U.S. Department of the Interior
Bureau of Land Management

DOI-BLM-UTG010-2009-0090-EA

Final Environmental Assessment
and
Biological Assessment

June 2010

Tumbleweed II
Exploratory Natural Gas Drilling Project

FINAL EA

Location: **Uintah County**
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1.0 PURPOSE AND NEED

1.1 INTRODUCTION

This Environmental Assessment (EA) has been prepared to analyze Stewart Petroleum Corporation's (Stewart) proposed exploratory natural gas drilling on their Federal leases. Stewart's leases are located in portions of Townships 14 - 15 South, Range 21 East (T14-15S: R21E), in Uintah County, Utah, approximately 32 miles south of Ouray, Utah and form the Tumbleweed II Project Area boundary (see **Figure 2-1**[1]). The Proposed Action and analyses within this EA evaluates the construction and drilling of up to nine deep, exploratory wells from seven well pads (Tumbleweed Unit Federal #4-3, #5-8, #9-3, #9-11, #17-4, #17-12, and #18-9), and the construction of production facilities, roads, and pipelines on Federal and State lands in the Tumbleweed II Project Area (**Figure 2-1 – Appendix E**). The majority of the leases fall within the Tumbleweed Federal Exploratory Oil and Gas Unit (TUF). However, given that two of Stewart Petroleum's leases boundaries extend beyond the TUF boundaries, the Project Area illustrated in **Figure 2-1** is defined by Stewart Petroleum's leasehold boundaries (i.e., Federal Lease Numbers UTU-74858, UTU-72667, UTU-72018, UTU-72059, and UTU-84256), rather than the TUF boundaries.

Surface ownership in the Tumbleweed II Project Area consists of 5,704 acres of Federal land administered by the BLM and 1,951 acres of State land cooperatively managed by the State of Utah School and Institutional Trust Lands Administration (SITLA) and the Utah Division of Wildlife Resources (UDWR). Mineral ownership for the proposed wells in this EA is entirely Federal.

The EA is a site-specific analysis of potential impacts that could result with the implementation of Alternative A - the Proposed Action, Alternative B - the No Action Alternative, Alternative C – Buried Pipeline Alternative, or Alternative D - Directional Drilling Alternative. The EA assists the Bureau of Land Management (BLM) in project planning and ensuring compliance with the National Environmental Policy Act (NEPA), and in making a determination as to whether any "significant" impacts could result from the analyzed alternatives. An EA provides analysis for determining whether a "Finding of No Significant Impact" (FONSI) can be issued or whether it would be necessary to prepare an Environmental Impact Statement (EIS). A FONSI is a document that briefly presents the reasons why implementation of the selected alternative would not result in "significant" environmental impacts (effects). If the decision maker determines that this project would result in "significant" impacts, then an EIS would be prepared.

If a FONSI is issued, the selected alternative would be approved via the Decision Record. This decision would be contingent upon Stewart meeting all Conditions of Approval (COAs) listed in the Decision Record, and subsequent approval of individual Applications for Permit to Drill (APDs) and right-of-way (ROW) grants.

1.2 TUMBLEWEED PROJECT HISTORY

This EA was preceded by the original *Tumbleweed Exploratory Drilling Environmental Assessment (EA-UT-080-05-201)* (BLM 2007a), for which a Decision Record and FONSI were signed on September 21, 2007. Since September 2007, a number of events have occurred that have prompted the publication of this current Tumbleweed II Exploratory Natural Gas Drilling Project EA, including for example, an appeal and State Director remand of the original 2007 Decision Record; completion of the 2008 Vernal RMP; BLM approval and subsequent rescinding of two Categorical Exclusions for the TUF #19-1 and TUF #18-8; addition of an air quality analysis to Chapters 3 and 4; addition of a directional drilling

[1] Figures are included in **Appendix E**.

alternative; etc. The Draft EA for the Tumbleweed II project was made available to the public for a 15+ day review period held from September 30 to October 16,, 2009. Detailed information on the history of the 2007 Tumbleweed exploratory drilling project and the rationale for publishing this new Tumbleweed II Exploratory Natural Gas Drilling Project EA is included in Appendix B.

1.3 PURPOSE AND NEED FOR THE PROPOSED ACTION

The BLM's purpose and need for the proposed project is to determine where and under what conditions the BLM would allow Stewart Petroleum to explore their current leases within the Tumbleweed II Project Area in accordance with their valid lease rights. National mineral leasing policies, and the regulations by which they are enforced, recognize the statutory right of leaseholders to explore and develop mineral resources to meet continuing national needs and economic demands, so long as undue and unnecessary environmental degradation is not incurred. Increased development of oil and gas resources in an environmentally responsible manner is necessary to satisfy the Federal Energy Policy (set out by the National Energy Policy Development Group in 2001). The BLM's objectives are to consider approval of the Proposed Action and alternatives in a manner that is consistent with management objectives identified in the RMP, is consistent with the lease rights granted to Stewart Petroleum, and is consistent with the BLM's authority to authorize the project so long as undue and unnecessary environmental degradation is not incurred.

Stewart's need for the project is to fulfill its obligations and responsibilities under its Federal leases to explore, develop and produce commercial quantities of hydrocarbons. Specifically, the purpose of the project is for Stewart Petroleum to drill up to nine[2] deep, exploratory wells from seven well pads in order to explore for, test, and potentially develop natural gas from the Dakota, Entrada and Wingate geologic formations, and if successful, produce commercial quantities of oil and/or gas under the terms and stipulations of Stewart's Federal leases in Uintah County, Utah.

1.4 CONFORMANCE WITH BLM LAND USE PLAN

Policies for exploration, development, and land use decisions within the Tumbleweed II Project Area are contained in the Vernal Field Office Approved RMP (BLM 2008a). The Approved RMP allows for processing of APDs and ROW grant applications in support of oil and gas operations, with the impacts of construction and operation activities (e.g., construction of roads, drilling of wells, operation of compressor stations, etc.) to be analyzed on a case-by-case basis. The management objective of the Approved RMP for energy resources is to encourage and facilitate the development by private industry of public land mineral resources in a manner that satisfies national and local needs and provides for economical and environmentally sound exploration, extraction and reclamation practices. Implementation of the Proposed Action, Alternative C, or Alternative D would respond to this objective by allowing Stewart to explore natural gas resources in the Tumbleweed II Project Area, while avoiding, minimizing, or mitigating the potential effects of construction, drilling, completion, and operational activities on biotic and abiotic resources. Therefore, the Proposed Action and Alternatives C and D would be in conformance with the Approved RMP.

1.5 RELATIONSHIP TO STATUTES, REGULATIONS, OR OTHER PLANS

This EA was prepared in accordance with NEPA and in compliance with all applicable regulations and laws passed subsequently, including Council of Environmental Quality (CEQ) regulations (40 Code of

[2] As discussed in **Appendix B**, the TUF #18-9 was drilled and completed in 2007. However, given that the DR approving that well was remanded, the surface disturbance and impacts of that existing well pad, well, and associated facilities are fully analyzed within this new EA.

Federal Regulations [CFR], Parts 1500-1508), U.S. Department of the Interior (USDI) requirements (Department Manual 516, Environmental Quality), and guidelines listed in the BLM's NEPA Handbook, H-1790-1 (BLM 2008b).

Although the majority of construction would occur on Federal lands, a small portion would occur on State lands managed by the SITLA in Section 16, T14S R21E. There are no comprehensive SITLA guidance documents for the vicinity of the Tumbleweed II Project Area. However, because SITLA's objectives are to produce funding for the State school system; because production on Federal leases in the region could potentially lead to drilling and production on State lands; and because the State has shown support for similar projects, the Proposed Action and Alternatives C and D are consistent with the objectives of the State.

The proposed natural gas exploration is also consistent with the Uintah County Public Lands Implementation Plan (Uintah County 2003) and the Uintah County General Plan (Uintah County 2005). These plans include information about public lands multiple-use, resource use and development, access, and wildlife management. The Public Lands Implementation Plan specifically states, "Uintah County's economy is based upon extractive mineral industries and would continue to be in the foreseeable future. The County supports maintaining and increasing renewable resource values, but the vital importance of the minerals industry should be given the highest priority possible. Utilizing Best Management Practices (BMPs) has demonstrated that the minerals industry and renewable resources can thrive at the same time." Based on this information and because the State has shown support for similar projects, the Proposed Action and Alternatives C and D are consistent with the objectives of Uintah County.

In May 1997 the Utah BLM published *Standards for Rangeland Health and Guidelines for Grazing Management for BLM Lands in Utah*. These standards for rangeland health were developed to ensure that various services, activities, and all renewable resources of the land are environmentally sustainable, and that non-renewable resources are recovered in ways that ensure the long-term health of the land managed by the BLM. The Proposed Action and alternatives carried through in this assessment is consistent with these standards. These standards cover upland soils, riparian systems, natural ecosystems, and water quality.

1.6 RELATED AND CONNECTED ACTIONS

In this EA, all connected actions are included in the Proposed Action. As defined by the CEQ (40 CFR, Part 1508), connected actions are closely related and therefore should be discussed in the same impact statement. Actions are connected if they:

(i) Automatically trigger other actions which may require environmental impact statements.
(ii) Cannot or will not proceed unless other actions are taken previously or simultaneously.
(iii) Are interdependent parts of a larger action and depend on the larger action for their justification.

Related actions are similar in time or place to the proposed project, but are independent of the proposed project. Projects related to the proposed exploratory drilling in the Tumbleweed II Project Area are discussed in the following paragraphs.

Seismic exploration within the Tumbleweed II Project Area was analyzed and approved in the *Bill Barrett Corporation Tumbleweed 3D Seismic Survey Environmental Assessment, Uintah County, Utah* (Tumbleweed 3-D Seismic EA) *(*EA No. UT-080-2003-409) (BLM 2005a). The Tumbleweed 3-D Seismic EA was a related action because the geologic data gathered during the seismic project were used to help identify site-specific placement of the proposed wells considered in this EA. The Tumbleweed

seismic project is not a connected action because: 1) the seismic project was conducted independently of these wells; and 2) these wells would have been proposed by Stewart and could be drilled regardless of the presence or absence of the seismic data.

The proposed pipeline in this EA would tie into the existing Winter Ridge pipeline, which was analyzed in the *Questar Gas Management Company's Winter Ridge Pipeline Environmental Assessment* (Winter Ridge EA) (EA No. UT-080-06-362). The proposed pipeline in this EA would tie into the existing Wolf Point compressor station, which was analyzed in Pioneer's *Wolf Point Pipeline Project Environmental Assessment* (Wolf Point EA) (EA No. UT-080-2000-0006). The existing pipeline and existing compressor station are considered related actions because they are tied into delivering gas from the proposed exploration wells to market. The existing Winter Ridge pipeline and Wolf Point compressor station, and their associated EAs, are not connected actions because the pipeline and compressor service other ongoing oil and gas projects/fields, and were approved and installed independent of the Tumbleweed exploratory drilling proposal, and would continue to be used for other projects regardless of the Tumbleweed proposal.

1.7 IDENTIFICATION OF ISSUES

As part of internal scoping, BLM resource specialists in the Vernal Field Office reviewed Stewart's Proposed Action and conferred with other agencies to assess the type and magnitude of potential impacts to affected resources. The potential issues listed below are consistent with relevant concerns and potential issues presented in **Appendix A** (Interdisciplinary Team [IDT] Checklist). These potential issues are carried forward for analysis in the Environmental Consequences section (**Chapter 4.0**) of this EA.

1.7.1 SOILS

Issue 1: Construction of proposed well pads, pipelines, roads, and associated facilities would result in the removal or disturbance of vegetation and soils.

Issue 2: Disturbance of soils could lead to increased soil erosion, sediment yield, and impacts to biological soil crusts.

1.7.2 WATER RESOURCES

Issue 1: Construction of proposed well pads, pipelines, roads, and associated facilities could result in direct and indirect impacts to surface water quality. The applicability of a Nationwide General Permit would be coordinated with the Army Corps of Engineers. (USACE).

Issue 2: Construction and operation of wells, pipelines, and associated facilities could potentially result in chemical spills that could be yielded to Tumbleweed II Project Area drainages and subsequently, the Green River.

1.7.3 VEGETATION (INCLUDING SPECIAL STATUS PLANT SPECIES AND INVASIVE, NON-NATIVE WEEDS)

Issue 1: Removal of vegetation and disturbance to underlying soils could increase soil erosion, soil compaction, and sediment yield.

Issue 2: Removal of vegetation and disturbance to underlying soils could increase the potential for weed invasion and establishment.

Issue 3: Traffic associated with operational activities could contribute to weed invasion.

Issue 4: The project has the potential to affect existing vegetation treatments in the Tumbleweed II Project Area.

Issue 5: The project has the potential to affect woodland resources.

1.7.4 RANGELAND MANAGEMENT AND WILD HORSES

Issue 1: Construction of proposed well pads, pipelines, roads, and associated facilities could result in the removal or disturbance of browse and forage.

Issue 2: Removal or disturbance of vegetation could decrease the overall vegetative productivity of the Tumbleweed II Project Area, and could reduce available forage for livestock, wild horses, and wildlife.

Issue 3: The removal of vegetation, increased traffic activity, and project-related noise could temporarily cause livestock and wild horses to forage in adjacent, undisturbed areas, thereby causing increased grazing impacts in those areas.

Issue 4: Fragmentation of rangeland may impact livestock movement throughout the Horse Point pasture of the Winter Ridge Allotment as well as the current wild horse herd in the Winter Ridge Herd Area.

Issue 5: Integrity of water sources throughout Horse Point Pasture may be impacted and subsequent displacement of both livestock and wild horses may occur. Horses could be displaced into Willow Creek and Meadow Creek. Livestock/wildlife ponds are located within the Project Area and the integrity of those water sources could be impacted by the proposed project.

1.7.5 FISH AND WILDLIFE (INCLUDING SPECIAL STATUS AND THREATENED AND ENDANGERED SPECIES)

Issue 1: The alternatives could result in a loss of wildlife habitat due to construction of well pads, pipelines, roads, and associated facilities.

Issue 2: The alternatives could result in a temporary decrease in wildlife use of Tumbleweed II Project Area habitats (i.e., displacement) during construction, drilling, and completion activities.

Issue 3: The alternatives could result in a temporary decrease in reproductive success and nutritional condition of wildlife caused by increased energy expenditure that could occur due to physical responses to noise and visual disturbance during construction, drilling, and completion.

Issue 4: The alternatives could result in a temporary increase in the potential for collisions between wildlife and motor vehicles due to increased traffic during construction, drilling, and completion.

Issue 5: Water depletion, sedimentation, or spills may occur and could impact fish.

Issue 6: The removal of vegetation and visual and noise disturbances during construction, drilling, completion, and operational activities could potentially affect fish and wildlife including special status species.

1.7.6 RECREATION

Issue 1: Surface disturbance, the placement of permanent structures and facilities, and increased human activity could decrease opportunities for primitive and unconfined recreation.

Issue 2 New road construction could provide increased access to motorized uses.

Issue 3: Temporary decrease in wildlife use of habitats (i.e., displacement) could reduce hunting opportunities.

1.7.7 CULTURAL RESOURCES

Issue 1: Surface-disturbing activities could adversely affect archaeological resources.

Issue 2: Road construction and operation could result in indirect impacts to cultural resources throughout the Tumbleweed II Project Area (e.g., increased visitation and pedestrian traffic, vandalism, OHV or other motorized vehicle use, and erosion).

1.7.8 AIR QUALITY

Issue 1: Emissions from earth-moving equipment, vehicle traffic, drilling and completion activities, separators, oil storage tanks, dehydration units, and daily tailpipe and fugitive dust emissions could adversely affect air quality.

1.7.9 VISUAL RESOURCES

Issue 1: Surface disturbance and oil and gas production facilities would introduce noticeable visual intrusions and change the visual character of the landscape.

1.7.10 NON-WSA LANDS WITH WILDERNESS CHARACTERISTICS

Issue 1: Surface disturbance and the installation of new roads, pipelines, and production facilities would impact the area's naturalness, solitude, and primitive recreation opportunities.

Issue 2: Based on the placement of the proposed exploratory gas wells and associated roads and pipelines, the Wolf Point inventoried area (11,802 acres) would no longer qualify as a wilderness characteristics area.

1.8 ISSUES CONSIDERED BUT DISMISSED FROM DETAILED ANALYSIS

Sections 1.8.1 and **1.8.2** discuss issues that were considered within the original *Tumbleweed Exploratory Drilling EA (EA UT-080-05-201)* (BLM 2007a) or brought up during the public comment period for that EA, which are not carried forward for analysis in this EA.

1.8.1 SPECIAL DESIGNATIONS

Public comments received by the BLM in 2007 on the original draft *Tumbleweed Exploratory Drilling EA (EA UT-080-05-201)* requested that the BLM include analysis of impacts to the potential Main Canyon Area of Critical Environmental Concern (ACEC) and potential Book Cliffs Special Recreation Management Area (SRMA). In response, the BLM included detailed information within the final *Tumbleweed Exploratory Drilling EA (EA UT-080-05-201)* (BLM 2007a) on how proposed development could impact these areas. Some of the background information for these areas is included in Appendix B of this current Tumbleweed II EA. However, the original analyses 2007 can be found in *Tumbleweed Exploratory Drilling EA (UT-080-05-201)* (BLM 2007a), which is available as part of the public record for this project.

On October 31, 2008 the Vernal Field Office released the Record of Decision and Approved RMP (Approved RMP) (BLM 2008a). Within the Approved RMP, neither the potential Main Canyon ACEC nor the potential Book Cliffs SRMA was designated. Because an assessment of impacts to these areas has already been included within the Approved RMP, and decisions have already been made to not carry these areas forward for management, analysis of potential effects to the former potential Main Canyon ACEC or former potential Book Cliffs SRMA-within this site-specific EA is not appropriate. However, potential impacts to individual resource components of these areas (e.g., cultural resources, recreation, etc.) are analyzed as appropriate within this current Tumbleweed II EA.

1.8.2 OZONE

Public comments received on the original *Tumbleweed Exploratory Drilling EA (UT-080-05-201)* (BLM 2007a) asserted that the BLM failed to address potential effects of the project on air quality. Since that time and in response to that public comment, the BLM completed an air quality analysis for the project. An affected environment discussion for air quality has been prepared and is included in **Section 3.2.10** of this EA. Direct and indirect impacts on air quality are discussed in the alternative-specific analyses in Chapter 4.0. Cumulative effects are discussed in **Section 4.2.5.10.**

During the preparation of this EA, the BLM, including the Utah BLM's State Office Air Quality Specialist, discussed and dismissed from consideration inclusion of project-specific photochemical grid modeling for ground level ozone (i.e., ozone modeling) in the EA. Ozone is a regional airshed issue and the complex photochemical reactions that occur in the formation of ozone are dependent upon, among other things, the total pollutant concentrations resulting from all emission sources within a regional airshed, regional climate patterns, and regional transport of emissions.

Ozone modeling requires a detailed and comprehensive accounting of regional ozone precursors (NOx, VOC) to accurately model ozone formation. Due to the relatively small size of the project, and ozone precursor emission levels, the results of a project-level ozone analysis would not provide any new substantive information that would further inform BLM decision-making through the NEPA process beyond the information provided from a regional ozone analysis. The emissions from the Proposed Action would not result in any substantive change in the regional cumulative VOC and NOx emission inventory included in the WRAP Phase III study for the Uinta Basin, 2006 Baseline Emissions, (WRAP, 2009). In addition, given the emission levels of the Proposed Action when compared to regional emissions inventories, the margin of uncertainty associated with such a project-level analysis would likely make the results statistically immaterial. The potential cumulative ozone impact from the Proposed Action cannot be modeled with any accuracy due to the level of the emissions from the Proposed Action, the size of the project, and the lack of a computer model sensitive enough to detect and analyze such changes in the regional emissions inventory.

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2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

The Proposed Action consists of a site-specific proposal that has been designed in cooperation between Stewart and the BLM. The Proposed Action and analyses within this EA evaluates the construction and drilling of up to nine deep exploratory natural gas wells from seven well pads (Tumbleweed Unit Federal #4-3, #5-8, #9-3, #9-11, #17-4, #17-12, and #18-9), production facilities, roads, and pipelines on Federal and State lands in the Tumbleweed II Project Area (**Figure 2-1 – Appendix E**). As discussed in **Appendix B**, the TUF #18-9 was drilled and completed in 2007. However, given that the DR approving that well was remanded, the surface disturbance and impacts of that existing well pad, well, and associated facilities are fully analyzed within this new EA. As such, the seven well pads and nine wells evaluated under this Proposed Action are listed below in **Table 2-1**.

Table 2-1 Proposed Well Pads and Wells Under the Proposed Action

Well Pad	Well	Federal Lease Number
New Wells on New Well Pads		
#4-3	#4-3	UTU-72059
#5-8	#5-8	UTU-72667
#9-3	#9-3	UTU-72059
#9-11	#9-11	UTU-72059
#17-4	#17-4	UTU-84256
#17-12	#17-12	UTU-84256
New Wells on Existing Well Pad		
#18-9	#18-8	UTU-72018
	#19-1	
Existing Well on Existing Well Pad		
#18-9	#18-9	UTU-72018

Approximately 5.5 miles of the proposed 10-inch diameter pipeline would be installed off-lease within the existing pipeline corridor that runs through the southern end of the Tumbleweed II Project Area to the existing Wolf Point compressor station.

2.1.1 WELL PERMITTING PROCESS

Stewart's Proposed Action for the Tumbleweed Project would require approval of the individual wells through the APD process. The detailed information required to be submitted for each APD is identified in Onshore Oil and Gas Order Number 1 and 43 CFR 3162.3.

The BLM's approval of the APDs is contingent on compliance with the following requirements:

- All activities must comply with applicable Federal, State, and local laws and regulations to the extent that such State and local laws are applicable to Federal leases;
- All activities must contain adequate safeguards to protect the environment;
- Disturbed lands must be properly reclaimed; and
- Public health and safety must be protected.

The TUF #18-9 is an existing, producing well with associated well pad, pipeline, and access road. In addition, onsite inspections have been conducted by the BLM for three of the proposed well pads (Tumbleweed Unit Federal #4-3, #9-3, #5-8) and access roads, and pipelines. As a result of those onsite evaluations, some of the originally proposed surface locations have been moved or drilling operations changed to accommodate site-specific concerns and reduce or eliminate potential impacts to resource values. For example, **Section 2.5.1** includes discussion on alternate road locations for the proposed TUF #4-3. However, this alternative was eliminated from further analysis after an onsite evaluation. In another example, the operator and BLM determined that the proposed well for the TUF #18-9 would have to be directionally drilled from the proposed well pad, as the bottomhole location occurs below a topographically challenging area. Following onsite inspections and subsequent re-locations and re-routes, APDs for the above-mentioned wells discussed in this EA were submitted to BLM.

Onsite inspections have not been completed for the proposed TUF #17-4, TUF #17-12, or TUF #9-11 well pads, access roads, and pipelines, or for the proposed well pads under Alternative D. After filing a Notice of Staking (NOS) or an APD, the BLM would conduct an onsite inspection of the proposed well, access road, and pipeline locations to identify site-specific impacts and to identify any avoidance techniques or other mitigation measures. Following the onsite evaluation the project proponent (Stewart) would either submit or revise the APD as determined appropriate.

2.1.2 WELL PAD CONSTRUCTION

In order to drill the proposed nine exploratory gas wells within the Tumbleweed II Project Area, up to seven well pads would be constructed[3]. Each well pad would initially occupy approximately 1.3 acres (approximately 350 x 160 feet). Based on topographical constraints, Stewart is proposing to drill three directional wells from the TUF #18-9. The well pad for the TUF #18-9 would be constructed using the same techniques as the well pads for single vertical wells. The addition of the TUF #18-8 and #19-1 to the TUF #18-9 well pad would not result in any additional surface disturbance. Total initial disturbance from well pad construction in the Tumbleweed II Project Area would be approximately 9.1 acres.

Construction of a well pad typically would involve the use of the following heavy equipment: a D6 or larger crawler tractor, a D12 or larger motor grader, a Class 125 or larger track hoe, a mid-sized backhoe, a 10-yard dump truck, and possibly a Class 988 loader. Equipment needs would vary depending on the site-specific conditions. All surface-disturbing activities would be supervised by a company representative who is familiar with the terms and conditions in the Decision Record and associated APDs.

In order to clear surfaces for well pad construction, a crawler tractor would strip existing topsoil and brush, and would stockpile the soil along the uphill side of the well pad, if feasible. All cut and fill slopes needed for the well pad would be constructed so that stability would be maintained for the life of the project. To prevent storm water from washing onto each well pad, diversion ditches and berms would be constructed with a motor grader. Prior to drilling operations, a reserve pit (approximately 190 feet by 80 feet by 10 feet deep) would be excavated adjacent to the working area. To avoid impacts to soils and shallow groundwater, the reserve pit would be lined with 12-milimeter (minimum) plastic nylon reinforced material. The liner would overlay a felt liner pad if rock is encountered during excavation. The pit liner would overlap the pit walls and be covered with dirt and/or rocks to hold it in place. The reserve pit liners would have minimum burst strength equal to or greater than 300 pounds, puncture strength equal to or greater than 160 pounds, and grab tensile strength exceeding 150 pounds. Each liner would be resistant to deterioration by hydrocarbons, and all liners would be tested in accordance with

[3] As previously stated, the TUF #18-9 well pad was constructed and the well was drilled and completed in 2007. However, given that the DR approving that well was remanded, the surface disturbance and impacts of that existing well pad, well, and associated facilities are fully analyzed within this new EA.

American Society for Testing and Materials standards. Spoil from the pit would be stockpiled within a drainage control berm along the edge of each pit and adjacent to each well pad. The depth of the reserve pit would be approximately 10 feet, with 2 feet of freeboard.

To assure stability, the reserve pit would be constructed on the cut side of the pads. The pit would not be constructed in a natural drainage, where flood hazards exist, or where surface run-off could enter the pit or damage the pit walls. Three sides of the reserve pit would be fenced before drilling, and the fourth side would be fenced as soon as drilling is completed. All fences would remain until the liquids are removed and the pits are backfilled. After the well has been drilled, all pits containing materials that might be hazardous to wildlife would be covered with steel mesh screen or netting to prevent entry by migratory birds, bats, or other wildlife species and livestock.

Each well pad would be surrounded by a berm to minimize erosion, and all drainage from the pads would be directed toward the reserve pit. The berm would also divert drainage from adjacent lands around areas of disturbance. Energy dissipaters such as straw bales, rock gabions, and silt fences may be used in areas where the possibility of down-cutting exists.

Well pad construction would take approximately 5 to 10 days per pad.

If the wells are productive, a portion of each well pad would be reclaimed following completion of the well(s). Production equipment at each well pad would include a well head(s), meter house(s), separator(s), produced water and oil tanks, and pipelines. Portions of the well pad surfaces not used to house production facilities, and not needed to provide continued access to those facilities, would be re-graded so that water would drain away from the reclaimed drilling pits. The re-graded areas would then be seeded with a seed mixture approved by the Authorized Officer (**Section 2.1.13**).

Approximately 0.35 acres (100 x 150 feet) of each well pad would remain in place over the life of the project. Total long-term well pad disturbance from the existing #18-9 well pad and six proposed well pads is estimated to be approximately 2.45 acres. If a well is unproductive, the pad would be entirely reclaimed following well plugging and abandonment. In the case of either a productive or unproductive well, reclamation activities would take place within one year of drilling activities.

2.1.3 ROAD CONSTRUCTION

Access to the Tumbleweed II Project Area would be achieved by following the Seep Ridge Road to the Three Pines Road. The Three Pines Road would be followed in a westerly direction to the intersection of the Winter Ridge Road. The Winter Ridge Road would then be followed in a northwest direction to the just beyond then Bull Canyon - Winter Ridge Road intersection. Tumbleweed II Project Area access would leave the Winter Ridge Road and proceed along unmarked roads for 0.8 miles to a point where new access would begin. A new access road 0.6 mile in length would then continue to the proposed Tumbleweed Unit exploratory wells.

Proposed access roads on federal lands would be permitted through the APD, Sundry Notice, or ROW grant process as appropriate[4]. Construction of new access roads and upgrading of existing roads would only occur within areas approved for disturbance and would be in accordance with BLM road guidelines established for oil and gas exploration and development activities as described in the BLM and U.S. Forest Service (USFS) publication *Surface Operating Standards for Oil and Gas Exploration and Development* (Fourth Edition) (i.e., the Gold Book), *BLM Manual Section 9113*, and BLM's

[4] A small portion of road/pipeline corridor is proposed off-lease, and would be permitted through the BLM's ROW grant process.

Hydrological Modification Standards for Roads (BLM and USFS 2007). Site-specific approval of road ROWs would be obtained through the BLM ROW grant process as appropriate. Impacts from all currently proposed ROWs are included in this EA.

The Proposed Action would require construction of up to approximately 4.2 miles of new road surface and upgrading of up to approximately 1.9 miles of existing roads (unnamed Class D roads) within the Tumbleweed II Project Area. Where possible, disturbance to steep slopes, rugged terrain, and ephemeral/intermittent drainages would be avoided. The initial construction width for both new roads and existing road upgrades would be 32-feet wide, which would result in approximately 23.7 acres of disturbance. Following road construction, unused road surfaces would be reclaimed, and each road would have a 16-foot running surface. All roads would be composed of a base overlain with 0.75-inch gravel, as needed. The surface would have a crown to facilitate drainage to a borrow ditch designed to minimize erosion potential. Grades would be less than 10 percent, and the maximum degree of curve would be less than 50 degrees. No cuts, fills, or turnouts would be necessary to access proposed well locations. The new and upgraded roads would have a design speed of approximately 20 miles-per–hour (mph). Reseeding of unused portions of the road would occur in the first planting season after construction is completed.

Road construction is estimated to take approximately 1 to 2 days per well pad. Timing of new road construction would be dependent upon the drilling schedule. New road construction in the Tumbleweed II Project Area would utilize a crawler tractor or track hoe to windrow vegetation to one side. A grader or bulldozer would establish borrow ditches and crown the road surface. If culverts are required, a track hoe or backhoe would trench the road and install the culverts. Some manual labor would be required when installing and armoring the culvert. Road base or gravel would be hauled in and a grader used to smooth the running surface as needed. If gravel is used, it would be obtained from a State-approved gravel pit. No unnecessary side-casting of material on steep slopes would occur.

Improvements of existing roads would typically require the following equipment: a class 12 or greater motor grader, a class D6 or larger crawler tractor, several 10-yard end dump trucks, and a water truck(s). Methods for improving the existing roads and two-tracks would be similar to those described above for new road construction.

Road traffic, to and within the Tumbleweed II Project Area, is estimated to be greater during the development phase than the production phase. During the exploratory development phase, average daily traffic (ADT) due to project-related activity would be approximately 10-20 vehicles per day per well. Because of timing limitations, development traffic would not occur during the winter season; however, all roads within Uintah and Grand counties, to and within the Tumbleweed II Project Area, would be maintained to provide all weather access when possible on a year-round basis in order to accommodate limited production traffic. Production traffic would be limited to 1-2 vehicles per day. Typical maintenance activities would include:

- Work necessary to preserve the existing roads;
- Physical upkeep and repair due to wear or damage whether from natural or other causes;
- Work required to maintain the shape of the road (grade and crown);
- Work required to maintain drainage features of the road (e.g., culverts and water bars);
- Work required to remove snow; and
- Work required to fill mud holes and dust pockets with acceptable road material.

All existing, upgraded, and new roads in the Tumbleweed II Project Area would require routine maintenance. Depending on moisture conditions, each roadway would be watered or treated with other approved dust suppressants to control dust and to facilitate grading. Up to approximately 320 barrels of water could be used per day during drilling and completion operations for dust abatement, depending on weather conditions. Drilling and completion may require up to 100 days to complete per well, therefore, up to 27.8 acre-feet of water could potentially be used for dust suppression to construct, drill and complete all wells and associated infrastructure. As discussed in **Section 2.1.10**, water would be obtained from a local water right owner in Main Canyon (State of Utah Application #49-123 [t34667]).

In order to protect road networks and the public, Stewart would comply with existing Federal, State, and county requirements and restrictions. All drivers and rig crews would be advised of potential hazards from recreational traffic along the access roads, as well as hazards due to blind corners, vehicles parked in the road, pedestrian traffic, livestock, wild horses, and wildlife. In addition, appropriate signs would be erected to warn non-project personnel about traffic hazards associated with project-related activities.

2.1.4 PIPELINE CONSTRUCTION

Pipelines would be necessary to transport gas from producing wells to their tie-in locations (i.e., the existing Winter Ridge Pipeline) in the SW ¼ of Section 16, T15S R21E. Approximately 12.3 miles of 10-inch diameter steel pipeline would be constructed and placed on the surface, co-located/adjacent to new or existing access roads within the Tumbleweed II Project Area. Surface disturbance for pipelines co-located with access roads was also accounted for in **Section 2.1.3**. Of the proposed pipelines, approximately 5.5 miles would be installed on BLM-administered lands outside of Stewart's leases and the Tumbleweed Unit but adjacent to the Winter Ridge Road and within the existing Winter Ridge pipeline corridor that leads to the Wolf Point compressor station. Prior to construction, all proposed pipelines would be permitted through the APD or ROW grant process as appropriate. Pipeline construction methods and practices would be completed in such a manner so as to minimize surface disturbance. Where surface pipeline is proposed adjacent to existing roads, the operator would need a construction area of approximately 10 feet wide outside and adjacent to the road. Pipelines co-located with new roads would be constructed within the disturbance corridor discussed in **Section 2.1.3**. Pipelines would be constructed by welding joints into long segments on the existing road surfaces. The welded segments would then be dropped into position using a boom adjacent to the existing roads, and a final welding pass would then be made to join all segments together. Following pipeline installation, portions of the construction area not occupied by the pipeline would be reclaimed (i.e., all but where the proposed pipeline sits on the surface), resulting in approximately 1.2 acres of long-term disturbance.

Pipeline construction is estimated to take a total of 1 to 2 days per mile of pipeline.

2.1.5 DRILLING OPERATIONS

Once construction of the well pads is completed, drilling equipment would be moved onto each drilling site. A standard drilling rig appropriate for the target depth would be set up on each well pad and powered by diesel engines. Only one rig would be operating in the Project Area at any one time. Diesel fuel would be delivered by tanker truck to a storage tank located on each well pad. The exact type and size of rig would be dependent upon rig availability at the time of project implementation. Drilling water would be trucked in from a local landowner (State of Utah Application #49-123 [t33231]). The water source consists of an unnamed spring branch in Main Canyon. Approximately 2 acre-feet of water would be needed to drill and complete each well. Wells would utilize a semi closed-loop circulation system with reserve and flare pits.

