is evaluated in terms of compliance with county road construction standards.

4.14.2 Proposed Action

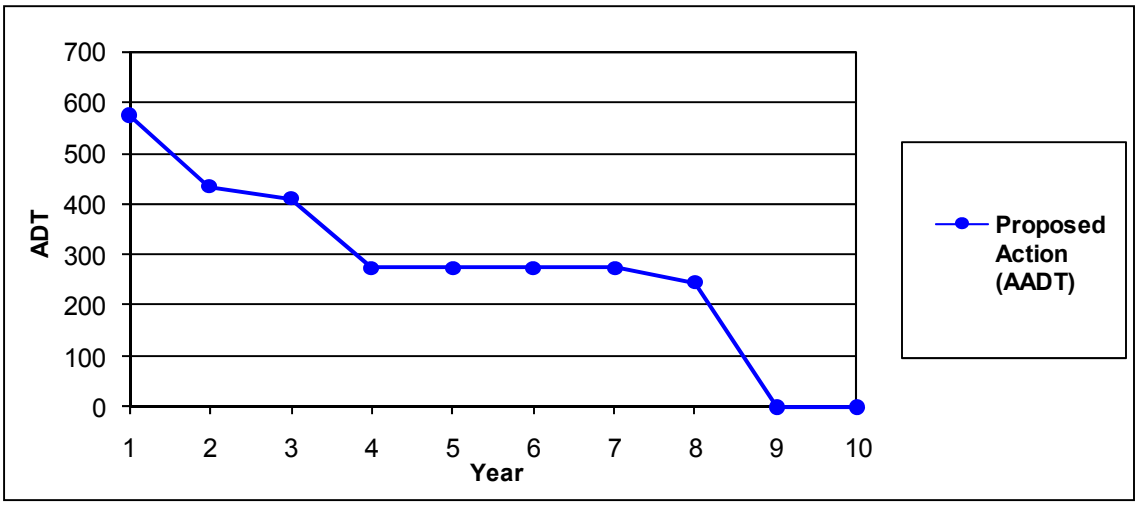
Under the Proposed Action, ADT is estimated to be approximately 575 vehicles per day during peak development. During peak production, the number of roundtrips is estimated to be approximately 126 vehicles per day. **Figure 4.14-1** shows estimated traffic levels during the development phase.

BBC and other operators' Proposed Action includes the construction of ancillary facilities that have the potential to reduce the impacts of traffic within the WTP Project Area. However, under the Proposed Action, the construction and use of these facilities is strictly voluntary; therefore, in order to provide the most conservative analysis, use of the following facilities were not included in the traffic estimates:

- Construction and use of worker housing locations (see **Section 2.2.9**).
- Construction and use of a water/condensate pipeline which would transfer produced water/condensate to disposal and/or storage facilities (see **Sections 2.1.1.3**).
- Construction and use of equipment storage areas for construction, drilling, and completion equipment, vehicles, pipe, CO_2 tanks, frac tanks, production equipment, and other standard gas field equipment (see **Section 2.2.1.4**).

Construction and use of air strips that would be used to provide aerial transportation of personnel and/or supplies to each of the three mesa tops within the WTP Project Area (see **Section 2.2.10**).

Figure 4.14-1 Proposed Action Traffic during the Development Phase



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4.14.2.1 Federal and State Highways

Traffic-Related Impacts

Federal and State highways providing access to the WTP Project Area include SR/US 40/191 and US 6/191. SR/US 40/191 provides primary access to the towns of Vernal and Roosevelt; whereas SR/US 6/191 provides primary access to the towns of Price and Wellington. Existing traffic data show that approximately 75 percent of all existing traffic in the WTP Project Area comes from Vernal/Roosevelt. The remaining 25 percent comes from Price/Wellington (**Table 3.14-5**). For the purposes of analysis, these same percentages were applied to traffic estimates for the Proposed Action. Thus, of the estimated 575 vehicles per day, it is assumed that 75 percent (approximately 431 vehicles) would travel to or from Vernal/Roosevelt, and 25 percent (approximately 144 vehicles) would travel to or from Price/Wellington.

Table 4.14-1 shows anticipated traffic increases on the segments of Federal and State highways providing access to the WTP Project Area during the development phase.

Table 4.14-2 shows heavy truck traffic impacts on segments of Federal and State highways during the *development* phase. Traffic increases on segments of Federal and State highways during the *production* phase would be minor.

Table 4.14-1 Total Traffic Impacts on Federal and State Highways During the Development Phase

Road Name	Segment Name	2004 ADT	Proposed Action ADT	Proposed Action ADT+ 2004 ADT[1]	Percent Change
SR/US 40/191	Southwest Including Myton	5,470	431	5,901	8
	South including Roosevelt	10,710	431	11,141	4
	East including Duchesne	4,985	431	5,416	9
SR/US 6/191	East including Wellington	9,565	144	9,709	2

[1]Traffic impacts calculated for this EIS are assumed to be additive (exiting traffic plus proposed traffic). However, it should be noted that the existing traffic numbers include traffic associated with existing oil and gas development and production activities occurring within the WTP Project Area. Thus, numbers are likely overstated.

Table 4.14-2 Truck Traffic Impacts on Federal and State Highways

Highway	Segment Name	2004 ADT	Percent Trucks	Proposed Action ADT	Percent Trucks	Proposed Action ADT+ 2004 ADT	Percent Trucks
SR/US 40/191	Southwest including Myton	5,470	17	431	30	5,901	18
	South including Roosevelt	10,710	36	431	30	11,141	36

Table 4.14-2 Truck Traffic Impacts on Federal and State Highways							
Highway	**Segment Name**	**2004 ADT**	**Percent Trucks**	**Proposed Action ADT**	**Percent Trucks**	**Proposed Action ADT+ 2004 ADT**	**Percent Trucks**
	East including Duchesne	4,985	19	431	30	5,416	20
SR/US 6/191	East including Wellington	9,565	30	144	30	9,709	30

As shown in **Table 4.14-1**, peak-year traffic associated with the Proposed Action would increase traffic on segments of SR/US 40/191 between Vernal and the WTP Project Area by 4 to 9 percent. Traffic increases on SR/US 6/191 would be approximately 2 percent. The higher percentage of traffic on SR/US 40/191 reflects both lower base traffic counts and a greater volume of gas field traffic.

As shown in **Table 4.14-2**, approximately 30 percent of the estimated traffic within the WTP Project Area would be heavy truck traffic. While the Proposed Action would cause an increase in the absolute number of trucks on segments of SR/US 40/191, the percentage of trucks would change by less than 1 percent. On SR/US 6/191, the absolute number would also increase; however, the percentage of trucks would remain unchanged.

An overall increase in heavy truck traffic would accelerate the deterioration of pavement, requiring the State to schedule pavement repair or replacement more frequently than under the existing traffic conditions. The 1997 Federal Highway Cost Allocation Study estimates that the cost per mile for an 80,000-pound truck on rural highways is 18.1 cents per mile, which is significantly higher than the 0.1 cent per mile damage caused by passenger vehicles (DOT 1997).

Because traffic increases would be minimal, it is assumed that there would be no perceptible effect on the overall rate of accidents on Federal or State highways providing access to the WTP Project Area. The locations where accidents are most likely to occur are at intersections where project-related vehicles turn onto or off of highways from access roads.

4.14.2.2 County Roads

Traffic-Related Impacts

As part of the Final EIS for *Oil and Gas Development on the Southern Ute Indian Reservation* (BLM-BIA-Southern Ute Indian Tribe 2002), criteria were developed to analyze the impact of additional vehicle traffic. It was concluded that traffic from development activities would have no perceivable impact if there was less than a 10 percent increase in traffic. An impact would occur if the project were to generate more than a 10 percent increase in daily traffic, and a significant impact would occur if the project increased traffic by more than 25 percent.

The relatively low levels of traffic currently occurring on county roads within the WTP Project Area combined with the level of development proposed by BBC and other

operators suggests that increased traffic would have a significant impact during both the development and production phases. Traffic increases are shown in **Table 4.14-3**.

Table 4.14-3 Traffic Increases on County Roads within the WTP Project Area

Location	2005-2006 ADT	Development ADT	Development + 2005-2006 ADT[1]	Percent Change	Production ADT	Production + 2005-2006 ADT	Percent Change
Nine Mile (Soldier Creek Mine)	26	144	170	554	63	89	242
Gate Canyon) (Wells Draw)	78	431	509	553	189	267	242

[1]Traffic impacts calculated for this EIS are assumed to be additive (exiting traffic plus proposed traffic). However, it should be noted that the existing traffic numbers include traffic associated with existing oil and gas development and production activities occurring within the WTP Project Area. Thus, numbers are likely overstated.

As shown in **Table 4.14-3**, during peak development, traffic increases in Nine Mile and Gate Canyon would be 554 and 553 percent, respectively. During production activities, traffic increases would be 242 approximately percent on both roads.

In 2005 and 2006, the Wyoming Local Technical Assistance Program (LTAP) with support from the Wyoming Department of Transportation (WYDOT) and Federal Highway Administration conducted a study to evaluate how quickly gravel roads deteriorate under various conditions and circumstances. All of the road segments in the study were described as “local” or “collector” roads that were structurally adequate and well maintained with reasonably good geometry and drainage characteristics. The results showed that the average life of a gravel road without maintenance was from several weeks to a year. The following variables had major influences on the rate at which roads deteriorated:

- Traffic speed had the greatest influence on the predicted deterioration rates. As speeds increase, the rate of deterioration also increases, indicating that faster traffic does significantly more damage to gravel roads.
- Traffic volume also had a major influence on deterioration rates. More vehicles per day and heavier truck traffic accelerated deterioration. The greatest predictive value was achieved by multiplying the truck traffic as measure in equivalent single axle loads (ESALs) per day by the ADT in vehicles.
- Surfacing gravel properties were shown to influence deterioration rates. The ratios between gravel, coarse sand, fine sand, and fines were a significant predictor of deterioration. In general, finer materials performed better.

Precipitation, more than seasonal effects, had an influence on the rate of deterioration. Faster deterioration rates were associated with the amount of precipitation that had fallen in the previous week (Huntington and Ksaibati 2006).

Information presented in this study indicates that implementation of the Proposed Action, and particularly increased traffic volumes, would increase the deterioration of county roads in the WTP Project Area. Increased deterioration would increase the costs and frequency of maintaining roads. The costs of maintaining roads in Carbon County would

be offset by BBC and other operators' compliance with the Carbon County Encroachment Ordinance (Carbon County 2005b), which requires operators to share maintenance responsibilities with the county in proportion to their use of the roads. In addition, revenue allocated to the Carbon County Transportation Special Service District from the PCIB could be used for road maintenance or improvement projects.

As discussed in the *WTP Transportation Plan* (**Appendix F**), Duchesne County, BBC and other operators have an informal agreement to cooperatively maintain roads in Duchesne County that would be impacted by project-related traffic. In addition, revenue could potentially be allocated to the Duchesne County Transportation Special Service District from the PCIB, which would be used for road maintenance or improvement projects.

Both Carbon and Duchesne Counties would likely incur costs associated with traffic enforcement in Nine Mile and Gate Canyons. The level of traffic enforcement could potentially have bearing on traffic speeds, perpetuating road deterioration rates.

According to Carbon County, aggressive patrol has increased over the past 18 months because of increases in reported accidents. In addition, the Safety Manager has conducted traffic studies and has been attempting to identify the most prevalent locations of these accidents. The Carbon County Sherriff's Department Chief Deputy has stated that patrols have been increased, and without setting a routine schedule that at least two cars per week are present in the Nine Mile Canyon area. Future plans call for increased patrols as well as continued negotiations with the BLM for funding assistance to add more patrol personal.

Heavy trucks associated with the proposed development could potentially exceed allowable weight limits for bridges and would require a special permit from the counties. Overweight vehicles could also require a transport permit to move and operate on county roadways. All applicable permits would be acquired by BBC and other operators in advance of project operations.

While it is assumed that increased traffic would also increase the potential for vehicle accidents on county roads that provide access to the WTP Project Area, it is difficult to predict the number of crashes. Variables other than traffic volume, including travel width, shoulder, curve radius, grade, traffic density, turnouts, roadside hazards, intersections, traffic controls, and sight distance also influence the number of accidents.

A study conducted by the Transportation Research Board National Research Council (National Cooperative Highway Research Program [NCHRP] 1994) evaluated the characteristics of traffic accidents on low-volume paved and unpaved roads. Results of the study are summarized below:

- Low-volume roads (those with ADT less than 2,000) have a higher percentage of injury accidents then high volume roads.
- In terms of accident types, low-volume roads have a larger percentage of run-off road crashes.
- Accidents on low-volume roads are affected primarily by roadway width, roadside hazards, and roadway terrain.

- The number of single vehicle and head-on vehicle accidents is primarily determined by road width.
- Accident rates and frequencies do not differ significantly between paved and unpaved surfaces where the ADT is less than 250 vehicles. However, accident rates are significantly higher on unpaved roads with an ADT above 250.
- Accidents rates were lower on unpaved roads with a travel surface less than 18 feet then those with wider travel surfaces. One possible explanation is that lower vehicle speeds on narrow unpaved roads reduces the number of accidents.
- The percentage of trucks does not affect the accident rate.

Information from this study indicates that the number of accidents would likely increase if the Proposed Action were implemented because of the level of traffic proposed on gravel roads.

4.14.2.3 BLM System Roads

Traffic-Related Impacts

No traffic data are available for the BLM system roads in the WTP Project Area; however, the fact that the majority of the proposed development is located on the mesa tops indicates that the vast majority of traffic entering into the WTP Project Area via Nine Mile or Gate Canyon would also be traveling on the BLM system roads. Traffic volumes would be highest in Harmon and Cottonwood Canyons, which are the primary access routes to the three mesa tops. Traffic volumes on the other BLM system roads would depend upon the specific operations that might be underway within the WTP Project Area, and would likely be concentrated in the areas under development.

If the Proposed Action were implemented, drilling activities would be approved on a year-round basis throughout the entire WTP Project Area. Approval of year-round drilling activities would result in high traffic in crucial big game winter range, sage grouse winter habitat, and high country watersheds. Impacts to these resources are discussed in **Sections 4.9**, Wildlife; and **4.5**, Water Resources.

To mitigate the impacts of year-round drilling, BBC is proposing to implement a wildlife mitigation plan. One of the primary components of the plan is to construct new roads around crucial sage grouse habitat and reclaim existing roads. In total, BBC and other operators intend to close approximately 5.3 miles of road, which is illustrated on **Figure 2.2-1**. The effectiveness of BBC and other operators' mitigation efforts are evaluated in **Section 4.9**, Wildlife.

One positive aspect of allowing year-round drilling is that BBC and other operators would not be required to move drill rigs in and out of the WTP Project Area each spring and fall. Rig mobilization and concentrating drilling activity during the summer months would intensify transportation-related impacts and conflicts with recreational users during the approved drilling period.

Construction-Related Impacts

Under the Proposed Action, BBC and other operators anticipate that approximately 178 miles of new or upgraded road would be necessary to provide service to the proposed well pads.

The majority of the proposed roads would be co-located with pipelines (approximately 165 miles). Co-located roads and pipelines would require an 80-foot wide disturbance corridor. The remainder of roads, which are proposed along an existing pipeline, would require a 40-foot wide disturbance corridor.

Surface disturbance impacts associated with roads construction and upgrades would be approximately 1,700 acres. Impacts would not occur concurrently, but would be distributed over an 8-year period.

Under the Proposed Action, all new roads would be managed as "open to the public," which means the proposed road network would open a substantial amount of previously unroaded land to motorized access. Whether this is perceived as an adverse or beneficial impact depends on the individual user. Motorized access, including use of OHVs, is discussed in detail in **Section 4.11**, Recreation.

If the Proposed Action were implemented, road construction would be required to access proposed well locations in specially designated areas within the WTP Project Area, including WSAs, lands with wilderness characteristics, and the potential Desolation Canyon and Nine Mile Canyon ACECs. Conceptual well locations indicate that road construction and or upgrades could also occur in other sensitive areas (e.g., canyon bottoms, floodplains, and riparian corridors). Impacts from construction in specially designated areas are discussed in **Section 4.17**, Special Designations. Impacts from construction in sensitive areas are discussed in **Sections 4.5**, Water Resources; **4.8**, Vegetation; and **4.16**, Visual Resources.

The BLM is responsible for the enforcement of all ROW authorizations. As such, it is the BLM's responsibility to inspect and ensure compliance with all ROW authorizations. Enforcement of all new ROW authorizations would require increased management by the BLM.

Instruction Memorandum No. 2008-012 contains information on the BLM's current Oil and Gas Inspection and Enforcement (I&E) Strategy. In general, Field Office staffing resources are determined through maintenance of an Inspection Strategy Matrices and resources are allocated based on inspection workloads. Therefore, it can be expected that if full field development is allowed to occur appropriate resources would be available to enforce stipulations in the area.

Existing Road Improvements

To access conceptual well locations, BBC and other operators would use each of the primary access routes in the WTP Project Area. BBC and other operators have indicated that the proposed upgrades to the BLM system roads illustrated on **Figure 2.2-1** would be sufficient to accommodate their road use needs. Upgrades are discussed in greater detail in **Appendix F** (*West Tavaputs Natural Gas Full Field Development Transportation Plan*). Notable upgrades include:

- Improvement of approximately 2.1 miles of the Harmon Canyon Road. Road improvements would improve drainage, eliminate blind curves, and remove dangerous sidewalls.
- Improvement of approximately 6.2 miles of the existing Horse Bench Road. The proposed improvements would improve drainage, decrease exposure to steep canyons, and reduce the present grade. Under the Proposed Action, BBC and other operators would also realign approximately 1,000 feet of existing road.
- Reroute/improvement of approximately 1.2 miles of dugway from Cottonwood Canyon to Flat Iron Mesa. The road improvement would reduce the present grade and improve drainage. In addition, BBC proposes to construct 1.9 miles of new road to Flat Iron Mesa across the drainage to the slope located directly to the north of the existing route. Under the Proposed Action, the new road would be used as an uphill route and the existing dugway as a downhill route during drilling operations. Following the development phase, the existing road would be reclaimed.
- Improvement of approximately 3.4 miles of existing road in Jack Canyon. The road would be positioned above the existing drainage to prevent road damage during flood events. As an alternative, BBC could potentially reroute the upper section of the road. The new route would intersect with the existing road in a tributary before it enters Jack Canyon. In either case, BBC and other operators would improve the road in the lower portion of Jack Canyon.

Where practicably feasible, improvements, realignments, and/or reroutes of Harmon Canyon and the dugway to Flat Iron Mesa would bring these particular roads in compliance with the BLM standards, which could partially mitigate environmental and safety concerns, minimize the costs of maintaining roads, and reduce bottlenecking problems.

Improvements of the Horse Bench Road and the reroute of Jack Canyon would open access to areas that are not currently accessible in most vehicles. Horse Bench and Jack Canyon are currently protected by the difficulty of access. Increased public access on Horse Bench could potentially impact cultural resources, the Desolation Canyon SRMA, the Desolation Canyon NHL, and the eligibility of the Green River for designation as a WSR. Increased access into Jack Canyon could potentially impact the wilderness values for which the WSA was nominated.

Other roads within the WTP Project Area would receive routine maintenance on an as needed basis to uphold or slightly improve the current condition. Common maintenance activities would include spot repairs, slide removal, drainage ditch installation, ditch cleaning, culvert installation, and culvert cleaning. In general, maintenance activities would be limited to the present road disturbance width; however, on occasions, additional disturbance could be required.

As discussed in the *WTP Transportation Plan*, any road use proposed by BBC and other operators would be authorized in compliance with the BLM directives, standards, and stipulations. If roads do not meet the BLM standards, authorization to use the road may or may not be granted. The decision to grant authorization would be entirely at the

discretion of the AO. As such, the BLM could deny use of any access road that does not meet the BLM road standards.

As previously discussed, in the county roads analysis (see **Section 4.14.2.2**), neither road width nor traffic type (i.e., heavy truck) has substantial bearing on the total number of accidents; however, these variables have the potential to affect the type of accidents (NCHRP 1994). Failure to comply with the BLM standards with regard to road width has the potential to increase the risk of single vehicle (e.g., rollovers) and head-on collisions. The disparity in size and weight between passenger vehicles and medium to heavy trucks required for construction of oil and gas facilities could result in an increase in accidents that are fatal or cause serious injury.

4.14.2.4 Dust and Proposed Dust Suppression

Under all alternatives BBC and other operators have agreed to put into operation a dust suppression plan (see **Appendix R**) and discontinue the use of magnesium chloride within canyon bottoms. According to the dust suppression plan, Lignin Sulfonate or a Soluble Polymer, such as TerraLOC, would be used in Nine Mile Canyon between Harmon and Cottonwood Canyons (12 miles), in Harmon Canyon (1 mile), in Gate Canyon (1 mile) and in Cottonwood Canyon (8 miles). Implementation of the dust suppression plan has the potential to substantially reduce dust generated by increased project-related traffic in these areas.

To alleviate the impacts of dust on WTP Project Area roads not included in the dust suppression plan, BBC and other operators have indicated that they would apply water (or other alternative dust suppressants) to the roadways. The BLM recognizes that the use of water as the sole dust suppressant has not, thus far, been effective within the WTP Project Area, likely because the amount of water and the frequency of application are insufficient. As discussed in the *WTP Transportation Plan*, if applied at frequent intervals (i.e., every 1 to 1.5 hours depending on climate and road conditions), water has the potential to eliminate between 50 and 70 percent of the fugitive dust generated.

As an alternative to using dust suppressants or due to safety concerns, certain road segments within Nine Mile, Gate, or the lower reaches of Harmon and Cottonwood Canyons, may be improved with hard surfacing, such as asphalt, chip and seal, or other materials, as approved by the BLM or counties as appropriate. Should BBC and other operators pave road segments, dust impacts would effectively be eliminated. It is acknowledged however that hardening of road surfaces within the WTP Project Area could result in both positive and negative impacts on various resources. For example,

Recreation: Decreases in dust and improved road conditions could potentially result in an improved visitor experience in Nine Mile Canyon. On the other hand, hardening of road surfaces may result in an increase in visitation to portions of the WTP Project Area, which could diminish the backcountry character and potentially lead to increases in conflict between recreational users and industry.

Cultural Resources: Increased visitation to the area may result in unauthorized collection of artifacts or intentional or unintentional damage to sites. Conversely, increased visitation and improved road conditions – especially at popular cultural sites – may result in reduced vandalism-related impacts to cultural sites as vandalism is more likely to occur when less people are present in an area (see **Section 4.12**).

Air Quality: Hardening of road surfaces within the WTP Project Area could increase short-term HAP emissions during paving activities, but would decrease particulate emissions during operations, which could decrease visibility impacts both short-term local and possibly long-term far-field.

Water Resources and Soils: Hardening of road surfaces within the WTP Project Area could lead to increased runoff to adjacent creeks and/or drainages (i.e., Nine Mile, Cottonwood, and Harmon). Runoff could include pollutants typically associated with paving activities. However, if the road is paved, dust suppressants would not be needed and the potential impacts of magnesium chloride or other suppressants to shallow groundwater and Nine Mile Creek would be reduced. Hardening of road surfaces would reduce the potential impacts of additional dust on surface water quality by substantially decreasing erosion and sediment yield to adjacent creeks and/or drainages.

Health and Safety: Decreases in dust and improved road conditions could potentially result in increased driver visibility, which could improve safety along roads within the WTP Project Area.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible Effects

There would be no irreversible impacts on transportation.

Irretrievable Effects

Road construction and improvement would increase overall road density within the WTP Project Area for the LOP. Upon project completion, all roads constructed specifically for the project would be removed.

4.14.3 Alternative B - No Action Alternative

During the development phase, which would last approximately 2 years, it is anticipated that the peak ADT would be approximately 205 vehicles. During production, peak ADT would be approximately 22 vehicles. **Figure 4.14-2** compares the No Action Alternative with the Proposed Action during the development phase.

4.14.3.1 Federal and State Highways

Traffic-Related Impacts

Traffic increases associated with the No Action Alternative would have a negligible impact on Federal and State highways providing access to the WTP Project Area.