As was discussed in **Section 1.2**, the TUF #18-9 was directionally drilled from a well pad in the NE/SE ¼ of Section 18, T15S R21E. The bottomhole for the TUF #18-9 is located in a topographically inaccessible area in the SW/SE ¼ of Section 18. As illustrated on **Figure 2-1 - Appendix E**, Stewart is proposing to drill two additional directional wells (TUF #19-1 and TUF #18-8) from the TUF #18-9, which are also located in topographically inaccessible areas.

All proposed wells would be drilled to the Entrada, Dakota, and Wingate Formations at approximately 11,000 to 12,000 feet in depth. Any shallow water zones encountered during drilling would be isolated by either casing or cement, and reported to the appropriate agencies. All potentially productive hydrocarbon zones would be cemented. Site-specific descriptions of drilling procedures would be included in the individual APDs submitted to the Authorized Officer by Stewart.

Upon completion of drilling, any hydrocarbons in the reserve pit would be removed as soon as possible and processed or disposed of at an appropriate offsite commercial facility. Cuttings generated during the drilling process would be buried in the reserve pit following the evaporation or removal of free liquids.

Under routine conditions, approximately three weeks (21 days) would be required for drill rig setup, drilling, and rig takedown for each vertical well. For the purposes of analysis, it is assumed an additional 10 days would be required for each directional well. Drilling and completion problems have the potential to extend this schedule. As many as 15 people may be present during construction and drilling operations.

2.1.6 WELL COMPLETION

Once the wells are drilled and assuming indications of potential well productivity, completion operations would commence. This would involve perforating the casing in target production zones, followed by fracturing (fracing) the formation by injecting an agent (i.e., water and carbon dioxide) into the formation under high pressure. The fracing material would contain sand or other proppant to keep the fractures from closing, thereby providing a conduit to allow the gas to flow to the well bore. The next phase would be to flow and test the well to determine rates or production. After the fracing fluid is recovered and gas meets pipeline specifications, the gas would be sent down the pipeline.

Well completion would be conducted using a truck-mounted work-over rig and would take approximately three weeks (21 days) per well, depending on site-specific conditions.

2.1.7 PRODUCTION OPERATIONS

When it is determined that a well is productive, production facilities would be consolidated to the extent feasible on the well pad, and would be placed where interim reclamation would be maximized. Production equipment to be installed at each well pad would include:

- 1 well head for each producing well,
- 1 meter house for each producing well,
- Gas flow and gathering pipelines for each producing well;
- 1, 1 MMbtu/day separator per producing well;
- 1, 400-bbl water tank per producing well; and
- 2, 400-bbl oil tanks per producing well.

Produced water and oil tanks would be surrounded by a secondary containment berm of sufficient capacity to contain the entire capacity of the largest single container and sufficient freeboard to contain precipitation. Produced water would be transported to commercial disposal sites by tanker trucks. Oil would be hauled by truck to an off-site processing facility.

All loading lines and valves would be placed inside the berm to contain spills. In addition to the tank battery and berm, a gas meter run would also be constructed within 500 feet of the wellhead. All gas flow lines would be buried between the production equipment and the housed meter. Gathering lines would be laid on the surface beyond the meter.

All security guidelines identified in 43 CFR 3162.7-3 and 312.7-5, *Onshore Oil and Gas Order No. 3-5, and American Gas Association Report No. 3,* would be followed. All permanent structures constructed or installed would be painted a flat, non-reflective standard color as directed by the BLM. Facilities would be painted within 6 months of installation. As required by the Occupational Safety and Health Administration (OSHA), some equipment may be excluded from this painting for safety considerations (e.g., fire extinguishers). All facilities and equipment associated with the Proposed Action would be restricted to areas approved for disturbance.

As practical, meters at all producing gas wells would be equipped with remote telemetry monitoring systems, which could reduce the number of pumper visits. However, for purposes of providing the most conservative impact analysis, it is assumed that each well would be visited once daily for visual inspection of equipment. A single pumper would complete daily inspections for all of the wells using a standard pick-up truck.

2.1.7.1 Compressor Station

If the wells are successful, produced natural gas would be transported via the proposed eight-inch diameter pipeline that ties into the existing Winter Ridge pipeline to the existing Wolf Point compressor station located on State of Utah lands (NW/NW of Section 32, T15S R22E). Additional field compression is not proposed for this exploration project.

2.1.8 DRY HOLE/NON-PRODUCING WELL PROCEDURES

If a drilled well is a dry hole or not capable of production, the entire well pad, and associated access road, would be reclaimed. Stewart would follow the procedures of the BLM and Utah Division of Oil, Gas and Mining (UDOGM) for plugging and abandonment of the well. All surface production equipment would be removed, and the well pad (and possibly associated access road) would be closed and reclaimed according to BLM specifications, the Surface Use Plan of Operations (SUPO), and applicable Conditions of Approval (COAs).

2.1.9 SURFACE DISTURBANCE ESTIMATES

Initial disturbances are those that would last the 7 to 8 years it generally takes for woody vegetation to be re-established in the Uinta Basin. Long-term disturbances are those that would last for the life of the project (20-30 years) plus the time it takes to re-establish vegetation.

Stewart's Proposed Action includes a commitment to reclaim those areas not needed for production. Recent BLM monitoring has documented that interim reclamation efforts in oil and gas development areas within the Vernal planning area have largely been unsuccessful due to the arid environment of the Uinta Basin. However, precipitation is higher and the affected soils have greater reclamation potential in the Tumbleweed II Project Area than elsewhere in the Vernal planning area. Therefore, implementation

of interim reclamation and revegetation practices could effectively reduce the initial disturbance resulting from the project, thus reducing the amount of long-term disturbance. However, for impact analyses within Chapter 4 of this EA, all surface disturbance and resulting direct and indirect impacts will be analyzed using the initial surface disturbance (worst-case scenario) calculations listed in **Table 2-1**.

Construction of the proposed well pads and associated access roads and pipeline ROWs would result in the initial disturbance of approximately 47.7 acres of vegetation and soils as outlined in **Table 2-2**. Once the proposed wells are completed, interim reclamation could reestablish approximately 32 acres of vegetation. Approximately 15.5 acres of vegetation and soils would remain disturbed for the life of the project.

Table 2-2. Initial and Long-Term Surface Disturbance Estimates - Proposed Action

Proposed Surface Facility/Activity	Initial Size - Length/Width	Initial Surface Disturbance	Long-term Size - Length/Width	Long-term Surface Disturbance
Proposed Well Pads **(7)**	1.3 acres / pad	9.1 acres	0.35 acre	2.45 acres
Proposed Roads	4.2 miles/32-feet wide	16.3 acres	4.2 miles/16-feet	8.1 acres
Existing Roads Needing Upgrades/Improvement	1.9 miles/32-feet wide	7.4 acres	1.9 miles/16-feet	3.7 acres
Proposed Surface-laid Pipeline	12.3 miles/10-feet wide	14.9 acres	12.3 miles/0.8 feet	1.2 acres
Total Surface Disturbance	**NA**	**47.7 acres***	**NA**	**15.5 acres**

*The total estimated surface disturbance for the Proposed Action differs slightly from the additive acreage of the individual disturbance components as a result of GIS analysis (47.4 acres), which removes areas of overlapping development (0.3 acre).

2.1.10 WATER SOURCES AND WATER USE

Stewart would haul water for drilling, completion, and dust suppression by truck from a local water right owner in Main Canyon (State of Utah Application #49-123 [t35783]). The water source consists of an unnamed spring branch in Main Canyon. There is no flow or water quality information available for this spring. Drilling and completion of up to nine proposed wells in the Tumbleweed II Project Area would require approximately 18 acre-feet of water (i.e., approximately 2 acre-feet per well). Up to 320 barrels of water could be used per day during drilling and completion operations for dust abatement. Drilling and completion may require up to 100 days per well, therefore up to 27.8 acre-feet of water could potentially be used for dust suppression. Total water use for drilling, completion, and dust suppression over the life of the project would be approximately 45.8 acre-feet.

2.1.10.1 Endangered Fish and Water Depletion

The U.S. Fish and Wildlife Service (USFWS) has identified four Federally-listed fish species (pikeminnow, humpback chub, bonytail, and razorback sucker) that could be affected by water depletion from the Green River as a result of the water wells proposed for use in construction of the Proposed Action. Water depletion for these exploratory gas wells is based off of the use of water permit 49-123 (t34667) in the SW1/4 of Section 32, T15S R23E. This State-approved water right consists of an unnamed spring branch in Main Canyon, which is fed by Main Canyon, a tributary to Willow Creek, and subsequently to the Green River. The water taken from this spring would qualify as an historic depletion to the Green River. **Table 2-3** summarizes water use and water depletion for this project:

Table 2-3. Water Source Information

Project Name and or Applicant Name	Stewart Petroleum
Permit number and or special use authorization	t35783
Lease Number(s)	U-72059 U-72667 U-74858 U-72018 U-84256
Water Right Number & Location	49-123, Main Canyon
General location and legal description	SW1/4 of Section 32, T15S R23E
Depletion amount in acre-feet	45.8 acre-feet total (drilling, completion and dust suppression)
Timing of depletion	Spring, Summer, Fall, or Winter
Identify if new or historic depletion	Historic
Sub-total water depletion for each applicant	45.8 acre-feet
Total depletion for the entire year in acre-feet	Approximately 15.3 acre-feet
Total number of APDs approved	One (18-9)
Total number of wells spudded	One (18-9)

2.1.11 HAZARDOUS MATERIALS AND OTHER WASTES

As mentioned previously, any hydrocarbons remaining in the reserve pit would be removed as soon as possible and processed or disposed of at an appropriate offsite commercial facility. All drilling mud/water would be hauled off-site to a licensed, commercial disposal facility. Cuttings generated during the drilling process would be buried in the reserve pit following removal of any excess liquids. On Federal lands, this would occur within 90-days of completing the well per BLM regulations.

Reportable quantities of chemicals on the EPA *Consolidated List of Chemicals Subject to Reporting Under Title III of the Superfund Amendments and Reauthorization Act of 1986* (SARA Title III) that would be used during drilling and completion include diesel fuel, sand (silica), hydrochloric acid, and carbon dioxide (gas). During production operations, natural gas condensate and crude oil would be produced. Triethylene glycol, ethylene glycol mix (50 percent), and methanol would also be used during production. Small quantities of consumer products (paint/spray paint, solvents, and lubrication oil) containing non-reportable volumes of hazardous substances may be stored and used during the life of the project. No extremely hazardous substances, as defined in 40 CFR Part 355, would be used, produced, stored, transported, or disposed of in association with the Proposed Action. Any spills of oil, gas, produced water, or any other potentially contaminating substances would be cleaned up and immediately removed to an approved disposal site in Vernal, Utah. Portable self-contained chemical toilets would be rented from and maintained by a commercial supplier in Uintah County. Upon completion of operations, or as required, these toilets would be removed and the contents disposed of in an approved sewage disposal facility in Vernal, Utah.

A Spill Prevention, Control, and Countermeasure (SPCC) Plan, which outlines the methodology to be used in the event of a spill, would be prepared and would be maintained onsite at all times. The SPCC Plan would describe how to contain a spill and how to facilitate rapid clean up of any hydrocarbon spill prior to its contamination of either surface or subsurface waters. Produced liquid hydrocarbons would be stored in tanks surrounded by an impervious berm. According to the 2002 Federal Register, Volume 67, Number 137, produced liquid hydrocarbons and condensates must be stored in tanks surrounded by a secondary containment berm of sufficient capacity to contain the entire capacity of the largest single container and sufficient freeboard to contain precipitation. All loading lines and valves would be placed inside the berm surrounding the tank, or would be surrounded by berms to contain spills. The tanks would be emptied, as necessary, and the liquids transported to market via 100-barrel capacity trucks.

2.1.12 WORKOVERS

Periodic workovers may be required to correct downhole problems in a producing well, return a well to production, increase or maintain production from a producing zone or to re-complete in a new zone. Workovers are generally completed within 1 to 2 weeks. Workovers do not require additional surface disturbance. A producing well could require a workover for any of the following reasons:

- Changing or replacing production tubing;
- Refracturing producing formations using advanced techniques designed to stimulate additional production;
- Cleaning out the well bore and perforations to stimulate/facilitate production; and
- Possibly "re-completing" in another potentially productive zone that was not originally completed at the time the well was drilled.

2.1.13 RECLAMATION

The following reclamation practices were designed to rehabilitate the Tumbleweed II Project Area so that disturbed areas would achieve visual compatibility with the surrounding undisturbed areas. Implementation of these practices could re-establish vegetative cover that would provide wildlife foraging habitat and livestock grazing habitat as soon as is practicable after construction, drilling and completion are finalized.

As described in **Section 2.1.9** above, implementation of interim reclamation and revegetation practices could effectively reduce the initial disturbance resulting from the project, thus the long-term disturbance could be substantially less. Therefore, for impact analyses within Chapter 4 of this EA, all surface disturbance and resulting direct and indirect impacts were analyzed using the initial or maximum surface disturbance calculations.

Following construction, drilling, and completion activities, all disturbed areas not needed for production would be reclaimed. These areas would include portions of new road and pipeline ROWs, as well as portions of well pads. The seed mixture for reclamation on BLM lands would be comprised of the grasses, forbs, and shrubs listed in **Table 2-4**. On BLM lands, seeding would be applied with a rangeland drill between August 15 and December 15. Stewart or their contractor would notify the BLM prior to seeding and would retain all seed tags from reclamation conducted on BLM lands.

Table 2-4 Seed Mixture for Reclamation on BLM Lands

Common Name	Scientific Name	Seed Rates[1]
Thickspike wheatgrass	*Elymus lanceolatus*	2 pounds (lbs)/acre
Paiute orchardgrass	*Dactylis glomerata* v. *paiute*	2 lbs/acre
Bluebunch wheatgrass	*Agropyrum spicatum*	2 lbs/acre
Blue flax	*Linum lewisii*	1 lb (pound)/acre
Scarlet globemallow	*Sphaeralcea coccinea*	1 lb/acre
Fourwing saltbush	*Atriplex canescens*	2 lbs/acre

[1] All seed rates are in terms of Pure Live Seed (PLS).

At the end of the life of each well, all lease roads associated with this development project would be reclaimed in accordance with the requirements of the responsible SMA. Reclamation would generally

involve re-contouring the surface to the approximate natural contours, re-establishing soil conditions, and reseeding with approved seed mixtures. Reclamation procedures would continue until the responsible SMA determines that the reclamation has been successful.

Stewart would initiate reclamation of disturbed habitat as appropriate. On producing wells, Stewart would re-contour the location as appropriate to minimize slopes (not to exceed 3:1). Areas not used for production purposes would be backfilled and blended into the surrounding terrain, topsoil would be re-spread and re-seeded, and erosion control devices installed. Mulching, erosion control measures, and fertilization may be required to achieve acceptable stabilization. Reclamation of all unused portions of road and pipeline ROWs would take place in the first planting season after initial disturbance. Road surfaces and other compacted areas would be ripped to a depth of 1 foot on 1.5-feet centers to reduce compaction prior to spreading the topsoil across the disturbed area. Stripped vegetation would be spread over the disturbed area for nutrient recycling, where practical. Road barriers to discourage travel would be used where necessary. Stewart would monitor reclamation to ensure successful reestablishment of vegetation in accordance with the Green River District Reclamation Guidelines for Reclamation Plans (BLM 2009a). In accordance with the Green River District Reclamation Guidelines, a site-specific reclamation plan will be attached to each APD.

Follow-up seeding or corrective erosion or weed control measures would occur in areas where initial reclamation efforts are unsuccessful. Any mulch used by Stewart would be weed and noxious weed seeds free and reasonably free from mold and fungi. Mulch may include native hay, small grain straw, wood fiber, live mulch, cotton, jute, synthetic netting, and rock. Straw mulch would contain fibers long enough to facilitate crimping and provide the greatest cover.

Prior to application of herbicides on BLM-administered land, a Pesticide Use Proposal (PUP) would be submitted and approved. Information about special status plant avoidance would be outlined in the PUP. Pesticide application record forms will be completed after each application and submitted to the BLM weed coordinator before November 1st of each year.

In the event that wells are not producers, or at such time the well is plugged and abandoned, the operator would submit a Notice of Intent to Abandon to the BLM. The BLM would then attach the appropriate surface rehabilitation COAs. Back filling, leveling, and re-contouring of the well pads would be performed as soon as possible after cessation of production and removal of structures and completion operations. Reclamation measures for plugged and abandoned wells and associated roads and pipeline ROWs would be identical to those described above for interim reclamation.

2.1.14 REQUIRED MEASURES

The following section discusses resource-specific environmental protection measures that would be implemented as required by law, the Vernal Field Office Approved RMP (BLM 2008a), Stewart's leases, and/or other statutory or regulatory requirements under any of the alternatives. Implementation of these required measures would help eliminate or minimize impacts to resources within the Tumbleweed II Project Area.

2.1.14.1 Air Quality

Stewart would comply with all applicable local, State, and Federal air quality laws, statutes, regulations, standards, and implementation plans.

As required by the EPA, Stewart would obtain all necessary air quality permits to construct, test, and operate facilities.

2.1.14.2 Cultural/Historical Resources

In accordance with the National Historic Preservation Act (NHPA) of 1966, as amended, the Archaeological Resources Protection Act (ARPA) of 1979, and the Native American Graves Protection and Repatriation Act (NAGPRA), prior to any project-related surface disturbance, all locations proposed for surface disturbance would be examined by an archaeologist approved by the appropriate SMA to determine the presence of cultural resources (i.e., Class III cultural resource inventories with 100 percent pedestrian field survey would be completed). Consultation would be completed with the Utah State Historic Preservation Office (SHPO) prior to the onset of development, as set out in existing regulations. If any cultural resources eligible for listing to the National Register of Historic Places (NRHP) are identified, recommendations would be made to avoid or recover such resources. To date, Class III inventories have been completed for the TUF #18-9, #17-4, and #17-12 proposed well pads and associated access roads and pipeline corridors. Additional Class III survey work would be completed following project approval and prior to any surface-disturbing activities.

If cultural resources are uncovered during surface-disturbing activities, Stewart would suspend operations at the site and immediately contact the appropriate AO, who would arrange for a determination of eligibility in consultation with the Utah SHPO and if necessary, would recommend a recovery or avoidance plan.

2.1.14.3 General Environmental Protection

As provided for in Stewart's lease serial number UTU-72059 (applicable to all or portions of Sections 4, 7-9, and 18, T15S, R21E), the Authorized Officer may require modifications of the SUPO to protect the environment during severe winter weather conditions.

2.1.14.4 Geological/Paleontological Resources

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

2.1.14.5 Health and Safety/Hazardous Materials

Stewart would institute a Hazard Communication Program for its employees and require subcontractor programs to operate in accordance with OSHA (29 CFR 1910.1200).

As required by OSHA, Stewart would place warning signs near hazardous areas and along roadways.

In accordance with 29 CFR 1910.1200, a Material Safety Data Sheet (MSDS) for every chemical or hazardous material brought on-site would be kept on file in Stewart's field office.

Chemicals and hazardous materials would be inventoried and reported by Stewart in accordance with the SARA Title III (40 CFR 335). If quantities exceeding 10,000 pounds or the threshold planning quantity are produced or stored, Stewart would submit appropriate Section 311 and 312 forms to the State and county emergency management coordinators and the local fire departments.

Stewart would transport and/or dispose of any hazardous wastes, as defined by the Resource Conservation and Recovery Act of 1976 (RCRA), as amended, in accordance with all applicable Federal, State, and local regulations.

All storage tanks that contain oil, glycol, produced water, or other fluid, which may constitute a hazard to public health or safety, would be surrounded by secondary means of containment for the entire contents of the largest single tank in use plus freeboard for precipitation. The appropriate containment and/or diversionary structures or equipment, including walls and floor, would be constructed so that any discharge from a primary containment system, such as a tank or pipe, would not drain, infiltrate, or otherwise escape to groundwater or surface waters before cleanup is completed.

Production facilities that have the potential to leak or spill oil, glycol, produced water, or other fluids, which may constitute a hazard to public health or safety, would be placed within appropriate containment and/or diversionary structures to prevent spilled or leaking fluid from reaching groundwater or surface waters. The appropriate containment and/or diversionary structure would be sufficiently impervious to oil, glycol, produced water, or other fluid and would be installed so that any spill or leakage would not drain, infiltrate, or otherwise escape to groundwater or surface waters prior to completion of cleanup.

Notice of any spill or leakage, as defined in BLM NTL 3A, would be immediately reported to the Authorized Officer by Stewart, as well as to such other Federal and State officials as required by law. Oral notice would be given as soon as possible, but within no more than 24 hours, and those oral notices would be confirmed in writing within 72 hours of any such occurrence.

2.1.14.6 Water Resources

As required under 40 CFR 112.3(e), Stewart would maintain a copy of the SPCC plan at each facility, if the facility is normally attended at least 8 hours per day, or at the nearest field office if the facility is not so attended. Stewart would also implement and adhere to SPCC plans in a manner such that any spill or accidental discharge of oil would be reported and remediated.

Where proposed activities would affect Waters of the U.S., Stewart would obtain appropriate approvals from the USACE.

2.1.15 APPLICANT-COMMITTED ENVIRONMENTAL PROTECTION MEASURES

In addition to the environmental protection measures that are required by law, the Vernal Field Office Approved RMP (BLM 2008a), Stewart's leases, or other applicable regulatory authorities, the following Applicant-Committed Environmental Protection Measures (ACEPMs) would also be applied to all activities on all Federal surface estate within the Tumbleweed II Project Area. Implementation of these measures would help avoid or minimize impacts to the environment.

2.1.15.1 Air Quality

All internal combustion equipment would be kept in good working order.

Stewart would use water or other approved dust suppressants at construction sites and along roads, as determined appropriate by the Authorized Officer.

Stewart would not allow any open burning of garbage or refuse at well sites or other facilities.

Drill rigs used for drilling in the Tumbleweed II Project Area would be equipped with Tier II or better diesel engines. The use of Tier II or better engines would greatly reduce the amount of NO_x that would be emitted during drilling operations. *Note: A Tier II rig was used to drill the Tumbleweed 18-9.*

Vent emissions from stock tanks and natural gas TEG dehydrators would be controlled by routing the emissions to a flare or similar control device which would reduce emissions by 95% or greater. This control measure would reduce VOC and HAP emissions from the project.

During drilling and completion operations, temporary worker housing would be located on the existing TUF #18-9 well pad. By providing housing close to the project, and reducing the amount of miles that the drilling and completion crews would travel, emissions associated with vehicle impacts would be reduced, specifically particulate matter from unpaved roads and tailpipe (VOC and NO_x) emissions. Approximately 10 workers (comprised of 2-4 person rig crews working 12-hour shifts, plus 2 drilling/geological consultants) would occupy the temporary worker housing site at any one time.

Low bleed pneumatics would be installed on separator dump valves and other controllers. The use of low bleed pneumatics would result in a lower emission of VOCs.

During completion operations Stewart would limit flaring to clean up uses and as soon as possible would install production equipment and gathering line which would limit VOC emissions.

Well site telemetry would be utilized to eliminate unnecessary pumper travel to the well site, thus further reducing vehicle tailpipe emissions.

2.1.15.2 Cultural/Historical Resources

Stewart would inform their employees, contractors and subcontractors about relevant Federal regulations intended to protect archaeological and cultural resources. All personnel would be informed that collecting artifacts, including arrowheads, is a violation of Federal law and that employees engaged in this activity would be subject to disciplinary action.

2.1.15.3 Health and Safety/Hazardous Materials

Stewart would utilize portable sanitation facilities at drill sites; place dumpsters at each construction site to collect and store garbage and refuse; and ensure that all refuse and garbage is transported to a State-approved sanitary landfill for disposal.

2.1.15.4 Rangeland Management and Wild Horses

Stewart would repair or replace to current BLM standards any fences, cattle guards, gates, drift fences, and natural barriers that are damaged as a result of the Proposed Action. Cattle guards would be used instead of gates for livestock control on most roads.

Where the proposed pipeline (from the existing compressor station) would cross the Horse Point and Winter Ridge Allotment boundary, Stewart would keep the boundary intact with an appropriate cattleguard and gate, and would make any fence modification to the four-strand barbed wire specification required for all cattle range fences.

2.1.15.5 Soils

Stewart would comply with standards identified in "The Surface Operating Standards for Oil and Gas Exploration and Development" (Gold Book) (BLM and USFS 2007)

Topsoil would be temporarily stockpiled and seeded to reduce erosion until interim reclamation is initiated. Topsoil stockpiles would also be designed to maximize surface area in order to reduce impacts to soil microorganisms. On reclaimed areas, topsoil depths would be distributed evenly unless conditions warrant a varying depth.

Areas used for spoil storage would be stripped of topsoil before spoil placement.

Appropriate erosion control and revegetation measures would be employed. In areas with unstable soils where seeding alone may not adequately control erosion, grading would be used to minimize slopes, and water bars would be installed on disturbed slopes. BMPs would be installed as specified in the SWMP.

These BMPs could include retention basins, infiltration basins, and vegetated filter strips. Erosion control efforts would be monitored by Stewart and necessary modifications made to control erosion.

Soils compacted during construction would be ripped and tilled as necessary prior to reseeding. Cut and fill sections on all roads and along pipelines would be revegetated with seed mixtures as defined in **Section 2.1.13**.

2.1.15.6 Vegetation

Removal and disturbance of vegetation would be kept to a minimum through construction site management (e.g., using previously disturbed areas and existing easements where feasible, placing pipelines adjacent to roads, limiting well pad size, etc.).

2.1.15.7 Water Resources

Stewart would inform their employees, contractors and subcontractors of the potential impacts that could result from accidental spills, as well as the appropriate actions to take if a spill does occur.

2.1.15.8 Wildlife

To minimize wildlife-vehicle collisions, Stewart would advise project personnel regarding appropriate speed limits in the Tumbleweed II Project Area. Employees and contractors would be educated about anti-poaching laws. If wildlife law violations are discovered, the offending employee would be subject to disciplinary action by Stewart and the violations would be reported to the UDWR.

Greater Sage-grouse

Prior to surface disturbance or drilling activity between March 1 and June 15, historic leks within a 2-mile radius of proposed surface disturbance would be surveyed during the breeding season to determine if they are being actively used by sage-grouse. If a lek is active, no surface-disturbing activities would occur within 2 miles of the active lek from March 1-June 15. Furthermore, if a lek is active, Stewart would limit all traffic (with the exception of traffic associated with emergency repairs or maintenance) within 2 miles of the active lek between 5:00am and 9:00am from March 1 to June 15.

No surface-disturbing activities would occur within ¼ mile of active sage-grouse leks year-round and no permanent facilities or structures would be allowed within 2 miles when possible.

Within ½ mile of known active leks, Stewart would use the best available technology such as installation of multi-cylinder pumps, hospital sound reducing mufflers, and placement of exhaust systems to reduce noise.

For active sage-grouse leks that are not visually screened from well pads by natural topography or vegetation, low-profile tanks will be used.

Raptors

Prior to any surface-disturbing activities associated with construction or drilling during the breeding season, a BLM-approved contractor would survey all areas within 1 mile of proposed surface disturbance, or as directed by the BLM, for the presence of raptor nests. If occupied/active raptor nests are found, construction or drilling would not occur during the nesting season for that species within the species-specific buffer described in the Approved RMP. In addition, as specified in these guidelines, modifications of these spatial and seasonal buffers for BLM-authorized actions would be permitted by the

AO, so long as protection of nesting raptors is ensured (BLM 2008). On SITLA-administered lands, raptor management would be coordinated with the appropriate AO.

Mexican Spotted Owl

No surface-disturbing activities would be allowed within "good" and "fair" Mexican Spotted Owl (MSO) habitat as defined by the BLM in SWCA (2005) until surveys have been conducted in accordance with USFWS protocol. If more than four years have elapsed since the last survey, another complete, two year, inventory would be required prior to any project-related surface-disturbing activities.[5]

In order to protect MSO and their habitat, the following survey and protection protocols would be put into effect for the proposed TUF #4-3, TUF #5-8, TUF #9-3, TUF #9-11, TUF #17-4, TUF #17-12, and TUF #18-9:

- No surface-disturbing activities would be allowed within "good" and "fair" habitat designations or within the ½-mile buffer of those designations until the two years of surveys have been completed.
- If MSO are documented during future surveys, the BLM would follow USFWS protocol for Protected Activity Center (PAC) establishment and raptor management protocol defined in "Best Management Practices for Raptors and their Associated Habitats in Utah."
- If no owls have been detected at the completion of the two seasons of calling surveys, no additional mitigation or BMPs (including special or timing restrictions) would be implemented. However, if more than four years have elapsed between the end of the two seasons of survey and the initiation of surface-disturbing activities at any proposed location then another complete inventory would be required prior to any surface-disturbing activities.

2.1.15.9 Paleontology

Prior to any surface-disturbing activities, in sensitive fossil areas (Class 4a) where bedrock is exposed at or near the surface (generally less than three feet below the soil surface), a qualified and approved paleontologist would examine locations proposed for surface disturbance for paleontological resources and make recommendations regarding the disposition and methods for avoiding impact to fossil resources. The need for onsite monitoring would be addressed at the onsite review. If any paleontological resources are found during surface-disturbing operations, all operations that could further disturb such materials would be suspended until the Authorized Officer of the appropriate Surface Management Agency (SMA) is contacted, and a review of the situation is completed.

2.2 ALTERNATIVE B - NO ACTION ALTERNATIVE

Under the No Action Alternative, Stewart's proposed exploratory drilling project would not be implemented. Current land use practices such as livestock grazing, wild horse management, hunting, and occasional recreation would continue.

[5] As of August 2009, 2 years of MSO surveys have been completed according to USFWS protocol for Stewart's proposed well pad locations (TUF #4-3, #5-8, #9-3, #9-11, #17-4, #17-12, and #18-9) and associated road and pipeline corridors in the Tumbleweed II Project Area. No MSO were seen or heard during any of the inventories conducted for this project (B&A 2009). Therefore, as of August 2009, Stewart's proposed development locations in the Tumbleweed II Project Area are cleared until the 2013 breeding season.

2.3 ALTERNATIVE C – BURIED PIPELINES

Alternative C would be identical in scope to the Proposed Action. However, under Alternative C, all 10-inch outer-diameter (OD) pipelines would be buried.

2.3.1 PIPELINE CONSTRUCTION

Buried pipelines would be installed using one of the following general construction sequences:

In areas where sufficient soil is present such that blasting would not be required, the following techniques would be employed to bury pipelines:

- A pre-disturbance weed inventory of areas proposed for surface disturbance would be completed at the expense of the operator.
- As needed (e.g., where buried pipelines would disturb surface waters), Stewart would obtain appropriate permits from the USACE.
- A brush-hog would be used to remove shrubs and small trees from the ROW. As practicably feasible, topsoil removal would not occur except directly over the trench.
- A trench approximately 4 feet deep would be excavated using a track hoe and the soil stockpiled to one side, making sure the topsoil and spoil do not get mixed together.
- The pipeline would be installed using a side-boom, the trench backfilled to a depth of approximately 3 feet, and the spoil compacted in the trench.
- Stockpiled topsoil would be placed over the compacted spoil to facilitate reclamation.
- Scalped vegetation would be placed back on the ROW to reduce erosion potential and reduce visual impacts.
- The entire ROW would be reseeded in the first fall after disturbance.

In areas where compacted sandstone or bedrock occurs, the following techniques would be employed to bury pipelines.

- A brush-hog would be used to remove shrubs and small trees from the ROW. As practicably feasible, topsoil removal would not occur except directly over the trench.
- A track hoe-mounted air drill would drill detonation holes at an interval of approximately every 4 feet along the trench route to be blasted.
- An approved granular explosive would be placed in the holes with primers and then wired together for detonation.
- As needed, areas along roads to be blasted may temporarily be closed for safety purposes.
- The charges would be detonated in accordance with relevant safety regulations.
- Following detonation, a track hoe and cat would be used to remove large rock debris from the trench.
- Spoil would be used to pad the bottom of the trench. As needed, additional soil would be brought in from an approved borrow area and used to pad the bottom of the trench.

- The pipeline would be installed using a side-boom, the trench backfilled to a depth of approximately 3 feet, and the spoil compacted in the trench. As needed, additional soil would be brought in from an approved borrow area and used to pad the bottom of the trench.
- Stockpiled topsoil would be placed over the compacted spoil to facilitate reclamation.
- Scalped vegetation would be placed back on the ROW to reduce erosion potential and reduce visual impacts.
- The entire ROW would be reseeded in the first fall after disturbance.

In order to install buried pipeline, ROWs for the buried pipeline would require a 30-foot wide disturbance corridor.

2.3.2 SURFACE DISTURBANCE ESTIMATES

Construction of the proposed well pads and associated access road and pipeline ROWs would result in the initial disturbance of approximately 77.5 acres of vegetation and soils, as outlined in **Table 2-5**. Once the proposed wells and pipeline are completed, interim reclamation could reestablish approximately 62 acres of vegetation. Following interim reclamation, approximately 15.5 acres of vegetation and soils would remain disturbed for the life of the project.

Table 2-5. Initial and Long-Term Surface Disturbance Estimates – Alternative C

Proposed Surface Facility/Activity	Initial Size - Length/Width	Initial Surface Disturbance	Long-term Size - Length/Width	Long-term Surface Disturbance
Proposed Well Pads **(7)**	1.3 acres / pad	9.1 acres	0.35 acre	2.45 acres
Proposed Roads	4.2 miles/32-feet wide	16.3 acres	4.2 miles/16-feet	8.1 acres
Existing Roads Needing Upgrades/Improvement	1.9 miles/32-feet wide	7.4 acres	1.9 miles/16-feet	3.7 acres
Proposed Buried Pipeline	12.3 miles/30-feet wide	44.7 acres	12.3 miles/0.8 feet	1.2 acres
Total Surface Disturbance	**NA**	**77.5 acres***	**NA**	**15.5 acres**

*The total estimated surface disturbance for the Proposed Action differs slightly from the additive acreage of the individual disturbance components as a result of GIS analysis (76.8 acres), which removes areas of overlapping development (0.7 acre).

2.4 ALTERNATIVE D – DIRECTIONAL DRILLING

Under Alternative D, Stewart would drill nine exploratory wells within the Tumbleweed II Project Area. Under Alternative D it is assumed that proposed bottom hole or target locations could be accessed from a combination of vertical and directional drilling from four well pads (see **Figure 2-2 - Appendix E**). The potential for expanded use of directional drilling is discussed below.

1) The proposed TUF #19-1 and TUF #18-8 wells would be directionally drilled from the existing TUF #18-9 well pad as described under the Proposed Action.

2) The proposed TUF #17-4 and TUF #9-11 well pads, access roads, and pipelines would be constructed as described under the Proposed Action. The proposed #TUF 17-4 and #9-11 wells would be then be vertically drilled, completed, and tested using procedures identical to those described in the Proposed Action.

3) Stewart would construct the TUF #4-11 well pad, from which up to two wells would be directionally drilled.

4) Through the above-described expanded use of directional drilling, the surface locations for the proposed TUF#17-12, TUF #9-3, TUF #5-8, and TUF #4-3 vertical wells, together with associated roads and pipelines, would be eliminated from the project.

Alternative D incorporates all other design features of the Proposed Action.

2.4.1 LIMITATIONS OF DIRECTIONAL DRILLING

Limitations in the utilization of directional drilling in the Project Area may exist. These could include but may not be limited to the following:

1) The wells included in the Proposed Action are exploratory, and the locations of these wells have been selected to test the area's potential for commercial production of oil and gas. In the exploratory drilling phase, before Stewart's engineers have obtained and analyzed results from a sufficient number of wells to determine what downhole conditions are likely to exist, the drilling of a well directionally could present potential problems of wellbore stability, stuck pipe, and potentially the inability to reach the well's intended objective downhole. The probability of encountering such problems increases with the distance of the directional "reach" or distance between the surface location of the well and the downhole production zones targeted in the well.

2) The ability to drill directionally is dependent on knowledge of site specific geologic conditions. Without this specific knowledge, there is an increased risk of the following problems: extended drilling time, stuck pipe, lost circulation, wellbore stability problems, failure to reach the intended objective, production problems and uncertain production data in the event of a discovery. Encountering these problems could lead to the drilling of additional wells before it is clear whether economically recoverable quantities of hydrocarbons are present.

The selection of this alternative or another alternative does not preclude the use of additional directional drilling in the event of future development.

2.4.2 SURFACE DISTURBANCE

In order to provide a clear basis for choice amongst the alternatives being considered within this EA, for the purposes of analysis, it is assumed that the nine proposed exploratory wells could be reached from the four well pads shown in **Figure 2-2 – Appendix E**. Surface disturbance under Alternative D is outlined in **Table 2-6**. The use of four pads under Alternative D would result in 9.5 fewer acres of initial disturbance as compared to the Proposed Action. Following interim reclamation, Alternative D would result in approximately 2.8 fewer acres as compared to the Proposed Action. As previously mentioned, Alternative D incorporates all other design features of the Proposed Action.

Table 2-6. Initial and Long-Term Surface Disturbance Estimates – Alternative D

Proposed Surface Facility/Activity	Initial Size - Length/Width	Initial Surface Disturbance	Long-term Size - Length/Width	Long-term Surface Disturbance
Proposed Well Pads **(4)**	1.8 acres / pad	7.2 acres	0.7 acre	2.8 acres
Proposed Roads	2.7 miles/32-feet wide	10.5 acres	2.7 miles/16-feet	5.2 acres
Existing Roads Needing Upgrades/Improvement	1.9 miles/32-feet wide	7.4 acres	1.9 miles/16-feet	3.7 acres
Proposed Surface-laid Pipeline	10.8 miles/10-feet wide	13.1 acres	10.8 miles/0.8 feet	1 acre

Proposed Surface Facility/Activity	Initial Size - Length/Width	Initial Surface Disturbance	Long-term Size - Length/Width	Long-term Surface Disturbance
Total Surface Disturbance	**NA**	**38.2 acres***	**NA**	**12.7 acres**

*The total estimated initial disturbance for Alternative D differs slightly from that calculated as a result of GIS analysis (37.8 acres), which removes areas of overlapping development (0.4 acre).

2.5 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

The following sections describe alternatives to the Proposed Action that were considered but eliminated from detailed analysis within this EA.

2.5.1 ORIGINAL PROPOSED ACTION THAT WAS ELIMINATED TO ADDRESS THE BLM'S CONCERNS (ORIGINALLY PROPOSED ROAD LOCATIONS FOR THE TUF #4-3

Stewart's original project proposal included alternate spur road locations to the TUF #4-3. The initially proposed road to the TUF #4-3 ran approximately 0.20 mile west of its current location. However, during field reconnaissance by the BLM, it was determined that the road intersected a small topographic depression that may accumulate water during storm events and spring runoff. To avoid impacts to this area, the BLM requested that Stewart move the proposed spur road to the east and outside of the depression area. Based on these BLM requests, the initially proposed spur road to the TUF #4-3 was eliminated from detailed consideration.

2.5.2 DIRECTIONAL DRILLING AS SUGGESTED DURING THE PUBLIC COMMENT PERIOD FOR EA UT-080-05-201

During the public comment period for the original *Tumbleweed Exploratory Drilling EA (UT-080-05-201)* (BLM 2007a), a comment letter was submitted by Mr. Ken Kreckel that suggested that the BLM had erred in rejecting consideration of a directional drilling alternative. Included within the referenced comments was a recommended directional drilling alternative. Under Mr. Kreckel's suggested alternative, three well pads would be constructed at the edge of the road. Five of the originally proposed six wells would then be directionally drilled north and/or west from these pads.

Mr. Kreckel's comment letter and suggested alternative was reviewed and considered by the BLM's Senior Petroleum Engineer. The BLM, in coordination with Stewart Petroleum's engineers determined that Mr. Kreckel's assumption that the additional proposed wells (i.e., those beyond the #18-9) within the Tumbleweed II Project Area can be directionally drilled from the locations suggested by the commenter largely because the nearby North Hill Creek (NHC) #8-13 well was directionally drilled is false and technically flawed. Due to drilling problems of individual wells (e.g., lost circulation zones and water flow intervals, over-pressured horizons) in the area, a deviated hole adds a significant mechanical risk to the operator's ability to complete and produce a well, and therefore could prevent the operator from meeting the purpose of the project. For example, because of potential lost circulation zones and water flow intervals in the Green River Formation, it is optimal to set surface casing through those intervals to a depth of about 2,200 - 3,000 feet. This casing depth requires the operator to drill a straight hole which is drilled by the surface casing rig. Using this example, the kick-off depth to begin drilling the angled section of the hole would start between 2,250 and 3,000 feet. This would require an angle of about 13 to 18 degrees in order to begin to bring the well back to vertical at the top of the Dakota Formation with dog leg severity of 2 to 4 degrees per 100 feet. This angle and these dog legs frequently cause problems

during completion and in setting and recovering downhole tools (i.e., packers, plugs and blanking tools). The angle and turns in the casing string also make it difficult to land the production tubing with enough tension to keep the tubing sufficiently straight to allow swabbing of the tubing and in some cases the ability to set blanking plugs in the tubing.

These are all undesirable conditions and could conceivably result in the ultimate loss of production from some individual horizons or, in the worst case, the loss of the well bore due to stuck tools in the hole and the inability to recover them or the targeted reserves. Additionally, the well pads as suggested by Mr. Kreckel would require the operator to drill a much longer horizontal displacement as compared to the well pads identified under Alternative D. The longer the horizontal displacement of the well bore the greater the probability of drilling and production problems that could result in the loss of the well bore. Because of these risks, the operator has to have considerable geologic data available to ensure successful directional drilling; data that's not usually available for exploratory wells such as those proposed in the Tumbleweed Unit.

In addition, the well pad locations as suggested by Mr. Ken Kreckel were proposed without the benefit of seismic data for the Tumbleweed Unit, and without information on the drilling results (and complications) of the TUF #18-9 drilling and completion; without the technical information needed to make an informed determination as to from where the wells could be drilled. Based on the preceding rationale, the directional drilling alternative as proposed by the commenter was eliminated from detailed analysis.

Based on the limitations discussed above, the BLM and Stewart Petroleum's engineers determined that the well pad locations recommended by Mr. Kreckel are not reasonable and would not meet the purpose and need for the project. However, the BLM and Stewart have determined that additional directional drilling from alternate well pad locations would be technically and economically feasible, and as suggested in Mr. Kreckel's comment letter, the BLM and operator have developed a similar directional alternative. The first exploratory well, TUF #18-9, was directionally drilled by Stewart in 2007. This well has been determined to be a "unit paying well". Based on this determination, the BLM Utah State Office concurred with economic feasibility for directional drilling in the Tumbleweed II Project Area. In reviewing Alternative D, the BLM Senior Petroleum Engineer in coordination with Stewart's engineers concluded that four proposed well pads with nine wells would meet the purpose and need for the project and is a reasonable alternative to Stewart's Proposed Action. The proposed well pads are described and illustrated under Alternative D. The locations of the well pads as proposed under **Section 2.4** are based on the operator's proprietary seismic data for the Tumbleweed Unit, as well as knowledge gained and lessons learned during the drilling and completion of the TUF #18-9.

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3.0 AFFECTED ENVIRONMENT

3.1 INTRODUCTION

Chapter 3 discusses the affected environment (i.e., the physical, biological, social, and economic values and resources) within the Tumbleweed II Project Area. This chapter provides a baseline for comparison of the potential impacts/consequences of the alternatives.

3.2 RESOURCES/ISSUES CARRIED FORWARD FOR ANALYSIS

Those resources or issues that occur within the Tumbleweed II Project Area and/or could potentially be affected by the alternatives have been carried forward for discussion in this chapter and as appropriate, carried forward for analysis in Chapter 4. These include soils; water resources; vegetation resources (including Threatened and endangered and special status species); rangeland and wild horse management; fish and wildlife including special status species; and air quality.

Resources or issues that were eliminated from detailed analysis are presented in **Appendix A** (i.e., those elements assigned a "no impact" or "not present" determination). These resources were dismissed from detailed analysis because either the alternatives would have no measurable effect on the resource, because the Proposed Action and ACEPM (**Sections 2.1**) would mitigate potential impacts of the alternatives to negligible levels, or because the resource is not present within the Tumbleweed II Project Area.

3.2.1 SOILS

According to Natural Resource Conservation Service (NRCS) (USDA-NRCS 2004) maps for Uintah County, nine soil series occur in the Tumbleweed II Project Area (see **Figure 3-1 – Appendix E**). However, only two of these associations, the Winteridge-Moonset association and the Towave-Gompers-Rock outcrop association, have the potential to be impacted by proposed development.

The Winteridge-Moonset association has the potential to be strongly alkaline (pH>8.5) and has moderate to high potential for reclamation. Approximately 2,647 acres of this association occurs on hills and plateaus with 1 to 8 percent slopes in the 7,655 acre Tumbleweed II Project Area. Soils in this association typically are 10 to 20 inches deep, well drained, and derived from alluvium. Textures range from loam to bedrock, and potential water and wind erosion is moderate to very high. Typical vegetation includes sagebrush (*Artemesia* spp.), western wheatgrass (*Pascopyrum smithii*), Indian ricegrass (*Achnatherum hymenoides*), muttongrass (*Poa fendleriana*), needle-and-thread (*Hesperostipa comata*), and saltbush (*Atriplex* spp.).

The Winteridge-Moonset association possesses characteristics typical of soils with a high potential to include biological soil crusts. Biological soil crusts (also known as cryptogamic, cryptobiotic, microbiotic, and microphytic soils) are composed of a symbiotic association of cyanobacteria, lichens, mosses, green algae, microfungi, and bacteria that form a rough carpet on the surface and a soil-binding matrix below (Belnap et al. 2001). Biological soil crusts typically occur as brownish or black soil crusts that appear on the surface of sandy desert soils. Since biological soil crusts are highly adaptable, they occur in the full range of arid soil types from shallow to deep, heavy to light textures, and moist to drier conditions. No site-specific inventories have been completed to document the presence of biological soil crusts in the Tumbleweed II Project Area. As the Winteridge-Moonset association occurs throughout the Tumbleweed II Project Area, it is assumed for the purposes of this EA that biological soil crusts may occur wherever this association is present.

Approximately 3,093 acres of the Towave-Gompers-Rock outcrop association occurs in the 7,655 acre Tumbleweed II Project Area primarily on very steep slopes (45 to 80 percent) surrounding Willow Creek and Upper Bottom Canyon. Typical vegetation includes Douglas-fir (*Pseudotsuga menziesii*), Utah juniper (*Juniperus osteosperma*), pinyon pine (*Pinus edulis*), Utah snowberry (*Symphoricarpos oreophilus*), mountain mahogany (*Cercocarpus* spp.), saline wildrye (*Leymus salinus*), slender wheatgrass (*Elymus trachycaulus*), Indian ricegrass, Rocky Mountain juniper (*Juniperus scopulorum*), big sagebrush (*Artemesia tridentata*), Utah serviceberry (*Amelanchier utahensis*), Mormon tea (*Ephedra viridis*), antelope bitterbrush (*Purshia tridentate*), bluebunch wheatgrass (*Pseudoroegneria spicata*), sandberg bluegrass (*Poa secunda*), and needle-and-thread (*Stipa comada*). Textures range from loam to bedrock and potential for runoff is very high. The reclamation potential for this unit is rated fair by the NRCS.

Natural, background erosion rates in the Tumbleweed II Project Area are about 1.45 tons per-acre per-year (BLM 1984).

3.2.2 WATER RESOURCES

The Tumbleweed II Project Area is drained by numerous small ephemeral tributaries of Willow Creek and Upper Bottom Creek. Willow Creek is a perennial stream that lies immediately west of the Tumbleweed II Project Area. However, there are no perennial streams, springs, or seeps within the immediate Project Area. From the Tumbleweed II Project Area, Willow Creek flows north-northwest more than 40 miles to its confluence with the Green River. As described in **Section 3.2.5**, Willow Creek does not provide habitat for fish species. Upper Bottom Creek is an ephemeral tributary of Willow Creek that occurs along the western and northern boundary of the Tumbleweed II Project Area.

Stream flow in Willow Creek and Upper Bottom Creek is dependent on seasonal storms and snowmelt runoff. The majority of runoff is generated by melting of the winter snow pack and occurs during the spring and early summer. During the late summer months, cloudburst rainstorms sometimes result in severe local flashfloods. With the exception of Willow Creek, the drainages are dry for most of the year and a single rainstorm event can account for a large percentage of the total annual runoff in these areas.

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

USGS Sample Results

The water quality characteristics of surface waters generally reflect the chemical nature of precipitation in the region and the geologic strata over which the water flows. Water sampling results are often compared to a numerical standard defined for protection of drinking water, aquatic organisms, and other beneficial water uses. Most States, including Utah, now have primacy for the administration of the CWA and have also adopted State water-quality standards (UDEQ 2000). The Utah standards include a series of aquatic water quality standards that are protective of aquatic organisms and fisheries.

Table 3-1 provides a summary of water quality analyses for samples collected from the USGS Willow Creek gauging station 09307500. This station on Willow Creek is located about 15 miles north of the Tumbleweed II Project Area. Water quality samples were collected at this station from September 1969 to September 1983. Waters in Willow Creek are described as calcium bicarbonate-sulfate type waters

with very high hardness (260 – 370 mg/L as $CaCO_3$). Total dissolved solids (TDS) ranges from 349 mg/L to 571 mg/L, and averages 482 mg/L. The waters are generally alkaline with pH ranging from 7.4 to 8.6 units. Specific conductance ranges from 450 to 920 uS/cm with an average of 693 uS/cm. These values are generally in the moderate salinity class and indicate that the waters can be used for irrigation (U.S. National Salinity Laboratory 1954). Values for all parameters reported are less than the associated aquatic life water quality standards, except for TSS and copper. Copper samples collected from the USGS Willow Creek gauging station 09307500 exceeded the aquatic standard for one of four samples. The sodium adsorption ratio (SAR) of the waters ranges from 0.6 to 2 and averages 0.97. These are considered to be safe values for SAR (Hergert and Knudsen 1997).

Table 3-1. Summary of Water Quality Analyses for Willow Creek above Diversions, USGS Gauging Station 09307500

Parameter	Aquatic Biota Standard[1]	Summary Statistics		
		No. of Samples	Range	Mean
General Water Quality Indicators				
Temperature (°C)	—	133	0 – 25	9.28
Specific Conductance (uS/cm)	—	72	450 – 920	693
Dissolved Oxygen (mg/L)	Min 6.5	40	6.8 – 12.2	8.89
pH (standard units)	6.5-9.0	40	7.4 – 8.6	8.13
Sodium Adsorption Ratio	—	33	0.6 – 2	0.97
Total Hardness (mg/L)	—	33	260 – 370	328
Total Dissolved Solids (mg/L)	1,200	24	349 – 571	482
Total Suspended Solids (mg/L)	**90**	**46**	**41 – 15,000**	**2240**
Ionic Constituents				
Calcium (mg/L)	—	35	54 – 86	71.3
Magnesium (mg/L)	—	35	24 – 46	35.9
Sodium (mg/L)	—	35	22 – 77	41.5
Potassium (mg/L)	—	35	1 – 3.3	1.74
Chloride (mg/L)	—	35	2.4 – 8	5.03
Sulfate (mg/L)	—	35	86 – 210	134
Fluoride (mg/L)	1.2 - 2.4[2]	35	<0.1 – 0.4	0.25
Ammonia (mg/L)	0.11 – 2.49[2]	25	<0.01 – 0.1	0.03
Silica (mg/L)	—	35	1.5 – 19	15.1
Bicarbonate (mg/L)	—	26	250 – 381	330
Nitrite & Nitrate (mg/L)	4	32	0.01 – 1.4	0.23
Trace Metals				
Aluminum (ug/L)	750	29	<10 – 80	30.1
Arsenic (ug/L)	190	21	1 – 7	3.90
Barium (ug/L)	1,000	8	70 – 200	95.9

Parameter	Aquatic Biota Standard[1]	Summary Statistics		
		No. of Samples	Range	Mean
Boron (ug/L)	—	34	30 – 100	49.1
Copper (ug/L)	**12**	**4**	**<2 – 670**	**173**
Iron (ug/L)	1,000	35	<10 – 90	33.0
Manganese (ug/L)	—	10	<10 – 20	11.0
Selenium (ug/L)	5	21	<1 – 2	0.64
Strontium (ug/L)	—	26	600 – 960	828
Zinc (ug/L)	—	14	<20 – 30	18.6

All samples are dissolved (filtered) unless otherwise noted.
Average values calculated using one-half the detection limit for non-detect values.
Bold values exceed standards.
[1]Aquatic life (Utah Water Quality Standards, R317-2 Utah Administrative Code).
[2]Value is dependent on temperature and pH
Source: http://waterdata.usgs.gov/nwis/

State of Utah Section 303(d) List

Section 303(d) of the CWA outlines a water protection program that is intended to clean up waters that remain polluted even after the application of technology-based limitations. A state's 303(d) list identifies water bodies where water quality standards are violated by one or more pollutants. The program requires the States to:

Identify waters that are and would remain in violation of State water quality standards after the application of technology-based controls;

Prioritize these waters, taking into account the severity of their pollution; and

Develop Total Maximum Daily Loads that would allow polluted water bodies to meet water quality standards, accounting for seasonal variations and a margin of safety.

Willow Creek is listed in Utah's 2006 Integrated Report list of 303(d) impaired water bodies for TDS (UDEQ 2006). The majority of the TDS in the Willow Creek watershed is due to erosion of the naturally saline geologic formations in the area, including the slightly to moderately saline Uinta Formation. Other potential sources of TDS in the watershed include irrigation return flows, erosion of unpaved road surfaces, as well as oil and gas activities.

According to BLM (Vernal Field Office) GIS data and the USFWS National Wetland Inventory, there are no riparian corridors or jurisdictional wetlands in the Tumbleweed II Project Area.

3.2.3 VEGETATION RESOURCES

3.2.3.1 Noxious and Invasive Weeds

Although undisturbed portions of the Tumbleweed II Project Area (those without access roads or previous development) are relatively weed-free, low levels of invasive and non-native species are present in and near the Tumbleweed II Project Area. Cheat grass (*Bromus tectorum*) and other non-native species, such as Russian thistle (*Salsola pestifer*), perennial pepperweed (Lepidium latifolium), and hound's-tongue (*Cynoglossum officinale*) are found along roads leading into the Tumbleweed II Project Area. Some non-native plants have spread into nearby rangelands, including those in the Tumbleweed II Project Area.

3.2.3.2 Tumbleweed II Project Area Vegetation Communities

Vegetation Communities

There are two primary vegetation communities within the Tumbleweed II Project Area: sagebrush-steppe and pinyon-juniper woodlands. The sagebrush-steppe community includes such species as big sagebrush, shadscale (*Atriplex confertifolia*), rubber rabbitbrush (*Chrysothamnus nauseosus*), snakeweed (*Gutierrezia* spp.), Mormon tea, winterfat (*Ceratoides lanata*), wild buckwheat (*Eriogonum* spp.), Indian ricegrass, prickly pear cactus (*Opuntia polyacantha*), and scarlet globemallow (*Sphaeralcea coccinea*). Pinyon-juniper woodlands include such species as pinyon pine, Utah juniper, serviceberry (*Amelanchier alnifolia*), curl-leaf mahogany (*Cercocarpus ledifolius*), needle-and-thread grass, Indian ricegrass, wild buckwheat, pepperweed, and prickly pear cactus. Sagebrush flats along Winter Ridge were chained in the 1950s. As such, average height of sagebrush within the Tumbleweed II Project Area is approximately 2 to 3 feet.

The BLM recently completed restoration work in the Tumbleweed II Project Area. The restoration work consisted of removing the encroaching pinyon and juniper trees from the sagebrush-grass vegetative community. Approximately 1,210 acres of vegetation have been treated in the Tumbleweed II Project Area.

Crested wheatgrass (*Agropyron cristatum*), and alfalfa (*Medicago sativa*) are examples of introduced species used by livestock, wild horses, and wildlife that are present in the Tumbleweed II Project Area.

As discussed in **Section 3.2.1**, reclamation potential for the Tumbleweed II Project Area is rated fair by the NRCS. Recent BLM field observations support this rating of reclamation potential in the area. In August 2009, the BLM assessed revegetation of two well sites, Winter Ridge U1 (API #04304710018) and Atlantic Alpine Southland 22-2 (#4304710059), which were plugged and abandoned in the 1960s (BLM 2009b). These two well sites are located in Section 22, T15S, R21E. The BLM found that sagebrush has established as the dominant species over the last 40 years. Rabbitbrush, an early successional species, was also prevalent. Although portions of the previous development footprints were still distinguishable, in general, these two well sites have progressed towards successfully blending in with the surrounding landscape. Based on proximity to Stewart's proposed wells, and for analysis purposes in this EA, it is assumed that reclamation potential in the Tumbleweed II Project Area would be similar to the reclamation potential at these two well sites.

Commercial Forests and Woodlands

Small pockets of mixed conifer are restricted to north-facing slopes at relatively high elevations within or surrounding the Tumbleweed II Project Area. These pockets of mixed conifer primarily include ponderosa pine (*Pinus ponderosa*) with isolated occurrences of Douglas fir and Engelmann spruce (*Picea engelmannii).* The understory consists of mountain mahogany, Utah serviceberry, snowberry (*Symphoricarpos oreophilus*), and Indian rice grass. The BLM authorizes limited commercial forest and woodland harvesting within the Tumbleweed II Project Area on approximately 4,448 acres of mixed conifer.

3.2.4 RANGELAND MANAGEMENT AND WILD HORSES

3.2.4.1 Rangeland Management

The Tumbleweed II Project Area occurs within Horse Point Pasture #4 of the Winter Ridge Allotment, which is grazed by cattle on a seasonal basis (i.e., 5/01–4/30). Approximately 5,188 acres of the Tumbleweed II Project Area fall within a portion of this pasture. An animal unit month (AUM) is defined as "the amount of dry forage required by one animal unit for one month based on a forage allowance of 26 pounds per day" (BLM 2008a). Within the Winter Ridge allotment, approximately 14 acres are required to support one AUM. Based on this estimate, the portion of Horse Point Pasture #4 in the Tumbleweed II Project Area supports roughly 370 AUMs.

3.2.4.2 Wild Horses

Wild horses within the Tumbleweed II Project Area are part of the Winter Ridge Herd. The Tumbleweed II Project Area provides year-long range for wild horses. According to management prescriptions in the Vernal Field Office Approved RMP, wild horses will be gathered and removed from the Winter Ridge Herd Area. The next approved gather for Winter Ridge is scheduled for July 2010. Horses will be gathered into corrals using low-flying helicopters and ground support. Following medical evaluations, the horses will then be removed from the Winter Ridge Herd Area. Forage will be allocated during the life of the plan until the horses have been removed. The Winter Ridge Herd Area designation will continue, but there will be no management for horses. Any horses present after the wild horses are removed will be in trespass (BLM 2008a).

3.2.5 FISH AND WILDLIFE

3.2.5.1 General Wildlife Species

Common mammals likely to occur in the Tumbleweed II Project Area include the black bear (*Ursus americanus*), mountain lion (*Felis concolor*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), gray fox (*Urocyon cinereargenteus*), raccoon (*Procyon lotor*), badger (*Taxidea taxus*), Nuttall's or mountain cottontail (*Sylvilagus nuttallii*), black-tailed and white-tailed jackrabbit (*Lepus californicus* and *Lepus townsendii* respectively), and various species of rodents and bats. Bird species that may be present in the Tumbleweed II Project Area include numerous species of migratory birds, upland game birds, and raptors. Waterfowl frequently use riparian areas along Willow Creek and other drainages. Reptiles that may be present in the Tumbleweed II Project Area include the short-horned lizard (*Phyrnosoma hernandesi*), sagebrush lizard (*Sceloporus graciosus*), western whiptail (*Cnemidophorus tigris*), Great Basin gopher snake (*Pituophis catenifer deserticola*), wandering garter snake (*Thamnophis elegans vagrans*), Great Basin spadefoot (*Spea intermontana*), midget-faded rattlesnake (*Crotalus oreganus concolor*), and various others.

Upland game birds known to utilize habitats within and near the Tumbleweed II Project Area include the greater sage-grouse (*Centrocercus urophasianus*) and wild turkeys (*Meleagris gallopavo intermedia*). The greater sage-grouse is considered a State of Utah Wildlife Species of Concern and is therefore discussed in Section 3.2.6 (Special Status Species).

Although no perennial drainages occur within the immediate Tumbleweed II Project Area, both Willow Creek and Upper Bottom Canyon are adjacent to the Tumbleweed II Project Area. Based on their relatively low flows, they generally do not hold enough water to support fish or other special status aquatic species. Both of these streams drain to the Green River, approximately 41 miles downstream from the Tumbleweed II Project Area.

3.2.5.2 Big Game

The principal big game species in the Tumbleweed II Project Area include elk (*Cervus canadensis*) mule deer (*Odocoileus hemionus*), and the occasional pronghorn antelope (*Antilocapra americana*), Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*), and bison (*Bison bison*). The UDWR has identified various types of big game seasonal ranges (i.e., summer, winter, yearlong). These ranges are ranked according to their relative biological value and are defined below.

Crucial: Habitat on which the local population of a wildlife species depends for survival because there are no alternative ranges or habitats available. Crucial value habitat is essential to the life history requirements of a wildlife species. Degradation or unavailability of crucial value habitat will lead to significant declines in carrying capacity and/or numbers of the wildlife species in question.

Substantial: Habitat that is used by a wildlife species but is not crucial for population survival. Degradation or unavailability of substantial value habitat will not lead to substantial declines in carrying capacity and/or numbers of the wildlife species in question.

Elk

Elk are common in most mountainous regions of Utah, where they can be found in mountain meadows and forests during the summer and in foothills and valley grasslands during the winter. Like other members of the deer family, this species relies on a combination of browse, grasses, and forbs, depending on their availability throughout the year.

Elk occupy much of the greater Tumbleweed II Project Area on a year-round basis. As shown on **Figure 3-2 – Appendix E**, the entire Tumbleweed II Project Area is designated as UDWR crucial value winter habitat. The Vernal Field Office Approved RMP recognizes UDWR crucial wildlife habitat boundaries, but does not designate forage allocations for these habitats (BLM 2008a).

Mule Deer

Mule deer occur throughout the western mountains, forests, deserts, and brushlands. Typical habitats include short-grass and mixed-grass prairies, sagebrush and other shrublands, coniferous forests, and forested and shrubby riparian areas. The species is common State-wide in Utah, where it can be found in many types of habitat, ranging from open deserts to high mountains to urban areas.

The UDWR has identified approximately 1,658 acres of land within the Tumbleweed II Project Area as crucial value winter habitat; and has identified the remainder (approximately 5,997 acres) as substantial value winter habitat. **Table 3-2** shows UDWR mule deer habitat values within the Tumbleweed II Project Area. UDWR mule deer habitats are also shown on **Figure 3-3 – Appendix E**. The Vernal Field Office Approved RMP recognizes UDWR crucial wildlife habitat boundaries, but does not designate forage allocations for these habitats (BLM 2008a).

Table 3-2. UDWR Mule Deer Habitat within the Tumbleweed II Project Area

Agency	Habitat Values	Acreage within the Tumbleweed II Project Area	Percent of the Tumbleweed II Project Area
UDWR	Crucial Value, Winter Season	1,658	21.7
	Substantial Value, Winter Season	5,997	78.3

Pronghorn Antelope

Pronghorn typically inhabit grasslands and semi-desert shrublands at elevations ranging from 4,000 to 6,000 feet. Pronghorn are typically less abundant in xeric habitats, preferring areas that average 12-15 inches of precipitation per year. Some pronghorn make seasonal migrations between summer and winter habitats, but these migrations are often triggered by availability of succulent plants and not local weather conditions (Fitzgerald et al. 1994).

Pronghorn antelope have been observed in the Tumbleweed II Project Area; however, habitat usage has been limited to the summer months. Approximately 1,878 acres of the 7,655 acre Tumbleweed II Project Area has been identified as UDWR substantial value summer habitat.

Rocky Mountain Bighorn Sheep

The Rocky Mountain bighorn sheep is native to rugged mountainous areas of western North America. A small population of Rocky Mountain bighorn sheep has been documented along Willow Creek. In recent years, bighorn sheep have been observed in Willow Creek Canyon immediately west of Winter Ridge. Approximately 5,744 acres of the 7,655 acre Tumbleweed II Project Area is considered as UDWR crucial value year-long habitat. The Vernal Field Office Approved RMP recognizes UDWR crucial wildlife habitat boundaries, but does not designate forage allocations for these habitats (BLM 2008a).

Bison

In 2003, bison were reintroduced to the East Tavaputs Plateau area. Since then, bison have occasionally been observed in the Tumbleweed II Project Area. The entire Tumbleweed II Project Area is considered UDWR crucial value year-long habitat. The Vernal Field Office Approved RMP recognizes UDWR crucial wildlife habitat boundaries, but does not designate forage allocations for these habitats (BLM 2008a).

3.2.5.3 Migratory Birds

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

Numerous migratory bird species may occupy the Tumbleweed II Project Area. Those migratory bird species that are Federally-listed under the Endangered Species Act (ESA) of 1973, as amended, are addressed in **Section 3.2.6**. This section identifies migratory birds that may inhabit the Tumbleweed II Project Area, including those species classified as Priority Species by Utah Partners in Flight (PIF) or as Birds of Conservation Concern (BCC) by the USFWS. Migratory bird species are addressed below in

Table 3-3 according to the habitat types (i.e., vegetative communities) found within the Tumbleweed II Project Area. Utah PIF priority species and BCC species are denoted by an asterisk (*).

Table 3-3. Migratory Bird Species Potentially Occurring Within the Tumbleweed II Project Area

Pinyon-Juniper Woodlands		Sagebrush-Steppe	
Common Name	**Scientific Name**	**Common Name**	**Scientific Name**
black-chinned hummingbird	*Archilochus alexandri*	Brewer's sparrow*	*Spizella breweri*
black-throated gray warbler*	*Dendroica nigrescens*	sage sparrow*	*Amphispiza belli*
bushtit	*Psaltriparus minimus*	sage thrasher	*Oreoscoptes montanus*
gray flycatcher	*Empidonax wrightii*		
gray vireo*	*Vireo vicinior*		
juniper titmouse*	*Baeolophus ridgewayi*		
northern shrike	*Lanius excubitor*		
pinyon jay*	*Gymnorhinus yanocephalus*		
Virginia's warbler*	*Vermivora virginiae*		
western scrub-jay	*Aphelocoma californica*		

Sources: Parrish et al. 2002; USFWS 2008; UDWR 2007.

3.2.5.4 Raptors

Some of the more common and visible birds in and near the Tumbleweed II Project Area include several species of raptors (**Table 3-4**). Habitats in and around the Tumbleweed II Project Area provide diverse breeding and foraging habitat for raptors. These habitats include cool desert shrub communities, rocky outcrops, riparian zones, and lower elevation shrublands.

Table 3-4. Raptor Species with the Potential to Occur in or Near the Tumbleweed II Project Area

Common Name	Scientific Name	Nesting Habitat
American kestrel	*Falco sparverius*	Tree cavities, cliff crevices
Bald eagle	*Haliaeetus leucocephalis*	Tall trees near large bodies of water (no nesting habitat provided in or near the Tumbleweed II Project Area)
Cooper's hawk	*Accipiter cooperii*	Ponderosa pine, Douglas fir, pinyon-juniper woodlands
Ferruginous hawk	*Buteo regalis*	Ground, pinyon-juniper woodlands, balanced pinnacles
Golden eagle	*Aquila chrysaetos*	Cliff ledges and rock outcrops
Great-horned owl	*Bubo virginianus*	Cliff ledges or nests of other species
Mexican spotted owl	*Strix occidentalis lucida*	On platforms and large cavities in trees, on ledges, and in caves.
Prairie falcon	*Falco mexicanus*	Cliff ledges
Red-tailed hawk	*Buteo jamaicensis*	Cliff ledges, rock outcrops, aspen, pinyon-juniper woodlands, etc.
Rough-legged hawk	*Buteo lagopus*	Grasslands, fields, marshes, sagebrush flats, and other open habitats
Sharp-shinned hawk	*Accipiter striatus*	Conifers and oak brush
Turkey vulture	*Cathartes aura*	Rock outcrops, caves, and tree cavities

The bald eagle, golden eagle, ferruginous hawk, and Mexican spotted owl (MSO) are special status species and thus, are discussed further in **Section 3.2.6**, Special Status Species.