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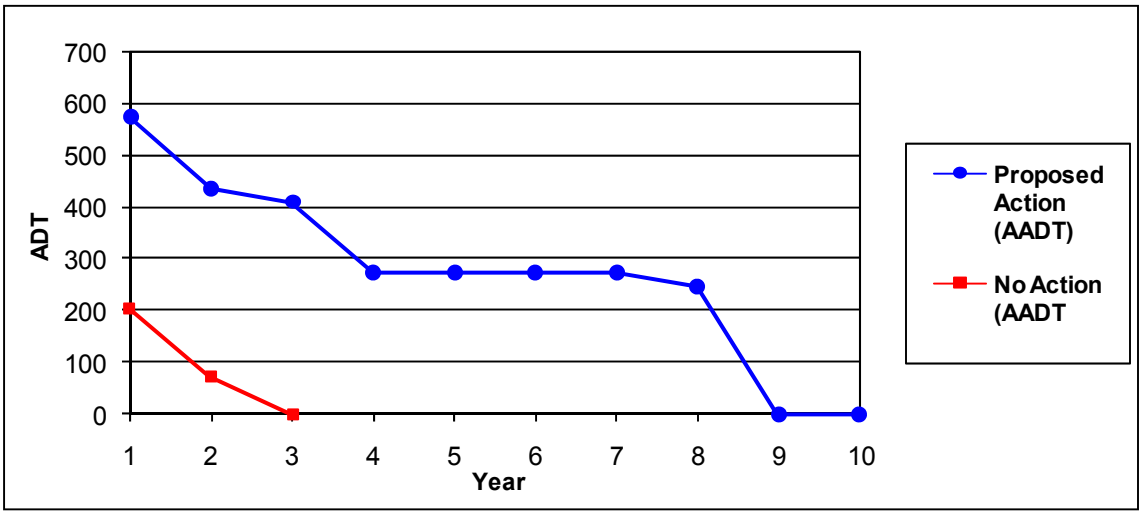
Figure 4.14-2 No Action Alternative Traffic during the Development Phase



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4.14.3.2 County Roads

Traffic-Related Impacts

If the No Action Alternative were implemented, traffic on county roads providing access to the WTP Project Area would increase substantially during the approximately 2 year development phase. Traffic impacts would be minor during the production phase.

4.14.3.3 BLM System Roads

Traffic-Related Impacts

If the No Action Alternative were implemented, traffic on the BLM system roads providing access to the WTP Project Area would increase substantially during the approximately 2 year development phase. Traffic impacts would be minor during the production phase.

Construction-Related Impacts

Under the No Action Alternative, BBC and other operators would construct approximately 32 miles of access road (includes road co-located with pipeline) in the WTP Project Area. As previously discussed, if the No Action Alternative were selected, the BLM would be required to grant BBC and other operators reasonable access to valid leases on State and private land in the WTP Project Area. As such, road construction would occur on Federal, State, and private lands in the WTP Project Area.

Existing Road Improvements

Under the No Action Alternative, BBC and other operators would construct as many as 15 wells on State sections located along Horse Bench. In its current condition, the Horse Bench Road is not passable in most vehicles. As such, the BLM would approve improvements to the existing road as described in BBC's *West Tavaputs Plateau Road Assessment*, which is included in the *WTP Transportation Plan* located in **Appendix F**.

Improvements to Horse Bench Road would open access to an area that is not currently accessible in most vehicles. Resources on Horse Bench are currently protected by the difficulty of access. Increased public access on Horse Bench could potentially impact cultural resources, the Desolation Canyon SRMA, the Desolation Canyon NHL, and eligibility of the Green River for designation as a WSR.

4.14.3.4 Dust and Proposed Dust Suppression

Under the No Action Alternative, impacts would be similar to those described under the Proposed Action; however, dust generation would be further reduced in proportion to the decrease in traffic.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.14.4 Alternative C - Transportation Impact Reduction Alternative

As discussed in **Section 2.4.1**, Alternative C includes a number of components that have the potential to reduce traffic volumes. **Figure 4.14-3** contrasts the traffic estimates associated with Alternative C, and those associated with the Proposed Action, during the development phase. If Alternative C were implemented, during peak-development, ADT would be 125 vehicles during the winter and 261 vehicles during all other seasons (**Table 2.4-3**). If the Proposed Action were implemented ADT would be approximately 575 vehicles (**Table 2.2-3**).

Thus, if Alternative C were implemented, ADT would be 55 to 78 percent less than under the Proposed Action. However, if the Proposed Action were selected, drilling and construction traffic would end after 8 years; whereas, if Alternative C were selected drilling and construction traffic would remain relatively constant for 15 years.

Incorporated into the traffic estimates are BBC and other operators' commitment to use aerial transportation for drilling workforce to each of the three mesa tops within the WTP Project Area during the development phase. The use of aerial transportation would reduce light truck traffic between the WTP Project Area and surrounding communities by approximately 8 roundtrips per day per drill rig. During the development phase, the use of aerial transportation would reduce traffic by approximately 25 percent (**Table 2.4-2**).

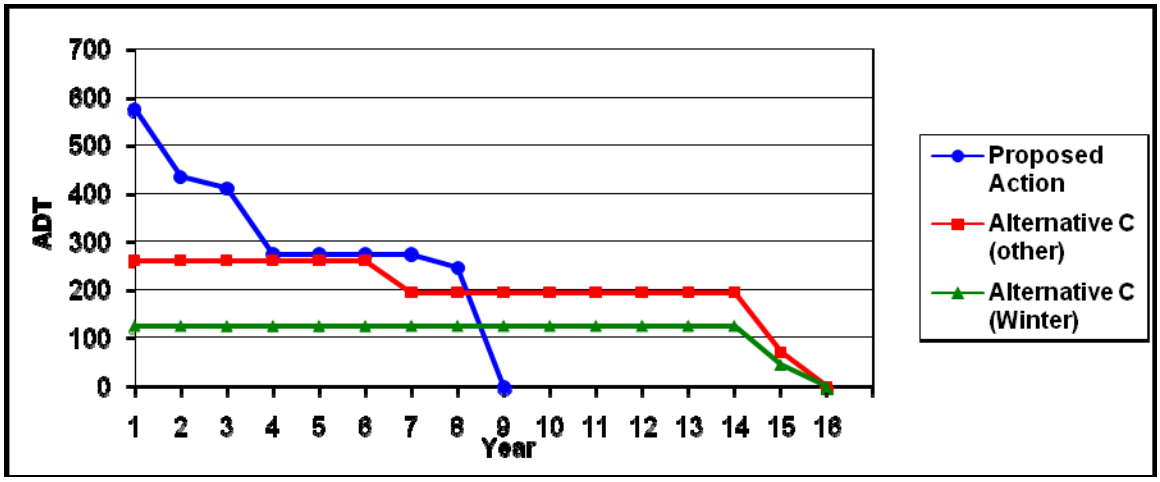
Similar to the Proposed Action, traffic to and from the WTP Project Area could also be reduced by use of worker housing (see **Section 2.4.10**). However, use of worker housing by project personnel is not enforceable. Therefore, in order to provide the most conservative impact study, use of worker housing is not built into this analysis.

If Alternative C were selected, traffic would also be substantially reduced during the production phase. Under Alternative C, it would be mandatory that BBC and other operators transport produced water and condensate via a water/condensate pipeline to approved disposal facilities. Transportation of water directly to disposal facilities via pipeline would reduce total production traffic by approximately 65 percent (**Tables 2.2-4** and **2.4-4**.

In addition to the above-mentioned traffic reductions, under Alternative C, BBC and other operators would be required to construct a new route through Trail Canyon. A conceptual location of this alternative access route is shown on **Figure 2.4-1**. Construction of this route (approximately 2.85 miles) would result in approximately 14 acres of surface disturbance. Trail Canyon is located directly north of Harmon Canyon, and would serve as the primary access route to Prickly Pear Mesa. Use of this route would nearly eliminate project-related traffic on the stretch of road in Nine Mile Canyon between Gate and Harmon Canyons.

Based on the number of proposed well locations on Prickly Pear Mesa, it can be assumed that 22 percent (or 22 to 57 vehicles per day) would be required to use the Trail Canyon alternative access route. Removal of this traffic from Nine Mile Canyon would reduce traffic congestion, enhance visitor safety, reduce conflicts between project-related and recreational traffic, and minimize indirect impacts (e.g., dust and vibration) to rock art and other cultural resources between Harmon and Gate Canyons.

Figure 4.14-3 Alternative C ADT during Development Phase



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4.14.4.1 Federal and State Highways

Traffic-Related Impacts

Increases in ADT on affected highway segments would be substantially lower under Alternative C than under the Proposed Action. However, the longer duration of drilling (approximately 7 years) would result in minor long-term traffic impacts including wear on roads. As with the Proposed Action, it is assumed that there would be no perceptible effect on the overall rate of accidents.

4.14.4.2 County Roads

Traffic-Related Impacts

As with Federal and State Highways, peak-year impacts on county roads would be substantially lower under Alternative C than under the Proposed Action. However, controlling the intensity of drilling activity would lengthen the duration of impacts. Traffic impacts would also be substantially lower during the production phase than under the Proposed Action.

If Alternative C were selected, BBC and other operators would transport routine drilling and completion supplies to the proposed equipment storage areas located on the three mesa tops during hours of low use (7:00 PM-10:00 AM). As illustrated in **Table 3.14-6**, the traffic study conducted for this EIS shows that approximately 80 percent of traffic enters or leaves the WTP Project Area between the hours of 6:00 AM and 6:00 PM. Transportation of routine drilling supplies has the potential to reduce traffic congestion during daytime hours within the WTP Project Area, particularly in Nine Mile, Gate, Cottonwood, and Harmon Canyons.

If Alternative C were chosen, BBC and other operators would also limit the transportation of routine drilling supplies and mobilization of drilling rigs on weekends and holidays. Traffic data collected for this EIS show that recreational traffic constitutes between 20 and 45 percent of the total traffic on weekends (**Table 3.14-7**). Reducing traffic on weekends and holidays would reduce the potential for conflicts between project-related traffic and recreational traffic within the WTP Project Area, particularly in Nine Mile Canyon.

As discussed under the Proposed Action (see **Section 4.14.2.2**), on unpaved road segments, the number of traffic accidents increases substantially when traffic volumes exceed 250 vehicles per day (NCHRP 1994). Under Alternative C, traffic volumes would remain at or near this threshold in Nine Mile and Gate canyon; whereas, under the Proposed Action, traffic volumes would exceed this threshold during each year of the development phase. Use of the Trail Canyon route would also disperse project-related traffic. Thus, the number of accidents expected under Alternative C could be substantially lower than the number expected under the Proposed Action.

4.14.4.3 BLM System Roads

Traffic-Related Impacts

Project-related traffic on the BLM system roads would be lower under Alternative C than the Proposed Action; however, impacts would occur over a prolonged period of time. In addition, traffic would be substantially lower during the production phase than under the Proposed Action.

If Alternative C were implemented, drilling activities would occur on a year-round basis throughout the entire WTP Project Area. Approval of year-round drilling activities would result in high traffic volumes in crucial big game winter range, sage grouse winter habitat, and high country watersheds. However, if Alternative C were implemented traffic during the winter would be substantially lower (125 vehicles) than if the Proposed Action were approved (575 vehicles). Impacts to these resources are discussed in **Sections 4.9**, Wildlife; and **4.5**, Water Resources.

To partially mitigate the impacts of winter-time activity, under Alternative C, BBC and other operators would be required to comply with certain special protection measures. As discussed in **Section 2.4.1.2** and as illustrated on **Figure 2.4-1**, BBC and other operators would be required to reroute roads around crucial sage grouse habitat. Following construction of new roads, approximately 5.7 miles of existing roads would be closed and reclaimed. The effectiveness of special protection measures is addressed in **Section 4.9**, Wildlife.

One positive aspect of allowing year-round drilling is that BBC and other operators would not be required to move all drill rigs in and out of the WTP Project Area each spring and fall. Rig mobilization and concentrating drilling activity during the summer months would intensify transportation-related impacts (e.g., bottlenecking and dust) and potential conflicts with recreational users during these periods.

Under Alternative C, gates would also be placed at the mouth of Harmon Canyon, Prickly Pear Canyon, and below the dugways from Cottonwood Canyon to the top of the plateau. Each of these gates would be closed from December 1 to April 15. Gating canyon roads that provide access to the West Tavaputs Plateau during the winter time would limit public access on roads that were not constructed for use during inclement weather, limit access into crucial winter wildlife habitats, and protect public safety.

In addition, if Alternative C were implemented, the BLM would gate (i.e., close to the public) the improved Horse Bench and Jack Canyon Roads on a year-round basis. Gating these roads would prevent the public from accessing areas which are presently not passable in most vehicles. Closure of the improved Horse Bench Road could prevent damage to cultural resources, impacts to the Desolation Canyon SRMA, Desolation Canyon NHL, and the potential Green River WSR corridor. Closure of the new Jack Canyon Road would prevent motorized access into the Jack and Desolation Canyon WSAs. Under Alternative C, maintaining road closures (i.e., gating roads) would be the responsibility of BBC and other operators. Monitoring compliance with road closures would be the responsibility of the third party monitor selected by BBC, other operators, and the BLM.

As discussed in **Section 3.14.2**, Carbon County has identified the majority of the roads within the WTP Project Area as being part of its transportation system; however, issues pertaining to R.S. 2477 are beyond the scope of this EIS. Closure of existing roads (seasonal or year-round) has the potential to create conflicts between the Federal government and individuals who participate in various forms of motorized recreation.

Construction-Related Impacts

If Alternative C were selected, the total miles of proposed road (179 miles) would be almost the same as if the Proposed Action were selected. However, if Alternative C were chosen, the intensity of construction would be less and the duration would be longer.

One of the most important differences between Alternative C and the Proposed Action is that under Alternative C, all new roads longer than 2 miles would be gated (i.e., closed to the public). In addition, all new roads that would provide motorized access into the WSAs would be gated (regardless of length). In total, approximately 103 of the 179 miles of proposed road (including co-located road and pipeline) would be closed to the general public. Closure of new roads in the WTP Project Area, and particularly in the WSAs, would limit motorized access in areas that are currently not accessible. As previously mentioned, if Alternative C were implemented, maintaining road closures (i.e., gating roads) would be the responsibility of BBC and other operators. Monitoring compliance with road closures would be the responsibility of the third party monitor selected by BBC, other operators, and the BLM.

As discussed in **Section 2.4.12** and illustrated on **Figure 2.4-1**, to partially mitigate the impacts of new road construction, BBC and other operators would also be required to reclaim approximately 13 miles of road that are redundant or that create unnecessary loops.

Existing Road Improvements

As discussed in **Section 2.4.2.2**, if Alternative C were implemented, BBC and other operators would be required to improve approximately 53 miles of existing road. Anticipated short-term disturbance associated with extensive road improvements would be approximately 124 acres. Roads needing extensive improvement, including Harmon Canyon, Dry Canyon, Cottonwood Canyon, the dugways to Flat Iron Mesa and Peter's Point, Cottonwood Spur, Cedar Ridge, and Jack Canyon are illustrated on **Figure 2.4-1**.

In some instances BBC and other operators would be allowed to reroute roads as an alternative to improving existing roads. Proposed reroutes for the dugways to Flat Iron Mesa and Peter's Point, the Jack Canyon Road, and Horse Bench Road are also illustrated on **Figure 2.4-1**. If BBC and other operators select to reroute a road segment, the existing road would be closed and reclaimed upon completion of the new road. Anticipated short-term disturbance from road reroutes would be approximately 29 acres.

Prior to upgrading or rerouting a road, BBC and other operators would submit to the BLM for approval appropriate road plans and profiles that would demonstrate compliance with the established BLM road standards. Conformance with the BLM road standards could entail improving or rerouting additional road segments beyond those that are illustrated on **Figure 2.4-1**. This decision would be at the discretion of the AO.

With respect to the Jack Canyon, if Alternative C were selected, BBC and other operators would be required to submit a plan of development for the proposed wells, roads, and pipelines that would be constructed in the bottom of the canyon prior to improving the existing road or constructing a new road. Improvement of the existing road or construction of new road would likely require authorization of a new ROW. If approved, the new ROW would be gated (i.e., limited administrative access only).

Where environmental conditions and/or economic considerations make road construction or upgrades to the BLM standards infeasible, BBC and other operators would be required to obtain a waiver to these standards from the AO.

Where feasible, compliance with the BLM road standards would mitigate environmental and safety concerns related to increased road usage. Widening access roads to a width of approximately 20 feet would allow for two-way traffic, thus reducing bottlenecking problems in steep canyons. Improving drainage and road surfacing would decrease long-term maintenance costs, dust, and erosion.

If Alternative C were implemented, no improvements would be made to the existing Prickly Pear Road, which is visible from Nine Mile Canyon. In addition, to ensure safety, only light truck traffic would be permitted on the road.

4.14.4.4 Dust and Proposed Dust Suppression

Under all alternatives, BBC and other operators would be required to put into operation a dust suppression plan, (see **Section 2.1.5.6**) which would substantially reduce the amount of dust generated by project-related traffic in canyon bottoms within the WTP Project Area. As discussed in **Table 2.6-8**, the BLM would consider dust suppression efforts effective when (1) no dust is generated above the cab of the vehicle, or (2) there are no hanging dust plumes. A COA to this effect would be added to all APDs. While implementation of the dust suppression plan and compliance with these COAs would mitigate the majority of dust impacts, Alternative C contains numerous other mitigation measures which would reduce the amount of project-related traffic, thereby further reducing the amount of fugitive dust generated in Nine Mile Canyon and elsewhere within the WTP Project Area.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.14.5 Alternative D - Conservation Alternative

If Alternative D were selected BBC and other operators would construct fewer well pads, roads, pipelines, and ancillary facilities than they would construct if the Proposed Action were implemented. As such, total traffic during the development and production phases would be reduced by approximately 30 percent. In addition, intensity of development would be controlled by limitations placed on the number of rigs operating in the WTP Project Area, surface disturbance thresholds, and seasonal drilling restrictions.

One of the many differences between Alternative D and the Proposed Action is that under Alternative D, BBC and other operators would not be allowed to drill or complete

wells during the winter season (November 1- May 15). As such, there would be minimal traffic in big game crucial winter habitat, sage grouse winter habitat, or high country watersheds during the winter closure. However, because winter drilling and completion activities would be restricted, BBC and other operators would be required to move drill rigs in and out of the WTP Project Area during the spring and fall. Rig mobilization as well as concentration of construction, drilling, and completion activities would intensify traffic impacts during the approved drilling season. This has the potential to create conflicts with other users who also typically use the WTP Project Area during the spring, summer, and fall seasons.

While winter restrictions would intensify traffic-related impacts during the spring, summer, and fall seasons, the impacts would still be managed by limitations placed on the number of rigs operating in the WTP Project Area. During peak-development, average daily traffic during the approved drilling season would be approximately 300 vehicles per day (**Table 2.5-3**); however, if the Proposed Action were implemented, during peak-development, traffic would be approximately 575 vehicles per day (**Table 2.2-3**).

The drawback to limiting development during the winter and limiting the number of drilling rigs during the approved drilling season is that the duration of impacts is drawn out over a longer period of time. As shown in **Figure 4.14-4**, under the Proposed Action, the development phase would last approximately 8 years, while under Alternative D, traffic would remain relatively constant for 20 years.

Under Alternative D no worker housing locations would be constructed in the WTP Project Area (see **Section 2.5.9**); as such, all project-related personnel would be required to commute to and from the WTP Project Area on a daily basis.

4.14.5.1 Federal and State Highways

Traffic-Related Impacts

Project-related increases in ADT on affected highway segments would be substantially lower under Alternative D than under the Proposed Action. However, the longer duration of drilling would result in minor long-term traffic impacts including wear on roads. As with the Proposed Action, it is assumed that there would be no perceptible effect on the overall rate of accidents.

4.14.5.2 County Roads

Traffic-Related Impacts

As with Federal and State Highways, peak-year impacts on county roads would be substantially lower under Alternative D than under the Proposed Action. However, controlling the intensity of drilling activity would lengthen the duration of impacts.

Traffic on county roads would be limited to production traffic during the winter season, which would result in higher traffic volumes during the summer and fall seasons (when the WTP Project Area is typically used for recreation).

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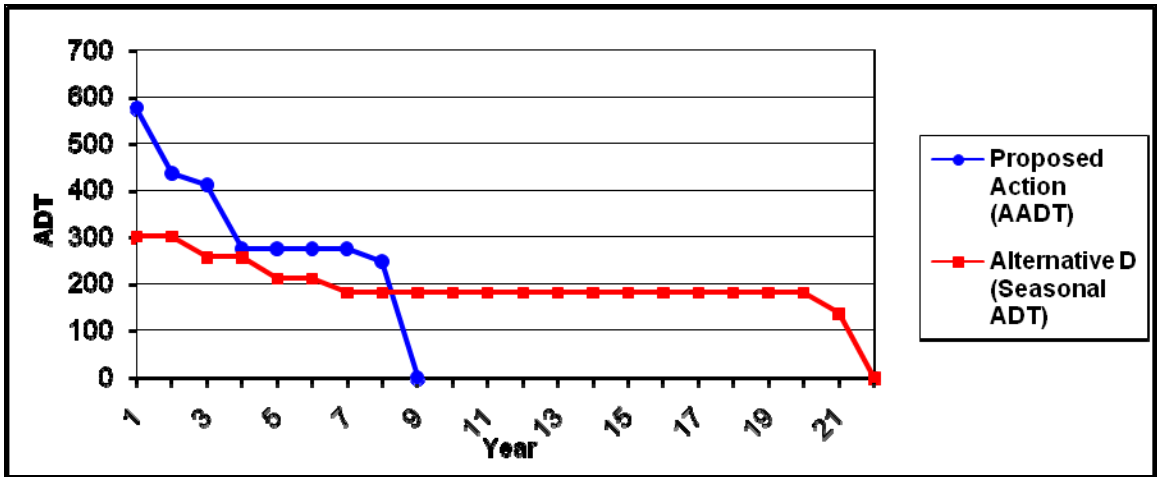
Figure 4.14-4 Alternative D ADT during the Development Phase



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Because development would be limited for approximately 5.5 months each year, no limitations would be placed on weekend, holiday, or daytime traffic.

If Alternative D were chosen, potential for traffic accidents would be highest during the approved drilling season. As discussed under the Proposed Action, accidents substantially increase on unpaved road segments with an ADT higher than 250 vehicles.

These impacts would also last over the life of the development phase, which is anticipated to take approximately 20 years. However, based upon the anticipated traffic volumes, it could be expected that the number of accidents would be less under Alternative D than under the Proposed Action.

4.14.5.3 BLM System Roads

Traffic-Related Impacts

Project-related traffic on the BLM system roads would be lower under Alternative D than the Proposed Action; however, impacts would occur over an extended period of time. In addition, traffic would be substantially lower during the production phase than under the Proposed Action.

Under Alternative D, the BLM would gate the Cedar Ridge, Horse Bench, Jack Canyon, and Jack Ridge roads on a year-round basis. Gating these roads would prevent the public from accessing areas which are presently not passable by most vehicles. Thus, these closures would reduce the potential for vehicle accidents or strandings. Year-round closure of the improved Horse Bench Road could also reduce traffic-related damage to cultural resources, traffic-induced impacts to Uintah Basin hookless cactus and Graham's beardtongue habitats and populations, and motorized vehicle use within the Desolation Canyon SRMA, Desolation Canyon NHL, eligible Green River WSR corridor, and the Jack and Desolation Canyon WSAs.

Construction-Related Impacts

If Alternative D were selected, approximately 127 miles of road would be constructed in the WTP Project Area, which is approximately 29 percent less than the total miles of road that would be constructed if the Proposed Action were selected.