In 2007, the BLM completed raptor nest inventories and no occupied raptor nests were documented in the Tumbleweed II Project Area (i.e., proposed surface disturbance locations plus ½-mile buffer zone) (BLM 2007b). In the summer of 2008, Buys & Associates, Inc. completed a raptor nest inventory of the Tumbleweed II Project Area. Three nests were identified within the Project Area during the inventory. Two of these nests were determined to be inactive at the time of the survey. An American kestrel nest was determined to be active during the survey. All three nests are located within the bottom of the Willow Creek drainage (B&A 2008).

Although all raptor species and their nests are protected from take or disturbance under the Migratory Bird Treaty Act (MBTA) (16 USC, 703 et seq.), general raptor management is dictated by surface ownership. On BLM-administered lands, raptor management is guided by *Best Management Practices for Raptors and Their Associated Habitats in Utah, August 2006* (BLM 2008). On SITLA-administered lands, raptor management is typically coordinated with the appropriate AO.

3.2.6 SPECIAL STATUS SPECIES

Numerous Federally-listed and Utah sensitive species have the potential to occur within Uintah County. The list of threatened, endangered, and candidate[6] species potentially occurring in the Tumbleweed II Project Area was provided by the USFWS (Utah Field Office), and the BLM list was provided by BLM's State Director during preparation of the Tumbleweed 3D Seismic EA (BLM 2005a). A brief description of each of the Federally-listed and state sensitive species with the potential to occur in the Tumbleweed II Project Area is presented below. All special status plant and wildlife species information considered during the preparation of this EA for the Tumbleweed II Project Area is summarized in **Appendix C**.

3.2.6.1 Special Status Fish Species

The USFWS has identified four Federally-listed fish species historically associated with the Upper Colorado River Basin, including the Green River: Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), razorback sucker (*Xyrauchen texanus*), and bonytail (*Gila elegans*). These fish are Federally- and State-listed as endangered and have experienced severe population declines due to flow alterations, habitat loss or alteration, and introduction of non-native fish species. The Green River and its 100-year floodplain have been designated as critical habitat for these four endangered fish species (USFWS 1994).

The endangered Colorado pikeminnow, humpback chub, razorback sucker, and bonytail were once abundant in the upper and lower Colorado River Basin. Today their distribution is limited to a small portion of their historic habitat. Habitats of these species include the major rivers and tributaries in the Colorado River System, backwaters, sloughs, oxbow lakes, seasonally inundated flood plains, and reservoirs (USFWS 1990a; USFWS 1990b; and USFWS 1998).

Three additional species of fish endemic to the Colorado River Basin, including the Green River, are the roundtail chub, flannelmouth sucker, and bluehead sucker. The roundtail chub is a State-listed threatened

[6] Candidate species have no legal protection under the ESA. Candidate species are those species for which the USFWS lacks sufficient information to support issuance of a proposed rule to list under the ESA. However, identification of and evaluation of impacts to candidate species can assist environmental planning efforts by providing advance notice of potential listings, allowing resource managers to alleviate threats and thereby, possibly remove the need to list species as endangered or threatened. Therefore, candidate species with the potential to occur in the Tumbleweed II Project Area are evaluated in this EA.

species, while the two suckers are species of special concern due to declining population numbers and distribution.

Although no streams occur within the immediate Tumbleweed II Project Area, both Willow Creek and Upper Bottom Canyon are adjacent to the Tumbleweed II Project Area. However, no habitat for the Colorado River endangered fish or BLM sensitive fish species occurs within these drainages. The nearest habitat for the Colorado River endangered fishes and BLM sensitive species occurs approximately 41 miles downstream of the Tumbleweed II Project Area in the Green River.

3.2.6.2 Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle was delisted from the Endangered Species List. Bald eagles are an opportunistic species, sometimes predator and sometimes scavenger. They feed heavily on fish and therefore, the bald eagle is almost always found near water. In areas where fish are not readily available, they feed on waterfowl and small mammals (e.g., jackrabbits). In many areas of the arid west, bald eagles primarily scavenge for food, feeding largely on dead and dying fish and carrion (e.g., ungulate species, waterfowl, rabbits, and small mammals) (Anderson and Patterson 1988; USGS-NPWRC 2002). As the rivers freeze over, bald eagles utilize ungulate winter ranges and primarily feed on carrion along roadways.

No bald eagle nests or identified winter roost areas occur within the Tumbleweed II Project Area. Winter foraging habitat for the species is found within the Tumbleweed II Project Area and therefore wintering bald eagles may occur there anytime between November 1 and March 31.

3.2.6.3 Golden Eagle (*Aquila chrysaetos*)

The golden eagle is protected under the Bald and Golden Eagle Protection Act, based upon the similarity of the juvenile bald eagle's appearance to that of the adult golden eagle. Throughout the summer, golden eagles are found in mountainous areas, canyons, shrublands and grasslands. During the winter, they inhabit shrub-steppe vegetation, as well as wetlands, river systems and estuaries. Given the habitat types and local resident species present in the Tumbleweed II Project Area, golden eagles may forage or could establish nests within the Tumbleweed II Project Area.

3.2.6.4 Greater Sage-grouse (*Centrocercus urophasianus*)

At the time the Draft Tumbleweed II Exploratory Natural Gas Drilling Project EA was published, the greater sage-grouse was identified as a State of Utah Wildlife Species of Concern because of widespread losses of sagebrush habitat throughout the western states, including Utah. Since then, on March 5, 2010, the USFWS announced the greater sage-grouse warrants the protection of the ESA, but is precluded by higher priority listing actions (i.e., by the need to take action on other species facing more immediate and severe extinction threats). As a result of this decision, the USFWS placed the greater sage-grouse on the candidate list for future action, meaning the species would not receive statutory protection under the ESA and individual states would continue to be responsible for managing the bird (USFWS 2010). However, the USFWS will review the status of the species annually to determine whether it warrants more immediate action (USFWS 2010).

Immediately following issuance of the decision above, the BLM released Instruction Memorandum (IM) No. 2010-071 (BLM 2010). This IM supplements the BLM's 2004 National Strategy for sage-grouse and identifies those management actions necessary to sustain sage-grouse populations while also achieving the Department of the Interior's energy-related priorities. Under this IM, the BLM will require a combination of management actions (e.g., onsite modification and offsite mitigation) for energy development projects proposed in "priority habitat" for sage-grouse. Management actions may also

include requirements to avoid priority sage-grouse habitat or require that development not exceed certain density thresholds. In general, it is important to note these management actions may be more protective than the stipulations or restrictions identified in a Field Office's current land use plan. In addition, priority habitat, which is the habitat of highest conservation value relative to maintaining suitable sage-grouse populations range-wide, has not yet been identified by the BLM using a consistent methodology. Priority habitat will be areas of high habitat quality supporting important sage-grouse populations, including those populations that are vulnerable to localized extirpation, but necessary to maintain range-wide connectivity and genetic diversity. Until these areas are identified, the BLM will identify priority habitat on an interim basis using a variety of plans and professional judgment.

In the Tumbleweed II Project Area, greater sage-grouse habitat is primarily found in the sagebrush-steppe community located much of which is located on Winter Ridge. Sage-grouse have been recorded in these communities, and suitable nesting, brooding, and lek habitat occur. Two historic leks occur in, or within 2 miles of, the Tumbleweed II Project Area. The UDWR has identified approximately 4,448 acres of sage-grouse crucial brooding habitat in the Tumbleweed II Project Area (**Figure 3-4**), within 2 miles of these lek sites. The Horse Point lek located in the Tumbleweed II Project Area has been considered active within the past 4-5 years. Activity on the Winter Ridge lek (outside the Tumbleweed II Project Area but within 2 miles) has not been monitored for the past 3-5 years. However, prior to that, the lek was considered inactive for several years. As sage grouse do occur in the Winter Ridge area, these leks could be used as strutting grounds in the future (BLM 2007b). Since sage-grouse leks are sensitive to human activity, legal locations of Tumbleweed II Project Area leks are not disclosed within this EA.

3.2.6.5 Mexican Spotted Owl (*Strix occidentalis lucida*)

The Mexican spotted owl (MSO), a Federally-threatened species, nests, roosts, and forages in a diverse array of biotic communities across its range (USFWS 2001). Preferred nesting habitat of the species in Utah includes complex, thickly forested, steep-walled, rocky canyons, with uneven-aged, multi-storied mature, and/or old growth stands that have high canopy closure. In the northern portion of its range (Utah and Colorado), most MSO nests are located in caves or on cliff ledges in steep-walled canyons (USFWS 2001).

The Final Assessment of Potential MSO Nesting Habitat on BLM-Administered Lands in Northeastern Utah (SWCA 2005) identified Willow Creek as potential "good" and "fair" nesting habitat. In 2006, the BLM reevaluated "fair" and "good" habitat designations found in SWCA's report, at which time habitat near the Tumbleweed Unit was confirmed as "fair" or "good". At the direction of the BLM, all areas of "fair" or "good" habitat must be surveyed for the presence of MSO prior to any disturbance within ½ mile of these areas. MSO surveys of "fair" and "good" habitat in and near the Tumbleweed II Project Area began as early as 2006. For some habitat areas, surveys were conducted 2007 and/or 2008. The most recent surveys were conducted by Buys & Associates in 2009 (B&A 2009). In reviewing these data, as of August 2009, 2 years of MSO surveys had been completed according to USFWS protocol for Stewart's proposed well pads (TUF #4-3, #5-8, #9-3, #9-11, #17-4, TUF #17-12, and TUF #18-9) and associated road and pipeline corridors in the Tumbleweed II Project Area. No MSO were seen or heard during any of the inventories conducted for this project (B&A 2009).

Two consecutive years of surveys are required for clearance of a MSO habitat. However, if more than 4 years have elapsed between the end of the two years of survey and the initiation of the Proposed Action, then another complete inventory (i.e., two years of survey) is recommended prior to project implementation (USFWS 2003). As of August 2009, Stewart's proposed development locations in the Tumbleweed II Project Area are cleared until the 2013 breeding season.

3.2.7 RECREATION

The Tumbleweed II Project Area is approximately 70 miles south of Vernal, Utah. The majority of roads that provide access to the Tumbleweed II Project Area from Vernal are either gravel surfaced or unimproved. Travel distance, road conditions, and adverse weather conditions can make it difficult to access the Tumbleweed II Project Area. As such, recreational use is relatively limited when compared with other areas in northeastern Utah. Because visitor use of the Tumbleweed II Project Area is limited, there are opportunities for primitive and unconfined recreation and high-quality hunting. The Tumbleweed II Project Area also offers limited opportunity for motorized recreation. Each of these recreational opportunities is discussed below.

The Tumbleweed II Project Area provides visitors with opportunities for primitive and unconfined recreation. The existing landscape could appropriately be characterized as remote, and as an area where human intrusions are substantially unnoticed. The land includes scenic vistas, a diversity of vegetation, flat-top narrow ridges, and open canyons, which provide opportunities for activities such as hiking, backcountry camping, and wildlife viewing. The majority of the recreation which occurs in the Project Area is centered on Willow Creek and Upper Bottom Canyon, which are accessible only by foot or horseback.

The Tumbleweed II Project Area occupies a portion of the Book Cliffs Hunting Unit for elk, mule deer, black bear, and cougar. Hunting seasons are different for each species and weapon type (e.g., archery, muzzleloader, any weapon); however, hunting seasons generally begin in the early fall and end in the early winter. Black bear, unlike other species, can also be hunted during the spring (UDWR 2009a). Although pronghorn, bighorn sheep, bison, and sage-grouse habitat can be found within the Tumbleweed II Project Area, hunting these species is not permitted. Opportunities for hunting within the Book Cliffs Hunting Unit are summarized in **Table 3-5**. It is important to note that the Tumbleweed II Project Area constitutes only a fraction of the Book Cliffs Hunting Unit, which for mule deer and elk incorporates a substantial portion of Uintah and Duchesne Counties, and for cougar and black bear incorporates a substantial portion of Uintah and Grand Counties (UDWR 2008a; UDWR 2009a; UDWR 2009b).

Table 3-5. Limited Entry Hunting Opportunities within the Book Cliffs

Hunt Seasons	Hunt Boundary	Weapon Type	2009 Season Dates	2009 Permits		2009 Applicants	
				Resident	Nonresident	Resident	Nonresident
Limited Entry Buck Deer	Book Cliffs	Archery	08/15 – 09/11	106	11	877	292
		Any Weapon	10/17 – 10/25	321	34	4,880	1,103
		Muzzleloader	09/23 – 10/01	106	11	1,004	198
Limited Entry Bull Elk	Book Cliffs, Bitter Creek	Archery	08/15 – 09/11	32	3	125	98
		Any Weapon	09/21 – 09/20 (early) & 11/07 – 11/13 (late)	49 26	5 2	1,337 220	394 84
		Muzzleloader	09/23 – 10/01	19	2	196	75
		Premium	All limited entry season	4	0	137	0

Hunt Seasons	Hunt Boundary	Weapon Type	2009 Season Dates	2009 Permits		2009 Applicants	
				Resident	Nonresident	Resident	Nonresident
Cougar	Book Cliffs, Bitter Creek	NA	11/19/2008 – 2/08/2009	13	1	72	27
Black Bear	Book Cliffs	NA	04/11 – 05/31 (spring); & 08/22 – 09/30; 10/31 – 11/22 (fall)	14 4	2 1	654	27

Source: (UDWR 2008a; UDWR 2008b; UDWR 2008c; UDWR 2009a; UDWR 2009b; UDWR 2009c; UDWR 2009d; UDWR 2009e; UDWR 2009f; UDWR 2009g)

Off-highway vehicle (OHV) use within the Tumbleweed II Project Area is "limited" to designated roads and trails (BLM 2008a). Because there are limited roads and no designated trails, motorized vehicle use is largely restricted.

3.2.8 CULTURAL RESOURCES

The cultural-chronological sequence in the Tumbleweed II Project Area includes the Archaic stage (7000 B.C. to A.D. 400), which can be further subdivided into Early, Middle, Late, and Terminal periods; the Formative stage (A.D. 700 to A.D. 1250), which is largely associated with the San Rafael Fremont in the Tumbleweed II Project Area; the Protohistoric stage (A.D. 1200 to A.D. 1750), largely associated with Numic-speaking (Ute) peoples; and the historic period, which began with the arrival of Europeans in the eighteenth century. The Tumbleweed II Project Area and adjacent areas include sites associated with the historical Northern Ute migration route along Main Canyon and historical inscription dating to the early French fur trade era.

As per regulations set forth under 36 CFR 800, the area of potential effects (APE) for the Tumbleweed project is defined as the individual areas surveyed for Class III inventories. To date, Class III inventories have been completed for the TUF #18-9, #17-4, and #17-12 proposed well pads and associated access roads and pipeline corridors. Following project approval and prior to beginning any project-related surface disturbance, additional Class III survey work (i.e., 100 percent pedestrian field surveys) would be conducted for the remaining proposed well pads and associated access roads and pipeline corridors in the Tumbleweed II Project Area. These additional surveys would be completed to ensure that all locations proposed for surface disturbance have been examined by an archaeologist approved by the appropriate SMA in order to determine the presence of cultural resources in the APE for the Tumbleweed project.

All cultural resource inventories completed within the Tumbleweed II Project Area have been and will continue to be conducted in compliance with Federal and State legislation including Section 106 of the NHPA of 1966, the NEPA of 1969, the Archaeological and Historic Preservation Act of 1974, the ARPA of 1979, the American Indian Religious Freedom Act of 1978, and the NAGPRA of 1990.

The NHPA sets forth national policy and procedures regarding "historic properties"—that is, regions, sites, buildings, structures, and objects included in or eligible for the National Register of Historic Places (NRHP). Section 106 of the NHPA requires Federal agencies to consider the effects of their undertakings on such properties, following regulations issued by the Advisory Council on Historic Preservation

(ACHP) (36 CFR 800). Criteria for evaluating the significance of resources for listing on the NRHP are outlined in 36 CFR 800.10, "National Register Criteria." The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

- That are associated with events that have made a significant contribution to the broad patterns of our history;
- That are associated with the lives of persons significant in our past;
- That embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; and
- That have yielded, or may be likely to yield, information important in prehistory or history.

Summary of Surveys Conducted and Inventory Results

In all, at least nine cultural resource surveys have been completed in the Tumbleweed II Project Area. These inventories were completed for 3D seismic exploration, well pads and associated roads and pipelines, and buried gas pipelines. These inventories cover approximately 2,460 acres, or roughly 32 percent, of the approximately 7,745 acre Tumbleweed II Project Area.

The nine previous inventories provide a broad, but varied coverage of the Tumbleweed II Project Area. Inventories conducted as part of a seismic exploration program provide a fairly systematic coverage of Horse Point and Winter Ridge, though the spacing of the shot lines were relatively wide and the corridors inventoried were relatively narrow (100 feet on either side of centerline). As part of these surveys, the canyon rim above Willow Creek received intensive coverage where seismic lines came within 300 feet of the rim. The bottom of Willow Creek was also inventoried at this time from canyon wall to canyon wall. Two large block inventories have been conducted on Winter Ridge. Eight well pads and their associated access have also been inventoried in the Tumbleweed II Project Area, three of which are detailed in this EA (TUF #18-9, #17-4, and #17-12). Several of the remaining proposed well locations and access routes are adjacent or partially covered by previously-inventoried areas. Additionally, several pipeline corridors have been inventoried throughout the Tumbleweed II Project Area.

Surveys conducted for the 2,460 inventoried acres in the Tumbleweed II Project Area have resulted in the identification of 36 prehistoric and historic cultural resources. Of these 36 sites, 5 sites are located within the APE for the TUF #18-9, #17-4, and #17-12 proposed well pads and associated access roads and pipeline corridors. More specifically, Class I and Class III inventories completed to date for these locations have resulted in the location of one previously recorded site (42Un3186) and the documentation of four new sites (42Un4530 – 42Un4533) (**Table 3-6**). These five sites are considered eligible for nomination to the NRHP under Criterion D due to their potential for buried cultural remains and likelihood for further contribution to various prehistoric research topics in the region. Consultations for the TUF #18-9, #17-4, and #17-12 have been completed with the Utah SHPO and Native American Tribes, and site-specific adjustments to these locations have been made, as necessary, to avoid the eligible sites listed below. Consultations for these locations would be re-initiated on a site-specific level as appropriate, if previously unknown sites are found during surface-disturbing activities.

Table 3-6. List of Known Archaeological Sites within the Tumbleweed II Project Area Based on Class I and Class III Inventories Completed to Date

Site Number	Site Type	Cultural Affiliation	NRHP Assessment	Recorded By
42Un3186	Prehistoric Temporary Camp	Unknown Prehistoric	Eligible	MOAC 2003
42Un4530	Lithic Scatter	Middle Archaic	Eligible	MOAC December 2004
42Un4531	Prehistoric Camp	Unknown prehistoric	Eligible	MOAC December 2004
42Un4532	Lithic Scatter	Unknown prehistoric	Eligible	MOAC December 2004
42Un4533	Prehistoric Temporary Camp	Unknown prehistoric	Eligible	MOAC December 2004

3.2.9 AIR QUALITY

Regional air quality is influenced by a combination of factors including climate, meteorology, the magnitude and spatial distribution of local and regional air pollution sources, and the chemical properties of emitted pollutants. Within the lower atmosphere, regional and local scale air masses interact with regional topography to influence atmospheric dispersion and transport of pollutants. The following sections summarize the climatic conditions and existing air quality within the Project Area and surrounding region.

Climate

The Project Area is located in the Uinta Basin, a semiarid, mid-continental climate regime typified by dry, windy conditions and limited precipitation. The elevation ranges from approximately 5,882 to 7,372 feet above mean sea level (famsl), with an average elevation of 6,627 famsl. The terrain is generally gently sloping with the exception of the incised drainages of the Green River Canyon and its tributary canyons on the eastern portion of the Project Area. The Uinta Basin is bordered by the Wasatch Range to the west, which extends north and south through the middle of the State, and the High Uinta Mountains to the north, which extend east and west through the northeast portion of the State.

Temperature and Precipitation

The closest climate measurements to the Project Area were recorded at Nutters Ranch, Utah (1963-1986). The Nutters Ranch station is located approximately 40 miles west/northwest of the geographic center of the Project Area. The elevation of the Nutters Ranch station is approximately 5,790 feet amsl (WRCC 2008). **Table 3-7** summarizes the mean temperature range, mean total precipitation, and mean total snowfall by month.

Prevailing synoptic-scale westerly air masses originating from the Pacific Ocean are typically interrupted by the western mountain ranges before reaching the Uinta Basin. As a result, the lower elevations of the Uinta Basin receive relatively slight amounts of precipitation. The higher elevations of the area generally receive more favorable amounts of precipitation. The annual mean precipitation at Nutters Ranch is 11.6 inches, and ranges from a minimum of 6.4 inches recorded in 1974, to a maximum of 24.8 inches recorded in 1965. On average, February is the driest month with a monthly mean precipitation of 0.53 inches, and August is the wettest month with a monthly mean precipitation of 1.37 inches. The annual average snowfall is 45.6 inches. December is the snowiest month. A maximum annual snowfall of 101 inches was recorded in 1964.

The surrounding area has an annual mean temperature of 46.2 degrees Fahrenheit (^{o}F). However, abundant sunshine and rapid nighttime cooling result in a wide daily range in temperature. Wide seasonal temperature variations typical of a mid-continental climate regime are also common. Average monthly

winter temperatures range from 9 °F to 38 °F, while average summer temperatures range from 50 °F to 84 °F. Recorded daily extreme temperatures are minus 40 °F in 1937 and 106 °F in 1994 (WRCC 2008).

Table 3-7. Temperature, Precipitation, and Snowfall at Nutters Ranch, Utah

Month	Average Temperature Range (in degrees Fahrenheit)	Average Total Precipitation (inches)	Average Total Snowfall (inches)
January	6.4 – 35.3	0.56	6.1
February	11.5 – 42.0	0.53	9.0
March	22.4 – 51.6	1.16	6.1
April	29.8 – 61.4	1.02	4.1
May	38.5 – 71.9	1.10	0.6
June	46.4 – 81.3	0.86	0.0
July	53.6 – 87.7	1.19	0.0
August	51.3– 85.4	1.37	0.0
September	42.2 – 77.1	1.08	0.5
October	31.2 – 65.3	1.16	1.3
November	20.1 – 49.4	0.71	5.4
December	9.2 – 36.6	0.85	12.4
Total Annual Average	30.2 – 62.1	11.57	45.6

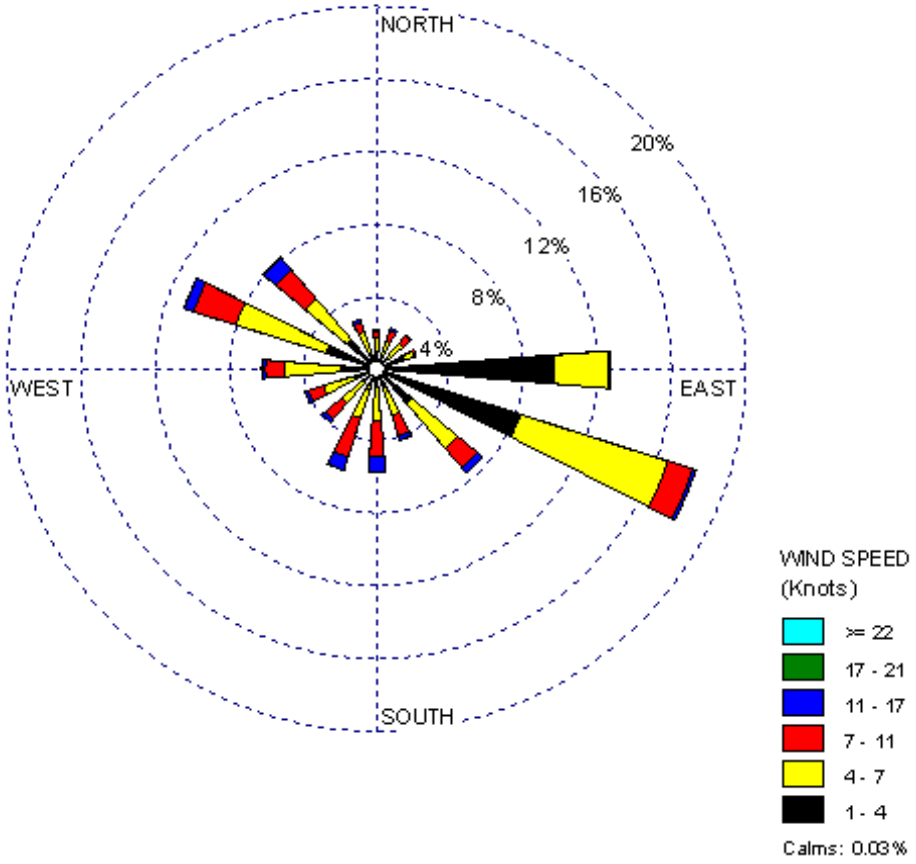
Source: WRCC 2008. Data collected at Nutters Ranch, Utah from 1963 to 1986 (http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ut6340)

Winds and Atmospheric Stability

The transportation and dilution of air pollutants are primarily a function of wind speed and direction. Winds dictate the direction in which pollutants are transported. As wind speed increases, the dispersion of emitted pollutants also increases, thereby reducing pollutant concentrations.

Wind data within the Project Area have not been directly measured. Local terrain effects will influence the wind profiles specific to the Project Area. However, representative wind speed and direction data has been developed for the West Tavaputs Draft Environmental Impact Statement (BLM 2008c). These data have been peer-reviewed by BLM air quality specialists and have been deemed representative of the Uinta Basin for dispersion modeling purposes. **Figure 3-5** presents a wind rose depicting wind speed and direction for all 5 years of data. Note that the data represent the direction from which the wind is blowing (Wind Direction Origin). For example, winds blowing from the north would transport pollutants to the south. As shown, winds originate predominately from the east-southeast 16.7 percent of the time. The average measured wind speed is 6.4 miles per hour. Winds are calm 0.03 percent of the time.

Figure 3-5 Wind Rose from AERMET Canyonlands NP Data 1995-1999
Wind Speed Direction (blowing from)



Average Wind Speed 5.52 Knots

Existing Sources of Air Pollution

The Uinta Basin has seen recent oil and gas development on Tribal, Federal, and private lands. Existing point and area sources of air pollution within the Project Area and surrounding region include the following:

- Exhaust emissions, primarily CO, NOx, PM2.5, and HAPs, from existing natural gas fired compressor engines used in transportation of natural gas in pipelines;
- Natural gas dehydrator still-vent emissions of CO, NOx, PM2.5, and HAPs;
- Gasoline and diesel-fueled vehicle tailpipe emissions of VOCs, NOx, CO, SO2, PM10, and PM2.5;
- Oxides of sulfur (SOx), NOx, and fugitive dust emissions from coal-fired power plants and coal mining and processing;
- Fugitive dust (in the form of PM10 and PM2.5) from vehicle traffic on unpaved roads, wind erosion in areas of soil disturbance, and road sanding during winter months; and
- Long-range transport of pollutants from distant sources.

Regulatory Environment

Criteria Pollutants

National Ambient Air Quality Standards (NAAQS) have been promulgated for the purpose of protecting human health and welfare with an adequate margin of safety. Pollutants for which standards have been set include sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), and particulate matter less than 10 microns in diameter (PM_{10}) or 2.5 microns in diameter ($PM_{2.5}$). Existing air quality in the region is acceptable based on EPA's NAAQS. The surrounding area is designated as an "attainment area," meaning that the concentration of criteria pollutants in the ambient air is less than the NAAQS. Site-specific air quality monitoring data are not available for the Project Area; however, estimated background criteria pollutant concentrations for the Uinta Basin were provided by the Utah Department of Environmental Quality, Division of Air Quality and incorporated into **Table 3-8**.

Ground-level ozone (O_3) is a secondary pollutant that is formed by a chemical reaction between NO_X and VOCs in the presence of heat and sunlight. Precursor sources of ozone – volatile organic compounds and nitrogen oxides – include motor vehicle exhaust and industrial emissions, gasoline vapors, some tree species emissions, wood burning, and chemical solvents. Sunlight and hot weather cause ground-level ozone to form. As a result, it is generally known as a summertime air pollutant. Ozone is a regional air quality issue because, along with its precursors, it transports hundreds of miles from its origins. Maximum ozone levels generally occur at locations many miles downwind from the sources. Primary health effects from ozone exposure range from breathing difficulty to permanent lung damage. Significant ground-level ozone also contributes to plant and ecosystem damage.

The NAAQS have been recently revised to reflect changes to the PM_{10} and $PM_{2.5}$ standards. The changes reflect a stricter $PM_{2.5}$ 24-hour standard for the 98^{th} percentile of a 3 year average (lowered from 65 micrograms per cubic meter [$\mu g/m^3$] to 35 $\mu g/m^3$) and elimination of the PM_{10} annual standard. These changes are illustrated in the **Table 3-8** below.

Under the Prevention of Significant Deterioration (PSD) provisions of the Clean Air Act (CAA), incremental increases of specific pollutant concentrations are limited above a legally defined baseline

level. Many national parks and wilderness areas are designated as PSD Class I. The PSD program protects air quality within Class I areas by allowing only slight incremental increases in pollutant concentrations. Areas of the State not designated as PSD Class I are classified as Class II. For Class II areas, greater incremental increases in ambient pollutant concentrations are allowed as a result of controlled growth. The PSD increments for Class I and II areas are presented in **Table 3-8**. The closest Class I areas are Arches National Park (74 miles south) and Canyonlands National Park (96 miles south).

Table 3-8. Ambient Criteria Pollutant Concentrations in the Uinta Basin

Pollutant	Averaging Period(s)	Uinta Basin Background Concentration[a] ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	PSD Class I Increment ($\mu g/m^3$)	PSD Class II Increment ($\mu g/m^3$)
SO_2	Annual 24-hour 3-hour	5 10 20	80 365 1,300	2 5 25	20 91 512
NO_2	Annual	17	100	2.5	25
PM_{10}	24-hour	63	150	8	30
$PM_{2.5}$	Annual 24-hour	11 15 / 52[c]	15 35	None None	None None
CO CO	8-hour 1-hour	1,111 1,111	10,000 40,000	None None	None None
O_3	8-hour	105	147 [b]	None	None

[a] Source: Utah Division of Environmental Quality - Division of Air Quality (UDAQ).

[b] The 147 $\mu g/m^3$ value in the table is equivalent to the NAAQS of 0.075 ppm.

[c] The state of Utah currently does not have an official background value for $PM_{2.5}$. The $PM_{2.5}$ concentrations given in this table represent 98th percentile values from limited $PM_{2.5}$ monitoring conducted in Vernal, Utahin 2006 and 2007. The smaller figure of the 24-hour averaging period is representative of average summer concentrations, while the larger value is representative of winter inversion conditions, based on this monitoring.

The UDAQ conducted limited monitoring $PM_{2.5}$ in Vernal, Utah that started in December 2006. During the 2006-2007 winter season, $PM_{2.5}$ levels were measured at the Vernal monitoring station higher than the new $PM_{2.5}$ health standard that became effective in December 2006. The $PM_{2.5}$ levels recorded in Vernal were similar to other areas in northern Utah that experience wintertime inversions. The State of Utah is in the process of identifying areas that are experiencing high $PM_{2.5}$ levels and identifying potential strategies to improve wintertime air quality in those areas.

Particulate Matter (PM_{10} and $PM_{2.5}$)

Airborne particulate matter (PM) consists of tiny coarse-mode (PM_{10}) or fine-mode ($PM_{2.5}$) particles or aerosols combined with dust, dirt, smoke, and liquid droplets. $PM_{2.5}$ is derived primarily from the incomplete combustion of fuel sources and secondarily formed aerosols, whereas PM_{10} is primarily from crushing, grinding, or abrasion of surfaces. Sources of PM include industrial processes, power plants, mobile sources, construction activities, and fires. With regard to mobile sources, more PM is emitted into the atmosphere from the use of diesel fuel than the use of gasoline.

PM causes a wide variety of health and environmental impacts. Many scientific studies have linked breathing PM to significant health problems, including aggravated asthma, increased respiratory symptoms, such as coughing, and difficult or painful breathing, chronic bronchitis, decreased lung function, and premature death. PM is the major cause of reduced visibility and can stain and damage stone and other materials, including culturally significant objects, such as monuments and statues.

Potential Control Measures

The sources of elevated $PM_{2.5}$ concentrations during winter inversions in Vernal, Utah haven't been identified as of yet. Based on experiences and studies in other areas of the Rocky Mountain west and the emission inventory in the Uinta Basin, potential sources and controls can however be tentatively identified. In Utah elevated $PM_{2.5}$ concentrations along the Wasatch Front are associated with secondarily formed particles from sulfates, nitrates, and organic chemicals from a wide variety of sources (UDAQ, 2006). In the Cache Valley of northern Utah approximately half of ambient $PM_{2.5}$ during elevated concentrations are composed of ammonium nitrate, most likely from agricultural operations, with the rest from combustion, primarily mobile sources and woodstoves (Martin, 2006). For comparison, $PM_{2.5}$ in most rural areas in the western United States is typically dominated by total carbonaceous mass and crustal materials from combustion activities and fugitive dust respectively (EPA, 2009).

As the Uinta Basin is neither a major metropolitan area as found on the Wasatch Front, nor has significant agricultural activities as found in Cache Valley, the most likely causes of elevated $PM_{2.5}$ at the Vernal monitoring station are probably those common to other areas of the western US (combustion and dust) plus nitrates and organics from oil and gas activities in the Basin. Typical combustion controls include burning restrictions such as open burning and woodstove bans during poor air quality, and improvements in combustion devices such as woodstove change-out programs. Mobil combustion controls include diesel engine retrofitting (school bus retrofits for example), clean fuels (low sulfur diesel), and vehicle miles travelled reduction programs. Oil and gas industry precursor controls include nitrogen oxide engine controls such as catalytic reduction, ignition retard, and newer low emission engines (Tier II or better). Though volatile organic compound (VOC) control measures are usually not required in $PM_{2.5}$ nonattainment areas unless it is demonstrated that their presence contributes significantly to $PM_{2.5}$ concentrations, their dual application in reducing ozone precursor gases suggest it may be prudent to include VOC controls in the overall emission control package. Examples of VOC controls that can be used for oil and gas development and production include flaring, green completions, vapor recovery, dehydrator and pneumatic controls, and fugitive leak detection. Several of these measures are included in the operator's ACEPMs for this project (see **Section 2.1.15.1**)

Hazardous Air Pollutants

Hazardous air pollutants (HAPs) are those pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental impacts. The EPA has classified 187 air pollutants as HAPs. Examples of listed HAPs associated with the oil and gas industry include formaldehyde, benzene, toluene, ethylbenzene, isomers of xylene (BTEX) compounds, and normal-hexane (n-hexane).