In addition, under Alternative D, BLM would not lease unleased lands with wilderness characteristics; and, NSO would be allowed within the Desolation Canyon or Jack Canyon WSAs, on unleased lands within the potential Desolation and Nine Mile Canyon ACECs, or on Federal land in canyon bottoms. Drilling restrictions within these areas would limit motorized access in areas that are currently unroaded, sensitive resource areas, as well as areas that are currently not readily accessible by vehicle. Thus, the magnitude of impacts would be minor when compared to the Proposed Action and the other BLM action alternatives.

Finally, under Alternative D, there would be no exceptions, waivers, or modifications to selective stipulations that limit surface occupancy in riparian areas, floodplains, natural springs, high country watersheds, or areas with slopes greater than 30 percent. These limitations would curtail impacts to water resources, vegetation, and wildlife. Each of

these impacts is discussed in **Sections 4.5**, Water Resources; **4.8**, Vegetation; and **4.9**, Wildlife.

Existing Road Improvements

As discussed in **Section 2.5.1.2**, if Alternative D were implemented, BBC and other operators would be required to improve approximately 47 miles of existing road. Anticipated short-term disturbance associated with extensive road improvements would be approximately 109 acres. Roads needing extensive improvement, including Harmon Canyon, Cottonwood Canyon, the dugways to Flat Iron Mesa and Peter's Point, Cottonwood Spur, and Cedar Ridge are illustrated on **Figure 2.5-1**. As no development is proposed in canyon bottoms or WSAs, there would be no upgrades to either the Jack Canyon or Dry Canyon roads.

Prior to improving a road, BBC and other operators would submit to the BLM for approval appropriate road plans and profiles that would demonstrate compliance with the established BLM road standards. Conformance with the BLM road standards could entail improving or rerouting additional road segments beyond those that are illustrated on **Figure 2.5-1**. This decision would be at the discretion of the AO.

Where environmental conditions and/or economic considerations make road construction or upgrades to the BLM standards infeasible, BBC and other operators would be required to obtain a waiver to these standards from the AO.

If Alternative D were implemented, the BLM would gate the improved Horse Bench Road. Gating of the improved Horse Bench Road could reduce impacts to cultural resources, impacts to the Desolation Canyon SRMA, Desolation Canyon NHL, and preserve the eligibility of the Green River as a WSR corridor.

4.14.5.4 Dust and Proposed Dust Suppression

As with all other alternatives, BBC and other operators would be required to put into operation a dust suppression plan, (see **Section 2.1.5.6**) which would substantially reduce the amount of dust generated by project-related traffic. As discussed in **Table 2.6-8**, the BLM would consider dust suppression efforts effective when (1) no dust is generated above the cab of the vehicle, or (2) there are no hanging dust plumes. A COA to this effect would be added to all APDs. While implementation of the dust suppression plan and compliance with these COAs would mitigate the majority of dust impacts, under Alternative D, industrial traffic would also be reduced by about 35 percent when compared with the Proposed Action.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.14.6 Alternative E - Agency Preferred Alternative

If the Agency Preferred Alternative were implemented, AADT would be approximately 441 vehicles during peak development (**Table 2.6-3**). As previously discussed, if the Proposed Action were implemented AADT would be approximately 575 vehicles (**Table 2.2-3**). Thus, if Alternative E were implemented, AADT would be approximately 23

percent less than the Proposed Action during peak development. Traffic eliminated during the peak year of development would be shifted to the last year of development. **Figure 4.14-5** contrasts the traffic estimates associated with the Agency Preferred Alternative and the traffic associated with the Proposed Action.

If the Agency Preferred Alternative were selected, traffic would be substantially reduced during the production phase. Under the Agency Preferred Alternative, BBC and other operators would be required to transport produced water and condensate via a water condensate pipeline (i.e., liquids gathering system) to approved disposal facilities with the following exceptions.

- Use of water/condensate lines would not be required in areas where development is considered exploratory.
- Use of water/condensate lines may not be required in remote locations where the number of proposed wells is limited (e.g., Cedar Ridge, Jack Canyon, and Cottonwood Ridge) and construction of water/condensate line would be cost prohibitive.
- Use of water/condensate lines may not be required in remote locations where the topographical variations could require construction of additional pumping facilities in addition to those illustrated on **Figure 2.6-1**.

Although water/condensate would not likely be required in all circumstances, to provide a comparison between the environmental impacts of each alternative, under this alternative, it is assumed that all produced water would be transported by pipeline. Transportation of water directly to disposal facilities via pipeline could reduce total production traffic by approximately 65 percent, when compared with the Proposed Action.

4.14.6.1 Federal and State Highways

Traffic-Related Impacts

If the Agency Preferred Alternative were selected, the impacts would be similar in nature to those described under the Proposed Action. As with the Proposed Action, it is assumed that there would be no perceptible effect on the overall rate of accidents.

4.14.6.2 County Roads

Traffic-Related Impacts

Traffic-related impacts would be similar to those described under the Proposed Action, but slightly lower during the peak year of development. In addition, traffic-related impacts may be reduced under this alternative as a result of the construction of turnouts and/or designated parking locations near frequently visited cultural sites. Traffic impacts would also decrease during the production phase, which would last for approximately 20 years.

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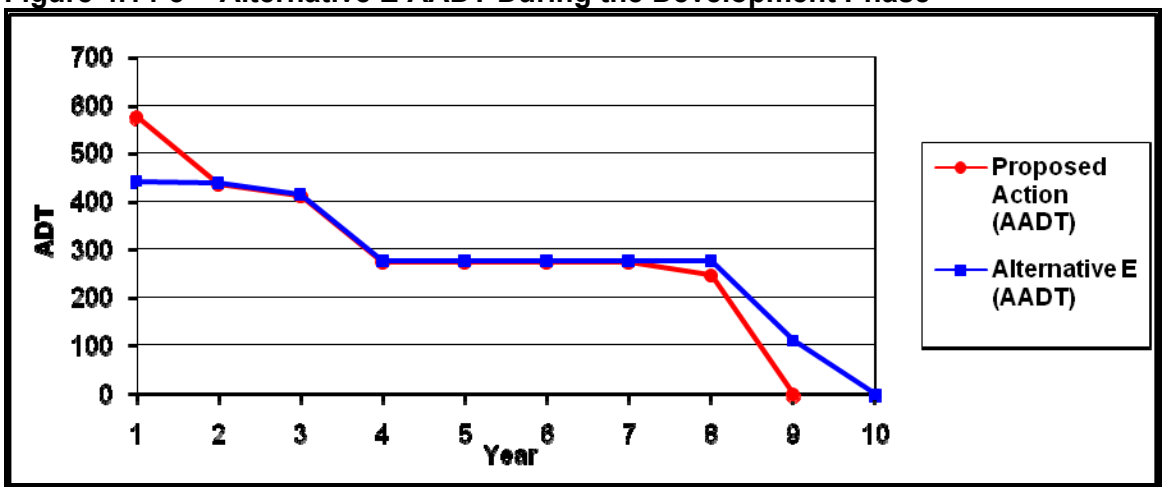
Figure 4.14-5 Alternative E AADT During the Development Phase



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In addition, BBC and other operators would limit the transportation of routine drilling supplies on weekends and holidays. Traffic data collected for this EIS show that recreational traffic constitutes between 20 and 45 percent of the total traffic on weekends (**Table 3.14-7**). Reducing traffic on weekends and holidays would reduce the potential for conflicts between project-related traffic and recreational traffic within the WTP Project Area, and particularly in Nine Mile Canyon.

4.14.6.3 BLM System Roads

Traffic-Related Impacts

Transportation-related impacts would be similar in nature to those described under the Proposed Action; however, they would be slightly lower during the first or peak year of development and substantially lower during production.

Similar to the Proposed Action, if the Agency Preferred Alternative were selected, drilling activities would be approved on a year-round basis throughout the entire WTP Project Area. Approval of year-round drilling activities would result in high traffic in crucial big game winter range, sage grouse winter habitat, and high country watersheds. Impacts to these resources are discussed in **Sections 4.9**, Wildlife; and **4.5**, Water Resources.

To partially mitigate the impacts of winter-time activity, under Alternative E, BBC and other operators would be required to comply with certain special protection measures. As discussed in **Section 2.6.1.3** and as illustrated on **Figure 2.6-1**, BBC and other operators would be required to reroute roads around crucial sage grouse habitat. Following construction of new roads, approximately 5.7 miles of existing roads would be closed and reclaimed. The effectiveness of special protection measures is addressed in **Section 4.9**.

One positive aspect of allowing year-round drilling is that BBC and other operators would not be required to move drill rigs in and out of the WTP Project Area each spring and fall. Rig mobilization and concentrating drilling activity during the summer months would intensify transportation-related impacts and conflicts with recreational users during these periods. Requirements to construct turnouts and visitor pullouts would improve safety along the WTP Project Area roads.

Construction Related-Impacts

If the Agency Preferred Alternative were selected, the total miles of proposed road (164 miles) would be slightly less than if the Proposed Action were selected (178 miles). Based upon the findings of the directional drilling report, no development would be permitted in canyon bottoms within reach of canyon rims. Therefore, less construction would occur in sensitive resource areas such as riparian areas, floodplains, and natural springs. In addition, there would NSO on unleashed lands within the Nine Mile Canyon ACEC, and reduction in the amount of road constructed within the WSAs. Equivalent levels of construction would likely be approved in high country watersheds and on steep slopes; however, these impacts would be moderated by BBC and other operators' compliance with transportation restrictions outlined in **Section 2.6.1.2** and best management practices and environmental protection measures discussed in **Tables 2.6-7** and **2.6-8**.

Under the Agency Preferred Alternative, new roads longer than 2 miles may be gated (i.e., closed to the public) in sensitive resource areas. In addition, all roads that would provide access to proposed well locations within the WSAs would be gated (regardless of length). In total, approximately 85 of the 164 miles of proposed road (including co-located road and pipeline) would be closed to the general public. Closure of new roads in the WTP Project Area, and particularly in the WSAs, would limit motorized access in areas that are currently not accessible by vehicle. Under Alternative E, maintaining road closures (i.e., gating roads) would be the responsibility of BBC and other operators. Monitoring compliance with the road closures would be the responsibility of the third party monitor selected by BBC, other operators, and the BLM (see **Appendix D**). No existing roads in the WTP Project Area would be closed.

Based upon the findings of the directional drilling report, under Alternative E, BBC and other operators would also be required to maximize the use of directional drilling within WSAs. Use of directional drilling has the potential to substantially reduce the amount of roads that would be constructed in these sensitive resource areas.

Existing Road Improvements

As discussed in **Section 2.6.2.2**, if Alternative E were implemented, BBC and other operators would be required to improve approximately 47 miles of existing road. Anticipated short-term disturbance associated with extensive road improvements would be approximately 124 acres. Roads needing extensive improvement, including Harmon Canyon, Cottonwood Canyon, the dugways to Flat Iron Mesa and Peter's Point, Cottonwood Spur, Cedar Ridge, and Jack Canyon are illustrated on **Figure 2.6-1**. As no development is anticipated in Dry Canyon, no road improvements would be necessary.

In some instances, BBC and other operators would be allowed to reroute roads as an alternative to improving existing roads. Proposed reroutes for the dugways to Flat Iron Mesa and Peter's Point, the Jack Canyon Road, and Horse Bench Road are also illustrated on **Figure 2.6-1**. If BBC and other operators select to reroute a road segment, the existing road would be closed and reclaimed upon completion of the new road. Anticipated short-term disturbance from road reroutes would be approximately 29 acres.

Prior to upgrading or rerouting a road, BBC and other operators would submit to the BLM for approval appropriate road plans and profiles that would demonstrate compliance with the established BLM road standards. Conformance with the BLM road standards could entail improving or rerouting additional road segments beyond those that are illustrated on **Figure 2.6-1**. This decision would be at the discretion of the AO.

With respect to the Jack Canyon, BBC and other operators would only be allowed to improve or reroute the road if they are unable to access their reserves from the canyon rim. Should construction within the canyon be necessary, BBC and other operators would be required to submit a plan of development for the proposed wells, roads, and pipelines that would be constructed in the bottom of the canyon prior to improving the existing road or constructing a new road. Improvement of the existing road or construction of new road would likely require authorization of a new ROW. If approved, the new ROW would be gated (i.e., limited administrative access only).

Where environmental conditions and/or economic considerations make road construction or upgrades to the BLM standards infeasible, BBC and other operators would be required to obtain a waiver to these standards from the AO.

Where feasible, compliance with the BLM road standards would mitigate environmental and safety concerns related to increased road usage. Widening access roads to a width of approximately 20 feet would allow for two-way traffic, thus reducing bottlenecking problems in steep canyons. Improving drainage and road surfacing would decrease long-term maintenance costs, dust, and erosion.

If Alternative E were implemented, no improvements would be made to the existing Prickly Pear Road, which is visible from Nine Mile Canyon. In addition, to ensure safety, only light truck traffic would be permitted to use the road.

4.14.6.4 Dust and Proposed Dust Suppression

As with all other alternatives, BBC and other operators would be require to put into operation a dust suppression plan, (see **Section 2.1.5.6**) which would substantially reduce the amount of dust generated by project-related traffic. The BLM would consider dust suppression efforts effective when (1) no dust is generated above the cab of the vehicle, or (2) there are no hanging dust plumes. A COA to this effect would be added to all APDs. While implementation of the dust suppression plan and compliance with these COAs would mitigate the majority of dust impacts, like Alternative C, Alternative E includes numerous other mitigation measures which would reduce the amount of project-related traffic, thereby further reducing the amount of fugitive dust generated in Nine Mile Canyon and elsewhere within the WTP Project Area.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.15 HEALTH AND SAFETY

4.15.1 Direct and Indirect Effects

4.15.1.1 Proposed Action

Under the Proposed Action, BBC and other operators plan to construction approximately 807 wells from 538 well pads over an 8-year period. The potential impacts on human health and safety associated with implementation of the Proposed Action would include:

- Occupational accidents and injuries;
- Increased traffic accidents;
- Adverse health effects from dust generation and emissions;
- Well fires, explosions, and accidental ignition of wildfires;
- Accidental rupture or damage of pipelines by heavy equipment;

- Use of hazardous materials and accidental spills; and
- Contact with hydrogen sulfide

In general, compliance with health and safety regulations would minimize human health and safety concerns. The following sections discuss each of the potential impacts in detail.

Occupational Hazards

The risks of serious accident or injury associated with oil and gas developments apply primarily to well site workers who are engaged in inherently hazardous activities working with high-pressure combustible gas. Statistical data on occupational accidents and fatalities for the oil and gas extraction labor category are available from the U.S. Bureau of Labor Statistics. Nationwide, the oil and gas industry experienced an accident rate of 2.1 accidents per 100 full-time workers and 25.6 fatalities per 100,000 workers in 2005 (BLS 2005). If the Proposed Action were implemented, during peak-development, BBC and other operators could employ as many as 358 employees per year. Based upon this employment rate, it is statistically probable that 7.6 occupational accidents would occur as a result of natural gas development during peak-development in the WTP Project Area. Similarly, based on the national rate for fatal accidents in the industry, there is a 9 percent chance of one fatality occurring during peak-development.

Potential for occupational accidents would be highest during peak-development when the number of employees and intensity of development is highest. The risk of accidents would likely drop in proportion to the decline in drilling and construction activities during the remainder of the development phase.

Compliance with applicable regulations including the Occupational Safety and Health Act (OSHA) would reduce the probability of occupational accidents. Assuming BBC and other operators are compliant with these regulations; occupational hazards would likely be below the national rate for the oil and gas industry.

Traffic Accidents

While it is assumed that increased traffic would increase the potential for vehicle accidents on roads that provide access to and within the WTP Project Area, it is difficult to predict the number of crashes. Variables other than traffic volume, including travel width, shoulder, curve radius, grade, traffic density, turnouts, roadside hazards, intersections, traffic controls, and sight distance could also affect the number of accidents. Approximately 30 percent of all project-related traffic would be truck traffic. Although truck traffic is not directly related to the number of accidents, the disparity in size and weight between passenger vehicles and medium to heavy trucks required from construction of oil and gas facilities could result in an increase in accidents that are fatal or cause serious injury.

If the Proposed Action were implemented, traffic volumes on critical access roads to the WTP Project Area would increase by approximately 550 percent during the development phase. Traffic-related impacts, including increased traffic accidents, are discussed in greater detail in **Section 4.14**, Transportation.

Dust Generation and Emissions

Project-related vehicle traffic on unpaved roads and the construction of roads, well pads, pipelines, and ancillary facilities would generate fugitive dust that would affect air quality. A constant exposure to respirable dusts over time could produce a decline in lung function. Individuals who smoke or have previously diagnosed respiratory illness have a greater risk in further reducing lung functions. To reduce potential impacts, the operators have agreed to put into operation a dust suppression plan, which would substantially reduce the amount of dust generated by industrial traffic in Nine Mile Canyon between Harmon and Cottonwood Canyons, as well as in Harmon and Cottonwood Canyons. Water would be used as dust control on other high-traffic routes during construction activities. Air quality in and near the WTP Project Area would also be impacted by vehicle emissions, operation of compressors, and occasional flaring during completion operations. Adverse air quality impacts are discussed in detail in **Section 4.3**, Air Quality.

As an alternative to using dust suppression or due to safety concerns, certain road segments within Nine Mile, Gate, or the lower reaches of Harmon and Cottonwood Canyons, may be improved with hard surfacing, such as asphalt, chip and seal, or other materials, as approved by the BLM or counties as appropriate. Should BBC and other operators pave road segments, dust impacts would effectively be eliminated. Decreases in dust and improved road conditions could potentially result in increased driver visibility, which could improve safety along roads within the WTP Project Area.

Well Fires, Explosions, Ignition of Wildfires

The development of natural gas wells includes the potential for well fires or explosions. Well fires could result from a blowout during drilling or work over, or from a gas leak during operations. Drilling operations on Federal mineral leases must comply with Onshore Oil and Gas Order Number 2, Drilling (Title 43 CFR Part 3160). This rule establishes standard safety procedures for drilling and minimum blowout-prevention equipment to control abnormally high pressures if they are encountered during drilling operations.

Well operations on Federal leases are also regulated under Title 43 CFR Chapter II, Subpart 3162.5 - Environmental Obligations. Approval of a drilling plan is required as part of the permitting process. The plan must address the procedures to be employed for fire prevention and firefighting procedures.

Increased human activity, increased public access, and natural gas development could result in a higher potential for wildfires. Because the WTP Project Area is contained within a FMU where wildland fires are fought aggressively, there would be no change to fire management prescriptions if the Proposed Action were implemented. New and improved access roads within the WTP Project Area could make initial attack on wildland fires easier. The proposed development would also create fuel breaks (e.g., areas where there is no vegetation) that could be effective in preventing the spread of wildland fires.

Human-caused wildfires resulting from unsafe well control practices would be averted by compliance with regulatory requirements and standard voluntary applicant-committed

mitigation measures which are discussed in **Table 2.2-6**. In general, well pads would be kept free of vegetation and trash in order to minimize the potential of wildfires.

Pipeline Hazards

Pipelines are the safest and most cost-effective means to transport natural gas; nonetheless, additional natural gas pipelines in the WTP Project Area would increase the potential for leaks or ruptures. Most ruptures occur when heavy equipment accidentally strikes a pipeline. Serious ruptures could potentially result in a fire or explosion.

Under the Proposed Action approximately 167 miles of new pipeline would be installed adjacent proposed roads, 19.5 miles of new pipeline would be installed along existing roads, and 10 miles of pipeline would be independent of road (cross-country). The Office of Pipeline Safety does not collect statistical data for gathering lines. Therefore, of the purposes of analysis, the likelihood of an incident involving a leak or rupture was determined by using statistical data for transmission lines. In 2005, statistical data for transmission lines showed that there was approximately one incident involving a leak or rupture for every 1,639 miles of pipeline. Based upon these statistics there is approximately a 12 percent chance that one incident could occur in the WTP Project Area during each year of the project. Statistics show that only 5 percent of incidents result in injury or fatality. Thus, the probability of a serious injury or fatality occurring is very unlikely.

Under the Proposed Action the majority of pipelines would be surface-laid and co-located next to new or existing roads. As such, the chance of heavy equipment damaging a pipeline is increased. Compliance with Federal Regulations pertaining to pipeline safety CFR Title 49 Part 186-199 would reduce potential leaks or ruptures.

Risk of Accidental Spills

Oil and gas development would increase the potential for accidental spills in the WTP Project Area; however, the risk of spills would be minimized by compliance with the regulations listed below.

Transportation of hazardous materials is addressed in Federal regulations (Title 49 CFR, and Parts 171-180). Under Title 40 CFR Parts 355, 370, and 372, facilities and operations that store significant amounts of chemicals must notify certain government agencies (e.g., EPA and DOT). The threshold quantity for most chemical is 10,000 pounds. For facilities with an above ground storage capacity of more than 1,320 gallons of oil or petroleum products, Federal regulations (Title 40 CFR part 112) require an SPCC plan. The goal of the SPCC is to prevent spills from reaching waterways.

These procedures are intended to minimize the potential for spills that could contaminate surface water or groundwater. The procedures are also intended to reduce hazardous material exposure to workers and the public. The BLM also requires the construction of containment berms of around aboveground tanks to minimize the impacts of leaks and spills. Bermed areas must be constructed to contain 110 percent of the capacity of the tank.

Hydrogen Sulfide

Samples from BBC wells within the WTP Project Area show that there is no hydrogen sulfide in the WTP Project Area. Therefore, hydrogen sulfide would not be expected during the extraction of additional natural gas. Thus, there would be no risks to health and safety.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

There are no irreversible and irretrievable effects that are specific on health and safety.

4.15.1.2 Alternative B- No Action

Under the No Action Alternative, approximately 81 gas wells would be drilled from 54 locations. For the purposes of analysis it is assumed that health and safety impacts would be similar to the impacts discussed under the Proposed Action. However, the potential for occupational accidents; pipeline leaks or ruptures; well fires, explosions and wildfires; and accidental spills would decrease because fewer wells, pipelines, and roads would be constructed. Health and safety risks such as traffic accidents and exposure to air pollutants would also be reduced seeing that traffic volumes, dust generation, and compression would be scaled in relationship to the amount of natural gas development.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

There are no irreversible and irretrievable effects that are specific on health and safety.

4.15.1.3 Alternative C- Transportation Impact Reduction Alternative

If Alternative C were implemented, BBC and other operators would construct the same number of wells pads, roads, and pipelines that they would constructed if the Proposed Action were implemented. The primary difference between Alternative C and the Proposed Action would be the intensity and the duration of the impacts. Under Alternative C, the intensity of development would be controlled by limiting the number of rigs operating at any given time and by surface disturbance thresholds.

In terms of health and safety impacts, intensity and duration have less bearing on impacts than the proposed number of well pads, roads, and pipelines. As such, the majority of health and safety impacts would be similar to those described in the Proposed Action. Impacts that would be different are discussed in the sections below.

Traffic Accidents

During the peak years of development and production, average daily traffic in the WTP Project Area would be reduced by 55 to 78 percent. In addition, if Alternative C were implemented, where feasible, BBC and other operators would be required to upgrade all the BLM system roads in accordance with the BLM road standards discussed in the *WTP Transportation Plan*. Reduced traffic volumes and compliance with the BLM road standards would likely decrease the number of potential accidents. Additionally, under Alternatives C, BBC and other operators would be required to construct a new route through Trail canyon, which would reduce the volume of traffic in Gate Canyon as well as in portions of Nine Mile Canyon (between Gate and Harmon Canyons). Reductions

in the amount of industrial traffic on Nine Mile Canyon Road could minimize the potential for recreational/industrial traffic accidents.

Dust Generation and Emissions

Limitations placed on the intensity of development would reduce fugitive dust emissions which are generated by construction activities. In addition, decreased traffic volumes would lessen the amount of fugitive dust generated by traffic on unpaved roads. When compared with the Proposed Action, potential human health impacts from peak 24-hour and annual vehicle dust generation and emissions would be substantially lower.

Pipeline Hazards

Under Alternative C, it is assumed that approximately 62 percent of the pipelines would be buried and 38 percent would be surface-laid. The disadvantage of burying pipelines is that it is more difficult to detect pipeline leaks. The key advantage of burying pipelines is that there is less risk of pipelines being damaged by heavy equipment operating on WTP Project Area roads.