The CAA requires the EPA to regulate emissions of toxic air pollutants from a published list of industrial sources referred to as "source categories." As required under the CAA, EPA has developed a list of source categories that must meet control technology requirements for these toxic air pollutants. Under Section 112(d) of the CAA, the EPA is required to develop regulations establishing national emission standards for hazardous air pollutants (NESHAP) for all industries that emit one or more of the pollutants in major source quantities. These standards are established to reflect the maximum degree of reduction in HAP emissions through application of maximum achievable control technology (MACT). Source categories for which MACT standards have been implemented include oil and natural gas production and natural gas transmission and storage.

There are no applicable Federal or State of Utah ambient air quality standards for assessing potential HAP impacts to human health. Therefore, reference concentrations (RfC) for chronic inhalation exposure and Reference Exposure Levels (REL) for acute inhalation exposures are applied as significance criteria. **Table 3-9** provides the RfCs and RELs. RfCs represent an estimate of the continuous (i.e., annual

average) inhalation exposure rate to the human population (including sensitive subgroups such as children and the elderly) without an appreciable risk of harmful effects. The REL is the acute (i.e., 1-hour average) concentration at or below which no adverse health effects are expected. Both the RfC and REL guideline values are for non-cancer effects.

Table 3.9. HAP Reference Exposure Levels and Reference Concentrations

Hazardous Air Pollutant (HAP)	Reference Exposure Level (REL 1-hr Average) (µg/m^3)	Reference Concentration [a] (RfC Annual Average) (µg/m^3)
Benzene	1,300 [b, c]	30
	160,000 [d]	-
Toluene	37,000 [b]	5,000
Ethylbenzene	350,000 [d]	1,000
Xylenes	22,000 [b]	100
n-Hexane	390,000 [d]	700
Formaldehyde	94 [b]	9.8

[a] EPA Air Toxics Database, Table 1 (EPA 2007a)
[b] EPA Air Toxics Database, Table 2 (EPA 2007a) REL from California EPA (most conservative level in Table 2)
[c] REL for benzene is for a 6-hr average.
[d] Immediately Dangerous to Life or Health (IDLH)/10, EPA Air Toxics Database, Table 2 (EPA 2007a) since no REL is available

Greenhouse Gases

Greenhouse gases keep the planet's surface warmer than it otherwise would be. But, as the concentrations of these gases continue to increase in the atmosphere, the Earth's temperature is climbing above past levels. According to NOAA and NASA data, the Earth's average surface temperature has increased by about 1.2 to 1.4º F in the last 100 years. The eight warmest years on record (since 1850) have all occurred since 1998, with the warmest year being 1998. However, according to the British Meteorological Office's Hadley Centre (BMO 2009), the United Kingdom's foremost climate change research centre, the mean global temperature has been relatively constant for the past nine years after the warming trend from 1950 through 2000. So while most scientists believe that Earth will continue to warm in the future, this warming has not occurred for the past ten years. Therefore, quantified or globally accepted predictions on the ultimate outcome of global warming are still unknown. The warmest year on record was 1998, a year associated with the most intense El Nino global phenomena ever experienced. Most of the warming from 1950 through 2000 is speculated to be the result of human activities. Other aspects of the climate, such as rainfall patterns, snow and ice cover, and sea level, are also changing.

3.2.10 VISUAL RESOURCES

The Tumbleweed II Project Area consists of flat top ridges and open canyons that offer scenic vistas. The canyon walls of Willow Creek and Upper Canyon Bottom have gently sloping terraces alternating with steep, cliff-forming outcrops. Dominant vegetation includes pinyon-juniper interspersed with bunch grasses, sagebrush, and rabbit brush. The area also includes isolated stands of aspen and fir, and patches of oak brush and mountain mahogany. The Tumbleweed II Project Area offers a predominantly natural appearing landscape with little evidence of human activity. Human imprints within the southernmost portion of the Tumbleweed II Project Area include the existing Winter Ridge Road and pipeline. The Project Area also includes an existing unnamed and unmaintained road leading to historical oil and gas developments. Deep canyons and narrow ridges as well as the diversity of vegetation screen most human intrusions from sight within the area. There are no developed recreation facilities, residential dwellings, critical viewpoints, or commonly traveled viewer sensitive routes that would be considered as Key Observation Points within the Tumbleweed II Project Area.

According to the Vernal Field Office Approved RMP, the entire Tumbleweed II Project Area has been designated by the BLM as VRM Class III. The objective of VRM Class III is to partially retain the existing character of the landscape. The level of change to the landscape should be moderate.

3.2.11 NON-WSA LANDS WITH WILDERNESS CHARACTERISTICS

Non-WSA lands with wilderness characteristics are defined as areas having at least 5,000 acres in a natural or undisturbed condition, and provide outstanding opportunities for solitude or primitive forms of recreation. The Tumbleweed II Project Area is completely contained within an 11,802-acre area that was inventoried by BLM in 2007 and found to have wilderness characteristics. Within the 2007 inventory of the Wolf Point area, there were an additional 2,764 acres that were inventoried and found not to have wilderness characteristics. This information is documented in a 2007 Wilderness Characteristics Review completed by the Vernal Field Office and further discussed in the Vernal Proposed Plan/Final EIS on pages 3-43 through 3-48.

As illustrated in **Figure 3-5**, the 11,802 acres of the Wolf Point area that were found to have wilderness characteristics are located north of the existing Winter Ridge Pipeline and west of the Bull Canyon Road. In 2007, Stewart Petroleum drilled the TUF #18-9 in the wilderness characteristics area and constructed approximately 0.6 miles of new access road co-located with surface-laid pipeline, and upgraded approximately 1.7 miles of existing two-track. To estimate the indirect impacts of this existing development on wilderness characteristics, a ½ mile sight and sound buffer was applied to all existing roads and well pads in the Tumbleweed Project Area. This GIS based exercise showed that of the 11,802 acres of non-WSA lands with wilderness characteristics, approximately 2,234 acres currently fall within ½ mile of existing access roads and oil and gas related development.

The ROD for the Approved Vernal RMP (2008) did not carry the Wolf Point area forward as a BLM natural area for the protection, preservation, or maintenance of the wilderness characteristics. This management decision was based on analysis in the Vernal Proposed Plan/Final EIS (2008), which showed Wolf Point as being located in an oil and gas development area with a moderate to high potential for future development. Page 4-227 of the Vernal Proposed RMP/Final EIS showed that 53 percent of the Wolf Point area is currently under lease. Given the existing leases, resource potential, level of past production, and ongoing exploration and development in the area, it was anticipated, under the Proposed RMP, that Wolf Point would have a direct loss of natural characteristics and opportunities for solitude and primitive and unconfined recreation due to surface disturbance and sights and sounds of development. Ultimately, the Proposed RMP analysis showed that 99 percent of the Wolf Point area would be affected over the life of the Approved RMP. A full analysis of impacts to this area and other non-WSA lands with wilderness characteristics in the Vernal Field Office is contained in the Proposed RMP/Final EIS from pages 4-175 to 4 -186. Under the Approved RMP the Wolf Point area is subject to other management decisions that allow for degradation or loss of the wilderness characteristics values.

During the RMP planning process, a BLM interdisciplinary team inventoried a total of 34 areas within the Vernal Field Office to determine if they possessed wilderness characteristics. The Vernal Field Office determined that 25 of the 34 areas outside of existing WSAs, totaling about 277,596 acres, were found to have wilderness characteristics. At the same time, they determined that 133,723 acres did not possess wilderness characteristics. The lands found to have wilderness characteristics were carried through the land-use planning process to assess the impacts of management options on these lands and to determine how their wilderness characteristics would be managed. The ROD for the Approved RMP carried forward 14 areas totaling 106,198 acres as BLM natural areas that are to be managed to protect, preserve, and maintain their wilderness characteristics values. The other lands are subject to other management decisions that allow for degradation or loss of the wilderness characteristics values.

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4.0 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter provides an analysis of the direct and indirect environmental consequences that could potentially result from the implementation of the Proposed Action, Alternatives B, C, or D. Applicant-committed environmental protection measures that would reduce or eliminate impacts were identified in **Section 2.1.15**. The analyses within this chapter assume that the alternatives, including those ACEPMs would be implemented. This chapter also provides an assessment of the known and potential cumulative impacts of the alternatives. As discussed in Chapter 2, the alternatives include a commitment/requirement for interim reclamation in areas not needed for production activities. However, for impact analyses within the following sections of this EA, direct and indirect impacts have been analyzed using the initial disturbance.

It is important to note that resource-specific surface disturbances within the analyses in this chapter may differ slightly from the total surface disturbance calculations presented in Chapter 2 as a result of GIS-based buffer and clip functions, which effectively remove any areas of special overlap between buffered features (e.g., overlapping well pad and road and pipeline ROWs). Therefore, the GIS analysis in Chapter 4 leads to slightly lower total distance values than those presented in the description of alternatives.

4.2 DIRECT/INDIRECT IMPACTS

Direct impacts are defined as effects that are caused by the action and occur at the same time and/or place (40 CFR 1508.8). Indirect impacts are effects caused by the action, but occur later in time and/or in a different place. The potential direct and indirect impacts from the Proposed Action, No Action Alternative, and Buried Pipelines Alternative are discussed in the following sections.

4.2.1 PROPOSED ACTION

4.2.1.1 Soils

Potential impacts to soils 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 destruction of biological soil crusts. Surface disturbance and removal of vegetation, including biological soil crusts, could also cause indirect effects on soils by reducing their water holding capacity. The loss of water holding capacity and impacts on microorganisms from increased erosion, removal of biological soil crusts, and contamination could also indirectly lead to the loss of topsoil productivity and the ability of these soils to support vegetation.

Implementation of the Proposed Action would initially disturb up to 45 acres of the Winteridge-Moonset soil association and approximately 2.5 acres of the Towave-Gompers-Rock outcrop association. Soils would be disturbed during construction of well pads, access roads, and pipelines.

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

The natural, background erosion rate for soils within the Uinta Basin is reported to be about 1.45 tons per-acre per-year (BLM 1984). The majority of the sediment included in this average rate is thought to be derived from erosion of the badlands areas that occur to the northeast of the Tumbleweed II Project Area (BLM 1984). Therefore, the erosion rate for the Winteridge-Moonset association is likely lower than this estimate.

Studies concerning the amount of increased erosion associated with the construction of oil and gas facilities have not been conducted. However, two studies conducted on sediment yield from disturbed surfaces provide some insight into the amount of increased erosion that could be expected from construction of well pads, roads, and other project facilities in the Tumbleweed II Project Area. Lusby and Toy (1976) reported that yields from reclaimed surface coal mines were initially 300 percent to 600 percent higher than from undisturbed surfaces. Frickel et al. (1975) found that yields increased to about 2.9 tons/acre/year (about a 100 percent increase) in the Piceance Basin of Colorado after construction of oil shale project facilities. Using these studies as examples, it is assumed that average erosion rates for soils in the Tumbleweed II Project Area would initially triple from about 1.45 tons/acre/year to about 4.35 tons/acre/year.

Based on this assumption, erosion rates within the 47.7-acre "zone of influence" would initially increase from a background rate of 68.8 tons/year to 206.6 tons/year. In general, 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, surface roughness, the amount of vegetative cover, and climatic conditions. As such, this erosion estimate and other alternative-specific estimates should be considered to be accurate within the range of +/- 100 percent. However, because the estimates were made using the same set of assumptions for each alternative, they provide a valuable way to compare the potential increased erosion that would result under the various alternatives.

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 liquid hydrocarbons from wellheads, conveyance pipelines, produced water sumps, and oil storage tanks. Other potential sources of soil contamination include leaks of saline water, liquid hydrocarbons, and hydro-fracturing chemicals from reserve pits, and spills and leaks of fuels and lubricants from vehicles and drilling equipment. Petroleum released to surface soils infiltrates the soil and can migrate vertically until the water table is encountered. Direct impacts from such a spill or leak on soils could include loss of vegetation, disruption of microbial communities, and changes to physical soil characteristics. Depending on the size and type of spill, the indirect effects on soils would primarily consist of the potential loss of soil productivity.

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. In addition, the segregation and reapplication of surface soils would 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. Compaction and blending could also reduce the reclamation potential of the soils.

Mapping of biological soil crusts has not been performed in the Tumbleweed II Project Area. However, based on its physical and biological characteristics, the Winteridge-Moonset soil association has a potential to support biological soil crusts. In addition to direct disturbances associated with construction activities, biological soil crusts are also vulnerable to vehicle traffic, livestock grazing, horseback riding, and pedestrian traffic. The fibers that compose the tensile strength of biological soil crusts are weak in comparison to the compressional strength placed on the crusts by machinery, human footprints, big game, livestock, or wild horse hoof prints. The impact of a given surface disturbance on biological soil crusts

depends upon its severity, frequency, timing, and type, as well as the weather conditions during and after the disturbance (Belnap et al. 2001). Biological soil crusts occurring in the Tumbleweed II Project Area have been disturbed primarily from livestock, wild horses, and wildlife. Surface disturbances associated with the Proposed Action could add to these disturbances by breaking, overturning and burying soil crusts to various degrees (Belnap et al. 2001). As stated in **Section 3.2.1**, it is assumed for purposes of this EA that biological soil crusts may occur wherever the Winteridge-Moonset association is present in the Tumbleweed II Project Area. It is further assumed that the Proposed Action could result in the direct disturbance of 47.7 acres of biological soil crusts, which is less than 1.8 percent of the 2,647 acres that of land that have potential to support biological soil crusts within the Tumbleweed II Project Area. The recovery of biological soil crusts is slow, on the order of hundreds of years. Therefore, any loss of biological crusts would be considered to be a long-term impact (Belnap et al. 2001).

4.2.1.2 Water Resources

Surface Water

Soil erosion calculations reveal that an estimated 206.6 tons/year of additional erosion could be expected to occur as a result of the Proposed Action. Over time, short-duration precipitation events and snowmelt could erode Tumbleweed II Project Area soils, thereby increasing the sedimentation of adjacent waterways. Sedimentation into adjacent streams could potentially degrade aquatic habitat by covering drainage substrates with fine sediment and acting as a carrier for other pollutants (trace metals, pesticides, plant nutrients, etc.). Because of the soil structure and limited precipitation in the Uinta Basin, the natural sediment load during rain events and during snowmelt is extremely high. Based on data collected at USGS gauging stations (the median of the calculated sediment loadings in tons/year), existing sediment loading in Willow Creek averages about 91,615 tons/year and the annual sediment loading in the Green River at Ouray, Utah is about 6,789,000 tons. The highest sediment loading occurs during the months of May and June from snowmelt runoff. If it is conservatively assumed that all sediment from the construction of the project facilities would eventually be transported to Willow Creek, the increased sediment loading to Willow Creek would be only about 0.23 percent. If all additional sediment were delivered to the Green River, the increase in sediment loading would be about 0.003 percent. Total dissolved solids could be expected to rise by similar amounts. However, because of natural factors that attenuate sediment delivery to creeks, and the application of BMPs, the actual amount of additional sedimentation that would be delivered to Willow Creek and on the Green River would be much less. Therefore, the amount of increased sediment loading in Willow Creek and the Green River would be negligible.

The Proposed Action would not result in direct surface disturbance to any Tumbleweed II Project Area drainages, other than the slightly increased sedimentation described above. There is a slight chance that development and production activities could lead to contamination of nearby surface water resources. Sources of potential surface water contamination include leaks from wellheads, pipelines, and oil storage tanks; leaks from tanker trucks; leaks of produced water, fracing fluids, and liquid hydrocarbons from reserve pits; leaching of contaminants from impacted soils near these facilities; and fuel spills. To reduce the potential for hydrocarbon contamination of Tumbleweed II Project Area drainages, several environmental protection measures would be implemented as described in Section 2.1.14. All pipelines would be designed to minimize the potential for spills and leaks and would be permitted through the APD or ROW grant process as appropriate. All storage tanks and production facilities that contain oil, glycol, produced water, or other potentially hazardous fluids would be surrounded by secondary means of containment for the entire contents of the largest single tank in use plus freeboard for precipitation or other appropriate containment and/or diversionary structures or equipment so that any discharge from a primary containment system, such as a tank or pipe, would not drain, infiltrate, or otherwise escape to groundwater or surface waters before cleanup is completed. In addition, a SPCC Plan, which outlines the

methodology to be used in the event of a spill, would be prepared and would be maintained onsite at all times. The SPCC Plan would describe how to contain a spill and how to facilitate rapid clean up of any spill prior to its contamination of either surface or subsurface waters. In the unlikely event that a release or spill occurs, steps would be immediately initiated to stop and contain the spill/leak and to remediate the impacted materials, thus reducing the likelihood of impacts to nearby drainages, and subsequently the Green River.

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 Willow Creek, potentially increasing erosion of the channel banks. The increased runoff could also lead to more efficient sediment delivery and increase turbidity in Willow 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.

Hydro-fracturing would be conducted as part of the Proposed Action. Hydro-fracturing 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. Hydro-fracturing would occur at depths that are 12,000 feet or more below the surface. Therefore, because of the great depth at which hydro-fracturing would be conducted, the potential for impacts to surface water resources from the proposed hydro-fracturing is considered to be negligible.

Consumptive water use reduces flows throughout the Upper Colorado River Basin, leading to cumulative habitat losses for aquatic species. Water used for drilling purposes would be obtained from a private surface owner located in Main Canyon. The surface owner has been granted water use through State of Utah Application #49-123. This water is considered part of the Upper Colorado River Basin. Drilling and completion may require up to 100 days per well, therefore, up to 27.8 acre-feet of water could potentially be used for dust suppression. Total water use for drilling, completion, and dust suppression over the life of the project would be approximately 45.8 acre-feet. Given the average annual streamflow of 4,064,290 acre-feet, as recorded by the USGS Green River Gauging Station near Ouray, Utah, this project-related depletion of water is hydrologically negligible.

4.2.1.3 Vegetation Resources

Vegetation Communities, Including Noxious and Invasive Weeds

Under the Proposed Action, a total of approximately 47.7 acres of vegetation, including approximately 21 acres of recent habitat restoration work completed by the BLM and UPCD, would be removed during construction, drilling, and completion activities. As discussed in **Section 4.2.1.1**, the removal of vegetation and disturbance to underlying soils could increase soil erosion, soil compaction, and sediment yield to nearby ephemeral drainages, Willow Creek, and livestock ponds. These impacts would result in the loss of topsoil productivity, which would decrease overall vegetative productivity and ultimately reduce available forage for livestock, wild horses, and wildlife.

According to NRCS data and recent field observations (BLM 2009b), reclamation potential in the Tumbleweed II Project Area is considered fair. Based on this information, in the Tumbleweed II Project Area where reclamation is implemented, it would be expected that ground cover by herbaceous and shrub species (e.g., rabbitbrush) could re-establish within 5 to 7 years following seeding of native plant species and diligent weed control efforts, consequently reducing soil erosion. Other vegetation types (e.g., sagebrush and pinyon-juniper woodlands) would take longer to recover. For example, it could take

approximately 20 to 50 years or more for larger shrubs and woodland species to be successfully reclaimed to pre-disturbance conditions.

The spread of non-native plants and noxious weeds is a concern in areas that are disturbed, such as along roadsides and wildlife use areas. During production, traffic associated with operational activities would continue to contribute to weed infestations and establishment. Establishment of weed species could delay or deter revegetation efforts. In addition, the season-long grazing use of the current population of wild horses would also slow the establishment of desirable plant species. Wild horses could potentially be drawn to the seeded areas and graze the newly germinated grasses and forbs. Removal of desirable vegetation could allow noxious and invasive species to establish in these disturbed areas. It is important to note that the above-mentioned impacts would be reduced under the Proposed Action by reclamation practices, weed control measures, and implementation of ACEPMs for vegetation and soil resources.

Commercial Forests and Woodlands

Under the Proposed Action, approximately 3.2 acres of commercial forests and woodland areas in the Tumbleweed II Project Area could be directly affected; in areas where mixed conifer trees are removed to construct well pads, roads, pipelines, and associated project infrastructure. Prior to surface-disturbing activities in these areas, Stewart would obtain a permit from the BLM for removal of the timber and would compensate the BLM for its economic value.

Vegetation Resources Mitigation

To mitigate the loss of recently completed habitat restoration work within the Tumbleweed II Project Area, the BLM will consider compensatory mitigation on an "as appropriate basis" in proportion with annual project-related disturbance. As feasible, the location of the habitat restoration work would be identified within the Tumbleweed II Project Area, and similar restoration efforts would be implemented as had previously been completed. Work would likely consist of removing encroaching pinyon and juniper trees from the sagebrush habitat in order to enhance sagebrush habitats. Vegetation mitigation would be completed at the expense of the operator. The details of this mitigation plan would be determined by the BLM and UDWR.

While the conversion of pinyon-juniper habitats into sagebrush habitats would have a 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. However, in the Vernal Field Office the extent of pinyon-juniper habitat is far greater than that of sagebrush habitat. 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.

4.2.1.4 Rangeland Management and Wild Horses

Rangeland Management

Under the Proposed Action, livestock grazing opportunities would be directly affected by a small-scale loss of vegetation, and thus browse and forage, within the Tumbleweed II Project Area. In Horse Point Pasture #4 of the Winter Ridge Allotment, the Proposed Action would result in the initial disturbance of approximately three AUMs[7]. This loss would equate to an approximate 0.8 percent reduction of overall capacity of the 370 AUMs in the Tumbleweed II Project Area. However, it is important to note that this

[7] 47.7 acres / 14 ac/AUMs = 3.4 AUMs

loss would not affect current grazing management practices or result in a reduction of the current grazing permit. Under the Proposed Action, no new fences (aside from those surrounding reserve pits) or other features that would affect livestock movement would be built. However, livestock could be temporarily displaced from grazing areas as a result of drilling and completion construction activities, and for the life of the project in areas where well pads are located. Displaced livestock could forage in adjacent, undisturbed areas, thereby causing increased grazing impacts in those areas.

Since reserve pits would be properly fenced in accordance with Onshore Order #1 to exclude livestock or wild horses, no livestock losses are anticipated due to exposure of livestock to reserve pits.

Four existing ponds used by livestock, wild horses, and wildlife are located within the Tumbleweed II Project Area. The integrity of those water sources could potentially be impacted by construction activities under the Proposed Action. Degradation of these water sources, potentially resulting from increased erosion, sedimentation, and changes to surface water runoff, could result in the displacement of livestock into Willow Creek and Meadow Creek.

Wild Horses

Surface disturbances associated with the Proposed Action would result in the loss and fragmentation of approximately 47.7 acres of wild horse grazing habitat in the Winter Ridge Herd Area. The Proposed Action could also temporarily displace wild horses due to increased traffic activity, human presence, and noise during construction, drilling, and completion. Displaced wild horses could forage in adjacent, undisturbed areas, thereby causing increased grazing impacts in those areas. As previously stated, management guidelines in the Vernal Field Office Approved RMP have prescribed for wild horses to be removed from the Winter Ridge Herd Area (BLM 2008a). As such, any potential impacts to the existing herd as a result of the Proposed Action would only occur until these animals are removed. Implementation of the Proposed Action, which includes the construction of surface pipelines, pits, well pads, and roads, has potential to inhibit the gathering and removal process. A high level or risk is associated with gathers due to the use of low-flying helicopters and ground support. The movement of horses while they are running could be affected depending on how the horses in front react to linear pathways (e.g., roads, pipelines, etc.), as well as other surface objects (e.g., rock outcrops, trees, and human made infrastructure). The manner in which horses react is fairly unpredictable and therefore, project-related surface occupancy and surface disturbance could affect the gathering process.

Since reserve pits would be properly fenced in accordance with Onshore Order #1 to exclude livestock or wild horses; no wild horse losses are anticipated due to exposure of horses to reserve pits.

Four existing ponds used by livestock, wild horses, and wildlife are located within the Tumbleweed II Project Area. The integrity of these water sources could potentially be impacted by construction activities under the Proposed Action. Degradation of these water sources, resulting from increased erosion, sedimentation, and changes to surface water runoff, could result in the displacement of wild horses into Willow Creek and Meadow Creek.

Rangeland Management and Wild Horses Mitigation

In order to offset potential impacts to water sources, the guzzler within Section 4, T15S, R21E could be improved for livestock, wild horse, and wildlife use. As an alternative to improving the existing guzzler, the BLM would consider requiring the construction of a new guzzler at ~ UTM 625751, 4376800. The decision as to which of these mitigation measures would be implemented will be determined following project approval but prior to additional surface disturbance.

At the direction of the BLM, the operator would improve the four existing ponds within the Tumbleweed II Project Area in order to minimize displacement of animals and to offset potential impacts to water sources.

4.2.1.5 Fish and Wildlife Resources

To determine the impacts of the Proposed Action on fish and wildlife resources in the Tumbleweed II Project Area, specific project components were examined relative to the temporal and spatial patterns of both resident and migratory wildlife species and current wildlife population trends in the Tumbleweed II Project Area. The primary impacts to wildlife resources would be the loss, disturbance, and/or fragmentation of habitat, and temporary displacement from habitat due to increased traffic activity, visual disturbances on the landscape, and human presence during construction, drilling, and completion activities, as well as operational activities. The severity of these impacts would depend on factors such as the sensitivity of the species, seasonal use patterns, type and timing of project activities, and physical parameters of affected areas (e.g., topography, vegetative cover, weather, etc.). Other impacts could include increased potential for wildlife poaching as a result of increased access to, and human activity in, the Tumbleweed II Project Area, and indirect impacts to wildlife habitat quality and quantity as a result of the potential for increased levels of weed infestation and soil erosion. These impacts could temporarily decrease wildlife reproductive success and nutritional condition by increasing energy expenditure. Increased energy expenditure could result as a physical response to noise and visual disturbances.

General Wildlife Species

The disturbance of 47.7 acres of wildlife habitat associated with the construction of wells, roads, pipelines, and related facilities would reduce habitat availability for a variety of wildlife species. Project implementation would also indirectly increase the level of functional habitat loss and habitat fragmentation in the Tumbleweed II Project Area; however, this reduction in habitat is not expected to negatively impact common wildlife species because of the following:

Many common wildlife species are habitat generalists, meaning they are not tightly restricted to specific habitat types; and

Many of the species-specific Applicant-Required Measures (**Section 2.1.14**) and ACEPMs (**Section 2.1.15**) would afford protection to the general wildlife species discussed in this document.

In addition, implementation of the Proposed Action would result in increased traffic during construction, drilling, and completion activities, thereby increasing the potential for collisions between wildlife and motor vehicles. As such, potential direct impacts to small mammals or reptiles would also include accidental mortality from collisions with motor vehicles on Tumbleweed II Project Area roads and by equipment at the construction sites. However, as vehicle speeds on Tumbleweed II Project Area roads would be low due to the physical terrain, the potential for wildlife-vehicle collisions would be low.

Big Game

Elk and Mule Deer

Surface disturbances associated with the Proposed Action would result in the disturbance of approximately 47.7 acres of UDWR-designated crucial value winter elk range and substantial value winter mule deer range. Habitat loss and fragmentation resulting from these disturbances could result in reduced habitat use by both elk and mule deer within and near disturbed areas, increased animal densities in adjoining habitats, and increased stress from intra- and inter-specific competition.

Disturbance from human activity could also reduce relative habitat values for elk and mule deer (Nicholson et al. 1997), especially during periods of heavy snow cover and cold temperatures. Both species typically experience severe physiological stress during the winter, particularly gestating females, because they require higher energy levels for survival and successful reproduction (Karpowitz 1984). The increased presence of vehicles, equipment, and people within the Tumbleweed II Project Area, combined with the potential for insufficient winter forage, could result in increased energy expenditures by elk and mule deer during severe winter periods (Garrott and White 1982; Karpowitz 1984). In addition, disturbances from drilling activities and increased traffic could temporarily displace elk and mule deer from habitats (including winter range) in areas of human activity (Edge and Marcum 1991). When displaced, individual elk and mule deer would move to other adjacent habitats where competition for resources may increase.

The Tumbleweed project is exploratory in nature, and human disturbances (i.e., increased traffic, noise, and human presence) caused by construction, drilling, and completion activities may be short-term in nature.

For wells that are productive, ongoing operational activities associated with the Proposed Action (e.g., pumper visits, workovers, etc.) could result in visual and noise related impacts on wildlife populations within the Tumbleweed II Project Area that could last for the 20 to 30 year life of the project.

Overall, individual elk and mule deer may be negatively affected by the direct and indirect impacts of the proposed project; however, the majority of these impacts may be temporary (i.e., lasting only during construction, drilling and completion activities). Furthermore, application of winter surface disturbance and drilling restrictions (December 1 – April 30) would reduce impacts to elk and mule deer winter habitat values. Given the temporary nature of most impacts and possible implementation of seasonal closures, the Proposed Action is not likely to negatively impact elk or mule deer at population levels.

Pronghorn Antelope

Surface disturbances associated with the Proposed Action would result in the loss and fragmentation of UDWR crucial summer pronghorn habitat. Approximately 21.4 acres of surface-disturbing activities associated with the Proposed Action would occur within UDWR substantial value summer pronghorn habitat, and long-term impacts would be reduced as a result of reclamation. Habitat loss and fragmentation, as well as visual and noise disturbances, could result in reduced habitat use by pronghorn within and near disturbed areas, increased animal densities in adjoining habitats, and increased stress from intra- and inter-specific competition.

Ongoing operational activities associated with the Proposed Action (e.g., pumper visits, workovers, etc.) could result in small-scale visual and noise related impacts on wildlife populations within the Tumbleweed II Project Area that could last for the 20 to 30 year life of the project.

It is important to note that the Tumbleweed project is exploratory in nature, and human disturbances (i.e., increased traffic, noise, human presence) caused by construction, drilling, and completion activities may be short-term in nature. While individual pronghorn might be negatively affected by the direct and indirect impacts of the project, and given the periodical occurrence of the species within the Tumbleweed II Project Area, the Proposed Action is not likely to negatively impact the species at a population level.

Rocky Mountain Bighorn Sheep

Surface disturbances associated with the Proposed Action would result in the direct loss and fragmentation of approximately 15.4 acres of UDWR crucial value year-long Rocky Mountain bighorn sheep habitat, in particular with surface disturbance activities associated with wells TUF #5-8 and TUF #4-3. Habitat loss and fragmentation, as well as visual and noise disturbances, could result in reduced habitat use by Rocky Mountain bighorn sheep within and near disturbed areas, increased animal densities in adjoining habitats, and increased stress from intra- and inter-specific competition.

Ongoing operational activities associated with the Proposed Action (e.g., pumper visits, workovers, etc.) could result in small-scale visual and noise related impacts on wildlife populations within the Tumbleweed II Project Area that could last for the 20 to 30 year life of the project.

It is important to note that the Tumbleweed project is exploratory in nature, and human disturbances (i.e., increased traffic, noise, human presence) caused by construction, drilling, and completion activities may be short-term in nature. While individual Rocky Mountain bighorn sheep might be negatively affected by the direct and indirect impacts of the project, given the periodical occurrence of the species within the Tumbleweed II Project Area, the Proposed Action is not likely to negatively impact the species at a population level.

Bison

The primary effect from the Proposed Action on bison would be the loss of foraging habitat. Surface disturbances associated with the Proposed Action would result in the direct loss of approximately 47.7 acres of UDWR crucial value year-long bison habitat. Habitat loss resulting from these disturbances could result in reduced foraging habitat used by bison within the Tumbleweed II Project Area, and increased bison densities in adjoining habitats.

Ongoing operational activities associated with the Proposed Action (e.g., pumper visits, workovers, etc.) could result in small-scale visual and noise related impacts on wildlife populations within the Tumbleweed II Project Area that could last for the 20 to 30 year life of the project.

Raptors

Temporary displacement of raptors from foraging habitats could occur due to the presence of humans and noise; however, after completion of construction, drilling, and completion operations, these impacts would be minimal. The Proposed Action would also result in a loss of approximately 47.7 acres of habitat for prey species. Given the abundance of foraging habitat in the surrounding area, habitat losses are not expected to reduce raptor prey bases to levels where take would occur. Based on the operator's commitment to conduct raptor nest inventories and to avoid construction or drilling activities within species-specific buffers of active raptor nests during the nesting season (see **Section 2.1.15.8**), the project is not likely to affect raptor nesting activity.

Ongoing operational activities associated with the Proposed Action (e.g., pumper visits, workovers, etc.) could result in small-scale visual and noise related impacts on raptors within the Tumbleweed II Project Area that could last for the 20 to 30 year life of the project.

It should be noted that the bald eagle, golden eagle, ferruginous hawk, and MSO are special status species and, therefore, impact analyses for these species are discussed under Special Status Species.

Migratory Birds

The Proposed Action would result in a direct loss of 47.7 acres of habitat for migratory birds. Impacts to migratory birds in the Tumbleweed II Project Area would be dependent upon the seasons of construction, drilling, and completion activities. If these activities are completed in the late fall, many of the migratory species would have left the Tumbleweed II Project Area for southern wintering grounds. Surface disturbance and visual and noise impacts during this time would be temporary, and project-related impacts would not likely have a measurable impact on migratory bird populations as a whole or individual species in general. If construction, drilling, and completion were to occur during the spring or summer months, the Proposed Action could result in potential disturbance of breeding or nesting activities or habitats.

This potential effect would have a greater impact on PIF Priority Species or BCC migratory bird species (**Section 3.2.5.3**) that may be nesting in the Tumbleweed II Project Area due to their smaller population sizes and limited distribution. Ground, shrub, and pinyon-juniper nesting species may be affected by habitat loss due to the removal of vegetation along pads and ROWs. As with other wildlife species discussed in this EA, displacement may cause individual birds to move into less suitable habitats or into habitats where inter- and intra-specific competition may occur. However, given the exploratory nature of this project and the short duration of construction, drilling, and completion impacts, implementation of the Proposed Action is not likely to result in a loss of viability in the Tumbleweed II Project Area, nor cause a trend toward Federal listing of these species.

Ongoing operational activities associated with the Proposed Action (e.g., pumper visits, workovers, etc.) could result in small-scale visual and noise related impacts on wildlife populations within the Tumbleweed II Project Area that could last for the 20 to 30 year life of the project.

Wildlife Mitigation

No surface disturbing activities that would result in adverse impacts to deer and elk within crucial value winter range would be allowed from December 1-April 30.

4.2.1.6 Special Status Species

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 implementing 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 designated critical habitat. If a Federal action "may affect, is likely to adversely affect" a Federally-listed species or its critical habitat, the responsible Federal agency must enter into formal consultation with the USFWS. Candidate and BLM Sensitive species are also managed to prevent future Federal listing as threatened or endangered. The sections below describe the special status species that may be affected by the Proposed Action.

Colorado River Endangered Fish Species

Although Willow Creek and Upper Bottom Creek do not provide habitat elements to support the endangered Colorado River fish, fish inhabiting areas downstream of the Tumbleweed II Project Area in the Green River could be affected by implementation of the Proposed Action as a result of water depletion for drilling, completion, and dust suppression operations.

Water depletion for the Proposed Action is based on the use of water permit 49-123 in the SW¼ of Section 32, T15S:R23E. The water source for this State-approved water right consists of an unnamed spring in Main Canyon, a tributary to Willow Creek, and subsequently to the Green River. This water right is considered a historic depletion.

Water depletions from the Upper Colorado River Drainage System, along with a number of other factors, have resulted in such drastic reductions in the populations of the Colorado pikeminnow, humpback chub, bonytail, and razorback sucker that the USFWS has listed these species as endangered and has implemented programs to prevent them from becoming extinct.

Water depletions reduce the ability of the river to create and maintain the primary constituent elements that define critical habitats. Food supply, predation, and competition are important elements of the biological environment. Food supply is a function of nutrient supply and productivity, which could be limited by the reduction of high spring flows brought about by water depletions. Predation and competition from nonnative fish species have been identified as factors in the decline of the endangered fishes. Water depletions contribute to alterations in flow regimes that favor nonnative fishes.

To address depletion issues, on January 21-22, 1988, the Secretary of the Interior; the Governors of Wyoming, Colorado, and Utah; and the Administrator of the Western Area Power Administration were cosigners of a Cooperative Agreement to implement the "Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin" (USFWS 1987). In order to further define and clarify the process in the Recovery Program, a Section 7 agreement was implemented on October 15, 1993, by the Recovery Plan participants. Incorporated into this agreement is a Recovery Implementation Program Recovery Action Plan (RIPRAP) which identifies actions currently believed to be required to recover the endangered fishes in the most expeditious manner. Activities and accomplishments under the Recovery Program provide the reasonable and prudent alternatives which avoid the likelihood of jeopardy to the continued existence of the endangered Colorado River fishes and avoid the likely destruction or adverse modification of critical habitat in Section 7 consultations on all impacts (except the discharge of pollutants such as trace elements, heavy metals, and pesticides) associated with historic water projects in the Upper Basin. Depletion charges or other measures are not required from historic projects.

The Proposed Action would result in water depletion from removal of water from the Upper Colorado River Drainage System for drilling, completion, and dust suppression operations. Therefore, the Proposed Action "***may affect, is likely to adversely affect***" the endangered Colorado pikeminnow, humpback chub, bonytail, and razorback sucker. However, because the aforementioned water depletion to the Upper Colorado River Basin is considered historic, a depletion fee payment would not be required. In addition, this project would tier to the Biological Opinion previously issued on September 17, 2007, for the original *Tumbleweed Exploratory Drilling Project EA (EA #UT-080-05-201)*. As such, re-initiation of formal Section 7 consultation with the USFWS would not be required to evaluate and offset impacts from water depletion to the Colorado River fish and their critical habitats in the Green River under the Tumbleweed II project.

Bald Eagle

Potential impacts to wintering bald eagles are likely to be negligible for the following reasons: 1) there are extensive areas of similar wintering habitat found adjacent to the Tumbleweed II Project Area and 2) surface-disturbing activities could be limited during the winter season under 43 CFR 3101.1-2, which states that at a minimum, measures shall be deemed consistent with lease rights granted provided that they do not require relocation of proposed operations by more than 200 meters; require that operations be sited off the leasehold; or prohibit new surface-disturbing operation for a period in excess of 60 days in any lease year."

Golden Eagle

Surface disturbances associated with the Proposed Action would result in the direct loss of approximately 47.7 acres of year-round habitat for prey species such as mammals, songbirds, and reptiles. Grant et al. (1991) suggests that incremental destruction of habitat for a raptors' prey base (e.g. ground squirrels, rabbits, mice) has had the largest effect on raptor populations in the Uinta Basin. Proposed surface disturbance and resulting prey habitat loss would be compounded by prey base losses that are already occurring in the Uinta Basin due to the ongoing drought. The loss of some prey species may limit foraging opportunities for individual golden eagles; however, prey reduction is not likely to reach the scale where take occurs.

Based on the operator's commitment to conduct raptor nest inventories and to avoid construction or drilling activities within species-specific buffers of active raptor nests during the nesting season (see **Section 2.1.15.8**), the project is not likely to affect golden eagle nesting activity.

Ongoing operational activities associated with the Proposed Action (e.g., pumper visits, workovers, etc.) could result in small-scale visual and noise related impacts on golden eagles within the Tumbleweed II Project Area that could last for the 20 to 30 year life of the project.

Overall, the Proposed Action may affect individual golden eagles, but would not likely result in a trend towards Federal listing of the species.

Greater Sage-grouse

Although anecdotal evidence has established that oil and gas development can cause sage-grouse populations to decline, the reasons for declines are still unknown (Connelly et al. 2000, Braun et al. 2002). Some potential impacts of oil and gas development to sage-grouse include: (1) direct loss and fragmentation of habitat from well, road, and pipeline construction, (2) increased human activity causing avoidance and displacement, and (3) increased predation from installation of infrastructure (i.e., storage tanks, power lines, etc.). Braun et al. (2002) maintains that oil and gas development may have negative short-term (site construction and drilling), and long-term (road developments) effects.

Surface disturbance associated with the Proposed Action would result in the following direct loss and fragmentation of 47.7 acres of sage-grouse crucial brooding habitats in the Tumbleweed II Project Area. Sagebrush habitats in the Project Area are primarily contiguous; however, existing roads have previously fragmented these habitats. Additional development across the Project Area would continue to fragment existing habitats and may deter sage-grouse from utilizing certain portions of the Project Area.

Numerous studies have determined that sage-grouse are affected by human activity (Lyon and Anderson 2003; Remington and Braun 1991; Braun 1986). 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 3.2 kilometers. Despite these trends, Remington and Braun (1991) reported that sage-grouse were displaced by surface disturbing activities but returned to fluctuating pre-disturbance levels once activity ceased. Lyon and Anderson (2003) also stated that although disturbed areas had lower initiation rates than undisturbed areas, nest success between the two areas was the same. Despite these findings, there is no evidence that populations attain their pre-disturbance levels, and population reestablishment could require 20 to 30 years (Braun et al. 2002).

Historic sage-grouse leks have been identified in the Project Area and nesting and brooding habitat does exist throughout the majority of the area. The primary effect of the Proposed Action on sage-grouse would be displacement or abandonment of these areas due to increased disturbance from human activity, increased traffic, and noise associated with construction and drilling activities. 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 of a road, regardless of traffic volumes. Noise from construction activities would also affect sage-grouse during the period those activities are taking place at a given location. Sage-grouse may be temporarily displaced by this noise and other human activities until construction activities were completed. Project related activities under the Proposed Action would likely have the greatest potential impact on lek activity in the Project Area. As outlined in the Approved RMP (BLM 2008a), and committed to by Stewart Petroleum (**Section 2.1.15.8**), no surface disturbing activities would occur within 2 miles of the active lek from March 1 to June 15. Furthermore, if a lek is active, Stewart would limit all traffic (with the exception of traffic associated with emergency repairs or maintenance) within 2 miles of the active lek between 5:00am and 9:00am from March 1 to June 15. Based on adherence to these stipulations, potential impacts to the active lek in the Project Area would be minimized. However, sage-grouse utilizing this lek could experience increased general distress due to project-related noise impacts (e.g., increased traffic near the lek) that would occur in the Project Area throughout the life of the project.

Predation is the most commonly identified cause of direct mortality for the sage-grouse (Schroeder et al. 1999, Connelly et al. 2000). Sage-grouse have many predators, which can vary in relative importance depending on the sex and age of the bird and the time of year. Sage-grouse predator populations influenced by oil and gas activities primarily include raptors (i.e., eagles, hawks, owls, falcons). Increased infrastructure associated with oil and gas development (i.e., power lines, storage tanks, fences) provide additional roosting structures that raptors can utilize for predation. No power lines or fences would be developed under the Proposed Action, however central storage tank facilities would be present. As such, installation of these facilities could potentially increase raptor predation on sage-grouse in the Project Area. However, as discussed in **Section 2.1.15.8**, for active sage-grouse leks that are not visually screened from these well pads by natural topography or vegetation, low-profile tanks would be used to prevent increased predation on sage-grouse by raptors and visually obscure development activities from the line-of-sight of strutting grounds.

Based on the above information, implementation of the Proposed Action may impact individual sage-grouse and could cause overall habitat use in the Project Area to be altered. However, with implementation of timing and spatial restrictions these impacts would be minimized. Additional ACEPMs for greater sage-grouse, that would further reduce impacts related to raptor predation, are listed in **Section 2.1.15.8**.

Mexican Spotted Owl

As of the publication date of this EA, 2 years of MSO surveys have been completed according to USFWS protocol for Stewart's proposed well pad locations (TUF #4-3, #5-8, #9-3, #9-11, #17-4, #17-12, and #18-9) and associated road and pipeline corridors. No MSO were seen or heard during any of the inventories conducted for this project (B&A 2009). Therefore, as of August 2009, Stewart's proposed development locations in the Tumbleweed II Project Area are cleared until the 2013 breeding season.

If construction, drilling, and completion activities were to begin after this clearance has ended (i.e., more than four years have elapsed between the end of the two seasons of surveys and the initiation of surface-disturbing activities at any proposed location), another 2-year inventory would be required prior to initiating any surface-disturbing activities. As discussed in **Section 2.1.15.8**, Stewart has committed to

several ACEPMs to protect MSO and their habitat. Specifically, no surface-disturbing activities would be allowed within "good" and "fair" habitat designations or within the ½-mile buffer of those designations until two years of survey have been completed in accordance with USFWS protocol. If MSO are documented during future surveys, the BLM would consequently follow USFWS protocol for PAC establishment and raptor management protocol defined in "*Best Management Practices for Raptors and Their Associated Habitats in Utah, August 2006*" (BLM 2008a). If no owls have been detected at the completion of the two seasons of calling surveys, no additional mitigation measures or BMPs (including timing and spatial restrictions) would be implemented.

Based on these continuing survey and PAC commitments, and that no MSO were documented during the 2008 and 2009 surveys, the Proposed Action would likely have no effect on breeding, nesting or foraging MSO. Furthermore, as the Proposed Action would not include any development within the Willow Creek and Upper Bottom Canyon corridors, potential impacts to designated MSO habitat would be minimal. Specifically, under the Proposed Action, 0.1 acre of good habitat and 0.2 acre of fair habitat would be disturbed as a result of construction activities. Based on the above assessment, BLM has determined that the Proposed Action ***"may affect, is not likely to adversely affect"*** the MSO.

Special Status Species Mitigation

No new surface-disturbing activities would be allowed within ½ mile of active sage-grouse leks year-round, unless with explicit cause and after consultation with the State, the BLM grants a variance to this buffer (PLPCO 2008).

4.2.1.7 Recreation

Implementation of the Proposed Action would reduce opportunities for primitive and unconfined recreation in the Tumbleweed II Project Area. Individuals that are attracted to backcountry recreation and solitude would encounter new roads, oil and gas facilities, and human activity (e.g., dust, traffic, and noise) in an area where limited surface disturbance has occurred to date. Impacts would be greatest during the construction, drilling, and completion phases, but would continue throughout the production phase. Although impacts would also extend beyond the immediate area of surface disturbance into those areas that are within sight and sound of development, proposed facilities would be located on a ridge out of sight of Willow Creek and Upper Bottom Canyon, which are the areas where most recreational use takes place. Construction and drilling visual impacts would also be isolated geographically since only one drill rig would be operating in the Tumbleweed II Project Area at any given time. Visual impacts to primitive and unconfined recreation during production would be partially mitigated by painting all production facilities to blend with the natural landscape, and through the use of low profile tanks.

Noise from construction and drilling equipment would also reduce the quality of the opportunity for recreational users seeking solitude in the immediate vicinity of the development. Noise effects would largely 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) the wells. During production, a limited loss of solitude would occur from noise and associated visual effects of the development. A drilling rig would be visible and would be heard throughout the Project Area for approximately 21 days per well. Tanks, wellheads, and metering equipment would be visible evidence of natural gas development activities. Slight impacts to solitude may also occur with the limited increase that can be expected in recreational and/or administrative use of the new access roads.

The Tumbleweed II Project Area offers opportunities for high-quality hunting. Since hunting opportunities are contingent upon the presence of wildlife, adverse impacts to wildlife would also affect

hunting opportunities. Disturbance and human activity could temporarily displace wildlife during the construction phase, thus temporarily reducing opportunities for hunting in the Tumbleweed II Project Area. However, impacts would likely be short-term and small-scale given that the project would be limited to the development of nine exploratory wells from seven well pads.

The 6.1 miles of new and improved road would increase access in the Tumbleweed II Project Area and possibly attract hunters that prefer hunting with motorized vehicles. On the contrary, the change in landscape could deter a segment of the hunting population that prefers hunting by foot or horseback. Increased access could also lead to illegal poaching.

If selected, the Proposed Action would authorize construction of new roads in areas that were previously inaccessible by motorized vehicle. No gating or seasonal closures are proposed. As discussed in the **Section 3.2.10**, OHV use within the Tumbleweed II Project Area is "limited" to designated roads and trails (BLM 2008a). New and improved roads would increase opportunities for OHV use within the limited use area. All new or upgraded roads would terminate at proposed well pads. In addition, no roads would be constructed in canyons and no new loop routes would be created. Therefore, it is expected that increased OHV use in the Tumbleweed II Project Area would be minimal.

4.2.1.8 Cultural Resources

Cultural resources are sensitive and nonrenewable resources that can be irreversibly damaged or destroyed by surface-disturbing activities, such as site and road construction, and secondary surface activities, such as vehicular and pedestrian traffic. Oil and gas development in the Tumbleweed II Project Area is a Federal undertaking in accordance with 36 CFR 800. Any such undertaking must consider potential effects to significant historic properties and must conform to Federal regulations in determining effects that a project may have on significant cultural resources and in mitigating those effects determined to be adverse. As defined in 36 CFR 800, adverse effects to significant historic properties include physical alteration, damage, or destruction, alteration of the character of the setting of a property that contributes to its significance, or neglect that results in deterioration or destruction.

All cultural resources in the Tumbleweed II Project Area are protected by Federal and State legislation. Under the Proposed Action, and in accordance with these mandates, required measures outlined in **Section 2.1.14.2** would minimize the potential for project-related surface disturbance to directly affect known and unidentified cultural resources within the Tumbleweed II Project Area. Prior to beginning any project-related surface disturbance, all locations proposed for surface disturbance would be examined by an archaeologist approved by the appropriate SMA to determine the presence of cultural resources (i.e., Class III cultural resource inventories with 100 percent pedestrian field survey would be completed). Additional consultation would be completed with the Utah SHPO prior to the onset of development, as set out in existing regulations. If any cultural resources eligible for listing to the NRHP are identified, recommendations would be made to avoid or recover such resources. Furthermore, if cultural resources are uncovered during surface-disturbing activities, Stewart would suspend operations at the site and immediately contact the appropriate AO, who would arrange for a determination of eligibility in consultation with the Utah SHPO and if necessary, would recommend a recovery or avoidance plan. To date, Class I and Class III inventories have been completed for the TUF #18-9, #17-4, and #17-12 proposed well pads and associated access roads and pipeline corridors. Consultations for these locations have been completed with the Utah SHPO and Native American Tribes, and site-specific adjustments to these locations have been made, as necessary, to avoid eligible sites. Section 106 consultation and Native American consultation would be re-initiated on a site-specific level as appropriate, if previously unknown sites are found during surface-disturbing activities. Based on these requirements, the Proposed Action would likely have no direct impacts on known cultural resources or historic properties within the

Tumbleweed II Project Area. In addition, direct impacts to unidentified cultural resources or historic properties would be expected to be negligible.

Implementation of the Proposed Action could, however, result in indirect impacts to cultural resources throughout the Tumbleweed II Project Area. Cultural resources in the Tumbleweed II Project Area could be vulnerable to indirect impacts that frequently result from secondary surface activities (e.g., increased vehicular and pedestrian traffic). Secondary surface activities would result from increased human activity near construction sites, which would increase the potential for vandalism, surface artifact collection, illegal excavation of artifacts, and fugitive dust and erosion from OHV or other motorized vehicle use. These activities could lead to the damage, destruction, or removal of scientific information, the loss of research potential, the loss of interpretation possibilities, and the destruction of the character or setting of a site. These impacts could be short-term or could continue into the future. For example, impacts related to increased erosion would likely last until reclamation is successful. In the interim, these impacts would be minimized by reclamation activities, dust suppression, and ACEPMs to control erosion. The potential for other indirect impacts to affect cultural resources would be minimized by ACEPMs to educate employees, contracts, and subcontractors about relevant Federal regulations intended to protect archaeological and cultural resources. All personnel would be informed that collecting artifacts, including arrowheads, is a violation of Federal law and that employees engaged in this activity would be subject to disciplinary action.

Overall, the extent of project-related impacts on cultural resources would be dependent upon the presence of cultural resources in uninventoried portions of the Tumbleweed II Project Area. For the purposes of analysis in this EA, previously inventoried portions of the Tumbleweed II Project Area have been used to quantify the potential number, types, and distribution of cultural resources that may occur in uninventoried portions of the Tumbleweed II Project Area. As discussed in **Section 3.2.8**, surveys conducted for the 2,460 inventoried acres in the Tumbleweed II Project Area have resulted in the identification of 36 prehistoric and historic cultural resources. If the site density of these resources is assumed to be constant over the entire Tumbleweed II Project Area, a rough estimate of 100-110 cultural resources would be expected to be present in the Tumbleweed II Project Area. This estimate should be considered as a loose approximation because the inventories conducted to date may not be representative of the entire Tumbleweed II Project Area. For example, this estimate is likely high because a significant portion of the uninventoried area consists of steep cliff walls between Willow Creek and Winter Ridge. To date, inventories conducted of the western canyon wall have resulted in the identification of very few sites. Based on similar topography, it is assumed that very few new sites will be encountered in uninventoried areas associated with the eastern canyon wall.

Under the Proposed Action, most of the proposed well pads and associated infrastructure would be constructed on Winter Ridge. From the rim of Willow Creek to the rim of Upper Bottom Canyon, Winter Ridge covers approximately 2,685 acres. Of these lands, nearly 1,870 acres (or 70 percent) have been inventoried for cultural resources and eight archaeological sites have been identified. These cultural resources were all identified on or near the rims of the bounding canyons. To date, no cultural resources have been identified on the flat ridgetop. Given the extent of survey work previously conducted on Winter Ridge and the known distribution of sites in this area, it is assumed that very few new sites will be encountered in uninventoried areas and those that are found will likely be associated with canyon rims.

4.2.1.9 Air Quality

The Proposed Action has different emission sources associated with two project phases: well development and well production. Well development includes emissions from earth-moving equipment, vehicle traffic, drilling, and completion activities. During well production there are continuous emissions from separators, condensate storage tanks, and daily tailpipe and fugitive dust emissions from operations

traffic. Air pollutant emissions from these sources would include: NO_X, CO, PM_{10}, $PM_{2.5}$, and VOCs. Benzene, toluene, and n-hexane would be the primary HAPs emitted.

During the construction, drilling, and completion phase, vehicle and road dust emissions would be emitted within the Project Area. Vehicle emissions would result from work crews commuting to and from the work site and from the transportation and operation of equipment to construct wells pads, access roads, and pipelines. NO_X, SO_2, and CO would be emitted from vehicle tailpipes. Fugitive dust concentrations would increase with additional vehicle traffic on unpaved roads and from wind erosion in areas of soil disturbance. Drill rig and fracturing engine operations would result mainly in NO_X and CO emissions, with lesser amounts of SO_2. These temporary emissions would be short-term during the drilling and completion times. Air quality impacts will be greatly reduced at the conclusion of construction and drilling activities.

Overall, emissions during the long-term production phase are less than emissions during development. During the operational phase of the Proposed Action, NO_x, CO, VOC, and HAP emissions would result from the long-term operation of condensate storage tank vents, and well pad separators. Additionally, road dust (PM_{10} and $PM_{2.5}$) would be produced by vehicles servicing the wells.

Emissions associated with gas compression were not evaluated because the existing Wolf Point Compressor has capacity to handle the additional gas from the Proposed Action. The air quality impacts for the Wolf Point Compressor were analyzed in the Questar Winter Ridge Pipeline EA, UT-080-06-362, ROW number UTU-76115.

Annual estimated emissions from the Proposed Action are summarized in **Tables 4-1**, **4-2**, and **4-3**. All development-related emission calculations, including well pad and road construction, well drilling, and well completion, assume all that nine wells and seven well pads would be developed in one year. Production and development emissions were calculated with the conservative assumption (i.e. assumption may overestimate effects) that all nine wells would be productive, and incorporating the ACEPMs identified in **Section 2.1.15.1** – Air Quality.

Emission rates were calculated using applicable EPA emission factors and anticipated level of operational activities, such as estimated vehicle trips, load factors, and hours of operation. Development-related emissions would produce elevated pollutant levels but would be short-term and localized for the duration of the activities. Detailed emission calculations for each activity are shown in **Appendix D.**

Table 4-1. Annual Emissions for Development of the Proposed Action

Pollutant	Development Emissions (tons/year)[1]					Total (tons/yr)
	Construction	Wind Erosion	Drilling	Completion	Interim Reclamation	
NO_X	2.60	-	20.0	1.46	1.76E-02	24.1
CO	0.91	-	12.4	4.58	0.14	18.1
VOC	0.17	-	1.79	1.37	1.1E-02	3.33
SO_2	0.07	-	0.77	2.6E-02	1.1E-03	0.87
PM_{10}	11.78	0.05	69.7	7.64	2.50	91.7
$PM_{2.5}$	1.53	7.78E-03	8.00	0.87	0.26	10.7
Benzene	-	-	3.58E-03	0.03	-	0.03
Toluene	-	-	1.30E-03	0.03	-	0.03

Pollutant	Development Emissions (tons/year)[1]					Total (tons/yr)
	Construction	Wind Erosion	Drilling	Completion	Interim Reclamation	
Ethylbenzene	-	-	-	2.52E-03	-	2.5E-03
Xylene	-	-	8.91E-04	1.26.E-02	-	1.3E-02
n-Hexane	-	-	-	0.07	-	0.07
Formaldehyde	0.06	-	3.64E-04	8.68E-04	-	0.06

[1] Assumes 9 wells, 7 well pads developed in 1 year.
Note: Please see appendix for emission calculations

Table 4-2. Total Annual Production Emissions from the Proposed Action[1]

Pollutant	Tons/Year			Total (tons/year)
	Well site Storage Tanks + Flare	Well site Heaters	Operations Vehicle	
NO_X	0.4	3.83	0.11	4.3
CO	1.9	3.22	1.17	6.3
VOC	10.1	0.21	0.06	10.4
SO_2	-	0.0	7.48E-03	7.5E-03
PM_{10}	-	0.29	24.1	24.4
$PM_{2.5}$	-	0.29	2.41	2.71
Benzene	0.33	8.1E-05	-	0.3
Toluene	0.08	1.3E-04	-	0.1
Ethylbenzene	0.00	-	-	0.0
Xylene	0.02	-	-	0.0
n-Hexane	0.15	0.07	-	0.2
Formaldehyde	-	2.9E-03	-	2.9E-03

[1] Emissions include 9 producing wells on 7 well pads (including associated operations traffic) Note: Please see appendix for emission calculations

Table 4-3. Tumbleweed Proposed Action Annual Emissions (tons/year) [1]

Pollutant	Development	Production	Total
NO_x	24.1	4.3	28.4
CO	18.1	6.3	24.4
VOC	3.33	10.4	13.7
SO_2	0.87	7.5E-03	0.9
PM_{10}	91.7	24.4	116.1
$PM_{2.5}$	10.7	2.71	13.4
Benzene	0.03	0.3	14.1
Toluene	0.03	0.1	3.5
Ethylbenzene	2.5E-03	0.0	0.2
Xylene	1.3E-02	0.0	0.8
n-Hexane	0.07	0.2	6.4
Formaldehyde	0.06	2.9E-03	0.1

[1] Emissions include 9 producing wells and associated operations traffic during the year in which the project is developed.

Note: Please see appendix for emission calculations

Criteria Pollutant Ambient Air Quality Impacts

Development $PM_{2.5}$ emissions from the three closest wells were evaluated. The emissions scenario consisted of one well pad/road being constructed, one well being drilled, and one well being completed. Each modeled well site had a well pad and one mile of road. As the locations are conceptual and the Project Area is relatively flat, AERMOD was run with the flat terrain option. **Table 4-4** shows the maximum predicted potential impacts of the Proposed Action development phase.

Table 4-4. Criteria Pollutants Maximum Predicted Impacts from the Proposed Action, Development Phase

Pollutant	Period	Project Impact ($\mu g/m^3$)	Percent of PSD Class II Increment (Percent)	Uinta Basin Background Concentration [d] ($\mu g/m^3$)	Maximum Project Impact Plus Background ($\mu g/m^3$)	National and Utah Ambient Air Quality Standard ($\mu g/m^3$)	Percent of NAAQS
$PM_{2.5}$	24-hour Maximum Average	3.6 [a]	NA	15 / 52 [e]	18.6 [f]	35	53 %
	Annual Mean	0.06	NA	11	11.06	15	74 %
PM_{10}	24-hour Maximum Average	8.2 [b]	27	71.5	70.8	150	48 %
NO_2 [c]	Annual Mean	1.97	8	17	18.97	100	19 %
CO	1-hour Maximum	403	NA	1,111	1,514	40,000	4 %
CO	8-hour Maximum Average	190	NA	1,111	1,301	10,000	13 %
SO_2	3-Hour	22	4	20	42	1300	3 %
	24-Hour	5.8	6	10	15.8	365	4 %
	Annual	0.7	4	5	5.7	80	7 %

[a] Concentration estimate represents a 3-year average of the 8th highest 24-hour $PM_{2.5}$ concentrations.
[b] Concentration estimate represents a 5-year average of the 6th highest 24-hour PM_{10} concentrations
[c] Modeled NO_x converted to NO_2 (multiplied by 0.75)
[d] Source: Utah Division of Environmental Quality - Division of Air Quality (UDAQ).
[e] 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, Utah . The smaller figure is representative of average summer concentrations, while the larger value is representative of winter inversion conditions, based on this monitoring.
[f] Because the winter inversion $PM_{2.5}$ value does not represent typical conditions in the project area for the reasons described below, 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 Vernal, 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 measurably contribute to $PM_{2.5}$ concentrations in the region of the Proposed Action.

Operations

The production facilities were analyzed using AERMOD with terrain. **Table 4-5** shows the maximum-predicted air quality impacts with the appropriate NAAQS. As shown, the predicted impacts would be less than the applicable NAAQS during the operations phase of the Proposed Action. The maximum impacts are predicted to occur at the edge of the 18-9 well pad where the NO_x sources include three heater separators.

Table 4-5. Criteria Pollutants Maximum Predicted Impacts from the Proposed Action, Operational Phase

Pollutant	Period	Project Impact ($\mu g/m^3$) well pad	Percent of PSD Class II Increment (%)	Uinta Basin Background Concentration [d] ($\mu g/m^3$) road	Maximum Project Impact Plus Background ($\mu g/m^3$)	National and Utah Ambient Air Quality Standard ($\mu g/m^3$)	Percent of NAAQS
$PM_{2.5}$	24-hour Maximum Average	well pad under construction 4.4 [a]	NA	15 / 52 [e]	19.4 [f]	35	55%
	Annual Mean	1.4	NA	11	12.4	15	83%
PM_{10}	24-hour Maximum Average	4.7 [b]	16%	28	32.7	150	22%
NO_2 [c]	Annual Mean	13.8	55%	17	30.8	100	31%
CO	1-hour Maximum	387.3	NA	1111	1498.3	40,000	4%
CO	8-hour Maximum Average	169.9	NA	1111	1280.9	10,000	13%

[a] Concentration estimate represents a 3-year average of the 8th highest 24-hour $PM_{2.5}$ concentrations
[b] Concentration estimate represents a 5-year average of the 6th highest 24-hour PM_{10} concentrations
[c] Modeled NO_x converted to NO_2 (multiplied by 0.75)
[d] Source: Utah Division of Environmental Quality - Division of Air Quality (UDAQ).
[e] The state of Utah currently does not have an official background value for $PM_{2.5}$. The $PM_{2.5}$ concentrations given in this table represent 98th percentile values from limited $PM_{2.5}$ monitoring conducted in Vernal, Utah and recorded 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.
[f] Because the winter inversion $PM_{2,5}$ value does not represent typical conditions in the project area for the reasons described below, 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 Vernal, 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 measurably contribute to $PM_{2.5}$ concentrations in the region of the Proposed Action.

Based on the model results, and the negligible amount of project-specific emissions, the Proposed Action is not likely to violate, or otherwise contribute to any violation of any applicable air quality standard, and may only contribute a small amount to any projected future potential exceedance of any applicable air quality standards.

Emissions of NOx and VOC, ozone precursors, can be seen to be 28.4 tons/yr for NOx, and 13.7 tons/yr of VOC from **Table 4-1** and **Table 4-2** (above) during the year of development. Thereafter emissions during production would decrease to 4.3 tons/yr for NOx, and 10.4 tons/yr of VOC. As can be seen from Table 4.9 below, emissions during project operations are estimated to represent less than 0.05% of the projected Uinta Basin emissions for NOx and VOC. Project emissions of ozone precursors would be dispersed and/ or diluted to the extent where any local ozone impacts from the Proposed Action would be indistinguishable from background conditions. Emissions of these infinitesimal levels can be expected to have a negligible impact on ozone formation.

Hazardous Air Pollutant (HAP) Ambient Air Impacts

The primary sources of HAPs are from oil storage tanks and smaller amounts from other production equipment. Small amounts of HAPs are emitted by construction equipment. However, these emissions are estimated to be less than 1 ton per year, and were not modeled. The central production facilities were modeled using AERMOD with terrain.

Modeled HAP concentrations were compared to available dose-response assessment data used by the EPA Office of Air Quality Planning and Standards for risk assessments of HAPs. Short-term impacts from HAP exposure were assessed by comparing maximum 1-hour average impacts to the HAP-specific acute reference exposure level (REL) and annual average impacts to the HAP-specific reference concentration (RfC for continuous inhalation exposure). The REL is the acute concentration at or below which no non-cancer adverse health effects are expected. The RfC is the average concentration (i.e., an annual average) at or below which no long-term, non-cancer adverse health effects are expected. As shown in **Table 4-6** the predicted concentrations for all HAPs are below non-cancer effect risk.

Table 4-6. Proposed Action Non-Carcinogenic Acute REL and RfC Impacts

HAP	REL [a] ($\mu g/m^3$)	Predicted Maximum One-Hour Impact	Percent of REL	RfC[d] ($\mu g/m^3$)	Predicted Maximum Annual Impact ($\mu g/m^3$)	Percent of RfC
Benzene	1,300 [b]	63.1	4.9	30	1.6	5.33%
Benzene	160,000 [c]	22.3	0.01	NA	NA	NA
Toluene	37,000 [a]	15.8	0.04	5,000	0.4	0.01
Ethylbenzene	350,000 [d]	0.23	0.00	1,000	0.01	0.00
Xylenes	22,000 [a]	7.9	0.04	100	0.20	0.20
n-Hexane	390,000 [d]	31.6	0.01	700	0.8	0.11

[a] REL is the California EPA reference exposure level for no adverse effects from EPA Air Toxics Database, Table 2 (EPA 2002a) http://www.epa.gov/ttn/atw/toxsource/summary.html

[b] REL for benzene is based on a 6-hr exposure (OEHHA 1999), predicted concentration is a 6-hr average.

[c] Immediately Dangerous to Life or Health (IDLH)/10 [determined by the National Institute of Occupational Safety & Health (NIOSH)], EPA Air Toxics Database, Table 2 (EPA 2007a) since no available 1-hr REL

[d] RfC is the reference concentration for no observed adverse effect from chronic inhalation (non-cancer) EPA Air Toxics Database, Table 1 (EPA 2007a) http://www.epa.gov/ttn/atw/toxsource/summary.html

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

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

The MLE scenario assumes people living in the Project Area. For the MLE exposure adjustment factor, it is assumed a family stays at a residence an average of 9 years and spends 64 percent of the day away from the home (EPA 1997). It is further assumed that households are exposed to one-quarter of the maximum concentration the remaining (36 percent) of the time. This results in an adjustment factor of 0.094 [(9/70)*((0.64*1)+(0.36*0.25))].

An example of an MEI could be that a pumper that visits well sites daily. For the MEI exposure adjustment factor, exposure is assumed to occur continuously (12 hours per day, 265 days per year) for the life of project (assumed to be 31 years). This results in an adjustment factor of 0.111 [(12/24)*(265/365)*(31/70)].

Table 4-7 presents the unit risk factor, exposure adjustment factor, and the estimated cancer risk for the MLE and MEI exposure scenarios for benzene. A range of unit risk factors is available for benzene. Both cancer risk ranges are in the acceptable range of cancer risk.

Table 4-7. Proposed Action Carcinogenic HAP Risk

Exposure Scenario	Hazardous Air Pollutant	Unit Risk Factor (1/µg/m^3)	Exposure Adjustment Factor	Modeled Annual Impact (µg/m^3)	Cancer Risk
Most Likely Exposure	Benzene	7.8 in a million	0.094	1.6	1.2 in a million
	Formaldehyde	13 in a million	0.094	0.014	0.02 in a million
		MLE MAX TOTAL RISK			**1.2 in a million**
Maximally Exposed Individual	Benzene	7.8 in a million	0.111	1.6	1.4 in a million
	Formaldehyde	13 in a million	0.111	0.014	0.02 in a million
		MEI MAX TOTAL RISK			**1.4 in a million**

MEI = maximally exposed individual
MLE = most likely exposure

There is uncertainty involved in adding cancer risk estimates together when exposure is to a mixture. Compounds in mixtures can interact synergistically (amplifying effects), antagonistically (reducing the effects), independently (no interaction), or they can have additive effects. The 'Max Total Risk' rows in **Table 4-7** represent the benzene risk which is likely to be a conservative risk estimate. As a result of the Proposed Action it is possible that 1.2 additional people out of 1,000,000 people exposed at the most

likely exposure level could contract cancer. A maximally exposed individual would have a 1.4 in 1,000,000 increased chance of contracting cancer.