Under Alternative C, gates would be used to prevent the public from using the majority of new roads that provide access to proposed well locations. Public closures of new roads that are co-located with pipeline would also decrease the risk of pipelines being damaged by motorized vehicles.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

There are no irreversible and irretrievable effects that are specific on health and safety.

4.15.1.4 Alternative D- Conservation Alternative

If Alternative D were implemented, BBC and other operators would construct approximately 35 percent fewer well pads, pipelines, and roads in the WTP Project Area than they would construct if the Proposed Action were implemented. For the purposes of analysis, it is assumed that the extent of health and safety impacts would decrease commensurate with decreased development.

In addition, if Alternative D were selected, the intensity of development would be controlled by limiting the number of rigs operating at any given time, seasonal restrictions, and by surface disturbance thresholds. Controlling the intensity of drilling activity would lengthen the duration of impacts. As previously mentioned, in terms of health and safety, intensity and duration have less bearing on impacts than the proposed number of well pads, roads, and pipelines. Nevertheless, limitations placed on the intensity of development would limit peak 24-hour fugitive dust and emissions generated by construction activities and traffic on unpaved roads.

Under Alternative D, gates would be used to prevent the public from using the Cedar Ridge, Horse Bench, Jack Canyon, and Jack Ridge roads. Public closures of these roads would reduce incidence for vehicle accidents or strandings in these areas.
If Alternative D were implemented, BBC and other operators would be required to upgrade all the BLM system roads in accordance with the BLM road standards

discussed in the *WTP Transportation Plan*. Compliance with the BLM road standards could potentially decrease the number of accidents.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

There are no irreversible and irretrievable effects that are specific on health and safety.

4.15.1.5 Alternative E- Agency Preferred Alternative

If the Agency Preferred Alternative were implemented, BBC and other operators would construct approximately the same number wells that they would construct if the Proposed Action were implemented. The primary difference between the Agency Preferred Alternative and the Proposed Action would be the intensity and the duration of the impacts. Under the Agency Preferred Alternative, the intensity of development would be controlled by surface disturbance thresholds.

In terms of health and safety impacts, intensity and duration have less bearing on impacts than the proposed number of well pads, roads, and pipelines. As such, the majority of health and safety impacts would be similar to those described in the Proposed Action. Impacts that would be different are discussed in the sections below.

Traffic Accidents

During the first or peak-year of development, average daily traffic in the WTP Project Area would be reduced by approximately 23 percent. During production traffic would be reduced by approximately 65 percent. In addition, if the Agency Preferred Alternative were implemented, where feasible, BBC and other operators would be required to upgrade all the BLM system roads in accordance with the BLM road standards discussed in the *WTP Transportation Plan*. Reduced traffic volumes and compliance with the BLM road standards, which could include increasing road width, eliminating blind corners, and constructing additional turnouts, would likely decrease the number of accidents. In addition, traffic-related impacts may be reduced under this alternative as a result of the construction of turnouts and/or designated parking locations near frequently visited cultural sites in Nine Mile Canyon.

Dust Generation and Emissions

Limitations placed on the intensity of development would reduce fugitive dust emissions which are generated by construction activities. In addition, decreased traffic volumes would lessen the amount of fugitive dust generated by traffic on unpaved roads. When compared with the Proposed Action, potential human health impacts from peak 24-hour and annual vehicle dust generation and emissions would be substantially lower.

Pipeline Hazards

Under Alternative E, it is assumed that approximately 62 percent of the pipelines would be buried and 38 percent would be surface-laid. The disadvantage of burying pipelines is that it is more difficult to detect pipeline leaks. The key advantage of burying pipelines is that there is less risk of pipelines being damaged by heavy equipment operating on WTP Project Area roads.

Under the Agency Preferred Alternative, gates would be used to prevent the public from using the approximately half of the new roads that provide access to proposed well locations. Public closures of proposed roads which are co-located with pipeline also decrease the risk of pipelines being damaged by motorized vehicles.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

There are no irreversible and irretrievable effects that are specific on health and safety.

4.16 VISUAL RESOURCES

4.16.1 Alternative A – Proposed Action

Development of natural gas in the WTP Project Area would alter the visual quality of the landscape from key vantage points, including travel routes and popular use areas. In addition, the proposed development would affect the existing VRM designations where development is inconsistent with existing classification requirements.

While past and ongoing natural gas development activities have introduced an industrial aspect to the WTP Project Area landscape, the current landscape is primarily natural with little evidence of human activity. Implementation of the Proposed Action would result in a noticeable increase in density of gas-production facilities throughout the WTP Project Area that would constitute a substantial change in the visual character of the existing landscape.

Impacts to visual resources would be considered adverse if the landscape, as seen from sensitive viewpoints, is substantially degraded or if modifications to the landscape are inconsistent with the VRM classification requirements prescribed by the BLM.

4.16.1.1 Short-Term Disturbance

The addition of 807 wells from 538 well pads and 178 miles of associated access roads (the majority of which would be co-located with pipeline) would result in a mixed rural/industrial landscape throughout the WTP Project Area. Additional components that would adversely affect the visual character of the landscape are pumping units, compressor stations, aggregate borrow areas, worker housing locations, water management facilities, equipment storage areas, and airstrips. Proposed facilities would introduce new elements of form, line, color, and texture into the landscape (as defined in **Appendix L**, the *Visual Resources Technical Support Document*), which would dominate foreground views. The rugged terrain throughout the Project Area would effectively screen much of the development from middle- and background viewing distances. However, in some instances, especially where expansive views from mesas and benches are available, proposed development would be visible from the middle- and background and could, occasionally, dominate the view.

During the 8-year development phase, direct impacts to visual resources would occur as a result of the addition of natural gas facilities, including clearing practices that remove vegetation and grading practices that create cut and fill slopes. Under the Proposed Action, all pipelines would be surface-laid with the exception of road crossings and sensitive areas as determined during onsite inspections. Surface-laid pipelines would be insulated with tin wrap that would be grey galvanized or painted tan to blend with the

surrounding landscape. Surface lines would not require substantial removal of vegetation so the short-term visual impacts would be less obvious than for facilities requiring substantial clearing and grading. However, surface pipelines would introduce new elements of form, line, color, and texture into the landscape that would last throughout the LOP (approximately 33 years).

Access roads that cut across the natural contours of the land to well sites, particularly on slopes where cutting and filling would be necessary, would have a greater visual impact than access roads that are aligned with the natural topographical contours. BBC and other operators have committed to align roads with the topography instead of cutting across the natural contours to access well pads. While this method minimizes visual impacts, it can result in a greater total area of surface disturbance.

Construction activities would generally be clustered both spatially and temporally. The visual intrusion of construction activities would generally be limited to the immediate vicinity of the activity and would not affect users outside of the viewshed of each construction site, with the exception of those areas visible from benches and mesas. Because drilling activities would typically occur 24-hours per day, visual impacts would include lighting of drill rigs and vehicle lights during nighttime hours. Safety and operational lighting at surface facilities such as compressor stations, temporary worker housing facilities, equipment storage facilities, etc., may be visible from short distances where the viewshed is screened by topography or vegetation, or from long distances in open areas. Nighttime lighting on drill rigs would be visible from long distances.

During the construction phase, the visual landscape as experienced from sensitive viewpoints, including travel routes and popular use areas, would be indirectly impacted by vehicles transporting equipment, materials, and personnel to and from the construction sites. Industrial traffic traveling on unpaved roads would generate dust. Dust generation and resulting impacts would be reduced along primary access roads including the Nine Mile Canyon, Harmon Canyon and Cottonwood Canyon roads with the adherence to the dust suppression plan (**Appendix R**).

4.16.1.2 Long-term Disturbance

Once construction activities are completed, long-term visual impacts would consist of reduced visual harmony within the overall landscape due to modifications that create lasting contrasts. Long-term landscape contrasts would result from vegetation removal and land work associated with well pads, roads, pipelines, and other facilities. Once production facilities are installed, portions of well pads, access roads, and pipeline ROWs that are not needed for production would be reclaimed; however, much of the disturbed area would continue to contrast with the natural form, line, color, and texture of the surrounding landscape. Production facilities would also be a long-term contrast with the natural landscape. Long-term disturbance would last for the LOP until field abandonment and final reclamation has been achieved.

During the production phase, indirect impacts to visual resources would occur as a result of production activities (e.g., industrial traffic, heavy equipment use, vehicle lights at night, and dust). However, human activity would be substantially lower than during the development phase. Safety and operational lighting at surface facilities such as compressor stations, equipment storage facilities, etc., may be visible from short

distances where the viewshed is screened by topography or vegetation, or from long distances in open areas.

4.16.1.3 Conformance with Visual Resource Management Class Objectives

As noted above, 538 well pads and associated facilities are proposed within the WTP Project Area under the Proposed Action. Facilities are proposed within areas identified as VRM Class I, II, and III (**Figure 3.16-1**). In some instances, development would not be in conformance with the existing management class objectives within which they fall. In those areas where development would fail to meet VRM Class objectives, the land would effectively be displaced from the existing BLM inventory of lands managed under that particular class. **Table 4.16-1** summarizes the development proposed within each VRM class in the WTP Project Area.

Table 4.16-1 Proposed Development and Estimated Surface Disturbance by VRM Class within the WTP Project Area under the Proposed Action

VRM Class	Total Acres of Land within VRM Classes	# Proposed Well Pads	Short-term Surface Disturbance (acres)	Short-term Surface Disturbance (percent)	Long-term surface Disturbance (acres)	Long-term Surface Disturbance (percent)
Class I	36,367	43	223	0.6	123	0.3
Class II	71,362	331	2,074	2.9	1,114	1.6
Class III	29,764	166	1,154	3.8	622	2.1
Class IV	423	0	0	0	0	0

= number

Visual Resource Management Class I Areas

As summarized in **Table 4.16-1**, a total of 43 new well pads would be constructed in VRM Class I areas, which are limited to the Jack Canyon and Desolation Canyon WSAs. Proposed development in these areas are on leases within the existing Peter's Point unit, which constitute valid existing rights. As detailed in **Section 3.16**, Class I objectives provide for the preservation of the existing character of the landscape. The level of change to the characteristic landscape should be very low and should not attract attention.

Due to the existence of leases with valid existing rights, disturbance would occur within WSA areas which would not meet VRM Class I objectives. The typical procedure would be to amend the VRM class to meet the necessary level of disturbance. However, because the areas (Jack Canyon and Desolation Canyon) will continue to be designated as WSAs, the BLM is required to maintain the VRM Class I designations in these areas. An amendment to the VRM class would take place only after a wilderness decision is reached by Congress.

Onsite inspections of visual resources would be required prior to drilling in Class I areas to determine appropriate mitigation measures.

Visual Resource Management Class II Areas

VRM Class II lands comprise the majority of the WTP Project Area. Consequently, most of the planned development falls within VRM Class II areas. Under the Proposed Action, 331 well pads would be constructed in VRM Class II areas. While the majority of the planned development within VRM Class II areas would take place on Prickly Pear Mesa, concentrated development is also planned on Horse Bench, and limited development is planned within the canyon bottoms (namely Nine Mile Canyon and Dry Canyon). While visual intrusions would result from the development of well pads within Nine Mile Canyon, those proposed facilities are on private parcels and would not be managed under the BLM's VRM system.

The objective of VRM Class II is to provide for management activities that retain the existing character of the landscape. The level of change to the characteristic landscape should, therefore, be minimal. Where possible, development in these areas should be located and designed in a manner to meet VRM objectives. Typically, onsite evaluations and visual contrast ratings would be required prior to drilling in all Class II areas to determine appropriate mitigation measures. However, given the level of proposed development, wells and associated facilities in VRM Class II areas would fail to meet the BLM Class II objectives in most cases (i.e., to retain the existing character of the landscape). Areas including portions of Prickly Pear Mesa, Flat Iron Mesa, Dry Canyon, and Horse Bench have high proposed well pad densities and a low potential for vegetative and topographic screening. The VRM class would need to be amended, in these cases, to VRM Class IV. The area known as Peter's Point would need to be amended to VRM Class III.

Visual Resource Management Class III Areas

As summarized in **Table 4.16-1**, a total of 166 new well pads and associated facilities would be constructed within VRM Class III areas under the Proposed Action. These areas are located primarily along Flat Iron Mesa, Cottonwood Ridge, and portions of Horse Bench (**3.16-3**). Class III objectives provide for activities that may contrast with the basic landscape elements, but remain subordinate to the existing landscape character. Activities in Class III areas may be visually evident, but should not be dominant.

Given the level of development proposed in Class III areas and limited visual mitigation, it is unlikely that all development would remain subordinate to the existing landscape character. Where the development fails to meet Class III objectives, the VRM class would need to be amended to a VRM Class IV.

Visual Resource Management Class IV Areas

No development is proposed within VRM Class IV areas of the WTP Project Area.

Private and State Lands

In addition to the development listed above, there are also facilities proposed on private and State lands in the WTP Project Area. Private and State lands are included in the BLM inventory of visual resources and the proposed facilities located on private and State lands are included in the total disturbance acres summarized in **Table 4.16-1**; however, while visual impacts would occur in these areas as described in **Sections 4.16.1.1** and **4.16.1.2**, the BLM does not manage the visual resources on private and State lands.

4.16.1.4 Viewsheds and Key Observation Points

A GIS-based viewshed analysis was conducted to determine those areas that could potentially be seen by visitors along major travel corridors throughout the WTP Project Area and as a baseline for selecting key observation points (KOPs). Viewsheds were run for Nine Mile Canyon, Harmon Canyon, Dry Canyon, Cottonwood Canyon (including the dugway to Flat Iron Mesa), Jack Canyon, Desolation Canyon, Jack Ridge, Cedar Ridge, Horse Bench, and Prickly Pear Mesa. For more information on the analysis see the *Visual Resources Technical Support Document* (**Appendix L**).

Table 4.16-2 summarizes the number of well pads that could potentially be visible from each of the travel corridors chosen for analysis. It is important to note that GIS-based viewshed analyses do not take into consideration vegetative screening. Additionally, the resolution of the Digital Elevation Model (DEM) (10 meters) used in the viewshed analysis likely excludes additional topographic features, which would effectively screen the proposed site locations from view of the casual observer. The actual number of visible well pads and facilities would, therefore, likely be lower than that reported. Finally, the viewsheds were run from points along these routes, meaning that not all wells visible from the route would be visible at one time, but rather, a person traveling along any given route could potentially see the listed number of wells at some point along that route.

Table 4.16-2 Potentially Visible Well Pad Locations from Travel Corridors within the WTP Project Area

Travel Corridor	Potentially Visible Well Pad Locations
Nine Mile Canyon	5
Harmon Canyon	0
Dry Canyon	21
Cottonwood Canyon – lower reaches	0
Flat Iron Mesa	30
Jack Canyon	9
Desolation Canyon	3
Jack Ridge	57
Cedar Ridge	80
Horse Bench	213

Analysis of the viewsheds revealed that new development within the WTP Project Area would not be visible from Prickly Pear Canyon Road or the roads along the lower

reaches of Dry, Cottonwood, or Harmon Canyons due to their incised nature and steep faces. The lower reaches of these canyons, along with the entire length of Nine Mile Canyon are the primary travel corridors for non-industrial visitation to the WTP Project Area and would therefore represent the areas of highest viewer sensitivity. Within Nine Mile Canyon, only the well pads and facilities proposed within the canyon itself (five well pads located on private parcels) would be visible.

Three of the proposed well pad locations along Cedar Ridge could be visible from the Green River in Desolation Canyon, which is another area of high viewer sensitivity. Those three well pads would be in the middle ground viewing distance from the river, and could be visible from isolated locations. Impacts would be greatest during the drilling phase, which typically occurs 24-hours per day and includes lighting of drill rigs during nighttime hours. Nighttime lighting on drill rigs would likely be visible from the Green River.

Within Dry Canyon, only the development proposed within the canyon itself (21 well pads and associated facilities) would be visible from Dry Canyon Road. Within Jack Canyon, only the development proposed within the canyon itself (nine new well pads) would be visible from the road.

From Flat Iron Mesa Road, a limited amount of development (approximately 30 new well pads) would potentially be visible to the casual visitor. However, this route receives very limited non-industrial use.

While the route along Horse Bench is not a widely used travel way within the WTP Project Area, vast amounts of land can be seen from this bench. From Horse Bench, an estimated 210 new well pads would be visible, primarily in the middle-ground distance (3 to 5 miles), but also within the foreground (0 to 3 miles) and background (over 5 miles) distances as well.

Prickly Pear Mesa also offers broad views of the WTP Project Area. This travel route, however, receives very little non-industrial use because it provides very limited access to other parts of the WTP Project Area.

Finally, views into (and limited access into) the Jack Canyon and Desolation Canyon WSAs are best provided by the routes along Jack Ridge and Cedar Ridge. Approximately 67 new well pads would be visible along the Jack Ridge Road and approximately 105 new well pads would be visible along Cedar Ridge Road.

Using a combination of field visits, viewshed analysis, and local knowledge of the area, KOPs were selected throughout the WTP Project Area. Among the initial KOPs selected were the Daddy Canyon developed recreation facility, the Great Hunt Panel, and numerous cultural sites along Nine Mile Canyon that receive frequent visitation. All of these KOPs were dropped from further consideration following the viewshed analysis, which revealed that new development within the WTP Project Area would not be visible from any of the aforementioned sites.

KOPs brought forward for analysis provide a representative view of the WTP Project Area (e.g., canyon bottoms, sage brush flats, pinyon-juniper areas, and views into side canyons). Visual simulations were prepared from each of the chosen KOPs to depict how the construction of natural gas facilities would change the visual landscape at

representative KOPs. Construction equipment, drilling and completion supplies, and human activity, which would also be visible to the casual viewer, are not depicted in the simulations. Simulations are included in the *Visual Resources Technical Support Document* (**Appendix L**).

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible Effects

Construction activities that would result in changes to the topography of the WTP Project Area would have an irreversible effect on visual resources.

Irretrievable Effects

The placement of natural gas facilities and the removal of vegetation would create visual contrasts that would last the LOP.

4.16.2 Alternative B - No Action

Under Alternative B, natural gas development would continue on private and State lands throughout the WTP Project Area, but would not be allowed on Federal leases. Visual impacts of activities on State and private leases would not be managed for visual resources under the VRM system. Impacts to Federal lands would be limited to ROWs necessary to gain reasonable access to private and State leases. Numerous wells would still be visible from KOPs within the WTP Project Area; however these impacts would be substantially less than all other alternatives based on reductions in the amount of overall development activity. No wells would be visible from the Green River.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.16.3 Alternative C – Transportation Impact Reduction

The level of development, location of facilities, and expected surface disturbance under Alternative C would be nearly identical to those described for the Proposed Action. Therefore, potential impacts to visual resources resulting from the implementation of Alternative C are also expected to be nearly identical to those described for the Proposed Action. Specific differences are noted below.

While the level of development under Alternative C would be nearly identical to that under the Proposed Action, the implementation of Alternative C would increase the overall LOP by approximately 7 years. Short-term construction-related visual impacts would, therefore, be evident over a longer period of time. However, the annual level of construction activity and surface disturbance would be reduced, as would the number of rigs in operation at any given time, so the visual impacts would be dispersed over a longer period of time.

With the extended LOP, traffic during the construction period is expected to be reduced by approximately 55 to 78 percent (depending on the season) when compared to the Proposed Action. This substantial decrease in traffic would reduce traffic-related visual

impacts proportionately (e.g., dust and the sights of industrial traffic). Adherence to the dust abatement plan would also reduce traffic-related visual impacts.

Under Alternative C, there is a mixture of buried and surface-laid pipeline proposed. Burial of pipelines is expected to occur on 62 percent of the project, with the other 38 percent being surface-laid. Where blasting would be necessary, changes in local topography would be evident. Impacts would be reduced with the requirement to use rock saws wherever possible. In the short-term, buried pipelines would result in a larger area of vegetative clearing and ground leveling as they would be installed adjacent to proposed and existing roads. Clearing would be kept to a minimum and topsoil and scalped vegetation would be placed back on the ROW to facilitate reclamation and reduce visual impacts. In the long term, buried pipeline corridors would begin to revegetate and blend with the surrounding landscape.

All new roads more than 2 miles long and roads that provide access to proposed wells within the Jack Canyon and Desolation Canyon WSAs, as well as the Horse Bench road, would be gated and closed to non-development-related and administrative motorized use on a year-round basis. While gating of roads would not reduce physical impacts to visual resources, it would reduce the number of observation corridors from which visitors could see development and development activity and thus reduce visual impacts on recreational use (Newman 2009, Gremillion 2009). The proposed new road into Jack Canyon (which falls within a VRM Class II area) would be visible from various locations within the Jack Canyon WSA.

Under Alternative C, environmental BMPs contained in WO IM 2007-021 and the latest version of the Gold Book (DOI-USDA 2007) (**Table 2.6-7**), as well as additional environmental protection measures and mitigating measures identified by the BLM and its cooperators (**Table 2.6-8**), would be uniformly applied across the WTP Project Area, many of which directly apply to visual resources.

4.16.3.1 Conformance with Visual Resource Management Class Objectives

Visual Resource Management Class I Areas

Visual impacts to VRM Class I Areas (the Jack Canyon and Desolation Canyon WSAs) would be similar to those described under the Proposed Action, with the exception that impacts would be mitigated as detailed in **Tables 2.6-7** and **2.6-8**. Regardless of mitigation measures, however, any disturbance within VRM Class I areas would be inconsistent with the management prescriptions for those areas. As with the Proposed Action, the typical procedure would be to amend the VRM class to meet the necessary level of disturbance. However, because the areas (Jack Canyon and Desolation Canyon) will continue to be designated as WSAs, the BLM is required to maintain the VRM Class I designations in these areas. An amendment to the VRM class would take place only after a wilderness decision is reached by Congress.

Visual Resource Management Class II Areas

Visual impacts to VRM Class II areas would be nearly identical to those described under the Proposed Action because the development scenarios are virtually identical. The primary difference between Alternative C and the Proposed Action would be the Trail Canyon re-route. Construction of the Trail Canyon route would lead to additional

disturbances within VRM Class II areas to the north of the Project Area (within the Nine Mile Canyon ACEC). In addition, under Alternative C visual impacts would be mitigated as detailed in **Tables 2.6-7** and **2.6-8.**

The objective of VRM Class II is to provide for management activities that retain the existing character of the landscape. The level of change to the characteristic landscape should, therefore, be minimal. Implementation of BMPs and mitigation measures, as well as onsite inspections, would reduce the amount of visual contrast resulting from the proposed development. In some areas, where topography and vegetative screening is optimal, VRM Class II objectives would be met. As with the Proposed Action, however, given the level of proposed development, most wells and associated facilities in VRM Class II areas (Prickly Pear, Horse Bench, Flat Iron Mesa, and Dry Canyon) would fail to meet the BLM Class II objectives (i.e., to retain the existing character of the landscape). The VRM class would need to be amended, in these cases, to a VRM Class III.

Visual Resource Management Class III Areas

The level of development in VRM Class III areas would be identical to that described under the Proposed Action. Under Alternative C, however, visual impacts would be mitigated as detailed in **Tables 2.6-7** and **2.6-8**. Because Class III objectives provide for activities that may contrast with the basic landscape elements, but remain subordinate to the existing landscape character, with the implementation of BMPs and environmental protection measures, the majority of the proposed development in VRM Class III areas would meet the objective. Given the level of proposed development and the lack of visual and topographic screening on Horse Bench, additional mitigation measures would be applied to this are as detailed in **Tables 2.6-7** and **2.6-8** to ensure that VRM Class III objectives are met.

Visual Resource Management Class IV Areas

No development is proposed within VRM Class IV areas of the WTP Project Area.

Private and State Lands

Impacts to private and State lands under Alternative C would be identical to those described under the Proposed Action

4.16.3.2 Viewsheds and Key Observation Points

Viewshed analysis under Alternative C is identical to that described under the Proposed Action given that the development footprint is identical under both alternatives. However, BMPs and mitigation measures described in Chapter 2 would likely reduce the actual number of visible well pads and development within each viewshed.