Evaluation of Air Quality Applicant-Committed Environmental Protection Measures

Stewart Petroleum has committed to the implementation of several air quality ACEPMs as outlined in **Section 2.1.15.1**. The implementation of these ACEPMs would result in lower emissions from the Proposed Action, both during the development phase (lower NOx emissions) and during production operations (lower VOC emissions). These measures were quantified where possible.

In the short-term, as can be seen from **Table 4-8**, if the proposal is approved NOx emissions from drill rig engines during well development would be reduced by 44% during the year development occurs by the implementation of the ACEPMs. Long-term VOC emissions from well site stock tanks would be reduced by 95% for the life of the project by the implementation of the ACEPMs.

Table 4-8. Emission Reductions due to Tumbleweed II Air Quality ACEPMs

	Without ACEPMs (tons/yr)	**With ACEPMs (tons/yr)**	**Emission Difference (tons/yr)**	**Percent Change**
Project Development				
NOx Emissions from Drill Rig Engines	43.5	19.2	-24.3	-44%
Project Operations				
VOC Emissions from Well Site Tank Emissions	195.8	9.8	-186.0	-95%

Note: see **Appendix D** for emission calculations

4.2.1.10 Visual Resources

As discussed in **Section 3.2.10**, the Tumbleweed II Project Area offers a predominantly natural appearing landscape with little evidence of human activity. The construction and operation of natural gas facilities and associated features, such as roads and pipelines, would result in both short-term and long-term impacts to the visual landscape and cause a direct loss of naturalness. These noticeable visual intrusions would change the visual character of the landscape.

Exposure of new bare ground in previously vegetated areas would introduce changes to the area's predominate colors of sage green and dark woodland green. Nighttime drilling activities would involve safety lighting, breaking up the generally black effect of night in the Tumbleweed II Project Area. Increased fugitive dust from activities conducted on bare ground would create dust plumes and result in visual change in the landscape for short intervals during construction. The placement of permanent facilities, including tanks batteries on well pads would introduce new elements of line, form, color, and texture, which contrast with the natural landscape.

All proposed wells would be located along a ridge located out of sight of both Willow Creek and Upper Canyon Bottom. Due to the rugged topography and vegetative diversity of the Tumbleweed II Project Area, many facilities would be visually screened.

Visual resource impacts in the Tumbleweed II Project Area are analyzed in terms of consistency of the Proposed Action with the existing VRM classification. The proponent has agreed to a number of measures which would reduce the above-mentioned visual impacts. In particular, all permanent facilities located on site longer than 6 months would be painted a color to match the surround environment; water

or other approved suppressants would be used during construction activities to abate fugitive dust; interim reclamation would be implemented on all disturbed areas that are not needed for production activities; and low profile tanks would be used if determined necessary. Implementation of these measures would minimize direct, indirect, short- and long-term impacts to the visual landscape. Therefore, the Proposed Action would be consistent with the area's VRM Class III designation.

4.2.1.11 Non-WSA Lands with Wilderness Characteristics

Under the Proposed Action, development of up to seven well pads with nine[8] deep exploratory wells, construction of up to 4.2 miles of new road surface, upgrading of up to 1.9 miles of existing road, and installation of production facilities would directly disturb approximately 47.7 acres within the Wolf Point wilderness characteristics area. Indirect impacts would extend beyond the 47.7 acres of direct disturbance, and would include those areas within sight and/or sound of construction activities or production facilities. To determine potential indirect effects of the project on wilderness characteristics, the assumption was made that areas within ½-mile of oil and gas related development and roads would lose the constituents used to define wilderness (i.e., naturalness and possessing opportunities for solitude and primitive and unconfined recreation). Using this assumption, a ½-mile sight and sound buffer was placed around the proposed well pads, roads, and pipelines and GIS calculations were run to determine how much of the wilderness characteristics area would be within ½ mile of development if the Proposed Action were implemented. Based on this analysis, a total of approximately 3,380 acres would be within ½ mile of development under the Proposed Action and would lose the constituents used to define wilderness characteristics

Figure 4-1 illustrates the Proposed Action within the 11,802-acre portion of the Wolf Point area that were found to have wilderness characteristics. Impacts to the individual components of wilderness characteristics are described below:

Size: Implementation of the Proposed Action would directly disturb approximately 47.7 acres or less than one percent of the total area with wilderness characteristics. Although linear surface disturbances would be introduced into the natural landscape, the size of the wilderness characteristics area would not be segmented into areas less than 5,000 acres.

Naturalness: Changes in naturalness are often described in terms of human modification of the natural landscape. The construction and operation of natural gas facilities and associated roads and pipelines, would result in both short-term and long-term impacts to the area's predominantly natural appearing landscape that currently has little evidence of human activity. Proposed roads, pipelines, and well pads would cause a direct loss of naturalness on 47.7 acres (less than one percent of the total wilderness characteristics area) and change the natural character of the landscape. This loss would be dispersed throughout much of the wilderness characteristics area and would not be concentrated or centralized within one area.

Indirect impacts would include all changes in the natural environment that would be visible to the casual observer from within the wilderness characteristics areas (e.g., surface disturbance, construction equipment, and production facilities). Under the Proposed Action, it is assumed that the indirect loss of naturalness (i.e., those wilderness characteristics areas that fall within the ½ mile sight and sound buffer of development) could be up to 3,380 acres. However, due to the rugged topography, vegetation, and overall size of the impacted area, many facilities would be visually screened. Therefore, naturalness may still exist in isolated pockets throughout the impacted area.

[8] As discussed in **Appendix B**, the TUF #18-9 was drilled and completed in 2007. However, given that the DR approving that well was remanded, the surface disturbance and impacts of that existing well pad, well, and associated roads, pipelines, and facilities are fully analyzed within this new EA, including potential effects on wilderness characteristics.

Outstanding Opportunities for Solitude: Noise from construction and drilling equipment would reduce the quality of the opportunity for solitude in the immediate vicinity of the development. These 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) the wells. During production, a limited loss of solitude would occur from noise and associated visual effects of the development. A drilling rig would be visible and would be heard throughout the Project Area for approximately 21 days per well. Tanks, wellheads, and metering equipment would be visible evidence of oil and gas development activities. Slight impacts to solitude may also occur with the limited increase that can be expected in recreational and/or administrative use of the new access roads. Constructing, drilling and maintaining the proposed wells, road, and pipeline would result in a direct loss of solitude on 47.7 acres (or less than one percent of the total unit) that were previously undisturbed. Implementation of the Proposed Action could indirectly impact approximately 3,380 acres of the wilderness characteristics area and opportunities for solitude.

Outstanding Opportunities for Primitive and Unconfined Recreation: Opportunities for primitive and unconfined recreation would be diminished in proportion to the expected loss of naturalness and solitude. In disturbed locations, the loss of opportunity for primitive recreation would be related to the change from an undeveloped setting to a more industrial setting. Due to the rugged topography and overall size of the impacted area, some of the facilities would be visually screened. Therefore, opportunities for primitive and unconfined recreation may still exist in isolated pockets throughout the impacted area; these opportunities would no longer be outstanding.

In summary, impacts to wilderness characteristics would last the life of the project until reclamation is complete. Although the proponent has agreed to a number of measures which would reduce the above-mentioned impacts (e.g., all permanent facilities located on site longer than 6 months would be painted a color to match the surround environment; water or other approved suppressants would be used during construction activities to abate fugitive dust; interim reclamation would be implemented on all disturbed areas that are not needed for production activities; and low profile tanks would be used if determined necessary), it is expected that wilderness characteristics would be degraded in the Wolf Point area. If all wells were developed and productive, the Wolf Point non-WSA lands with wilderness characteristics would lose their natural values due to the additive affect of surface disturbing activities, roads, pipelines, and production facilities. As predicted in Chapter 4 of the Vernal Proposed Plan/Final EIS (2008), the amount of lands currently under lease in the Wolf Point wilderness characteristics area - in combination with the anticipated development of those leases - would cause this area to lose the naturalness value and degrade the solitude and primitive recreation opportunities of the wilderness characteristic lands.

4.2.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, current management plans would continue to guide management of the Tumbleweed II Project Area, and the proposed natural gas exploration project, access road construction, and pipeline construction would not be implemented. As such, there would be no additional oil and gas related direct or indirect impacts to resources as a result of this alternative. Existing roads within the Tumbleweed II Project Area would continue to be used for access to existing oil and gas operations (i.e., the TUF #18-9 and Winter Ridge pipeline), grazing, and other land use activities. Future natural gas exploration in the Tumbleweed II Project Area could be considered on a case-by-case basis through the APD process or under separate NEPA analysis.

4.2.2.1 Soils

Project-related impacts to soil resources, including biological soil crusts, would not occur under the No Action Alternative. Disturbance to Tumbleweed II Project Area soils would continue at present levels from existing oil and gas development, livestock grazing, wild horses, and recreational use.

4.2.2.2 Water Resources

Project-related impacts to water resources would not occur under the No Action Alternative. Impacts to water resources would continue at present levels from existing oil and gas development, livestock grazing, and recreation.

4.2.2.3 Vegetation Resources

Project-related impacts to vegetation resources would not occur under the No Action Alternative. Impacts to vegetation would continue at present levels from existing oil and gas development, livestock grazing, rangeland management, and recreational use. Weed infestation related to these activities would also continue at present levels or could potentially increase in the absence of weed control mitigation.

4.2.2.4 Rangeland Management and Wild Horses

Project-related impacts to rangeland management and wild horses would not occur under the No Action Alternative. Impacts to rangeland management and wild horses would continue at present levels and from existing oil and gas development, and recreational use.

4.2.2.5 Fish and Wildlife Resources

Project-related impacts to fish and wildlife would not occur under the No Action Alternative. Habitat loss/fragmentation, displacement, and other impacts would continue at present levels from existing oil and gas development, livestock grazing, and recreational use.

4.2.2.6 Special Status Species

Project-related impacts to special status species would not occur under the No Action Alternative. Impacts to special status species would continue at current levels from existing oil and gas development, livestock grazing, and recreation.

4.2.2.7 Recreation

Project-related impacts to recreation would not occur under the No Action Alternative. Impacts to recreation would continue at present levels from existing oil and gas development and livestock grazing.

4.2.2.8 Cultural Resources

Under the No Action Alternative, project-related impacts to cultural resources would not occur. Impacts to cultural resources would continue at present levels from existing oil and gas development and recreational use.

4.2.2.9 Air Quality

Under the No Action Alternative the proposed exploratory gas wells would not be drilled and there would be no additional impacts to air quality. Effects on ambient air quality would continue at present levels from existing oil and gas development in the region and other emission producing sources.

4.2.2.10 Visual Resources

Under the No Action Alternative the proposed exploratory gas wells would not be drilled and there would be no additional impacts to visual resources.

4.2.2.11 Non-WSA Lands with Wilderness Characteristics

Under the No Action Alternative, oil and gas related surface disturbance within the portion of the Wolf Point area found to have wilderness characteristics would be limited to the existing TUF #18-9 and associated road and pipeline. Under the No Action Alternative, additional well pads and associated pipelines, roads, and production facilities would not be developed and there would be no additional impacts to wilderness characteristics from oil and gas related activities. To estimate the indirect impacts under the No Action alternative, a ½ mile sight and sound buffer was applied to the existing TUF 18-9 well and associated access roads and pipelines. This GIS-based exercise showed that approximately 2,234 acres of the Wolf Point wilderness characteristics areas falls within ½-mile of existing oil and gas related development and roads and have lost the constituents used to define wilderness characteristics.

Additional project-related impacts to non-WSA lands with wilderness characteristics would not occur under the No Action Alternative. Disturbance to these areas would continue at present levels from existing oil and gas development, livestock grazing, and recreational use.

Impacts to the individual components of wilderness characteristics are described below:

Size: Under the No Action Alternative no additional well pads, access roads, or pipelines would be developed in the Tumbleweed II Project Area and there would be no further reduction in size of the wilderness characteristics area.

Naturalness: The continued operation of the TUF #18-9 and associated road and pipeline within the Tumbleweed II Project Area would continue to result in both short-term and long-term impacts to the predominantly natural appearing landscape that has little evidence of human activity. These oil and gas production facilities would continue to affect the natural character of the landscape in the southwest portion of the Wolf Point area. This existing infrastructure would continue to cause a direct loss of naturalness on approximately 7 acres. However, this loss is concentrated and centralized in one area within the wilderness characteristics lands, thus the naturalness of the area as a whole basically remains unchanged.

Indirect impacts would include all changes in the natural environment that would be visible to the casual observer from within the wilderness characteristics areas (e.g., surface disturbance, construction equipment, and production facilities). Under the No Action Alternative, it is assumed that the indirect loss of naturalness could be up to 2,234 acres. However, as the TUF# 18-9 well pad is located on a treed ridge, it is not visible from the majority of the surrounding wilderness characteristics area.

Outstanding Opportunities for Solitude: Noise from production equipment and pumper traffic has reduced the quality of the opportunity for solitude in the immediate vicinity of the producing well, pipelines and roads. The tanks, wellhead, metering equipment, and pipeline are visible evidence of the existing oil and gas activity. Slight impacts to solitude occur with the limited increase that can be expected in recreational and/or administrative use of the 0.6-mile, existing access road to the well pad. Maintaining the producing #18-9 well, road, and pipeline has resulted in a direct loss of solitude on approximately 7 acres in a concentrated and centralized area was previously undisturbed. However, under the No Action Alternative this existing development plus other development in the wilderness characteristics area would indirectly impact approximately 2,234 acres. Because the existing oil and gas

activity is limited within the 11,802-acre wilderness characteristics area, outstanding opportunities for solitude would basically remain unchanged outside of the existing disturbances.

Outstanding Opportunities for Primitive and Unconfined Recreation: Opportunities for primitive and unconfined recreation have been diminished in proportion to the loss of naturalness and solitude associated with existing development in the Tumbleweed II Project Area. Because existing oil and gas development is limited, the loss of opportunity for primitive recreation and change from an undeveloped setting to a more developed setting would be less than that under the Proposed Action. However, as the TUF# 18-9 well pad is located on a treed ridge, the facility is not visible from the majority of the surrounding wilderness characteristics area. Under the No Action Alternative, opportunities for primitive and unconfined recreation still exist throughout the majority of the Tumbleweed Project Area portion of the wilderness characteristics area except for the concentrated area of development near the TUF #18-9 location.

In summary, under the No Action Alternative, impacts to wilderness characteristics in the Wolf Point wilderness characteristics area would be directly impacted on approximately 7 acres within the Tumbleweed II Project Area.

4.2.3 ALTERNATIVE C – BURIED PIPELINES

Under Alternative C, project-related impacts would be similar in nature to those discussed under the Proposed Action. However, surface disturbance would be slightly greater than under the Proposed Action as all 10-inch OD pipelines would be buried, which would require a wider ROW. Specifically, total surface disturbance in the Tumbleweed II Project Area would be approximately 62 percent (or 29.8 acres) greater under Alternative C than under the Proposed Action. Resource-specific differences are discussed in the sections below. In addition, it should be noted that recommended mitigation for certain resources (i.e., vegetation, wildlife, special status species, and rangeland management and wild horses) would be identical to that described under the Proposed Action.

4.2.3.1 Soils

Potential impacts to soil resources would be similar in nature to those discussed under the Proposed Action. However, under Alternative C, there would be a total of 77.5 acres of surface disturbance. Erosion rates within the 77.5-acre disturbance area would increase from a background rate of approximately 112.4 tons/year to 337.1 tons/year until successful reclamation stabilizes disturbed soils. In addition, implementation of Alternative C could result in the long-term disturbance of approximately 74 acres of biological soil crust in the Winteridge-Moonset soil association, which is greater than 60 percent more disturbance of this soil type compared to the Proposed Action. The loss of biological crusts would have no effect on the reclamation potential of soils in the area.

4.2.3.2 Water Resources

Potential impacts to water resources would be similar in nature to those discussed under the Proposed Action. However, surface waters that would be avoided by surface pipeline crossings under the Proposed Action would be impacted from buried pipelines under Alternative C. Additionally, there would be 77.5 acres of initial surface disturbance. Soil erosion calculations reveal that an estimated 337.1 tons/year of additional erosion could be expected to occur as a result of Alternative C.

4.2.3.3 Vegetation Resources

Potential impacts to vegetation resources would be similar in nature to those discussed under the Proposed Action. However, under Alternative C, there would be 77.5 acres of surface disturbance and

habitat loss, which is approximately 62 percent more than that under the Proposed Action. Of this disturbance, approximately 27.4 acres of recent habitat restoration and approximately 4.1 acres of commercial forests and woodlands would be disturbed, which accordingly are 30 percent (or 6.4 acres) and 28 percent (or 0.9 acres) more than that under the Proposed Action. The potential for weed infestation would be higher under Alternative C given the increase in surface disturbance and construction activities associated with burying pipelines.

4.2.3.4 Rangeland Management and Wild Horses

Potential impacts to rangeland management and wild horses would be similar in nature to those discussed under the Proposed Action. However, under Alternative C, there would be 77.5 acres of surface disturbance and habitat loss for range/horse habitat.

4.2.3.5 Fish and Wildlife Resources

Potential impacts to fish and wildlife resources would be similar in nature to those discussed under the Proposed Action. However, under Alternative C, there would be 77.5 acres of surface disturbance and wildlife habitat loss.

4.2.3.6 Special Status Species

Potential impacts to special status species would be similar in nature to those discussed under the Proposed Action. However, under Alternative C, there would be approximately 77.5 acres of surface disturbance and habitat loss.

4.2.3.7 Recreation

Potential impacts to recreation would be similar in nature to those discussed under the Proposed Action. However, under Alternative C, there would be approximately 77.5 acres of initial surface disturbance.

4.2.3.8 Cultural Resources

Potential impacts to cultural resources would be similar to those discussed under the Proposed Action; however, as a result of the increased initial surface disturbance there is a slight increase in the possibility of impacts to unknown, subsurface cultural deposits.

4.2.3.9 Air Quality

The sources of emissions for Alternative C are identical to those described for the Proposed Action. However, emissions from earth-moving equipment as well as fugitive dust emissions would be slightly higher because of pipeline excavation/trenching activities. Impacts from drilling, completion, and well production would the same as those addressed under the Proposed Action.

4.2.3.10 Visual Resources

Potential impacts to Visual Resources would be similar in nature to those discussed under the Proposed Action. However, under Alternative C, there would be approximately 77.5 acres of initial surface disturbance. In the short-term, removal of vegetation and trenching/excavation would create additional landscape contrasts. However, provided reclamation efforts are successful, burial of pipelines could reduce long-term visual resource impacts because surface pipelines would introduce new elements of line, form, color, and texture into the landscape that would last for the life of the project.

4.2.3.11 Non-WSA Lands with Wilderness Characteristics

Under the Buried Pipeline Alternative, Stewart would drill nine exploratory wells accessed from seven well pads as described in the Proposed Action. However, the pipelines would be buried instead of surface-laid, contributing 29.8 acres greater surface disturbance than the Proposed Action. The well pads and the associated pipelines, roads, and production facilities would directly disturb approximately 77.5 acres within the Wolf Point non-WSA lands with wilderness characteristics area. Indirect impacts would extend beyond the 77.5 acres of direct disturbance, affecting approximately 3,380 acres of the wilderness characteristics area that would be within ½ mile of development and would lose the constituents used to define wilderness characteristics.

As analyzed in the Proposed Action, impacts to wilderness characteristics would last the life of the project until reclamation is complete. Although the proponent has agreed to a number of measures which would reduce the above-mentioned impacts (e.g., all permanent facilities located on site longer than 6 months would be painted a color to match the surround environment; water or other approved suppressants would be used during construction activities to abate fugitive dust; interim reclamation would be implemented on all disturbed areas that are not needed for production activities; and low profile tanks would be used if determined necessary), it is expected that wilderness characteristics would be degraded in the Wolf Point area. As predicted in Chapter 4 of the Vernal Proposed Plan/Final EIS (2008), surface disturbance associated with the development of leased lands would cause this area to lose the naturalness value and degrade the solitude and primitive recreation opportunities of the wilderness characteristic lands.

Figure 4-1 illustrated the proposed development within the Wolf Point wilderness characteristics area. Impacts to the individual components of wilderness characteristics would be similar to those discussed under the Proposed Action.

4.2.4 ALTERNATIVE D – DIRECTIONAL DRILLING

Under Alternative D, project-related impacts would be similar in nature to those discussed under the Proposed Action. However, these impacts would be slightly less in extent than those described above under the Proposed Action. Under Alternative D, Stewart would drill nine exploratory wells from four well pads. As such, total surface disturbance in the Tumbleweed II Project Area would be approximately 20 percent (or 9.5 acres) less than under the Proposed Action. Resource-specific differences are discussed in the sections below. In addition, it should be noted that recommended mitigation for certain resources (i.e., vegetation, wildlife, special status species, and rangeland management and wild horses) would be identical to that described under the Proposed Action.

4.2.4.1 Soils

Impacts to soil resources under Alternative D would be similar in nature to those discussed under the Proposed Action; however, surface disturbance would be limited to the Winteridge-Moonset association soil type and the magnitude of the impacts to soils would be reduced in proportion to reductions in the amount of surface disturbance (approximately 9.5 acres fewer acres disturbed under Alternative D as compared to the Proposed Action) and therefore, a marginal decrease in the amount of erosion.

4.2.4.2 Water Resources

Impacts to water resources under Alternative D would be similar in nature to those discussed under the Proposed Action; however, the magnitude of the impacts to water resources would be reduced in proportion to reductions in the amount of surface disturbance (approximately 9.5 acres fewer acres

disturbed under Alternative D as compared to the Proposed Action) and therefore, a marginal decrease in the amount of erosion and potential sediment yield.

4.2.4.3 Vegetation Resources

Impacts to vegetation under Alternative D would be similar in nature to those discussed under the Proposed Action; however, the magnitude of the impacts to vegetation communities, fugitive dust, and weed invasion would be reduced in proportion to reductions in the amount of surface disturbance (approximately 9.5 acres fewer acres disturbed under Alternative D as compared to the Proposed Action). Of this disturbance, approximately 15.7 acres of recent habitat restoration and approximately 0.8 acres of commercial forests and woodlands would be disturbed, which accordingly are 25 percent (or 5.3 acres) and 75 percent (or 2.4 acres) less than that under the Proposed Action.

4.2.4.4 Rangeland Management and Wild Horses

Impacts to rangeland management and wild horses under Alternative D would be similar in nature to those discussed under the Proposed Action; however, the magnitude of the impacts to wild horse habitat and AUM loss would be slightly reduced in proportion to reductions in the amount of surface disturbance (approximately 9.5 acres fewer acres disturbed under Alternative D as compared to the Proposed Action).

4.2.4.5 Fish and Wildlife Resources

Impacts to fish and wildlife resources under Alternative D would be similar in nature to those discussed under the Proposed Action; however, the magnitude of habitat loss and disturbance would be slightly reduced in proportion to reductions in the amount of surface disturbance (approximately 9.5 acres fewer acres disturbed under Alternative D as compared to the Proposed Action).

4.2.4.6 Special Status Species

Impacts to special status species under Alternative D would be similar in nature to those discussed under the Proposed Action; however, the magnitude of habitat loss and disturbance would be slightly reduced in proportion to reductions in the amount of surface disturbance (approximately 9.5 acres fewer acres disturbed under Alternative D as compared to the Proposed Action).

4.2.4.7 Recreation

Impacts to recreation under Alternative D would be similar in nature to those discussed under the Proposed Action; however, the magnitude of the impacts would be reduced in proportion to reductions in the amount of surface disturbance (approximately 9.5 acres). When compared with the Proposed Action, the construction of fewer well pads, roads, and pipelines, as well as the centralization of permanent facilities, including tanks batteries on four well pads) would minimize impacts to primitive and unconfined recreation. Impacts to primitive and unconfined recreation would specifically be decreased in the northern portion of the Tumbleweed II Project Area.

4.2.4.8 Cultural Resources

Impacts to cultural resources under Alternative D would be similar in nature to those discussed under the Proposed Action; however, direct impacts to unidentified cultural resources, which could occur as a result of well pad, road, and pipeline construction, would be reduced in proportion to reductions in the amount of surface disturbance (approximately 9.5 acres).

4.2.4.9 Air Quality

The sources of emissions under Alternative D are identical to those described for the Proposed Action. Under Alternative D, the most highly developed well pad, TUF #18-9, could support up to three well heads, three heater separators, and six oil tanks. Since the maximum impacts from the Proposed Action occur at the edge of the well pad with identical facilities, the impacts under Alternative D would be identical to those described under the Proposed Action for all criteria and hazardous pollutants.

4.2.4.10 Visual Resources

Visual resource impacts under Alternative D would be similar in nature to those discussed under the Proposed Action; however, the magnitude of the impacts would be reduced in proportion to reductions in the amount of surface disturbance (approximately 9.5 acres). The construction of fewer well pads, roads, and pipelines would partially mitigate impacts to the visual landscape which can result from the exposure of new bare ground in previously vegetated areas. In addition, the centralization of permanent facilities, including tanks batteries on four well pads (as opposed to seven well pads under the Proposed Action) would decrease long-term visual contrasts. Impacts to visual resources would be specifically reduced in the northern portion of the Tumbleweed II Project Area, which currently has little evidence of human activity.

4.2.4.11 Non-WSA Lands with Wilderness Characteristics

Under the Directional Drilling Alternative, Stewart would drill nine exploratory wells accessed from four well pads. The well pads and associated pipelines, roads, and production facilities would directly disturb approximately 38.2 acres within the Wolf Point wilderness characteristics area. Indirect impacts would extend beyond the 38.2 acres of direct disturbance, affecting approximately 2,810 acres of the wilderness characteristics area that would be within ½ mile of development and would lose the constituents used to define wilderness characteristics.

Potential impacts to the Wolf Point wilderness characteristics area would be similar in nature to those discussed under the Proposed Action but would be less extensive based on the 20% reduction in surface disturbance as compared to the Proposed Action, and concentration of production facilities on four well pads instead of seven well pads as under the Proposed Action. Under Alternative D, there would be 38.2 acres of initial surface disturbance (a decrease of 9.5 acres from the Proposed Action Alternative) due to directional drilling off of fewer well pads. This would decrease total surface disturbance by 20 percent as compared to the Proposed Action. Directional drilling under Alternative D would also reduce the indirect impacts to wilderness characteristics values from that which is described under the Proposed Action analysis.

Under the Directional Drilling Alternative, impacts to wilderness characteristics would last the life of the project until reclamation is complete. Although the proponent has agreed to a number of measures which would reduce the above-mentioned impacts (e.g., all permanent facilities located on site longer than 6 months would be painted a color to match the surround environment; water or other approved suppressants would be used during construction activities to abate fugitive dust; interim reclamation would be implemented on all disturbed areas that are not needed for production activities; and low profile tanks would be used if determined necessary), it is expected that wilderness characteristics would be degraded in the Wolf Point area. If all wells were developed, the Wolf Point non-WSA lands with wilderness characteristics would lose their natural values. As predicted in Chapter 4 of the Vernal Proposed Plan/Final EIS (2008), the surface disturbance associated with the development of the leased

lands would cause this area to lose the naturalness value and degrade the solitude and primitive recreation opportunities of the wilderness characteristic lands.

Figure 4-2 illustrates the proposed development under the Directional Drilling Alternative within the Wolf Point wilderness characteristics area.

4.2.5 CUMULATIVE IMPACT ANALYSIS

Cumulative impacts result from the incremental impacts of an action when added to past, present, and reasonably foreseeable future actions, regardless of who takes the action. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time. The Vernal Field Office Approved RMP (BLM 2008a) included detailed analyses of broad cumulative impacts for oil and gas development. This project incorporates by reference the analyses within the RMP.

This section of the EA discusses cumulative impacts as the incremental effect to specific resources or issues that would occur under Alternatives A, C, or D, in conjunction with other cumulative actions. In support of the cumulative impact discussion, this chapter provides discussion on past and present oil and gas activities in the Uinta Basin, both of which serve as introductions to the outlook for reasonably foreseeable development (RFD) in the Tumbleweed II Project Area and the greater Uinta Basin. Other significant activities would be livestock grazing, vegetative management through prescribed burning, and recreational projects. The Cumulative Impact Analysis Area (CIAA) for most resources is the Vernal planning area. For some resources, (i.e., air quality), the CIAA is much larger.

4.2.5.1 Oil and Gas

In 2002 as part of the land use plan revision process, the BLM prepared a RFD scenario to project environmental impacts of oil and gas exploration and development across a 15-year period. Projections included in-depth reviews of potential for occurrence, past well production, current well production, and future potential for production. Since that time, the BLM has carefully monitored industry trends and has concluded that the RFD can be considered accurate for up to approximately 5 years from the time the ROD for the Approved RMP was signed (October 31, 2008). Within the next approximately 5-year timeframe, the BLM intends to monitor the impacts to resources in the Vernal planning area and ensure that the impacts that were disclosed in the Vernal Field Office Proposed RMP and Final EIS analysis are not exceeded by the pace of development.

Exploratory drilling is currently proposed in the western and southwestern portions of the Uinta Basin on BLM-administered, Tribal and National Forest lands. Exploratory wells are typically characterized by larger, deeper, more remote locations requiring greater per-well expenditures, potential delays in infrastructure access, and greater financial risk (Linden 2003). If exploratory drilling within the Tumbleweed II Project Area is successful, it can reasonably expected that Stewart would attempt to fully develop the natural gas resources within their lease areas in the future.

Future oil and gas development in the Uinta Basin and the Tumbleweed II Project Area would depend not only upon the results of exportation, but a number of other variables including the cost to develop the resources, and technological advancements. Development of Tribal lands will continue and perhaps increase as exploratory wells are drilled in the Hill Creek Extension, which is adjacent to the Tumbleweed II Project Area. Future oil and gas exploration in the Ashley National Forest will likely increase as a result of new leasing and management strategies. However, the level of future development on Tribal and National Forest System lands is unknown.

As of March 2007, there were 5,671 producing oil and gas wells in the Vernal Field Office planning area (UDOGM 2007). According to the above-mentioned RFD scenario prepared by the BLM, an additional 6,530 wells could be drilled in the CIAA over the next 5 years, for a total of 12,201 wells. The nine proposed wells in the Tumbleweed Unit would constitute less than 0.5 percent of the cumulative scenario. The following surface disturbance assumptions have been applied regarding future construction associated with oil and gas development and power lines in the Vernal planning area:

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

Based on these assumptions, the additional surface disturbance of the cumulative scenario for oil and gas development would be 28,835 acres, for a total surface disturbance within the CIAA of 44,091 acres. The details of this estimation are shown in **Table 4-9**.

Table 4-9. Cumulative Surface Disturbance from Oil and Gas Development

Planning Area	Existing Wells	RFD Wells	Total # Wells	Well Pads (acres)[1]	Access Roads (acres)	Total Pipelines (acres)	Compressor Stations (acres)	Total Disturbance (acres)
Vernal Field Office	5,671	6,530	12,201	29,282	8,907	5,734	168	44,091

[1]Well pad disturbance is overestimated, since it assumes one well per pad. In some cases, two or more wells may be drilled from a single well pad.

4.2.5.2 Soils

Cumulative impacts to soils in the planning area would result from existing and reasonably foreseeable oil and gas activities, livestock grazing/management, and recreational activities when combined with the anticipated impacts under Alternatives A, C, or D. Based on RFD projections, vegetation disturbance, impacts on biological soil crusts, and erosion and sediment yield within the Vernal planning area is likely to continue to increase. Each acre of disturbance adds to a cumulative effect by increasing erosion, destroying native vegetation, and increasing potential spread of noxious weeds.

Alternatives A, C, or D would disturb relatively small areas (47.7, 77.5, and 38.3 acres, respectively) of surface soils. However, any increase in surface disturbance must be acknowledged as incrementally and cumulatively adding to soil disturbance within the CIAA. The total estimated cumulative disturbance of 44,091 acres in 1,691,116 acre-Vernal planning area would increase by 0.09 percent to 0.18 percent due to project construction, depending on the action alternative selected. Additional BLM-authorized actions (oil and gas development, livestock grazing, prescribed burning, and recreation) that could result in increased erosion and sediment yield within the CIAA are also likely to occur. Of these potential soil-disturbing activities, existing and proposed roads are the features of highest concern. Unlike surface and buried pipelines, active roadways are not reclaimed, thus sediment yield from roads can continue at rates two to three times above background rates into the indefinite future. The Proposed Action would create an additional 6.1 miles of new or upgraded roadway in the CIAA.

Rangeland Health Standard 1 states that "upland soils should exhibit permeability and infiltration rates that sustain or improve site productivity, considering the soil type, climate, and landform". Alternatives A, C, or D would add to other actions that have a negative impact on the attainment of this standard, due

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

Assuming successful implementation of Applicant-Required Measures and ACEPM, erosion and sediment yield impacts from the 47.7 acres of vegetation and soil disturbance under the Proposed Action (77.5 acres under Alternative C, 38.2 acres under Alternative D) would be minor. In the context of cumulative impact analyses, each acre of vegetation and soil disturbance subsequently adds to cumulative soil resource impacts in the Vernal planning area by incrementally increasing erosion and sediment yield; however, these contributions would be minor.

4.2.5.3 Water Resources

Cumulative impacts to water resources in the planning area would result from agriculture, livestock grazing, recreation, vehicular traffic, oil and gas development, and mining and industrial activities when combined with the anticipated impacts under Alternatives A, C, or D.

Alternatives A, C, and D would result in a slight increase in erosion rates and sediment yield. If reclamation and mitigation measures are not successful, additional sedimentation and turbidity of surface water could result. The increased erosion, combined with increases associated with other oil and gas development, recreational activities including OHV use, livestock grazing, and mining, could have cumulative negative impacts on aquatic habitat within affected drainages.

As a result of the Proposed Action, the estimated annual sediment loading to Willow Creek, based on the median suspended solids concentration and the average annual runoff recorded at USGS station 09307500, is about 21,560 tons. Therefore, if all additional sediment was delivered to Willow Creek, the increased sediment loading to Willow Creek at this location would be about 0.5 percent. The alternative-specific contributions from the other action alternatives would be similar and would incrementally contribute to cumulative sediment loading. The alternatives could also incrementally contribute to TDS loading to Willow Creek.

The design features of the alternatives, including the placement of sedimentation control devices along new roads and at drilling locations, would reduce the amount of additional sediment that actually reaches the ephemeral and perennial streams in the CIAA. Because the Green River is about 41 miles away, additional sediment loading to the Green River would be negligible under either alternative.