Specifically regarding conceptual well locations within the viewshed of the Green River, no development would be permitted unless to do so would preclude the development of valid and existing lease rights. If development were to occur within the viewshed, drilling and completion would only be permitted outside of the high use river recreation season (May 15th to August 15th) which would limit the number of users that would be impacted. In addition, lighting at drilling locations and facilities would be downshielded/directed to areas where development activities are occurring, which would minimize the area

impacted by nighttime lighting. Based upon the aforementioned mitigation measures, it is likely that impacts to Green River recreationists would be reduced when compared to the Proposed Action.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.16.4 Alternative D – Conservation Alternative

Under Alternative D, BBC and other operators would construct approximately 558 wells from 348 well pads, which is approximately 65 percent of the total number of well pads proposed under the Proposed Action and Alternative C. Ancillary facilities including roads and pipelines would also be reduced in proportion to the reduction in well numbers. The duration of development would be approximately 21 years and drilling windows would be limited by seasonal restrictions.

In general, potential impacts to visual resources under Alternative D would be similar in nature to those described under the Proposed Action but the magnitude of the impacts would be reduced in proportion to the reduction in planned development. However, this reduction would not be equally distributed across the WTP Project Area. Specifically, there would be no new well pads constructed in the following areas:

- Federal lands within Jack Canyon and Desolation Canyon WSAs;
- Federal lands within the Desolation Canyon NHL;
- Unleased Federal lands within areas designated as likely to have wilderness characteristics;
- Unleased Federal lands within the potential Nine Mile Canyon and Desolation Canyon ACECs; and
- Federal lands within canyon bottoms (where doing so would not preclude the development of valid and existing lease rights).

Additionally, impacts during the construction period would be reduced seasonally as no winter drilling would occur.

Under Alternative D, environmental BMPs contained in WO IM 2007-021 and the latest version of the Gold Book (DOI-USDA 2007) (**Table 2.6-7**), as well as additional environmental protection measures and mitigating measures identified by the BLM and its cooperators (**Table 2.6-8**), would be uniformly applied across the WTP Project Area, many of which directly apply to visual resources. Adherence to the Dust Abatement Plan would also reduce fugitive dust generation within Nine Mile, Harmon, and Cottonwood Canyons. Finally, under Alternative D, the BLM would gate Cedar Ridge, Horse Bench, Jack Canyon, and Jack Ridge roads. While gating of these roads would not effect development impacts to visual resources, it would reduce negative visual impacts associated with motorized access in visually sensitive landscapes (i.e., VRM Class I and II areas). Gating of these roads to the public would specifically reduce unauthorized motorized vehicle use within Jack and Desolation Canyons thereby preserving the naturalness of these areas, reducing visual impacts on recreational use within these areas (Newman 2009, Gremillion 2009). Gates on the roads to Horse

Bench and Cedar Ridge would similarly reduce traffic related visual impacts along these roads, which also provide access into VRM Class I and II areas.

4.16.4.1 Conformance with Visual Resource Management Class Objectives

Potential visual impacts in relation to conformance with VRM class objectives would be reduced, when compared to the Proposed Action, as a result of the reduced level of development and the implementation of BMPs and environmental mitigation measures detailed in **Tables 2.6-7** and **2.6-8**. Estimated surface disturbance in each VRM Class is summarized in **Table 4.16-3**.

Table 4.16-3 Proposed Development and Estimated Surface Disturbance by VRM Class within the WTP Project Area under Alternative D

VRM Class	Total Acres of Land within VRM Classes	# Proposed Well Pads	Short-term Surface Disturbance (acres)	Short-term Surface Disturbance (percent)	Long-term surface Disturbance (acres)	Long-term Surface Disturbance (percent)
Class I	36,367	0	0	0	0	0
Class II	71,362	236	1,532	2.1	1,077	1.5
Class III	29,764	112	826	2.8	593	2.0
Class IV	423	0	0	0	0	0

= number

Visual Resource Management Class I Areas

As no surface disturbance would be allowed within the Jack Canyon and Desolation Canyon WSAs, there would be no impacts to visual resources in VRM Class I areas under Alternative D.

Visual Resource Management Class II Areas

Visual impacts to VRM Class II areas would be reduced under Alternative D as compared to the Proposed Action. Under Alternative D, only 236 well pads are proposed in VRM Class II areas as compared to 331 pads under the Proposed Action. Implementation of BMPs and mitigation measures would further reduce the amount of visual contrast resulting from the proposed development.

It should be noted that in VRM Class II areas, development within the canyon bottoms would be substantially reduced and development on Horse Bench would be limited to existing leases. The visual impact to these areas, therefore, would be substantially reduced.

In some areas, where topography and vegetative screening is optimal, VRM Class II objectives could be met. Given the level of proposed development, however, many wells and associated facilities in VRM Class II areas would fail to meet the BLM Class II objectives (i.e., to retain the existing character of the landscape). Areas that would need to be amended to a VRM Class II would include Prickly Pear Mesa, Flat Iron Mesa, and leased parcels on Horse Bench because of high well pad density and low potential for topographic and/or vegetative screening. The VRM Class II would be retained in Dry Canyon because no well pads are proposed within the canyon under this alternative.

Visual Resource Management Class III Areas

The level of development in VRM Class III areas would be reduced from 166 to 112 proposed well pads under Alternative D as compared to the Proposed Action. In addition, visual impacts would be mitigated as detailed in **Tables 2.6-7** and **2.6-8**. Because Class III objectives provide for activities that may contrast with the basic landscape elements, but remain subordinate to the existing landscape character, with the implementation of BMPs and environmental protection measures, the proposed development in VRM Class III areas would meet the objective.

Visual Resource Management Class IV Areas

No development is proposed within VRM Class IV areas of the WTP Project Area.

Private and State Lands

Impacts to private and State lands under Alternative D would be identical to those described under the Proposed Action

4.16.4.2 Viewsheds and Key Observation Points

Potential visual impacts in relation to each of the viewsheds would be similar in nature to those described under the Proposed Action but the level of development and expected surface disturbance would be reduced as shown in **Table 4.16-4**. In addition, impacts would be mitigated through the implementation of BMPs and environmental mitigation measures. Again, of specific note, is the lack of development in the WSAs and canyon bottoms, which would eliminate all wells that could potentially be visible from the Green River.

Table 4.16-4 Potentially Visible Well Pad Locations from Travel Corridors within the WTP Project Area under Alternative D

Travel Corridor	Potentially Visible Well Pad Locations
Nine Mile Canyon	5
Harmon Canyon	0
Dry Canyon	5
Cottonwood Canyon – lower reaches	0
Flat Iron Mesa	22
Jack Canyon	0
Desolation Canyon	0
Jack Ridge	28
Cedar Ridge	49
Horse Bench	128

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.16.5 Alternative E – Agency Preferred Alternative

Under Alternative E, BBC and other operators would construct approximately 807 wells from 494 well pads, which is approximately 92 percent of the total number of well pads under the Proposed Action. Ancillary facilities including roads and pipelines would also be reduced in proportion to the reduction in well numbers. The duration of development would be approximately 9 years and drilling would occur year-round.

As with Alternative C, there is a mixture of buried and surface-laid pipeline proposed. Burial of pipelines is expected to occur on 62 percent of the project, with the other 38 percent being surface-laid. Where blasting would be necessary, changes in local topography would be evident. Impacts would be reduced with the requirement to use rock saws wherever possible. In the short-term, buried pipelines would result in a larger area of vegetative clearing and ground leveling as they would be installed adjacent to proposed and existing roads. Clearing would be kept to a minimum and topsoil and scalped vegetation would be placed back on the ROW to facilitate reclamation and reduce visual impacts. In the long term, buried pipeline corridors would begin to revegetate and blend with the surrounding landscape.

In general, potential impacts to visual resources under Alternative E would be similar in nature to those described under the Proposed Action but the magnitude of the impacts would be reduced in proportion to the reduction in proposed surface disturbance. In addition, transportation-related impacts would be reduced and special protective measures for resources in the WTP Project Area would be implemented. Although most of the protective measures described in Chapter 2 would serve to limit or mitigate visual impacts either directly or indirectly, of particular note to visual resources would be the following:

- Gating all new roads longer than 2 miles after drilling and completion activities are completed;
- Gating all roads that provide access to proposed well locations in the WSAs;
- As feasible (where to do so would not preclude development of valid and existing lease rights), no surface occupancy by new well pads or other facilities would be allowed on Federal lands within the Jack Canyon and Desolation Canyon WSAs;
- No surface occupancy by new well pads or other facilities on Federal lands within the Desolation Canyon NHL; and
- As feasible (where to do so would not preclude development of valid and existing lease rights), no surface occupancy by new well pads or other facilities on Federal lands within the canyon bottoms.

Under Alternative E, environmental BMPs contained in WO IM 2007-021 and the latest version of the Gold Book (DOI-USDA 2007) (**Table 2.6-7**), as well as additional environmental protection measures and mitigating measures identified by the BLM and its cooperators (**Table 2.6-8**), would be uniformly applied across the WTP Project Area, many of which directly apply to visual resources.

Furthermore, under the WTP PA (**Appendix T**) for cultural resources, dust abatement would be required throughout the revised APE; an area larger in size than the WTP Project Area. The expanded requirements for dust abatement would reduce fugitive

dust from vehicle traffic to a greater extent than under the Proposed Action, thereby reducing visibility impairment along roads to, from, and within the WTP Project Area.

4.16.5.1 Conformance with Visual Resource Management Class Objectives

Potential visual impacts in relation to conformance with VRM class objectives would be reduced under Alternative E, when compared to the Proposed Action, as a result of the reduced level of development and the implementation of BMPs and environmental mitigation measures detailed in **Tables 2.6-7** and **2.6-8**. Estimated surface disturbance in each VRM Class is summarized in **Table 4.16-5**.

Table 4.16-5 Proposed Development and Estimated Surface Disturbance by VRM Class within the WTP Project Area under Alternative E

VRM Class	Total Acres of Land within VRM Classes	# Proposed Well Pads	Short-term Surface Disturbance (acres)	Short-term Surface Disturbance (percent)	Long-term surface Disturbance (acres)	Long-term Surface Disturbance (percent)
Class I	36,367	17	136	0.4	69	0.2
Class II	71,362	305	1,902	2.7	988	1.4
Class III	29,764	166	1,133	3.8	598	2.0
Class IV	423	0	0	0	0	0

= number

Visual Resource Management Class I Areas

Impacts to visual resources in VRM Class I areas would be reduced as compared to the Proposed Action (17 well pads under Alternative E as compared to 43 well pads under the Proposed Action) because surface disturbance would be limited within the Jack Canyon and Desolation Canyon WSAs to non-Federal lands or areas where NSO stipulations would preclude development of valid and existing lease rights.

Visual impacts to VRM Class I areas (the Jack Canyon and Desolation Canyon WSAs) would be similar to those described under the Proposed Action, with the exception that impacts would be mitigated as detailed in **Tables 2.6-7** and **2.6-8**. Regardless of mitigation measures, however, any disturbance within VRM Class I areas would be inconsistent with the management prescriptions for those areas. As with the Proposed Action, the typical procedure would be to amend the VRM class to meet the necessary level of disturbance. However, because the areas (Jack Canyon and Desolation Canyon) will continue to be designated as WSAs, the BLM is required to maintain the VRM Class I designations in these areas. An amendment to the VRM class would take place only after a wilderness decision is reached by Congress.

Visual Resource Management Class II Areas

Visual impacts to VRM Class II areas would be reduced under Alternative E as compared to the Proposed Action. Under Alternative E, 311 well pads are proposed in VRM Class II areas as compared to 331 pads under the Proposed Action.

Implementation of BMPs and mitigation measures would further reduce the amount of visual contrast resulting from the proposed development.

Given the level of proposed development, many wells and associated facilities in VRM Class II areas would fail to meet the BLM Class II objectives (i.e., to retain the existing character of the landscape). Specific areas of high well pad density and low potential for topographic and/or vegetative screening would include Prickly Pear Mesa, Horse Bench, and Flat Iron Mesa. The VRM class would need to be amended, in these cases, to VRM Class III. Because there would be no development within Dry Canyon, this area would be retained as a VRM Class II.

Visual Resource Management Class III Areas

The level of development in VRM Class III areas would be identical to that in the Proposed Action. Under Alternative E, however, visual impacts would be mitigated as detailed in **Tables 2.6-7** and **2.6-8**. As Class III objectives provide for activities that may contrast with the basic landscape elements, but remain subordinate to the existing landscape character, with the implementation of BMPs and environmental protection measures, the proposed development in VRM Class III areas would meet the objective in most cases. Given the level of proposed development and lack of vegetative and topographic screening on Horse Bench, additional mitigation measures have been developed for this area which would ensure that the area would be retained as a VRM Class III. In addition, no surface occupancy would be allowed on unleased lands within the potential Nine Mile Canyon ACEC.

Visual Resource Management Class IV Areas

No development is proposed within VRM Class IV areas of the WTP Project Area.

Private and State Lands

Impacts to private and State lands under Alternative E would be identical to those described under the Proposed Action.

4.16.5.2 Viewsheds and Key Observation Points

Potential visual impacts in relation to each of the viewsheds would be similar in nature to those described under the Proposed Action but the level of development and expected surface disturbance would be reduced as shown in **Table 4.16-6**. In addition, impacts would be mitigated through the implementation of BMPs and environmental mitigation measures. Again, of specific note, is the reduced level of development in the WSAs and canyon bottoms.

Specifically regarding conceptual well locations within the viewshed of the Green River, no development would be permitted unless to do so would preclude the development of valid and existing lease rights. If development were to occur within the viewshed, drilling and completion would only be permitted outside of the high use river recreation season (May 15th to August 15th) which would limit the number of users that would be impacted. In addition, lighting at drilling locations and facilities would be downshielded to areas where development activities are occurring, which would minimize the area impacted by nighttime lighting. Based upon the aforementioned mitigation measures, it is likely that

impacts to Green River recreationists would be reduced when compared to the Proposed Action.

Table 4.16-6 Potentially Visible Well Pad Locations from Travel Corridors within the WTP Project Area under Alternative E

Travel Corridor	Potentially Visible Well Pad Locations
Nine Mile Canyon	5
Harmon Canyon	0
Dry Canyon	4
Cottonwood Canyon – lower reaches	0
Flat Iron Mesa	30
Jack Canyon	5
Desolation Canyon	3
Jack Ridge	46
Cedar Ridge	72
Horse Bench	203

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be the same as under the Proposed Action.

4.17 SPECIAL DESIGNATIONS

4.17.1 Alternative A – Proposed Action

A number of both existing and proposed areas of special designation fall within or in close proximity to the WTP Project Area. Potential impacts to each of those areas are discussed below. While each area is discussed individually in this section, it is important to note that many of the areas overlap spatially; therefore, potential impacts disclosed are not of an additive nature.

4.17.1.1 Areas of Critical Environmental Concern (ACEC)

Nine Mile Canyon ACEC

Approximately 7,100 acres of the existing Nine Mile Canyon ACEC fall within the WTP Project Area. This ACEC is managed by the Vernal Field Office. The boundary coincides with the Carbon/Duchesne County line.

Under the Proposed Action, no surface disturbance would occur on Federal lands within the Nine Mile Canyon ACEC; however, increased traffic and human activity in Nine Mile Canyon has the potential to impact the relevant and important values for which the ACEC was designated. Additionally, development on private lands excluded from, but falling within the boundary of the ACEC (four well pads, a pump station, and ancillary facilities) would also have a potential impact on the relevant and important values for which the area was designated. As discussed in **Section 3.17.1**, these values include cultural, visual, and wildlife resource values. Both direct and indirect impacts to these

resources are examined in detail in **Sections 4.12**, **4.16**, and **4.9**, respectively. In general, it is expected that cultural resources within the ACEC could be impacted by dust, vandalism, OHV use, erosion, and impacts to unidentified TCPs. Visual resources are expected to be impacted as the introduction of new surface facilities and increased industrial traffic and human activity would detract from the natural landscape. Wildlife resources would be impacted through displacement of wildlife, habitat loss, degradation, and fragmentation as a result of human activity.

Lower Green River ACEC

Under the Proposed Action, no development would occur within or in close proximity to the Lower Green River ACEC. Therefore, there would be no impact to the relevant and important values for which the ACEC was designated.

Potential Nine Mile Canyon ACEC

As discussed in **Section 3.17.1**, under the management guidelines of the Price River MFP (BLM 1984a) there are no designated ACECs within the WTP Project Area. However, approximately 47,263 acres of the Potential Nine Mile Canyon ACEC, being analyzed in the Draft Price RMP, fall within the WTP Project Area. If the Proposed Action were implemented, 173 well pads, approximately 54 miles of road co-located with pipeline, along with ancillary facilities would be would be constructed within the area being considered for designation. Total short-term disturbance within the potential ACEC would be approximately 1,076 acres.

The relevant and important values for which the Potential Nine Mile Canyon ACEC is nominated are discussed in detail in **Section 3.17.1** and include significant cultural features and high quality wildlife habitat, including habitat for special status wildlife and plant species. Direct and indirect impacts to these resources are examined in detail in **Sections 4.12**, **4.9**, and **4.10**, respectively. In general, it is expected that cultural resources within the ACEC could be impacted by dust, vandalism, OHV use, erosion, and impacts to unidentified TCPs. Finally, wildlife resources (including threatened and endangered species) would be impacted through displacement of wildlife, habitat loss, degradation, and fragmentation as a result of human activity. Impacts would, however, be partially mitigated with the adherence to applicant-committed environmental protection measures as discussed in **Sections 2.1, 2.2** and listed in **Table 2.2-6**.

While an ACEC designation does not *necessarily* change the allowed use of the land, based upon the extent of the proposed development and the impacts disclosed in the aforementioned resource sections, impacts to the relevant and important values for which the Potential Nine Mile Canyon ACEC was nominated are expected to be substantial within the immediate vicinity of the proposed development and along existing roads used for project purposes (especially during the construction period).

Potential Desolation Canyon ACEC

Approximately 53,128 acres of the Potential Desolation Canyon ACEC fall within the WTP Project Area. If the Proposed Action were implemented, up to 193 well pads, approximately 58 miles of road and pipeline, and associated ancillary facilities would be constructed within the area being considered for designation. Total short term-disturbance within the potential ACEC would be approximately 1,232 acres.

The relevant and important values for which the Potential Desolation Canyon ACEC is nominated are discussed in detail in **Section 3.17.1** and include scenic and cultural values, and ecological systems and processes. The potential direct and indirect impacts to cultural and scenic resource values are discussed in **Sections 4.16** and **4.12** respectively. In general, it is expected that cultural resources within the ACEC could be impacted by dust, vandalism, OHV use, erosion, and impacts to unidentified TCPs. Visual resources are expected to be impacted as the introduction of new surface facilities and increased industrial traffic and human activity would detract from the natural landscape. Ecological processes include both biotic and abiotic resources which are discussed in multiple places throughout the document. Impacts would, however, be partially mitigated with the adherence to applicant-committed environmental protection measures as discussed in **Sections 2.1, 2.2** and listed in **Table 2.2-6**.

As previously discussed, an ACEC designation does not *necessarily* change the allowed use of the land. Based upon the extent of the proposed development and the impacts disclosed in the relevant resource sections of this chapter, impacts to the relevant and important values for which the Potential Desolation Canyon ACEC was nominated are expected to be substantial within the immediate vicinity of the proposed development and along existing roads used for project purposes (especially during the construction period).

Potential Four Mile Wash ACEC

Under the Proposed Action, no development would occur within or in close proximity to the potential Four Mile Wash ACEC. Therefore, there would be no impact to the relevant and important values for which the ACEC is currently being considered for designation.

4.17.1.2 Wilderness Study Areas

Portions of two existing WSAs fall within the WTP Project Area: the Jack Canyon WSA and the Desolation Canyon WSA. Potential impacts to these areas are discussed below.

Jack Canyon WSA

Under the Proposed Action, 13 proposed well pads and associated access road co-located with pipeline would be constructed within the Jack Canyon WSA boundary. Total surface disturbance would be approximately 67 acres, or less than 1 percent of the existing acreage of the WSA. As discussed in **Section 3.17.2**, past oil and gas activities in the Peter's Point Unit have previously diminished the natural character the Jack Canyon WSA to a limited extent. The proposed facilities would further modify the natural character of the landscape by introducing additional industrial components to the largely undeveloped and natural environment. Therefore, the BLM would not be able to meet the objectives of the IMP "to preserve the wilderness character of WSAs until Congress determines whether or not they should be designated as wilderness." Given adequate time (approximately 50 years), lands would be expected to regain wilderness characteristics and be available for wilderness consideration on a going-forward basis.

All proposed surface-disturbing and human activity within the Jack Canyon WSA would occur on pre-FLPMA leases within the Peters Point Federal Oil and Gas Unit in the easternmost portion of the WSA. Development of these leases would fall under the valid existing rights clause of the *Interim Management Policy for Lands under Wilderness Review* (BLM 1995b), which states the following:

> Activities for the use and development of such leases must satisfy the nonimpairment criteria, unless this would unreasonably interfere with rights of the lease as set forth in the mineral lease. Where it is determined that the rights conveyed can be exercised only through activities that will permanently impair wilderness suitability, the activities will be regulated to prevent unnecessary or undue degradation. Nevertheless, even if such activities impair the area's wilderness suitability, they will be allowed to proceed.

Access to the Jack Canyon WSA is currently provided by four different boundary roads which consist of 33-foot ROWs held by the BLM - the currently impassible Jack Canyon Road (on the northeast), the Jack Ridge Road (on the north), a spur road (on the west), and the Cedar Ridge Road (on the south). The operators intend to either reroute or improve the existing road in Jack Canyon (**Appendix F** – *West Tavaputs Full Field Development EIS Transportation Plan*), which would increase access into the Jack Canyon WSA.

Surface disturbance and human activity that would result from implementation of the Proposed Action would have the following impacts on the values for which the area was identified as a WSA.

Size: Implementation of the Proposed Action would directly disturb approximately 67 acres of surface. The majority of the WSA, a contiguous block of over 7,400 acres, would remain undeveloped

Naturalness: Infrastructure (e.g., well pads, roads, pipelines, ancillary facilities) and or human activity resulting from construction and or production activities would cause a direct loss of naturalness within the Jack Canyon WSA on approximately 67 acres. Impacts from oil and gas development would last for the 20-year production lifespan of individual wells and would continue following well abandonment and reclamation until vegetation is reestablished that replicates the natural character of the area.

Visual and auditory evidence of human activity would result from drilling and operating the proposed wells. Short-term visual and auditory impacts to naturalness would result from drilling rigs on the well pads, increased construction traffic, and human presence. Long-term visual evidence of oilfield activity would include maintained roads, well pads with associated facilities, aboveground pipelines, vehicle traffic, and associated noise. Noise effects would be temporary in that they would last only during the time it would take to construct (daytime activity only) and drill (around the clock activity) all the wells. Increased vehicle and human traffic would be highest during those times that construction is occurring within the wilderness characteristics area. Noise levels in and around a particular site are affected by specific types of noise events, proximity to noise sources, intervening topography, vegetation, and meteorological conditions (including wind speed and direction). These factors would determine noise levels for receptors

based on distance from the source, but noise would likely be audible up to several miles from a noise source.

Outstanding Opportunities for Solitude: Noise from construction and drilling equipment and increased human activity would reduce opportunity for solitude. These effects would be most noticeable during the development phase when construction, drilling, and completion activities would occur. During the production phase, noise and human activity would generally be limited to one or two vehicles per day (e.g., pumper and water and condensate trucks), and increases in recreation and/or administrative traffic associated with the construction of a new or improved access road. While noise impacts were not modeled for the entire WSA, select locations within the Project Area were modeled to provide a representative sample of noise propagation in sensitive areas. Noise impacts are further discussed in **Section 4.18.1.1**.

For analysis purposes, as discussed in **Section 3.17.3.3**, a GIS-based fragmentation analysis was performed, which revealed that approximately 4,572 acres of the Jack Canyon WSA are within ½-mile of existing development. Outstanding opportunities for solitude within these areas could be compromised. If the Proposed Action were implemented, an additional 1,122 additional acres (or 15 percent) of land within the WSA would be within ½-mile of development. Outstanding opportunities for solitude in this area could effectively be lost.

It should be noted that this GIS-based analysis does not take into consideration variables such as existing road conditions and/or use, visual and topographical screening, or noise propagation in mountainous/canyon terrain. Therefore, opportunities for solitude and/or primitive and unconfined recreation would likely exist in isolated areas within the ½-mile buffer.

Outstanding Opportunities for Primitive and Unconfined Recreation: Opportunities for primitive and unconfined recreation within the Jack Canyon WSA (including hiking, climbing, hunting, camping and sightseeing) would be diminished in proportion to the expected loss of solitude.

Supplemental Values: The Jack Canyon WSA is highly scenic when viewed from the canyon bottoms as well as from key observation points that overlook the canyon along Peters Point and Cedar Ridge. Canyon bottoms, which include intermittent streams and riparian vegetation also provide high-value wildlife habitat for numerous big game, predator, and special-status species. Under the Proposed Action, one well within the WSA would be constructed in the Jack Creek drainage. Impacts to visual resources, vegetation, wildlife, and special-status species are addressed in **Sections 4.16**, **4.8**, **4.9**, and **4.10**, respectively.

Desolation Canyon WSA

Under the Proposed Action, 30 proposed well pads and approximately 8 miles of road co-located with pipeline would be constructed within the Desolation Canyon WSA. Total surface disturbance associated with new construction activities would be approximately 166 acres. As discussed in **Section 3.17.2**, past oil and gas activities within the Peter's Point Unit have diminished the natural character the Desolation Canyon WSA within the WTP Project Area to a limited extent. Proposed development would add to the modified nature of a small portion of the WSA. Therefore, the BLM would not be able to meet the

objectives of the IMP "to preserve the wilderness character of WSAs until Congress determines whether or not they should be designated as wilderness." Given adequate time (approximately 50 years), lands would be expected to regain wilderness characteristics and be available for wilderness consideration on a going-forward basis.

As with the Jack Canyon WSA, all proposed surface disturbance and human activity within the Desolation Canyon WSA would occur on pre-FLPMA leases within the Peters Point Federal Oil and Gas Unit. Development of these leases would fall under the valid existing rights clause of the *Interim Management Policy for Lands under Wilderness Review.*

As illustrated in **Figure 2.2-1**, all proposed roads within the Desolation Canyon WSA would connect to the existing Jack Canyon or Cedar Ridge roads. Jack Canyon is currently impassable by vehicle; however, the operators intend to either reroute or improve the existing road. Approximately 1.8 miles of road improvement (between the WSA boundary and the existing 5-14 well site) would be within the Desolation Canyon WSA.

As discussed in **Section 3.14**, Cedar Ridge road could appropriately be called a primitive road, meaning it has not recently been maintained by mechanical means. Because the road separates the Jack and Desolation Canyon WSAs, any improvements would likely cause disturbance in either the Desolation Canyon or Jack Canyon WSA.

If the Proposed Action were implemented both the Jack Canyon and Cedar Ridge roads would be extended. The proposed road extensions would also be within the Desolation Canyon WSA.

Surface disturbance and human activity that would result from implementation of the Proposed Action would have the following impacts on wilderness values.

Size: Implementation of the Proposed Action would directly disturb approximately 160 acres. The majority of the WSA, a contiguous block of over 24,000 acres within the Project Area, would remain undeveloped.

Naturalness: Infrastructure (e.g., well pads, roads, pipelines, ancillary facilities) and or human activity resulting from construction and or production activities would cause a direct loss of naturalness within the Desolation Canyon WSA on approximately 160 acres. Impacts from oil and gas development would last for the 20-year production lifespan of individual wells and would continue following well abandonment and reclamation until vegetation is reestablished that replicates the natural character of the area (approximately 5 years).

Visual and auditory evidence of human activity would result from drilling and operating the proposed wells. Short-term visual and auditory impacts to naturalness would result from drilling rigs on the well pads, increased construction traffic, and human presence. Long-term visual evidence of oilfield activity would include maintained roads, well pads with associated facilities, aboveground pipelines, vehicle traffic, and associated noise. Noise effects would be temporary in that they would last only during the time it would take to construct (daytime activity only) and drill (around the clock activity) all the wells. Increased vehicle and human traffic would be highest during those times that construction is occurring within the wilderness characteristics area. Noise levels in and

around a particular site are affected by specific types of noise events, proximity to noise sources, intervening topography, vegetation, and meteorological conditions (including wind speed and direction). These factors would determine noise levels for receptors based on distance from the source, but noise would likely be audible up to several miles from a noise source.

Outstanding Opportunities for Solitude: Noise from construction and drilling equipment and increased human activity would reduce opportunity for solitude. These effects would be most noticeable during the development phase when construction, drilling, and completion activities would occur. During the production phase, noise and human activity would generally be limited to one or two vehicles per day (e.g., pumper and water/condensate trucks), and increases in recreation and/or administrative traffic associated with the construction of new or improved access roads into the WSA. While noise impacts were not modeled for the entire WSA, select locations within the Project Area were modeled to provide a representative sample of noise propagation in sensitive areas. Noise impacts are further discussed in **Section 4.18.1.1**.

As discussed in **Section 3.17.3.3**, a GIS-based fragmentation analysis revealed that approximately 5,853 acres of the Desolation Canyon WSA are within ½-mile of existing roads. Outstanding opportunities for solitude within these areas could be compromised. If the Proposed Action were implemented, an additional 6,370 acres (2.2 percent of the Desolation Canyon WSA or 25.8 percent of the WSA within the WTP Project Area) of land within the WSA would be within ½-mile of development. Outstanding opportunities for solitude in this area could also effectively be lost.

It should be noted that this GIS-based analysis does not take into consideration variables such as existing road conditions and/or use, visual and topographical screening, or noise propagation in mountainous/canyon terrain. Therefore, opportunities for solitude and/or primitive and unconfined recreation would likely exist in isolated areas within the ½-mile buffer.

Outstanding Opportunities for Primitive and Unconfined Recreation: Opportunities for primitive and unconfined recreation within Desolation Canyon include white water river running, camping, hiking, back packing, fishing, swimming, and sightseeing. Three well pads are proposed within the visual corridor of the river that would be located in the middle ground viewing distance (along Cedar Ridge). Since the closest development to the river would be approximately 2 miles to the west (in Jack Canyon), it is possible that auditory disturbance to recreational users on the river could be experienced. Development in any region of the WSA, including those areas outside of the river corridor, would diminish opportunities for unconfined recreation in proportion to the expected loss of solitude.

Supplemental Values: Desolation Canyon is known for its topographical and wildlife diversity, remoteness, scenic quality, special-status species, and cultural resources. Impacts on these resources are addressed in **Sections 4.9**, **4.16**, **4.10**, and **4.12**, respectively.

4.17.1.3 Non-WSA Lands with Wilderness Characteristics

In addition to the WSAs discussed above, the WTP Project Area also contains portions of two areas that possess wilderness characteristics. Potential impacts to the Jack Canyon and Desolation Canyon WIAs are discussed below.

Jack Canyon

As discussed in **Section 3.17.3**, the WTP Project Area includes approximately 1,465 acres of land found to have wilderness characteristics contiguous and north of the existing Jack Canyon WSA. Under the Proposed Action, 12 well pads and associated facilities would be constructed in the area identified as having wilderness characteristics. Total surface disturbance would be approximately 75 acres or 5 percent of the total area identified as having wilderness characteristics.

The proposed development has the potential to impact wilderness characteristics by altering the attributes that are used to define and categorize areas as having wilderness characteristics. The attributes that may be affected by land disturbing and human activities are size, naturalness, the opportunity for solitude and/or primitive and unconfined recreation, and supplemental values.

Naturalness: Any surface disturbance that would occur as a result of the construction and production of proposed roads, well pads, and associated ancillary facilities would cause a direct loss of naturalness. The Proposed Action would result in the direct loss of approximately 75 acres of the natural landscape within the Jack Canyon WIA. The majority of the area would remain undeveloped.

Visual and auditory evidence of human activity would result from drilling and operating the proposed wells. Short-term visual and auditory impacts to naturalness would result from drilling rigs on the well pads, increased construction traffic, and human presence. Long-term visual evidence of oilfield activity would include maintained roads, well pads with associated facilities, aboveground pipelines, vehicle traffic, and associated noise.

Opportunities for Solitude and Primitive and Unconfined Recreation: Oil and gas development activities within the Jack Canyon WIA would spatially limit areas in which solitude could be sought and where primitive and unconfined recreational opportunities would be available.

As discussed in **Section 3.17.3.3**, a GIS-based fragmentation analysis revealed that nearly all (approximately 1,437 acres) of the Jack Canyon WIA is within ½-mile of existing development. Outstanding opportunities for solitude and primitive and unconfined recreation on these acres could be compromised. If the Proposed Action were implemented, an additional 28 acres of land within the WIA (or the entire area) would be within ½-mile of development. Therefore, these characteristics could effectively be lost in the entire WIA.

It should be noted that this GIS-based analysis does not take into consideration variables such as existing road conditions and/or use, visual and topographical screening, or noise propagation in mountainous/canyon terrain. Therefore, opportunities for solitude and/or primitive and unconfined recreation would likely exist in isolated areas within the ½-mile buffer.

Only a portion of the 8-year construction phase would involve construction within the Jack Canyon WIA, noise from heavy equipment, increased vehicle and human traffic, and visual intrusions would reduce the opportunity for solitude within the Jack Canyon wilderness characteristics area. Noise effects would be temporary in that they would last only during the time it would take to construct (daytime activity only) and drill (around the clock activity) all the wells. Increased vehicle and human traffic would be highest during those times that construction is occurring within the WIA. Noise levels in and around a particular site are affected by specific types of noise events, proximity to noise sources, intervening topography, vegetation, and meteorological conditions (including wind speed and direction). These factors would determine noise levels for receptors based on distance from the source, but noise would likely be audible up to several miles from a noise source.

During the 20 year production phase, a continued loss of solitude would occur as a result of a limited increase in traffic and potential human interaction that can be expected from recreational, administrative, and maintenance use of new access roads.

Supplemental Values: The inventory units of the Jack Canyon WIA are quite scenic, have interesting geological features, and offer high-value wildlife habitat. A portion of the area is used by the Range Creek wild horse herd. Impacts on these resources are addressed in **Sections 4.16**, **4.9**, and **4.7**, respectively.

Impacts to wilderness characteristics would last the LOP. After plugging and abandonment of the wells, and subsequent reclamation, sagebrush, grasses, and forbs would reestablish themselves and the site would begin to replicate in color, texture, and form some of the natural character of the area. Given adequate time (approximately 50 years), lands would be expected to regain wilderness characteristics and be available for wilderness consideration on a going-forward basis.

Desolation Canyon

As discussed in **Section 3.17.3**, the WTP Project Area includes approximately 31,745 acres of land found to have wilderness characteristics contiguous and north of the existing Desolation Canyon WSA. Under the Proposed Action, 198 proposed well pads and approximately 67 miles of road co-located with pipelines would be constructed within the area identified as having wilderness characteristics. Total surface disturbance and direct impacts to size would be approximately 1,205 acres. Loss of naturalness is expected to be proportional to the amount of surface disturbance proposed within the WIA.

Impacts related to surface disturbance and human activity that would result from implementation of the Proposed Action would be identical in nature to those described above for the Jack Canyon WIA.

The fragmentation analysis reveals that opportunities for solitude and primitive and unconfined recreation would be effectively lost on approximately 11,471 acres. This represents a 36 percent increase over those areas that have already been impacted (see **Section 3.17.3.3**).

It should be noted that this GIS-based analysis does not take into consideration variables such as existing road conditions and/or use, visual and topographical screening, or noise propagation in mountainous/canyon terrain. Therefore, opportunities for solitude and/or primitive and unconfined recreation would likely exist in isolated areas within the ½-mile buffer.

Supplemental Values: The Desolation Canyon inventory unit contains cultural, scenic, geologic, botanical, and wildlife values. Impacts on these resources are addressed in **Sections 4.12, 4.16, 4.8** and **4.9**, respectively.

4.17.1.4 Wild and Scenic Rivers (WSR)

There are currently no river segments designated as WSRs within the WTP Project Area; however, potential WSRs are being analyzed in the Draft Vernal RMP and the Draft Price RMP. Implementation of the Proposed Action has the potential to impact the ORVs for which the rivers are being analyzed. Potential impacts to eligible river segments are discussed below.

Green River

Under the Proposed Action, no development would occur within ¼ mile of the Green River. Therefore, there would be no direct impacts to the ORVs in the immediate environment. Indirect impacts to the ORVs for which the Green River was found eligible for designation could include possible auditory disturbance to recreational users on the river, potential visual intrusions in the middleground viewing distance, potential increases in sedimentation and depletion to the river (which could affect the endangered Colorado river fish), and potential displacement of wildlife. Each of these impacts is discussed in detail in the appropriate resource sections of this document.

Nine Mile Creek

Under the Proposed Action there would be approximately five well pads and two pump stations constructed within a ¼ mile of Nine Mile Creek. Total surface disturbance would be approximately 47 acres. All well pads and one pump station would be located on private surface.

New development would be in line-of-sight of the river. Impacts associated with the Proposed Action would also include increased traffic and human activity. As discussed in **Section 3.17.4**, tentative classifications are based upon the type and degree of human development present at the time of inventory. Classifications also prescribe the type of management activity that would be allowed to occur along a river segment. All proposed development falls along the river segment assigned a “recreational” classification. Some development and substantial evidence of human activity is permissible along segments of river classified as recreational. As discussed in Chapter 3, the Nine Mile Creek corridor already contains existing development and substantial human activity. Additional development and human activity associated with the Proposed Action would be consistent with the tentative “recreational” classification as long as the ORVs are not compromised. While the Proposed Action contains measures that would reduce impacts to the ORVs for which Nine Mile Creek has been determined eligible (e.g., a long-term dust suppression plan), given the level of development proposed and the associated increase in traffic, especially during the construction

period, it is likely that the ORVs for this segment of the river would still be compromised under the Proposed Action. Both direct and indirect impacts to cultural, historic, and visual resources are discussed in the appropriate resource sections of this EIS.

4.17.1.5 BLM Backcountry Byways

Under the Proposed Action, the Nine Mile Canyon Backcountry Byway would be affected during development and production phases. For the LOP, Nine Mile Canyon Road (the byway) would provide access to the development on the plateau. The current ADT on this route is approximately 106 vehicles. Under the Proposed Action, at peak development, the ADT is expected to increase by 575 vehicles or by approximately 555 percent. As discussed under **Section 2.1.5.6**, BBC and other operators have agreed to put into operation a dust suppression plan, which would substantially reduce the amount of dust generated by project-related traffic. However, increased traffic, noise, and social interaction would still diminish the quality of a visit along the byway. The impact would be most apparent during heavy equipment mobilization through the canyon and during both well pad and pipeline construction in the canyon itself (five well pads are proposed on private parcels in Nine Mile Canyon).

Additionally, as an alternative to the dust suppression plan, BBC and other operators have indicated that certain road segments within Nine Mile, Gate, or the lower reaches of Harmon and Cottonwood Canyons, may be improved with hard surfacing, such as asphalt, chip and seal, or other materials, as approved by the BLM or counties as appropriate. Should BBC and other operators pave road segments, dust impacts would effectively be eliminated. It is acknowledged however that hardening of road surfaces within the WTP Project Area could result in both positive and negative impacts on various resources. For example, decreases in dust and improved road conditions could potentially result in an improved visitor experience in Nine Mile Canyon. On the other hand, hardening of road surfaces may result in an increase in visitation to portions of the WTP Project Area, which could diminish the backcountry character and potentially lead to increases in conflict between recreational users and industry.

The integrity of the byway designation could also be diminished due to the loss of landscape context associated with the route from visual modifications, elevated noise levels, and potential for conflict between industrial and recreational uses.

4.17.1.6 Utah Scenic Backways

As discussed in **Section 3.17.5**, Nine Mile Canyon has also been declared a State Scenic Backway because of its unique scenic, historic, and recreational qualities. Impacts would be identical to those described in **Section 4.17.1.5** above.

4.17.1.7 National Historic Landmarks

No development is planned under the Proposed Action within the Desolation Canyon NHL. However, three wells along Cedar Ridge could potentially be located within the visual corridor of the river. In addition, a limited number of wells could be developed within the sound corridor of the river. Noise impacts are more thoroughly analyzed in **Section 4.18.1.1**. Development within sight or sound of the Green River is not consistent with the Desolation and Gray Canyons of the Green River Management Plan (BLM 1979). It should be noted that all wells that could be located within the visual

corridor would be in the middle ground viewing distance (see **Section 4.16.1.4**). As the closest development to the river would be approximately 2 miles to the west, it is possible that recreational users on the river could experience auditory disturbance. Visitors who hike into the side canyons from the river would, depending on their location within the NHL, be in closer proximity to development and could be more apt to be impacted by the sights and sounds of development.

Existing motorized access into the Desolation Canyon NHL is via an unmaintained and particularly hazardous road along Horse Bench. Under the Proposed Action, upgrades to Horse Bench road would end outside of the NHL boundary, but would provide vehicles with easier access to overlooks into Desolation Canyon, and potentially travel the entire length of this unmaintained route through the NHL to its intersection with Nine Mile Canyon. The Desolation Canyon NHL is closed to OHV use.

IRREVERSABLE AND IRRETRIEVABLE EFFECTS

There would be no irreversible or irretrievable effects on the potential Green River WSR corridor, on the existing Lower Green River ACEC, the potential Four Mile Wash ACEC, or the Desolation Canyon NHL.

Irreversible and irretrievable effects on the ORVs for which the Nine Mile Creek has been determined eligible for inclusion the NWSRS are appropriately addressed in the visual and cultural resources sections.

Irreversible and irretrievable effects on the relevant and important values for which the existing Nine Mile Canyon ACEC was designated; and for which the potential Nine Mile Canyon and Desolation Canyon ACECs being considered for designation; are appropriately discussed in other resource sections.

Irreversible Effects

Given enough time WSAs and non-WSA lands with wilderness characteristics could regain their wilderness characteristics. However, impacts to these areas would generally be considered irreversible, in that once physical developments or other human modifications are in place it is difficult to remove evidence of them (USFS 1982). Development would likely prevent the BLM from managing these areas in a manner that protects their wilderness values in the future.

4.17.2 Alternative B – No Action

Under Alternative B, the No Action Alternative, natural gas development would continue on private and State leases but would not be authorized on Federal leases in the WTP Project Area. As areas of special designation do not apply to State and private lands, potential impacts to these areas would be limited to ROWs across the BLM lands to grant access to private or State leases. Portions of those ROWs would traverse the Desolation Canyon WIA, Nine Mile Canyon ACEC, and Desolation Canyon ACEC. However, impacts to these areas would be limited. In addition, improvements to Horse Bench road would provide increased access to the Desolation Canyon NHL. Because no development would occur within the Jack Canyon or Desolation Canyon WSAs, there would be no activities that would impair their wilderness suitability.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable would be the same as those discussed under the Proposed Action with the following exceptions.

- Under the No Action alternative there would be no irreversible and irretrievable impacts to WSAs.
- Under the No Action alternative there would be no irreversible and irretrievable impacts to the Jack Canyon WIA.

4.17.3 Alternative C – Transportation Impact Reduction

The primary difference in impacts to special designations under Alternative C, when compared to the Proposed Action, is the substantial reduction of traffic levels, the use of the alternate Trail Canyon route, and the gating of numerous roads throughout the WTP Project Area. In addition, under Alternative C, the LOP would be extended by 7 years which would extend potential impacts over a longer period.

Under Alternative C, the level of proposed development and extent of surface-disturbing activities under Alternative C are similar to those under the Proposed Action. The direct impacts of implementing Alternative C within areas of special designation would therefore be nearly identical to those described under the Proposed Action. However, under Alternative C, environmental BMPs contained in WO IM 2007-021 and the latest version of the Gold Book (DOI-USDA 2007) (**Table 2.6-7**) as well as additional environmental protection measures and mitigating measures identified by the BLM and its cooperators (**Table 2.6-8**) would be uniformly applied across the WTP Project Area, many of which would mitigate indirect impacts to areas of special designation.

4.17.3.1 Areas of Critical Environmental Concern (ACEC)

Nine Mile Canyon ACEC

Potential impacts to the existing Nine Mile Canyon ACEC would be identical in nature to those described for the Proposed Action with the following exceptions. Traffic levels would be substantially reduced during the construction period which would, in turn, reduce traffic-related impacts. The construction phase would also be extended by 7 years meaning that potential impacts would be experienced over a longer period of time. Construction of a new route in Trail Canyon would result in approximately 14 acres of new surface disturbance within the Nine Mile Canyon ACEC. However, use of this route would effectively eliminate industrial traffic use of Nine Mile Canyon between Gate and Harmon Canyons thereby eliminating traffic-related impacts to the ACEC in this area. Additionally, application of BMPs and environmental mitigation measures detailed in Chapter 2 (**Tables 2.6-7** and **2.6-8**) would help to reduce the impacts of development in the ACEC. When compared to the Proposed Action, inclusion of the design features of Alternative C combined with the aforementioned practices and mitigation measures would reduce visual, auditory, and atmospheric affects which would, in turn, reduce impacts to cultural resources and wildlife.

Lower Green River ACEC

Under Alternative C, no development would occur within or in close proximity to the Lower Green River ACEC. Therefore, there would be no direct or indirect impact to the relevant and important values for which the ACEC was designated.

Potential Nine Mile Canyon ACEC

Potential impacts to the Potential Nine Mile Canyon ACEC would be similar in nature to those described under the Proposed Action. However, traffic reductions under Alternative C would limit traffic-related impacts during both the development and production phases. Additionally, as discussed above, use of the Trail Canyon route would effectively eliminate industrial traffic use of Nine Mile Canyon between Gate and Harmon Canyons thereby eliminating traffic-related impacts to the ACEC in this area. Finally, application of BMPs and environmental mitigation measures detailed in Chapter 2 (**Tables 2.6-7** and **2.6-8**) would help to reduce the visual and noise impacts of development in the potential ACEC. When compared to the Proposed Action, inclusion of the design features of Alternative C combined with the aforementioned practices and mitigation measures would reduce visual, auditory, and atmospheric affects which would, in turn, reduce impacts to cultural resources and wildlife

Potential Desolation Canyon ACEC

Potential impacts to the Potential Desolation Canyon ACEC would be similar in nature to those described under the Proposed Action. However, traffic reductions under Alternative C would limit traffic-related impacts during both the development and production phases. In addition, the gating of roads would substantially limit access within this area. Finally, application of BMPs and environmental mitigation measures detailed in Chapter 2 (**Tables 2.6-7** and **2.6-8**) would help to reduce the visual and noise impacts of development in the potential ACEC.

Potential Four Mile Wash ACEC

Under Alternative C, no development would occur within or in close proximity to the potential Four Mile Wash ACEC. Therefore, there would be no impact to the relevant and important values for which the ACEC is currently being considered for designation.

4.17.3.2 Wilderness Study Areas (WSA)

Jack Canyon and Desolation Canyon WSAs

While surface disturbance within the Jack Canyon and Desolation Canyon WSAs is expected to be similar to the Proposed Action, gating of access roads within the WSAs would limit unauthorized motorized vehicle access, which would reduce use-related impacts that were described under the Proposed Action. In addition, if a new road into Jack Canyon is constructed, the existing Jack Canyon Road would be reclaimed as soon as the new/rerouted access road is complete. Finally, application of BMPs and environmental mitigation measures detailed in Chapter 2 (**Tables 2.6-7** and **2.6-8**) would help to reduce the visual and noise impacts of development in the WSAs.

4.17.3.3 Non-WSA Lands with Wilderness Characteristics

Jack Canyon and Desolation Canyon

Potential impacts under Alternative C would be similar to those described under the Proposed Action for both the Jack Canyon and Desolation Canyon non-WSA lands with wilderness characteristics. However, loss of naturalness, solitude, and opportunities for primitive and unconfined recreation would be reduced to a limited extent with the reduction in traffic and the gating of roads through the WTP Project Area. Finally, application of BMPs and environmental mitigation measures detailed in Chapter 2 (**Tables 2.6-7** and **2.6-8**) would help to reduce the visual impacts of development in the WIAs.

4.17.3.4 Wild and Scenic Rivers (WSR)

Potential impacts to the eligible river segments would be similar in nature to those described under the Proposed Action with the following exceptions. The ORVs for Nine Mile Creek would not be impacted to as great an extent under Alternative C given the reduction in traffic proposed and the use of the Trail Canyon Road which would effectively eliminate traffic from the portion of Nine Mile Canyon Road extending from Harmon to Gate Canyon. The level of development within the vicinity of the creek would; however, remain the same as under the Proposed Action. **Tables 2.6-7** and **2.6-8** contain numerous environmental protection and mitigation measures that would minimize impacts to the ORVs. While the BLM only has the authority to enforce these measures on Federal lands, it is recommended that other surface management or permitting agencies consider applying these measures to State and private lands. Provided that BMPs are applied to all lands within Nine Mile Canyon (i.e., State, private, and Federal), impacts to ORVs would be reduced to a level that would not, then, preclude the BLM from designating this segment as suitable.

4.17.3.5 BLM Backcountry Byways

There would be a substantial reduction in traffic numbers under Alternative C along the Nine Mile Canyon Backcountry Byway (especially between Gate and Harmon canyons) when compared to the Proposed Action, due to both traffic reduction measures, and the use of Trail Canyon Road. The potential for social interaction (e.g., encounters with industrial workers) would decrease substantially as compared to the Proposed Action, but would still increase over current levels. Consequently, impacts to the byway would be expected to be similar in nature but substantially less in magnitude to those described under the Proposed Action.

Adherence to the dust suppression plan and/or hardening of road surfaces would minimize impacts comparable to those described under the Proposed Action.

4.17.3.6 Utah Scenic Backways

Potential impacts to the Nine Mile Canyon Scenic Backway would be identical to those described in the previous section.

4.17.3.7 National Historic Landmarks

No development is planned under Alternative C within the Desolation Canyon NHL. However, according to the viewshed analysis, three conceptual well locations along Cedar Ridge could be visible from the Green River. In addition, a limited number of wells could be developed within the sound corridor of the river. Noise impacts are more thoroughly analyzed in **Section 4.18.1.1**. Development within sight or sound of the Green River is not consistent with the Desolation and Gray Canyons of the Green River Management Plan (BLM 1979). It should be noted that all wells within the visual corridor would be in the middle ground viewing distance (see **Section 4.16.1.4**).

As discussed in **Table 2.6-8**, during the onsite process, wells would not be located within the viewshed of the Green River unless to do so would preclude the development of valid and existing lease rights. If development were to occur within the viewshed, drilling and completion would only be permitted outside of the high use river recreation season (May 15th to August 15th). Also, operators would be required to reduce noise from drilling and completion operations from within sound of the Green River (approximately 2 miles), through use of mechanisms such as hospital-grade mufflers on drill rigs. Based upon the aforementioned mitigation measures, it is likely that impacts to visitors within the SRMA would be reduced.

It should be noted that visitors who hike into the side canyons from the river would, depending on their location within the NHL, be in closer proximity to development and could be more apt to be impacted by the sights and sounds of development.

Motorized access into the Desolation Canyon NHL is via an unmaintained and particularly hazardous road along Horse Bench. Although Horse Bench would be upgraded, it would also be gated so the general public could not gain access into the NHL from the improved Horse Bench Road.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable would be the same as under the Proposed Action.

4.17.4 Alternative D – Conservation Alternative

Under Alternative D, conservation of resources within special designation areas would be accomplished by a number of measures including NSO stipulations in the following areas:

- Federal lands within Jack Canyon and Desolation Canyon WSAs;
- Federal lands within the Desolation Canyon NHL;
- Unleased Federal lands within the potential Nine Mile Canyon and Desolation Canyon ACECs; and
- Federal lands within canyon bottoms (where doing so would not preclude the development of valid and existing lease rights).

In addition, Alternative D would include year-round gating of the Cedar Ridge, Jack Canyon, Jack Ridge, and Horse Bench roads. Lastly, the BLM would not lease unleased lands within wilderness characteristics in the WTP Project Area.

4.17.4.1 Areas of Critical Environmental Concern (ACEC)

Nine Mile Canyon ACEC

Potential impacts to the Nine Mile Canyon ACEC are expected to be similar in nature to those described under Proposed Action, but reduced in proportion to reductions in traffic.

Lower Green River ACEC

Under Alternative D, no development would occur within or in close proximity to the Lower Green River ACEC. Therefore, there would be no direct or indirect impact to the relevant and important values for which the ACEC was designated.

Potential Nine Mile Canyon ACEC

Under Alternative D, 102 new well pads and approximately 38 miles of road and pipeline are proposed within the Potential Nine Mile Canyon ACEC on existing leases. Approximately 702 acres of surface would be disturbed initially. This represents approximately a 42 percent reduction in amount of development anticipated when compared to the Proposed Action. Potential impacts are expected to be similar in nature to those described under the Proposed Action but would be reduced in proportion to the reduction in anticipated level of development. In addition, no exceptions, waivers, or modifications land use plan stipulations, along with BMPs and environmental mitigation measures detailed in Chapter 2 (**Tables 2.6-7** and **2.6-8**) would further reduce impacts to the relevant and important criteria for which the area was proposed as an ACEC.

Potential Desolation Canyon ACEC

Under Alternative D, 84 new well pads and approximately 35 miles of road and pipeline are proposed within the potential Desolation Canyon ACEC on existing leases. Approximately 634 acres of surface would be disturbed initially. This represents approximately a 52 percent reduction in amount of development anticipated when compared to the Proposed Action. Potential impacts are expected to be similar in nature to those described for the Proposed Action but would be reduced in proportion to the reduction in anticipated level of development. In addition, no exceptions, waivers, or modifications to land use plan stipulations, along with BMPs and environmental mitigation measures detailed in Chapter 2 (**Tables 2.6-7** and **2.6-8**) would further reduce impacts to the relevant and important criteria for which the area was proposed as an ACEC.

Potential Four Mile Wash ACEC

Under Alternative D, no development would occur within or in close proximity to the potential Four Mile Wash ACEC. Therefore, there would be no impact to the relevant and important values for which the ACEC is currently being considered for designation.

4.17.4.2 Wilderness Study Areas (WSA)

Under Alternative D, no development would be allowed within the WSAs. Because no development would occur within the Jack Canyon or Desolation Canyon WSAs, there would be no activities that would impair their wilderness suitability. In addition, the road in Jack Canyon, and the Cedar Ridge and Jack Ridge roads would be gated (i.e., limited administrative access only), thereby minmizing unauthorized motorized access into the WSAs. Minimizing public access on Cedar Ridge would effectively close use of the designated motorized vehicle route which cherry-stems into the Desolation Canyon WSA. Gating of Jack Canyon would also result in closure of a designated motorized vehicle route, which goes from the Jack Canyon 101-A well location to the Desolation Canyon WSA boundary. Gating this road would also minimize unauthorized motorized vehicles in the WSA, which has been documented by the BLM in the past. Based upon the information above, gating of roads under Alternative D would have a beneficial impact on the WSAs.

4.17.4.3 Non-WSA Lands with Wilderness Characteristics

Jack Canyon

Under Alternative D, no development would occur within Jack Canyon WIA. Therefore, no direct or indirect impacts are anticipated. In addition, gating the Jack Ridge Road would reduce motorized access on the road that separates the Jack Canyon WIA from the Jack Canyon WSA.

Desolation Canyon

Under Alternative D, 87 new well pads and approximately 39 miles of road and pipeline are proposed within the Desolation Canyon WIA on existing leases. Approximately 638 acres of surface would be disturbed initially. This represents approximately a 53 percent reduction in amount of development anticipated when compared to the Proposed Action. Potential impacts are expected to be nearly identical in nature to those described for the Proposed Action but would be reduced in proportion to the reduction in anticipated level of development. In addition, no exceptions, waivers, or modifications to land use plan stipulations, along with BMPs and environmental mitigation measures (see **Tables 2.6-7** and **2.6-8**) would further reduce impacts within the area.

Fragmentation analysis reveals that opportunities for solitude and primitive and unconfined recreation would be effectively lost on approximately 8,246 acres falling within ½-mile of roads if Alternative D were implemented. This represents a 26 percent increase over those areas, revealed through baseline fragmentation analysis in **Section 3.17.3.3**, to have already been impacted.

It should be noted that this GIS-based analysis does not take into consideration variables such as existing road conditions and/or use, visual and topographical screening, or noise propagation in mountainous/canyon terrain. Therefore, opportunities for solitude and/or primitive and unconfined recreation would likely exist in isolated areas within the ½-mile buffer.

Gating of the Horse Bench Road would limit public access on Horse Bench, which would be upgraded under this alternative. Gating this road could also reduce unauthorized

cross-country travel on Horse Bench, which has been documented by the BLM, and subsequently reduce the resulting impacts of unauthorized access in the WIA (i.e., loss of naturalness and solitude).

4.17.4.4 Wild and Scenic Rivers (WSR)

Potential impacts to the eligible river segments would be similar in nature to those described under the Proposed Action. However, ORVs for Nine Mile Creek would not be compromised to as great an extent under Alternative D given the reduction in development proposed, which would correspond to a reduction in traffic. The level of development within the vicinity of the creek would, however, remain the same as under the Proposed Action. **Table 2.6-7** and **2.6-8** contain numerous environmental protection and mitigation measures that would minimize impacts to the ORVs. While the BLM only has the authority to enforce these measures on Federal lands, it is recommended that other surface management or permitting agencies consider applying these measures to State and private lands. Provided that BMPs are applied to all lands within Nine Mile Canyon (i.e., State, private, and Federal), impacts to ORVs would be reduced to a level that would not, then, preclude the BLM from designating this segment as suitable.

Gating of the Horse Bench Road, and to a lesser extent, gating of the Jack Canyon Road would reduce motorized travel within the Green River WSR corridor.

Based upon the information above, gating of roads under Alternative D would have a beneficial impact on the WSR corridor.

4.17.4.5 BLM Backcountry Byways

Potential impacts to the Nine Mile Scenic Backcountry Byway would be similar in nature to those described in the Proposed Action but would be reduced in proportion to the reduction in level of development.

4.17.4.6 Utah Scenic Backways

Potential impacts to the Nine Mile Scenic Backway would be similar in nature to those described under the Proposed Action but would be reduced in proportion to the reduction in level of development.

4.17.4.7 National Historic Landmarks

No development is planned under Alternative D within the Desolation Canyon NHL. All development would be outside of the visual corridor of the river and, as the closest development to the river would approximately 4 miles to the west; it is unlikely that any auditory disturbance to recreational users on the river would be experienced. However, propagation of noise through rugged terrain is unpredictable, so there is a possibility that construction-related noise, especially during blasting, could be heard within the NHL. Noise impacts are more thoroughly analyzed in **Section 4.18.1.1**. Unauthorized access into the Desolation Canyon NHL is via an unmaintained and particularly hazardous road along Horse Bench. Although Horse Bench Road would be upgraded under this alternative, it would also be gated so no motorized access could be gained by the general public into the NHL. To a lesser extent, gating of the Jack Canyon and Cedar Ridge roads would also reduce unauthorized motorized travel within the NHL. Based

upon the information above, gating of roads under Alternative D would have a beneficial impact on the NHL.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable would be the same as those discussed under the Proposed Action with the following exceptions.

- Under Alternative D there would be no irreversible and irretrievable impacts to WSAs.
- Under the Alternative D there would be no irreversible and irretrievable impacts to the Jack Canyon WIA.

4.17.5 Alternative E – Agency Preferred Alternative

In general, potential impacts to areas of special designation under Alternative E would be similar in nature to those described under the Proposed Action but the magnitude of the impacts would be reduced in proportion to the reduction in proposed surface disturbance within these areas. In addition, transportation related impacts would be reduced and special protective measures for resources in the WTP Project Area would be implemented. Specific components of Alternative E of note to special designations are:

- No surface occupancy by new well pads or other facilities on Federal lands within the Desolation Canyon NHL;
- Gating new roads longer than 2 miles after drilling and completion activities are completed in sensitive resource areas (see **Section 2.6.11.3**);
- Gating all roads that provide access to proposed well locations in the WSAs;
- Burial of all pipelines within the Project Area;
- As feasible (where to do so would not preclude development of valid and existing lease rights), no surface occupancy by new well pads or other facilities would be allowed on Federal lands within the Jack Canyon and Desolation Canyon WSAs;
- As feasible (where to do so would not preclude development of valid and existing lease rights), no surface occupancy by new well pads or other facilities on Federal lands within the canyon bottoms; and
- NSO would be applied to unleased lands within the Nine Mile Canyon ACEC as illustrated in the proposed plan within the proposed Resource Management Plan and Final Environmental Impact Statement for the Price Field Office.

Under Alternative E, environmental BMPs contained in WO IM 2007-021 and the latest version of the Gold Book (DOI-USDA 2007) (**Table 2.6-7**) as well as additional environmental protection measures and mitigating measures identified by the BLM and its cooperators (**Table 2.6-7** and **2.6-8**) would be uniformly applied across the WTP Project Area, many of which directly apply to resources of concern within areas of special designation.

4.17.5.1 Areas of Critical Environmental Concern (ACEC)

Nine Mile Canyon ACEC

Potential impacts to the existing Nine Mile Canyon ACEC are expected to be identical to those described for the Proposed Action with the following exception. **Table 2.6-7** and **2.6-8** contain numerous environmental protection and mitigation measures that would minimize impacts to the relevant and important values for which the area was designated an ACEC.

Lower Green River ACEC

Under Alternative E, no development would occur within or in close proximity to the Lower Green River ACEC. Therefore, there would be no direct or indirect impact to the relevant and important values for which the ACEC was designated.

Potential Nine Mile Canyon ACEC

Impacts to the potential Nine Mile Canyon ACEC are expected to be similar in nature to those described under the Proposed Action. Under Alternative E, 156 well pads are proposed within the ACEC and an estimated 981 acres would be disturbed. This represents a 9 percent reduction when compared to the Proposed Action. Well pads removed from the potential ACEC, as compared to the Proposed Action include all well pads proposed within Dry Canyon as well as those proposed on unleased lands within the ACEC boundary, primarily north of Horse Bench. BMPs and environmental mitigation measures detailed in Chapter 2 (see **Tables 2.6-7** and **2.6-8**) would help to reduce the impacts to the relevant and important criteria for which the area is nominated.

The relevant and important values for which the Nine Mile Canyon ACEC is nominated are discussed in detail in **Section 3.17.1** and include significant cultural features and high quality wildlife habitat, including habitat for special status wildlife and plant species. Direct and indirect impacts to these resources are examined in detail in **Sections 4.12**, **4.9**, and **4.10**, respectively. Removal of well pad locations within Dry Canyon in particular would reduce impacts to relevant and important criteria as this area is known to contain a high concentration of cultural resources.

While an ACEC designation does not *necessarily* change the allowed use of the land, based upon the extent of the proposed development and the impacts disclosed in the aforementioned resource sections, impacts to the relevant and important values for which the potential Nine Mile Canyon ACEC was nominated are expected within the immediate vicinity of the proposed development and along existing roads used for project purposes (especially during the construction period).

Potential Desolation Canyon ACEC

Potential impacts to the potential Desolation Canyon ACEC are expected to be similar in nature to those described for the Proposed Action. Under Alternative E, 170 well pads and associated facilities are proposed within the ACEC. An estimated 1,115 acres of disturbance are expected, which represents a 10 percent reduction when compared with the Proposed Action. BMPs and environmental mitigation measures detailed in Chapter

2 (see **Tables 2.6-7** and **2.6-8**) would help to reduce the impacts to the relevant and important criteria for which the area is nominated.

The relevant and important values for which the Desolation Canyon ACEC is nominated are discussed in detail in **Section 3.17.1** and include scenic and cultural values and ecological systems and processes. The potential direct and indirect impacts to the relevant and important values for which the area was nominated are discussed in **Sections 4.16**, **4.12**, and **4.9**, respectively.

As previously discussed, an ACEC designation does not *necessarily* change the allowed use of the land. Based upon the extent of the proposed development and the impacts disclosed in the relevant resource sections of this chapter, impacts to the relevant and important values for which the potential Desolation Canyon ACEC was nominated are expected within the immediate vicinity of the proposed development and along existing roads used for project purposes (especially during the construction period).

Potential Four Mile Wash ACEC

Under Alternative E, no development would occur within or in close proximity to the potential Four Mile Wash ACEC. Therefore, there would be no impact to the relevant and important values for which the ACEC is currently being considered for designation.

4.17.5.2 Wilderness Study Areas (WSA)

Jack Canyon WSA

Under Alternative E, four well pads and associated facilities are proposed within the Jack Canyon WSA. Direct impacts to size and naturalness are expected on approximately 36 acres as opposed to 67 acres under the Proposed Action. However, impacts to solitude and the opportunities for primitive and unconfined recreation are expected to be similar to the Proposed Action. Under Alternative E, all roads providing access to proposed well locations in the WSAs would be gated to prohibit motorized public access. Additionally, the application of BMPs and environmental mitigation measures detailed in Chapter 2 (see **Tables 2.6-7** and **2.6-8**) would likely reduce impacts to the WSA.

Desolation Canyon WSA

Under Alternative E, 16 well pads and associated facilities are proposed within the Desolation Canyon WSA. Direct impacts to size and naturalness are expected on approximately 94 acres as opposed to 166 acres under the Proposed Action. However, impacts to solitude and the opportunities for primitive and unconfined recreation are expected to be nearly identical to the Proposed Action. Under Alternative E, all roads providing access to proposed well locations within the WSA would be gated to prohibit motorized public access. Additionally, if a new road is necessary into Jack Canyon, immediately following construction activities the old road would be closed and reclaimed. These measures, combined with the application of BMPs and environmental mitigation measures detailed in Chapter 2 (see **Tables 2.6-7** and **2.6-8**), would likely reduce impacts to the WSA to a limited extent.

4.17.5.3 Non-WSA Lands with Wilderness Characteristics

Jack Canyon

Under Alternative E, direct and indirect impacts to the Jack Canyon WIA would be nearly identical to those described under the Proposed Action. The exception is that BMPs and environmental mitigation measures detailed in Chapter 2 (see **Tables 2.6-7** and **2.6-8**), would likely reduce impacts to the WIA to a limited extent.

Desolation Canyon

Under Alternative E, direct and indirect impacts to the Desolation Canyon WIA would be nearly identical to those described under the Proposed Action. The exception is that BMPs and environmental mitigation measures detailed in Chapter 2 (see **Tables 2.6-7** and **2.6-8**), would likely reduce impacts to the WIA to a limited extent.

4.17.5.4 Wild and Scenic Rivers

Under Alternative E, potential impacts to segments of river eligible for WSR designation are expected to be similar to those described under the Proposed Action with the following exceptions. Under Alternative E, the BLM has developed criteria for developing pump stations on public lands within canyon bottoms. These criteria would preclude the construction of pump stations within 330 feet from the centerline of streams and within sight and sound of properties eligible for inclusion in the NRHP. Additionally, **Table 2.6-7** and **2.6-8** contain numerous environmental protection and mitigation measures that would minimize impacts to the ORVs. While the BLM only has the authority to enforce these measures on Federal lands, it is recommended that other surface management or permitting agencies consider applying these measures to State and private lands. Provided that BMPs are applied to all lands within Nine Mile Canyon (i.e., State, private, and Federal), impacts to ORVs would be reduced to a level that would not, then, preclude the BLM from designating this segment as suitable.

4.17.5.5 BLM Backcountry Byways

Potential impacts to the existing Nine Mile Canyon Backcountry Byway are expected to be similar to those described for the Proposed Action; however impacts may be reduced under this alternative as a result of the construction of turnouts and/or designated parking locations near frequently visited cultural sites in Nine Mile Canyon. In addition, during the first or peak year of development, traffic would be reduced when compared to the Proposed Action.

4.17.5.6 Utah Scenic Backways

Potential impacts to the existing Nine Mile Canyon Scenic Byway are expected to be similar to those described for the Proposed Action; however impacts may be reduced under this alternative as a result of the construction of turnouts and/or designated parking locations near frequently visited cultural sites in Nine Mile Canyon. In addition, during the first or peak year of development, traffic would be reduced when compared to the Proposed Action.

4.17.5.7 National Historic Landmarks

Potential impacts to the Desolation Canyon NHL are expected to be identical to those described under Alternative C with the exception that upgrades to Horse Bench road would allow vehicles to gain easier access to overlooks into Desolation Canyon, and potentially travel the entire length of this unmaintained route through the NHL to its intersection with Nine Mile Canyon.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable would be the same as under the Proposed Action.

4.18 NOISE

4.18.1 Introduction

As discussed in **Section 3.18.3.1**, the EPA has established an average 55dBA noise level (L_{dn}) as a guideline for acceptable environmental noise. The L_{eq} dBA noise level represents an average noise level over a period of time (24 hours or less). A second measure, the average day/night noise level (L_{dn} dBA) represents a continuous noise source for a longer period of time. L_{eq} dBA is obtained by adding ten decibels to noise levels during the nighttime hours between 10 PM and 7 AM to account for extra noise sensitivity during sleeping hours as follows:

$$L_{dn} = 10 * LOG \{1/24 [15 * (10^{Ld/10}) + 9 * (10^{(Ln+10)/10})]\}$$

where: Ld is the average daytime noise level L_{eq} dBA.

Ln is the average nighttime noise level L_{eq} dBA.

LOG = common logarithm base 10.

This formulation results in the addition of 6.4 dBA to the L_{eq} measured during the day to obtain the average day-night noise level. For example, if the noise predicted from a source is a constant 56 dBA over a 24-hour period (such as that produced by a compressor station), then the average day-night noise level would be 62 L_{dn} dBA.

The L_{dn} noise scale is most applicable in residential environments where people are affected by environmental noise for extended periods of time. The remote areas of the WTP are obviously not residential areas. Nonetheless, given that it is a standard unit of measure, the L_{dn} noise levels are presented in this analysis for all sources except traffic noise (which is related to maximum hourly traffic levels).

Noise from an individual source is the greatest in the immediate vicinity. Noise decreases with increasing distance from a source and can be affected by specific types of noise events, proximity to noise sources, intervening topography, dense vegetation, and meteorological conditions (including wind speed and direction, temperature and humidity). These factors affect noise levels for receptors based on distance from the source, but noise can potentially be audible up to several miles from the source if existing background noise is low and the source noise is sufficiently high. Sound propagation is difficult to model in rugged terrain such as the WTP Project Area.

However, the noise level at a given distance from a single source can be estimated using the Inverse Square Law of Noise Propagation (Harris 1991). Essentially, this law states that noise decreases by 6 dBA with every doubling of distance from a source. For example, if the noise at 50 feet from an industrial engine is 70 dBA, the noise at 100 feet would be 64 dBA, and 58 dBA at 200 feet. This method for estimating noise is:

$$L2 = L1 - 20 \times LOG\ (R2/R1)$$

Where:

L2 = noise predicted at a selected distance R2 from the source;

L1 = noise measured at a distance R1 from the source; and

LOG = common logarithm base 10.

Noise can also be estimated from multiple sources either as a cumulative noise source or as the cumulative effect of multiple sources at a location. The noise level of multiple noise sources is not directly arithmetically additive, but is rather a logarithmic summation. For example, if a sound level of 70 dB is added to another sound level of 70 dB, the total is only a 3-decibel increase (to 73 dB), not a doubling to 140 dB. Furthermore, if two sounds are of different levels, the lower level adds less to the higher as this difference increases. If the difference is as much as 10 dB, the lower level adds almost nothing to the higher level. In other words, adding a 60 decibel sound to a 70 decibel sound only increases the total sound level less than one-half decibel. The total effect of multiple co-located noise sources is characterized by the following relationship (Harris 1991):

$$L = 10 * LOG\ (10^{L1/10} + 10^{L2/10} + ... + 10^{Ln/10})$$

Where:

L_1, L_2, ..., L_n are the source sound levels of individual co-located sources;

L is the overall noise level; and

LOG is the common logarithm base 10.

Noise can be roughly estimated in complex terrain (e.g., within a canyon environment) with the following assumptions. First, the canyon walls would act as perfect reflecting surfaces. Next, the total noise at a certain distance would be a summation of multiple noise rays emanating from the noise source.

Although multiple reflections would occur, the three most significant rays are considered in a noise analysis as shown in **Figure 4.18-1**. The first noise ray would be a direct line-of-sight from the source to the receptor (i.e., the red line). The second ray would be one reflection off each canyon wall (i.e., the blue line) at such an angle that the ray would terminate at the receptor. The third ray would represent two reflections off the canyon walls again at angles such that these rays would also terminate at the receptor. Each ray would contribute a decreasing amount to the total noise because of the greater distance that the noise would travel from the source to the receptor. The direct line-of-sight ray would produce the noise level calculated from the equation above. The reflected rays would produce noise levels predicted as an individual source. The total noise level would then be a logarithmic summation of the three contributing noise rays.

Traffic noise can be estimated based on the distribution of vehicle types (large trucks, medium trucks, and combined cars and pickup trucks), average traffic over a 1-hour time period (generally the peak traffic hour), vehicle speed, and distance from the roadway. The average 24-hour noise level (Ldn DBA) is not applicable to the traffic noise because the noise evaluation is for the peak hourly traffic, not the 24-hour period. Noise can be estimated along a roadway using the following formulas (FHWA 1978) for each of the three types of vehicles:

Leq (h) LT = (28.1 X LOG (S*1.6)) + (10 X LOG NLT) - (10 X LOG D) - 3.9

Leq (h) MT = (23.9 X LOG (S*1.6)) + (10 X LOG NMT) - (10 X LOG D) + 14.9

Leq (h) HT = (14.6 X LOG (S*1.6)) + (10 X LOG NHT) - (10 X LOG D) + 37.0

where:

Leq LT = average hourly noise level of cars and light trucks [dBA]

Leq MT = average hourly noise of medium trucks [dBA]

Leq HT = average hourly noise level of heavy trucks [dBA]

S = average speed of cars and light trucks [miles per hour]

NLT = average hourly number of cars and light truck

NMT = average hourly number of medium trucks

NHT = average hourly number of heavy trucks

D = distance from center line of roadway [meters]

LOG = the common logarithm base 10.

The total noise is the logarithmic summation of the three types of vehicles as follows:

Leq (Total) = 10 X LOG {10^(Leq(LT)/10) + 10^(Leq(MT)/10) + 10^(Leq(HT)/10)}

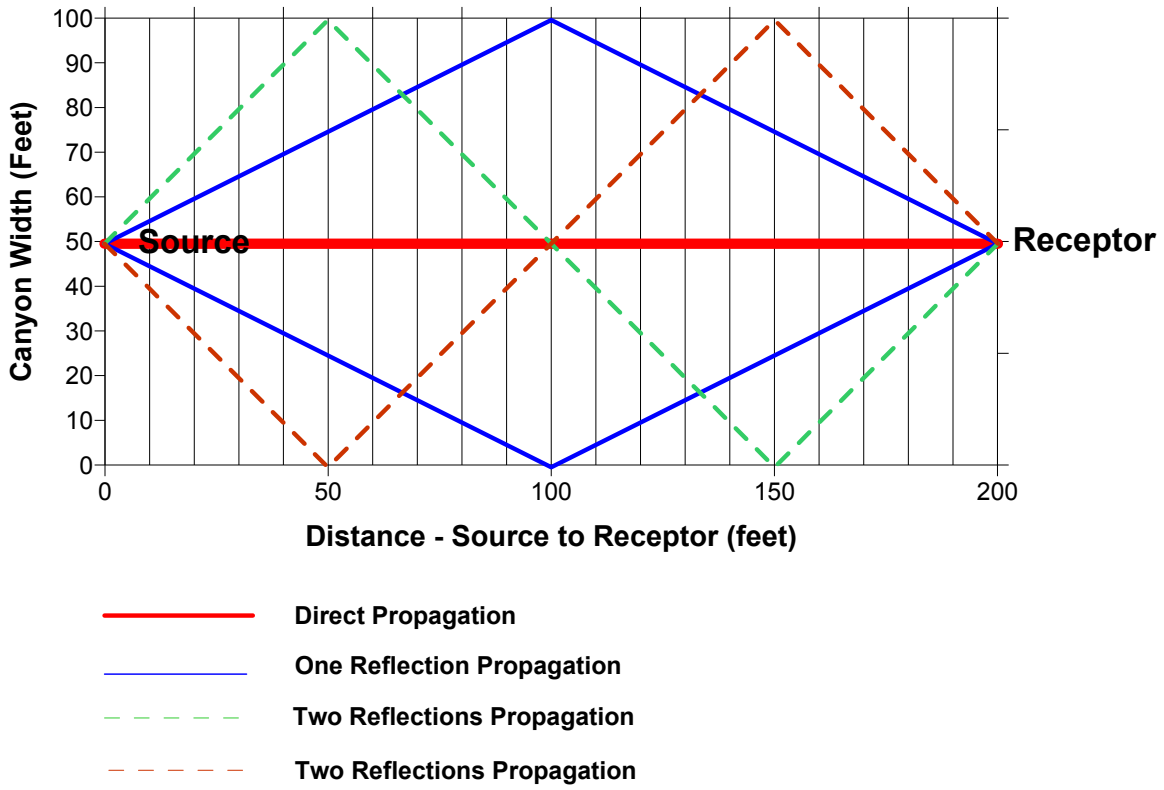
4.18.1.1 Alternative A - Proposed Action

Noise above existing levels would occur during construction, drilling, completion, and operation of natural gas facilities. Elevated noise from construction would occur over the 7 to 21-day period it would take to construct an individual well pad and associated roads, pipelines, and ancillary facilities. Elevated noise levels would occur for longer periods (ranging from 42 to 100 days) during drilling and completion activities for individual wells. During the operational phase, noise near production facilities, compressor stations, and along WTP roads would increase over current levels for the LOP but would be reduced substantially from that during construction, drilling, and completion.

Development Noise Impacts

Construction noise levels would be short-term and spatially limited. The average construction site noise level would be approximately 85 dBA at 50 feet from the site. Elevated noise levels would also occur along access roads as vehicles and heavy equipment traveled to each site. Additionally, noise levels would be elevated along access roads during the construction sequences. Use of WTP Project Area airstrips would result in periodic increases in Project Area noise as airplanes land on and take off from WTP airstrips in order to transport project-related workers and/or supplies. Under the Proposed Action, three airstrips would be utilized to support air travel.

Figure 4.18-1 Noise reflection in Complex Terrain



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Noise impacts from drilling activities would be moderate and of longer duration, on average, than construction activities at any one location. Based on a measured noise level of 50 dBA at ¼ mile (1,320 feet) from a drill rig, noise levels would likely exceed 55 dBA within 800 feet of drill rigs and completion rigs. Drilling noise would occur continuously for 24 hours per day and would last approximately from 42 to 146 days at an individual site depending on the depth of the formation.

The highest expected noise levels would occur during venting of gas during well completion for a maximum of 24 hours per day for approximately 2 to 4 days per well. Venting noise has been measured as 66 dBA at 500 feet. Noise from venting would be above 55 dBA at distances of approximately 1/3 mile (1,800 feet) from the well. However, these elevated noise levels would only last for a maximum of 2 to 4 days at any one location.

Operational Noise Impacts

After construction, drilling, and completion activities, the primary source of operational noise would be compressor stations. Elevated noise would also occur at producing wells and along access roads (from truck traffic and regular maintenance at well sites). Should BBC and other operators utilize remote telemetry equipment would reduce daily pumper traffic and associated noise levels within the WTP Project Area.

Compressor Station Noise

Noise has been measured at typical compressor units (USGS 1981). A noise level of 77 dBA from one large compressor engine can be expected at 50 feet from a compressor engine. This measured baseline value along with the preceding equation were applied to estimate the overall source noise predicted at an individual compressor station with multiple compressor engines under the Proposed Action. As proposed, each new compressor station would have 4 to 7, 1,600-hp, gas-fired compressor engines. Additionally, the existing Dry Canyon Compressor Station located on private land in Section 7, Township 12 South, Range 16 has 10 compressor engines enclosed in a building. **Table 4.18-1** shows the predicted noise (L_{dn} dBA) near a compressor station proposed for the WTP Project Area at 100-foot increments out to 3,000 feet for the existing Dry Canyon and proposed compressor stations with 4 and 7 compressor engines. Addition noise levels resulting from rugged terrain effects are shown. Under all alternatives, the operator would install hospital-grade mufflers on compressor engines and would enclose all compressor engines in buildings or portable structures, which would help to attenuate compressor station noise levels. The noise attenuation for buildings can range from 10 to 20 dBA depending on the building structure. The distance at which the noise level would be below 55 dBA (L_{dn}) would range from 1,200 feet for a 7-engine station to 800 feet for a 4-engine station. However, these distances would approximately double if the compressor stations were located in canyon or canyon-like terrain. Therefore, based upon the published noise level effects, the health and welfare of the general population would not be at risk from any of the identified effects of noise at that level beyond 1/3-mile from the proposed new compressor stations as a result of the Proposed Action. However, noise would generally be heard at distances out to 2 miles in remote areas where the background noise level at night is about 25 dBA and 30-45 dBA during the day.

Table 4.18-1 Predicted Noise (dBA L_{dn}) Near New WTP Compressor Stations [1]						
Distance (feet)	**10 Engines**	**Canyon Terrain Effect**	**7 Engines**	**Canyon Terrain Effect**	**4 Engines**	**Canyon Terrain Effect**
100	77.0	80.8	75.4	79.2	73.0	76.8
200	71.0	76.5	69.4	75.0	67.0	72.5
300	67.4	73.7	65.9	72.1	63.4	69.7
400	64.9	71.5	63.4	69.9	60.9	67.5
500	63.0	69.7	61.5	68.1	59.0	65.7
600	61.4	68.2	59.9	66.6	57.4	64.2
700	60.1	66.9	58.5	65.3	56.1	62.9
800	58.9	65.8	57.4	64.2	**54.9**	61.8
900	57.9	64.8	56.3	63.2	53.9	60.8
1000	57.0	63.9	55.4	62.3	53.0	59.9
1100	56.2	63.1	**54.6**	61.5	52.2	59.1
1200	55.4	62.3	53.8	60.8	51.4	58.3
1300	**54.7**	61.6	53.2	60.1	50.7	57.6
1400	54.1	61.0	52.5	59.5	50.1	57.0
1500	53.5	60.4	51.9	58.9	49.5	56.4
1600	52.9	59.9	51.3	58.3	48.9	55.9
1700	52.4	59.3	50.8	57.8	48.4	55.3
1800	51.9	58.8	50.3	57.3	47.9	***54.8***
1900	51.4	58.4	49.9	56.8	47.4	54.4
2000	51.0	57.9	49.4	56.4	47.0	53.9
2100	50.5	57.5	49.0	56.0	46.5	53.5
2200	50.1	57.1	48.6	55.6	46.1	53.1
2300	49.7	56.7	48.2	55.2	45.7	52.7
2400	49.4	56.3	47.8	***54.8***	45.4	52.3
2500	49.0	56.0	47.5	54.4	45.0	52.0
2600	48.7	55.7	47.1	54.1	44.7	51.7
2700	48.4	55.3	46.8	53.8	44.4	51.3
2800	48.0	55.0	46.5	53.5	44.0	51.0
2900	47.7	***54.7***	46.2	53.2	43.7	50.7
3000	47.4	54.4	45.9	52.9	43.4	50.4

Bolded entries indicate distance from the source where noise level becomes less than 55 dBA.
Bolded italicized entries indicate distance from the source where noise levels become less than 55 dBA in a canyon or canyon-like terrain
[a] building noise attenuation assumed to be 10 dBA for this analysis.

Traffic Noise

Noise generated by vehicles is a function of the type, speed, and quantity of vehicles that pass by a location. Traffic noise for this analysis is based on maximum hourly traffic levels, the assumption that all vehicles would travel at 30 miles per hour (mph), and at a receptor source at a distance of 25 feet from the roadway centerline. The majority of

vehicles entering the WTP Project Area would travel south through Gate Canyon. Approximately 80 percent of the vehicle traffic would turn east on Nine Mile Canyon Road and the other 20 percent would turn west. An evaluation of noise is presented for eastbound and westbound traffic on Nine Mile Canyon. Traffic noise would decrease along other roads in the WTP Project Area as traffic diverges onto proposed and existing access roads.

Traffic surveys (see **Section 3.14**) indicate that the current AADT along Gate Canyon Road is 86 vehicles between 6:00 am and 6:00 pm. Furthermore, about 10 percent of the AADT (9 vehicles per hour) occurs during the peak traffic hour. The projected traffic levels for the WTP Proposed Action are 575 vehicles per day during development and 126 vehicles per day during operations for a total of 803 vehicles per day when the added to current traffic levels (see **Section 4.14.2**). Traffic studies have indicated that the maximum hourly traffic level is 10 percent of the daily total, or 80 vehicles per hour. Additionally, the distribution of cars and light trucks, medium-size trucks, and heavy trucks was determined to be 35, 35, and 30 percent, respectively. As shown on **Table 4-18.2**, on Nine Mile Canyon Road west of Gate Canyon Road, traffic noise would increase from 53.7 dBA L_{eq} to 60.8 dBA L_{eq}. East of the intersection with Gate Canyon Road, traffic noise would increase from 57.1 dBA L_{eq} to 66.8 dBA L_{eq} on Nine Mile Canyon Road.

Table 4.18-2 Predicted Traffic Noise on Nine Mile Canyon Road

Current Vehicles/Day – 102				Proposed Action vehicles/Day 803			
Percent Eastbound	80	Percent Westbound	20	Percent Eastbound	80	Percent Westbound	20
Total Eastbound	82	Total Westbound	20	Total Eastbound	642	Total Westbound	161
10% maximum in 1 hour	8	10% max in 1 hour	2	10% maximum in 1 hour	64	10% max in 1 hour	16
Heavy Trucks (30%)	2	Heavy Trucks (30%)	1	Heavy Trucks (30%)	20	Heavy Trucks (30%)	5
Medium Trucks (35%)	3	Medium Trucks (35%)	1	Medium Trucks (35%)	22	Medium Trucks (35%)	6
Cars/Pickup Trucks (35%)	3	Cars/Pickup Trucks (35%)	1	Cars/Pickup Trucks (35%)	22	Cars/Pickup Trucks (35%)	6
Heavy Truck Noise	55.8	Heavy Truck Noise	52.8	Heavy Truck Noise	65.8	Heavy Truck Noise	59.7
Medium Truck Noise	51.1	Medium Truck Noise	46.3	Medium Truck Noise	59.8	Medium Truck Noise	54.1
Cars/Pickup Truck Noise	39.3	Cars/Pickup Truck Noise	34.6	Cars/Pickup Truck Noise	48.0	Cars/Pickup Truck Noise	42.4
Total Noise	**57.1**	Total	**53.7**	Total	**66.8**	Total	**60.8**

Note: Noise is predicted 25 feet from the roadway centerline with average vehicle speed 30 mph. Noise levels would be 3 dBA less at 50 feet from the roadway centerline.
% = percent

Noise in Sensitive Areas

The WTP Project Area contains numerous noise-sensitive areas and wildlife species for which noise thresholds have not been established, yet increased noise levels could have a substantial impact. Thus, while long-term noise impacts would likely be below established thresholds for public health and welfare (55 dBA), other resources and land

uses within the WTP Project Area could be adversely affected by even minor increases in ambient noise levels. For example, increased noise levels within the Jack Canyon, and Desolation Canyon WSAs could detract from recreational experiences within these areas (see **Section 4.11** and **Section 4.17**). Additionally, even moderate increases in noise levels could have substantial impact on wildlife (e.g., an individual raptor), causing displacement from the habitat affected by noise impacts (see **Section 4.9** and **Section 4.10**). For the purposed of analysis noise predictions were calculated for the WSAs and along the Green River. These particular locations have been identified by the public as the most noise sensitive areas within the WTP Project Area given that they offer opportunities for solitude and primitive and unconfined recreation. The Green River corridor also provides important habitat for numerous noise sensitive species (e.g., Mexican spotted owl). While no specific modeling was conducted for other noise sensitive areas, (e.g., wilderness characteristics areas) based on the level of proposed development, it can be assumed that noise would substantially increase within these areas.

Desolation Canyon WSA

As discussed in **Section 4.17**, the Green River through Desolation Canyon is the focal point of the Desolation Canyon WSA. In order to evaluate noise impacts within the WSA and along the Green River corridor, cumulative noise effects were calculated from two proposed salt water disposal wells and three pump jacks within a four-square mile area. As shown on **Figure 4-18.1**, this area is south of the existing Horse Bench Road and north of the WSA boundary, and falls within the potential Desolation Canyon ACEC and Desolation Canyon WIA. Pump jacks for the analysis were placed randomly on wells bordering the WSA within the four-square mile area as it is assumed that only 10 percent of wells would need to be equipped with pump jacks. As a result of pump jack placement, noise is predicted to be elevated to about 55 dBA L_{dn} along the border of the WSA, but decrease to 45 to 40 dBA L_{dn} and then to 38 dBA Ldn along the Green River near the Peter's Point (see **Figure 4.18-1**). These noise levels would be above the assumed background noise levels of 25 dBA during the night and 30 to 45 dBA during the day. However, if the pump jacks were installed on wells further north of the WSA boundary, the noise predicted noise effects within the WSA would be reduced.

Noise effects from drilling were also evaluated at two well locations proposed within the Desolation Canyon WSA, which are approximately 1.5 miles from Green River. Of these two well pads, one is located near the end of Cedar Ridge and could potentially be within direct line-of-sight of the Green River (see **Figure 3.16-7**); the other is located in the bottom of Jack Canyon near the edge of the Peter's Point Federal Oil and Gas Unit, and would not be visible from the river because of intervening canyon topography. Noise propagation within Jack Canyon was estimated using the Canyon Model described in the introduction of this noise section. The source noise of a drill rig is 50 dBA at ¼ mile. Using the single source models described above, the predicted average day/night noise level (L_{dn} dBA) along the Green River would be approximately 34.0 dBA from drilling on Cedar Ridge, and approximately 41.0 along the Green River dBA near the confluence with Jack Creek from drilling activities in the bottom of Jack Canyon. These levels would be above the average background levels of 25 dBA at night and slightly above the average background levels of 30 to 45 dBA during the day. As previously discussed noise from drilling activities would be short-term in nature.

It should also be noted that baseline noise levels could actually be higher along the Green River because of water flow. This would especially be true near the Jack Creek rapids.

Jack Canyon WSA

Cumulative noise effects were evaluated from a seven-engine compressor station, three water supply wells (one existing and two proposed), two proposed salt water disposal wells and two pump jacks within a three-square mile area northwest of the Jack Canyon WSA near Sage Brush Flats. As shown on **Figure 4-18-2**, noise levels would be elevated near facilities, but would rapidly decrease with distance away from the sources. Noise levels would be 38 dBA L_{dn} or less at locations within the northwest corner of the Jack Canyon WSA. These noise levels would be above the assumed background noise levels of 25 dBA during the night and 30 to 45 dBA during the day. Noise levels in lower Jack Canyon were discussed in the analysis of Desolation Canyon above.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

There would be no irreversible or irretrievable commitment of resources as a result of noise created by the Proposed Action.

4.18.1.2 Alternative B - No Action

Noise related impacts under the No Action Alternative for construction, drilling, completion, and operational activities would be similar in nature to those described under the Proposed Action on a site specific basis, but would be reduced in proportion to reductions in the amount of proposed development. Construction, drilling, and completion noise effects would last for a shorter time period since development would largely be limited to State and private lands. In addition, a much smaller number of wells pads and wells would be developed. Traffic noise would be less at all locations because of lower traffic volumes. Since no drilling would occur in the areas near the Desolation Canyon WSA, no increased noise would occur within the WSA or along the Green River. Noise effects from facilities constructed near Sage Brush Flat would be audible within Jack Canyon WSA.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be same as under the Proposed Action.

4.18.1.3 Alternative C – Transportation Reduction Alternative

Noise related impacts under Alternative C for construction, drilling, completion, and operational activities would be similar to those described under the Proposed Action. Notable differences would include a requirement for use of remote telemetry and water/condensate pipelines to transport water, which would help reduce project-related traffic (and associated noise) during the production phase of the project. Also, the use of the Interplanetary airstrip would be prohibited under this alternative, thereby, eliminating noise of airplane landings and takeoffs from that location. This feature of Alternative C is important in the context of eliminating noise-related impacts within sage-grouse core winter use areas (see **Section 4.10**). **Table 2.6-8** also includes mitigation measures designed to reduce noise within 2 miles of the Green River. These measures would

include use of hospital grade mufflers on drill and completion rigs within 2 miles of the Green River, which would decrease noise levels by approximately 10 dBA when compared with the Proposed Action. This noise reduction would lower the predicted average day/night noise level at the Green River (L_{dn} dBA) to 24.0 dBA from drilling on Cedar Ridge and 31.0 dBA from drilling activities in the bottom of Jack Canyon. These levels would be slightly above the average background levels of 25 dBA at night and below the average background levels of 30 to 45 dBA during the day. However, under Alternative C, no drilling would occur during within 2 miles of the Green River during the peak recreational use period, which is from May 15 to August 15. Noise effects from cumulative sources located outside the WSAs would be similar to the Proposed Action in the Desolation and Jack Canyon WSAs. Additionally, traffic noise in Nine Mile Canyon would be slightly less than under the Proposed Action.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be same as under the Proposed Action.

4.18.1.4 Alternative D – Conservation Alternative

Noise related impacts under Alternative D for construction, drilling, completion, and operational activities would be similar to those described under the Proposed Action. However, noise related impacts in sensitive areas would be substantially reduced under Alternative D given that the BLM would not lease unleased lands with wilderness characteristics; and, NSO restrictions that would apply to WSAs, potential ACECs, and canyon bottoms (where to do so would not violate valid and existing lease rights). This feature of Alternative D is important in the context of reducing or eliminating noise-related impacts within these areas of special designation (see **Section 4.17**). Notable differences would also include a requirement for use of remote telemetry would help reduce project-related traffic during the production phase of the project. Also, use of the Interplanetary airstrip would be prohibited under this alternative, thereby, eliminating noise of airplane landings and takeoffs from that location. This feature of Alternative D is important in the context of eliminating noise-related impacts within sage-grouse core winter use areas (see **Section 4.10**). Traffic noise in Nine Mile Canyon would be slightly less than under the Proposed Action. Noise levels in the Jack Canyon and Desolation Canyon WSAs would be similar to the No Action Alternative because there would be no development in these areas.

IRREVERSIBLE AND IRRETRIEVABLE EFFECTS

Irreversible and irretrievable effects would be same as under the Proposed Action.

4.18.1.5 Alternative E – Agency Preferred Alternative

Noise related impacts under Alternative E for construction, drilling, completion, and operational activities would also be similar to those described under the Proposed Action. Notable differences would include a requirement for use of remote telemetry and water/condensate pipelines to transport water, which would help reduce project-related traffic (and associated noise) during the production phase of the project. Also, use of the Interplanetary airstrip would be prohibited under this alternative, thereby, eliminating noise of airplane landings and takeoffs from that location. This feature of Alternative E is important in the context of eliminating noise-related impacts within sage-grouse core

winter use areas (see **Section 4.10**). With regard to noise sensitive areas within the WTP Project Area, increased use of directional drilling under Alternative E would reduce the number of proposed well locations within the WSAs. Through the use of increased directional drilling, elevated noise levels within the WSAs would be and spatially limited. Finally, similar to Alternative C, Alternative E includes mitigation measures which would effectively reduce noise within 2 miles of the Green River.

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