Soils compacted on existing roads, new access roads, and well pads contribute slightly greater runoff than undisturbed sites. The increased runoff could lead to slightly higher peak flows in Willow Creek, potentially increasing erosion of the channel banks. The increased erosion would increase turbidity in the river during storm events.

Assuming three wells would be drilled per year, project-related water consumption would deplete the flow in Main Canyon by 15.3 acre-feet per year for three years. The water rights for this source of water were filed in 1921, therefore, use of this water is considered to be a historical depletion. Combined with other oil and gas activities, the cumulative depletion to the Green River would be less than 1 percent. Therefore, no diversions or alterations of flow regimes of the Green River are expected to occur.

Alternatives A, C, or D, combined with other oil and gas development and increased recreational activities, would slightly increase the chance that accidental spills of fuels, lubricants, and other petroleum products would occur and contaminate surface water within the CIAA. Spills of fuels or produced fluids from well pads, pipelines, and compressor stations also have the potential to contaminate the shallow alluvial groundwater along Tumbleweed II Project Area drainages.

Alternatives A, C, or D could result in a slight increase in erosion rates and sediment yield to floodplains in the CIAA. The increased erosion, combined with increases associated with other oil and gas development, recreational activities including OHV use, and livestock grazing, could have cumulative negative impacts on floodplain ecological functioning within the CIAA.

4.2.5.4 Vegetation Resources

Cumulative impacts to vegetation in the planning area would result from oil and gas activities, livestock grazing/management, and recreational activities reasonably certain to occur when combined with the anticipated impacts under Alternatives A, C, or D. Alternatives A, C, or D would disturb relatively small areas (47.7, 77.5, and 38.3 acres, respectively) of vegetation. However, any increase in surface disturbance must be acknowledged as incrementally and cumulatively adding to vegetation disturbance within the Vernal planning area. Specifically, the total estimated cumulative disturbance of 44,091 acres in the 1,691,116 acre-Vernal planning area would increase by 0.09 percent to 0.18 percent due to project construction, depending on the action alternative selected. Assuming successful implementation of Applicant-Required Measures and ACEPMs, vegetation losses from the 47.7 acres of disturbance under the Proposed Action (77.5 acres under Alternative C, 38.2 acres under Alternative D) would be minor. Each acre of vegetation disturbance subsequently and incrementally adds to cumulative vegetation impacts in the Vernal planning area; however, these contributions would be minor.

4.2.5.5 Rangeland Management and Wild Horses

Cumulative impacts to rangeland resources and wild horses in the planning area would result from past, present, and reasonably foreseeable oil and gas activities, livestock grazing/management, and recreational activities. Continued loss of vegetation would in turn, decrease potential livestock grazing habitat (i.e., AUMs) across the Winter Ridge Allotment. Cumulative habitat loss in the 42,189-acre (3,013-AUM) Winter Ridge Allotment would increase by approximately 0.09 to 0.18 percent due to surface disturbing activities depending on the action alternative selected. Similarly, cumulative habitat loss in the 46,500-acre Winter Ridge Herd Area for wild horses would increase by approximately 0.08 to 0.17 percent due to surface disturbing activities depending on the action alternative selected.

Provided successful implementation of Applicant-Required Measures, ACEPMs, and mitigation measures, impacts from the initial removal of somewhere between 38.2 to 77.5 acres of vegetation (2.7 - 5.5 AUMs) under alternatives would be negligible. In the context of cumulative impact analyses, loss of each individual AUM and each acre of wild horse habitat incrementally adds to cumulative losses in the CIAA; however, these contributions would be minor

4.2.5.6 Fish and Wildlife

Alternatives A, C, or D would cumulatively add to losses of big game foraging habitats; raptor breeding/nesting areas, and/or cover; habitat displacement; and mortality resulting from past, present and reasonably foreseeable future projects in the planning area. Based on Stewart's compliance with protective Federal stipulations on timing of project operations, implementation of Applicant-Required Measures, ACEPMs, mitigation measures, and the short-term and small-scale nature of exploratory drilling, Alternatives A, C, or D would result in minor impacts to fish and wildlife in the Tumbleweed II

Project Area. Although, any impact on wildlife habitats and behaviors incrementally adds to the cumulative effects of other activities on fish and wildlife within the planning area, these contributions would be minor. Cumulative impacts would not occur under the No Action Alternative.

4.2.5.7 Special Status Species

Alternatives A, C, or D would add to cumulative impacts to special status species from the loss of foraging habitats; breeding/nesting areas, and/or cover; habitat displacement; and mortality from past, present, and reasonably foreseeable future projects in the planning area. With the exception of potential depletions to Colorado River Basin and consequent impacts to the endangered Colorado River fish, based on Stewart's compliance with protective Federal stipulations regarding threatened and endangered species, implementation of the ACEPMs and mitigation measures, Alternatives A, C, or D would result in negligible impacts on special status species. Although, any impact on special status species incrementally adds to the cumulative effects of other land use projects on special status species within the Vernal planning area, these contributions would be minor. Cumulative impacts to threatened, endangered, candidate, and sensitive species would not occur under the No Action Alternative.

Declines in the abundance or range of many special status species (such as the endangered Colorado River fish) have been attributed to various human activities on Federal, State, and private lands, such as human population expansion and associated infrastructure development; construction and operation of dams along major waterways; water retention, diversion, or dewatering of springs, wetlands, or streams; recreation, including off-road vehicle activity; expansion of agricultural or grazing activities, including alteration or clearing of native habitats for domestic animals or crops; and introductions of non-native plant, wildlife, or fish or other aquatic species, which can alter native habitats or out-compete or prey upon native species. Many of these activities are expected to continue on State and private lands within the range of the various Federally-protected wildlife, fish, and plant species, and could contribute to cumulative effects to the species that would occur as a result of Alternatives A, C, or D. Species with small population sizes, endemic locations, or slow reproductive rates, or species that primarily occur on non-Federal lands where landholders may not participate in recovery efforts, would generally be highly susceptible to cumulative effects.

Reasonably foreseeable future activities that may affect river-related resources in the area include oil and gas exploration and development, irrigation, urban development, recreational activities, and activities associated with the Upper Colorado River Endangered Fish Recovery Program. Implementation of all or any of these projects has affected and continues to affect the environment including but not limited to water quality, water rights, socioeconomic, and wildlife resources.

4.2.5.8 Recreation

The CIAA for recreation includes the Vernal planning Area, and the Book Cliffs hunting units as established by the UDWR, respectively.

Implementation of Alternatives A, C, or D would contribute to the loss of primitive and unconfined recreational opportunities in the CIAA and result in an increase in OHV use; however, these contributions would be minor.

Impacts from the Tumbleweed project would also cumulatively add to a loss of hunting opportunities in the Book Cliffs. However, the Tumbleweed II Project Area constitutes only a fraction of the limited entry Book Cliffs Hunting Units, which for mule deer and elk incorporates a substantial portion of Uintah and Duchesne Counties, and for cougar and black bear incorporates a substantial portion of Uintah and Grand Counties (UDWR 2007b; UDWR 2007c; UDWR 2007d). Given that activities would be short-term and

small-scale, impacts to the CIAA would be minor. It is not anticipated that the Alternatives A, C, or D would result in a reduction in the number of permits issued by the UDWR or change the allowed uses of the land within the Tumbleweed II Project Area, which currently includes hunting.

4.2.5.9 Cultural Resources

The CIAA for cultural resources is the Tumbleweed II Project Area. Cumulative impacts on cultural resources in the CIAA would primarily result from activities associated with surface and subsurface disturbance such as oil and gas development projects, increased visitation to the Tumbleweed II Project Area, recreational/OHV use, and fire management. Impacts may result from specific cultural resource management decisions and from non-surface-disturbing activities that create atmospheric, visual, and/or auditory effects. These latter impacts would apply to sites or locations that together comprise the overall cultural experience for all visitors to the area, and especially to those deemed sacred or traditionally important by Native American Tribes and used by these groups in such a manner that atmospheric change, visual obstructions, and/or noise levels impinge upon that use. These types of impacts cumulatively affect not only the historic setting, feeling, and viewshed of cultural properties, but also their eligibility potential for nomination to the NRHP.

Based on cultural survey and avoidance requirements outlined in **Section 2.1.14.2**, the Tumbleweed project would likely have no direct impacts on known cultural resources or historic properties within the CIAA, and direct impacts to unidentified cultural resources or historic properties would be expected to be negligible. The greatest cumulative threat to cultural resources would be indirect impacts. When considered alongside other past, present, and RFD actions, the impacts of Alternatives A, C, or D may cumulatively and incrementally impact unknown cultural resources in the CIAA by introducing atmospheric, visual, and auditory intrusions on the landscape. In addition, secondary surface activities (e.g., increased vehicular and pedestrian traffic) may also cumulatively and incrementally impact unknown cultural resources in the CIAA by increasing the potential for vandalism, surface artifact collection, illegal excavation of artifacts, and fugitive dust and erosion from OHV or other motorized vehicle use. Collectively, these potential project-related impacts could result in irreversible damage to, or loss of, important cultural resources across the CIAA, or contribute to an alteration of the overall historical setting within the CIAA. However, these contributions would be expected to be minor due to the small size of the project and provisions to reduce, minimize, or avoid project-specific and cumulative impacts on cultural resources.

As noted in **Sections 2.1.14** and **2.1.15**, the project alternatives incorporate several required measures and ACEPMs that are intended to reduce, minimize, or avoid project-specific and cumulative impacts on cultural resources. In addition, many potential cumulative impacts on cultural resources would be reduced or eliminated through the implementation of Federal regulatory laws, actions, and guidelines designed to protect cultural resources, and through the consultation process with the Utah SHPO and Native American Tribal representatives.

4.2.5.10 Air Quality

The CIAA for air quality is the Uinta Basin. Cumulative air quality impacts are defined as the combination of emissions resulting from the Proposed Action, existing nearby permitted sources, and Reasonably Foreseeable Development (RFD) within the region. Areas of concern include the Uinta Basin, the High Uinta Wilderness Area, as well as nearby mandatory federal PSD Class I areas such as Arches and Canyonlands National Parks and Flat Tops Wilderness. Potential Air Quality Related Value (AQRV) impacts to sensitive areas include regional impacts on visibility, total nitrogen and sulfur deposition, and Acid Neutralization Capacity (ANC).

Air quality assessments presented in the technical support document (BLM 2005) for the Vernal RMP and Final EIS (BLM 2008d) have recently addressed the impacts to air quality in the Uinta Basin and surrounding areas of special concern, considering both existing permitted sources and an extended look at development over a fifteen year timeframe. The development alternatives were based on BLM's proposed plans for resource development, which included estimates for the number of wells drilled for oil and gas, compressor stations, and pipelines, along with other foreseeable development activities by non-BLM entities. In general, results from this analysis, and based on Reasonable Development Scenarios in conjunction with existing sources, indicate that existing air quality in the region is good.

In particular, based upon recent regional and large-scale air analyses, cumulative well development activities in the Uinta Basin are not expected to affect attainment of NAAQS standards or regional PSD increments. Existing and RFD stationary sources including compressor engines and turbines, while of greater concern, are anticipated to be adequately spaced to allow for favorable dispersion conditions. For a much larger project within the Uinta Basin analyzing approximately 800 wells, a cumulative analysis looked at air quality impacts for comparison to the NAAQS, except for ozone, and found that project impacts would not result in any exceedance of any non-ozone NAAQS. Additionally, the cumulative effects analysis on visibility impairment within nearby Class I and selected Class II areas found that potential changes in visibility and acid deposition were within acceptable guidelines (*West Tavaputs Plateau Natural Gas Full Field Development Plan Draft Environmental Impact Statement* UT-070-05-055, BLM, February 2008). Based upon this qualitative comparison, the addition of 9 wells to the Uinta Basin will not cause any exceedance of any non-ozone NAAQS, or adversely impact visibility within nearby Class I and Class II areas.

Several oil and gas exploration and development projects are underway or proposed within the Uinta Basin. Implementation of the Proposed Action (or Alternatives C or D) would cumulatively contribute insignificant emissions levels to the area immediately adjacent to the Project Area and within the greater Uinta Basin.

Temporary incremental increases in emissions of NOx, SO_2, CO, and VOCs from the Proposed Action (or Alternatives C or D) during development would be expected to occur in the short term from mobile combustion sources associated with construction and drilling equipment and the temporary increase in vehicle traffic.

In general, the increase in emissions associated with Alternatives A, C, or D would be localized, in some cases temporary (well development phase), and on a much smaller scale in comparison with regional emissions. BLM requires operators to comply with all applicable air quality regulations. In addition, the project proponent has committed to additional mitigation measures to further reduce the already negligible emissions levels from the project.

The Proposed Action would not result in any appreciable cumulative air quality impacts. Impacts to air quality from development would be short term and entirely negligible. No cumulative effects from project operation emissions are anticipated based upon the negligible emission levels and the temporary nature of the emissions from the proposed project activities.

Ozone

For regional ozone issues, when the emissions inventory for the production phase of the Proposed Action is compared to the regional emission inventory compiled during the WRAP Phase III study for the Uinta Basin, 2006 Baseline Emissions, (WRAP, 2009), it can be seen from **Table 4-10** that the VOC and NOx emissions from the Proposed Action comprise a small percentage of the WRAP baseline emissions.

Table 4-10. Proposed Action versus 2012 WRAP Phase III Emissions Inventory Comparison

Species	Proposed [a] Action Production Emissions (ton/yr)	WRAP Phase III 2012 Uintah Basin Emission Inventory [b] (ton/yr)	Percentage of Proposed Action to WRAP Phase III
NO_x	4.3	16,547	0.03%
VOC	10.4	127,495	0.01%

[a] see Table 4-2
[b] http://www.wrapair.org/forums/ogwg/PhaseIII_Inventory.html Uintah Basin Data

The WRAP Phase III baseline inventory for the Uinta Basin for VOC emissions in 2006 was 71,546 tons/yr. For 2012, the NOx and VOC emissions are projected at 16,547 and 127,495 ton/yr, respectively. Potential VOC emissions from the Proposed Action represent only 0.01% of the total 2012 VOC estimated emissions for the region, and potential NOx emissions from the Proposed Action represent only 0.03% of the total 2012 VOC estimated emissions for the region.

Based on the magnitude of the projected increase in VOC emissions for the Uinta Basin from 2006 to 2012, and the inconsequential contribution that would be emitted from the Proposed Action, an accurate analysis of potential ozone impacts from the Proposed Action is not feasible. Any cumulative ozone impacts from the Proposed Action would be indistinguishable from, and dwarfed by, the margin of uncertainty associated with the regional cumulative VOC and NOx emission inventory. Thus the potential cumulative ozone impact from the Proposed Action cannot be modeled with any accuracy due to the level of the emissions from the Proposed Action, the size of the project, and the lack of model sensitivity. When compared to regional emissions inventories, the amounts of ozone precursors emitted from the Proposed Action are not expected to have a measurable contribution or effect on regional ozone formation.

The Independent Petroleum Association of Mountain States (IPAMS), in cooperation with the oil and gas operators in the Uinta Basin, the Bureau of Land Management (BLM), and other regulatory agencies conducted the Uinta Basin Air Quality Study (UBAQS) to estimate changes to air quality and air quality related values (AQRV) within the Uinta Basin that may result from future industrial activity, including oil and gas development.

Data used as input for the UBAQS consisted of the most complete, accurate and current emissions and meteorological data available. Emissions data included the WRAP Phases II and III inventories for oil and gas sources in addition to other non-oil and gas emissions sources.

Scaling factors, based on expected rates of development, were applied to the baseline emissions 2006 inventory, and "on-the-books" regulations were applied to the uncontrolled 2012 emissions projections to generate the final 2012 emissions projections by county for the six-county focus area of the UBAQS that comprises the Uinta Basin.

The Uinta Basin Air Quality Study (UBAQS) model results indicate that average ambient concentrations of criteria pollutants will remain below the NAAQS within the six-county Uinta Basin area. Specifically, the UBAQS results estimated that the Uinta Basin would be in attainment of the 8-hour ozone NAAQS for 2012 (Uinta Basin Air Quality Study (UBAQS), Executive Summary and Overview, IPAMS, June 2009)

In terms of cumulative effects from the Tumbleweed II project, the Proposed Action is within the modeled scope of projected development, and as such, would not violate, or otherwise contribute to any

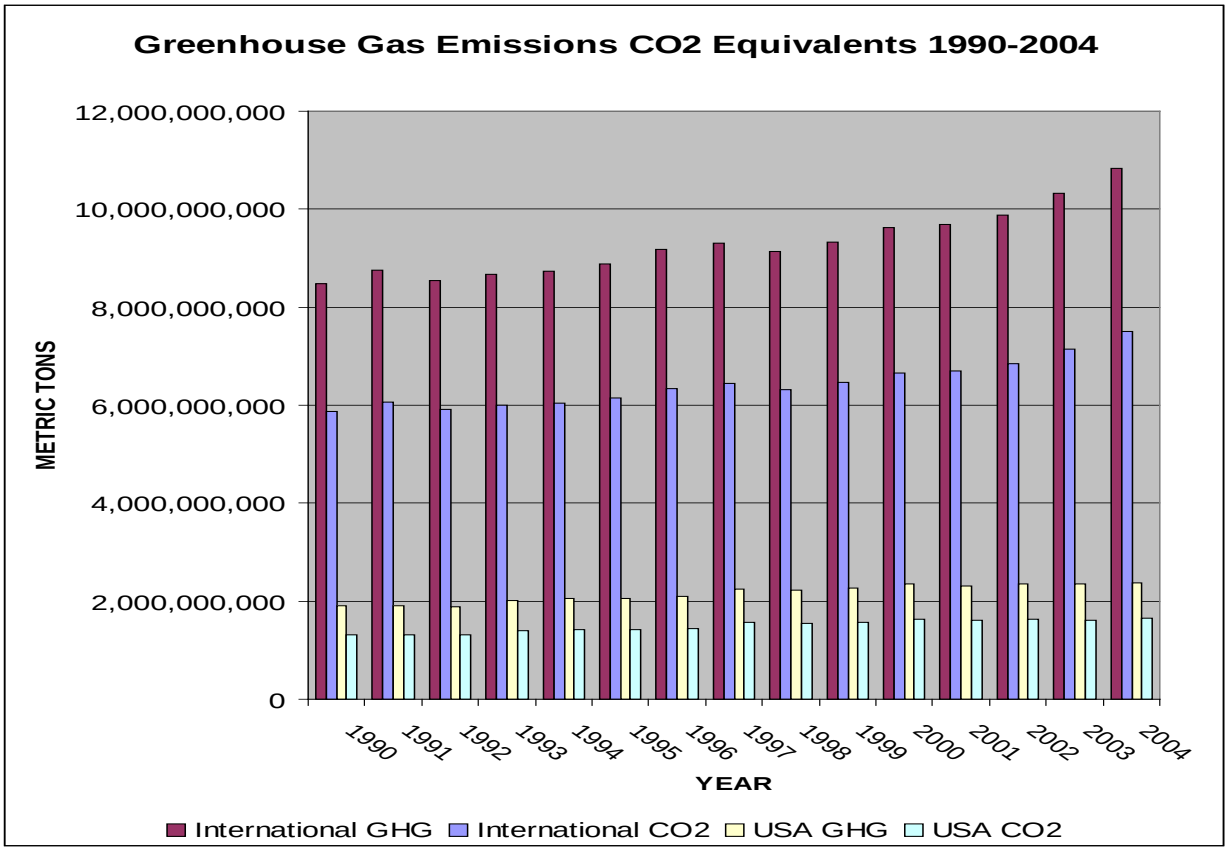
violation, of any applicable air quality standard, and it would not contribute to any projected future potential exceedance of any applicable air quality standards.

Greenhouse Gas (GHG) Emissions

The extent of climate change effects, and whether these effects prove harmful or beneficial, will vary by region, over time, and with the ability of different societal and environmental systems to adapt to or cope with the change (IPCC, 2007).

The IPCC concludes that "impacts of climate change will vary regionally but, aggregated and discounted to the present, they are likely to impose net annual costs which will increase over time as global temperatures increase." The IPCC estimates that for increases in global mean temperature of less than 1-3°C (1.8-5.4° F) above 1990 levels, some places and sectors will see beneficial impacts while others will experience harmful ones. Some low-latitude and polar regions are expected to experience net costs even for small increases in temperature. For increases, in temperature greater than 2-3°C (3.6-5.4°F), the IPCC says it is likely that all regions will experience either declines in net benefits or increases in net costs. "Taken as a whole," the IPCC concludes, "the range of published evidence indicates that the net damage costs of climate change are likely to be significant and to increase over time."

The following chart shows the trend in global and USA total GHG and CO_2 from fossil fuel combustion from 1990 to 2004, the latest year that data are readily available. USA emissions rose until 2000, and then have been relatively constant to present. However, worldwide GHG emissions have steadily risen from approximately **8.5 billion metric tons** per year in 1990 to **10.8 billion metric tons** per year in 2004, an increase of 27.1 percent. Although data are not readily available, it is reasonable to expect international GHG emissions have continued to increase beyond 2004 levels because of the economic development especially in China and India. EPA data indicate that USA emissions have been relatively constant beyond 2004 levels (EPA 2008a).



Source: http://www.epa.gov/climatechange/economics/international.html

Estimated GHG emissions from the Proposed Action are on the order of 8,100 metric tons. When compared to annual GHG emissions for the United States and worldwide, potential emissions from the Tumbleweed project are substantially less (see **Table 4.11)**.

Table 4.11. Comparison of Tumbleweed II EA Greenhouse Gas Emissions to 2004 USA and Global Totals (metric tons/year)

Tumbleweed GHG Emissions	8,100
Tumbleweed % of USA GHG Emissions	0.0004%
Tumbleweed % World GHG Emissions	0.0001%

In light of the uncertainties of the spatial distribution of precipitation pattern changes, global warming could cause the Uinta Basin to warm if GHG emissions increase and if the long-term computer models are correct. At the same time, precipitation could increase or decrease. If precipitation decreases, semi-arid desert conditions could worsen in the Uinta Basin. However, if precipitation increases, vegetation could increase in the Uinta Basin.

The assessment of GHG emissions and climate change is still in its earliest stages of formulation. At present, under current scientific data and models, it is not technically feasible to know with any certainty the net impacts to climate due to global emissions, let alone regional or local emissions. The inconsistency in results of scientific models used to predict climate change at the global scale, combined with the lack of scientific models designed to predict climate change on regional or local levels, prohibits the ability to quantify potential future impacts of decisions made at the local level, particularly for small scale projects such as the Proposed Action.

Drilling and development activities from the Proposed Action would contribute a negligible amount of hydrocarbon emissions, including GHGs, released into the local airshed. The incremental contribution to global GHG gases from the Proposed Action cannot be currently analyzed to provide potential effects at the present time.

4.2.5.11 Visual Resources

The CIAA for visual resources is the Vernal Planning Area. Oil and gas activities are the predominant source of modification to the visual landscape within the CIAA. Other activities which could potentially have an impact on the scenic quality of the landscape are OHV use, trial and/or road development, vegetation manipulation, and fire management.

Construction and operation of natural gas facilities and associated features such as roads and pipelines within the Project Area would incrementally contribute to the loss of naturalness within the Book Cliffs region and greater Uinta Basin. Implementation of Alternatives A, C, or D would introduce new elements of line, form, color, and texture contrast with the existing landscape.

All activities that occur on Federal lands in the CIAA are required to conform to the VRM Class objectives set forth in the Vernal Approved RMP. The VRM system provides the BLM with a way to identify and evaluate scenic values, preserve those scenic vistas that are deemed most important, and to design or mitigate visual intrusions to the extent possible in other areas.

Lands managed by the State of Utah, the Ute Indian Tribe, or private individuals that are interspersed with BLM-administered lands in the Vernal planning area do not have requirements relating to the protection of visual resources. Therefore, activities proposed on these lands would contribute to cumulative visual impacts across the CIAA.

4.2.5.12 Non-WSA Lands with Wilderness Characteristics

The CIAA for wilderness characteristics is within the Vernal planning area as a whole. Included in the cumulative impact analysis are all lands found by BLM to possess wilderness characteristics since 1996. These areas possess all of the values needed for wilderness including size, naturalness, and opportunities for solitude or primitive and unconfined recreation.

During the wilderness characteristics review between 1996 and 2007, there were 411,319 acres re-inventoried by BLM (see Chapter 3, Vernal Proposed Plan/Final EIS) of which 133,723 acres were found not to have wilderness characteristics. Of the 277,596 acres found to have wilderness characteristics, 106,198 acres are protected, preserved, and maintained for their wilderness values in the Vernal ROD as BLM natural areas. In accordance with management prescriptions in the ROD, these areas would remain in a pristine state. The remaining 171,398 acres do not have prescribed management to protect the wilderness values, and allow for uses that can degrade the wilderness characteristics of these areas. The Wolf Point wilderness characteristics area falls within this latter category of lands.

Alternatives A, C and D would preclude BLM from preserving the wilderness values in the Wolf Point wilderness characteristics area due to surface disturbance associated with proposed natural gas development. It is expected that all 11,802 acres of the Wolf Point wilderness characteristics area would no longer retain wilderness characteristics due to the additive and cumulative effects of oil and gas development.

Loss of the 11,802 acres of wilderness characteristics lands in Wolf Point area would result in the loss of 4 percent of all 277,596 acres of non-WSA lands with wilderness characteristics in the Vernal Field Office. Of the 178,398 acres that were not carried forward for their protection, preservation and maintenance of wilderness values in the Vernal ROD, 6.9 percent of that land base would be foregone based on development of the Wolf Point area.

Additional reasonably foreseeable oil and gas development could affect other non-WSA lands with wilderness characteristics within the Vernal Field Office area. Other past and present oil and gas projects that have been approved and could or already have impacted non-WSA wilderness characteristics lands in the White River area include Kerr McGee's Bonanza project, Enduring Resource's West Bonanza project, the Resource Development Group (RDG) project, Enduring Resources' Rock House Project, and Kerr McGee's Greater Natural Buttes project. The Resources Development Group (RDG) project and Enduring Resource's Big Pack EA would impact the Lower Bitter Creek non-WSA lands with wilderness characteristics. Stewart's Tumbleweed EA has impacted the Wolf Point non-WSA lands with wilderness characteristics. XTO's Kings Canyon EA, Gasco's EIS, EOG's 8 Alger Pass Wells EA, and Uintah County's As-is-Where-is Road UTU69125-20 would impact the Desolation Canyon non-WSA lands with wilderness characteristics. Cochrane's Horse Point Well EA would impact the Hideout Canyon non-WSA lands with wilderness characteristics.

5.0 CONSULTATION AND COORDINATION

5.1 CONSULTATION, COORDINATION, AND PREPARATION

The persons and agencies coordinated in preparation of the Tumbleweed Exploratory Drilling Project EA are identified in **Table 5-1**. The purpose and authorities for the consultation, and findings/conclusions are also provided in **Table 5-1**.

Table 5-1. List of Persons, Agencies, and Organizations Consulted.

Agency/Organization	Purpose & Authorities for Consultation or Coordination	Findings & Conclusions
U.S. Fish & Wildlife Service	Section 7 Consultation under the Endangered Species Act (16 USC 1531) and EA Preparation and Review	Formal Section 7 Consultation with the USFWS over the original *Tumbleweed Exploratory Drilling EA (EA-UT-080-05-201)* was concluded on September 13, 2007, in a letter and Biological Opinion from the USFWS to the BLM VFO. The revised Tumbleweed II EA has not changed to the extent that re-initiation of consultation would be necessary. The USFWS has determined that additional consultation is not required (see **Appendix F**). In addition, the USFWS played an active role in the development of this EA as a member of the BLM's IDT under the Pilot Office Project. Section 365 of the Energy Policy Act of 2005 established the Federal Permit Streamlining Pilot Project to improve coordination of oil and gas permitting on Federal mineral estate as a means of meeting the Nation's need for dependable, affordable, environmentally responsible energy. Pilot Offices are intended to be innovators in better coordination of the permitting that allows efficient development and the inspection & enforcement that help ensure environmental responsibility. The USFWS, which participates in the Pilot Office Project provided direct input as a non-BLM preparer of this EA (see Table 5-3 and Appendix A).
Utah State Historical Preservation Office	Section 106 Consultation.	Section 106 consultation was formally initiated between the BLM and Utah SHPO on December 3, 2008. See **Appendix F** of the EA for SHPO consultation documentation and SHPO's no adverse effect concurrence. Consultation for this project is considered to be closed for those portions of the project that have had a Class III survey completed (i.e., the proposed well pads, roads, and pipeline corridors for the TUF #18-9, TUF #17-4, and TUF #17-12) as each of these reports recommended a "no historic properties affected" determination. Section 106 consultation will be re-initiated on a site-specific level as appropriate, following receipt of any site-specific

Agency/Organization	Purpose & Authorities for Consultation or Coordination	Findings & Conclusions
		applications and prior to any surface disturbance at new locations and if previously unknown sites are found during surface-disturbing activities.
Native American Tribes	Native American Consultation	Native American Tribal consultation was formally initiated by the BLM on December 8, 2008. The following tribes were contacted: White Mesa Ute, Ute Mountain Ute, Ute, Southern Ute, Hopi, Navajo Nation, Laguna Pueblo, Zia Pueblo, Santa Clara Pueblo, Eastern Shoshone, and Northwest Band of Shoshone. The Laguna Pueblo responded on December 18, 2008 and stated that no significant impacts would occur, but requested that they be notified if additional sites are found. No other responses were received. See **Appendix F** of the final EA for consultation documentation from interested Native American Tribes. Consultation for this project is considered to be closed for those portions of the project that have had a Class III survey completed. Native American consultation will be re-initiated on a site-specific level as appropriate, following receipt of any site specific applications and prior to any surface disturbance at new locations and if previously unknown sites are found during surface-disturbing activities.
EPA	General Coordination	The EPA was provided a copy of the draft EA for their review and comment. The BLM did not receive any comments from the EPA. However, the Tumbleweed II Project Area falls within Indian Country, thus air quality (as well as water quality) for the area is within the jurisdiction of the EPA. As stated in Chapter 2 of the EA, as required by the EPA, Stewart would obtain all necessary air quality permits to construct, test, and operate facilities.
USACE	EA Preparation and Review	The USACE played an active role in the development of this EA as a member of the BLM's IDT under the Pilot Office Project. Section 365 of the Energy Policy Act of 2005 established the Federal Permit Streamlining Pilot Project to improve coordination of oil and gas permitting on Federal mineral estate as a means of meeting the Nation's need for dependable, affordable, environmentally responsible energy. Pilot Offices are intended to be innovators in better coordination of the permitting that allows efficient development and the inspection & enforcement that help ensure environmental responsibility. The USACE, which participates in the Pilot Office Project provided direct input as a non-BLM preparer of this EA (see **Table 5-3** and **Appendix A**).

Agency/Organization	Purpose & Authorities for Consultation or Coordination	Findings & Conclusions
State of Utah	EA Preparation and Review	The State of Utah, Division of Air Quality and Division of Wildlife Resources provided written comments on the original *Tumbleweed Exploratory Drilling EA (EA-UT-080-05-201)*. The agencies' comments have been incorporated into the content of this current EA as appropriate. In addition, the UDWR provided wildlife information (e.g., GIS shapefiles, wildlife population data, etc.) for the wildlife analyses within this EA.
Uintah County	EA Preparation and Review	Uintah County played an active role in the development of this EA as a Cooperating Agency (CA) for this project. In their role as a CA, Uintah County representatives provided direct input as a non-BLM preparer of this EA (see **Table 5-3** and **Appendix A**).

5.2 SUMMARY OF PUBLIC PARTICIPATION

This EA was preceded by the original *Tumbleweed Exploratory Drilling Environmental Assessment (EA-UT-080-05-201)* (BLM 2007a), for which a Decision Record and FONSI were signed on September 21, 2007. Since September 2007, a number of events have occurred that have prompted the publication of this current Tumbleweed II EA, including for example, an appeal and State Director remand of the original 2007 Decision Record; completion of the new Vernal RMP; BLM approval and subsequent rescinding of two Categorical Exclusions for two additional wells in the area; addition of an air quality analysis to Chapters 3 and 4; addition of a directional drilling alternative, etc. Detailed information on the history of the Tumbleweed exploratory drilling project is included in Appendix B. Public participation for the Tumbleweed II Draft EA (DOI-BLM-UTG010-2009-0090-EA) was initiated with the posting of the proposed project on the BLM's Environmental Notice Bulletin Board (ENBB) in November, 2008. All comments submitted for the previously published EA UT-080-05-201 which are still applicable and within the context of the new RMP, were taken into account as this new EA was written.

The Tumbleweed II EA was provided to the public for a 15+ day review and comment period, which ended on October 16, 2009. The BLM received 22 comment letters on the project; 21 of which encouraged BLM's approval of the project; two of which (including one of the aforementioned support letters) offered additional information and comments for the BLM to consider. All substantive comments and BLM's response to those comments are summarized in Table 5-2. If any clarifications or modifications to this EA were made as a result of public comments, the BLM's responses in **Table 5-2** indicate where in the document and to what extent modifications were implemented.

Table 5-2. Response to Comments

Commenter	Comment	BLM Response
SUWA	The Tumbleweed II EA prematurely dismisses the directional drilling alternative previously provided by Mr. Ken Kreckel on behalf of SUWA (attached hereto). *See* EA at 29-30. The BLM refused to consider a directional alternative in the prior EA because it was supposedly premature and technically difficult. *See* 2007 EA at 27-28. The Tumbleweed II EA now admits that directional drilling is "economically" feasible and that it would fit the project applicant's goals. EA at 30. This demonstrates the impropriety of the BLM's rejection of Mr. Kreckel's analysis. NEPA clearly tasks the BLM with considering non-speculative, technically feasible alternatives. *See Utahns for Better Transp.*, 305 F.3d at 1172. Just because this alternatives may not be preferred by Stewart does not release the BLM from its obligation to fully consider it. *See Colorado Envtl. Coal.*, 185 F.3d at 1174. The Tumbleweed II EA does not say that Mr. Kreckel's alternative is technically infeasible, it simply says that it would be more difficult than vertical drilling. *See* EA at 30. Whether or not an option is "economically" feasible for Stewart, does not release the BLM from its NEPA obligation of considering that alternative. *See Colorado Envtl. Coal.*, 185 F.3d at 1174. The fact that the BLM and Stewart have already changed positions on directional drilling from the 2007 EA to the Tumbleweed II EA illustrates the fickleness of its current position disfavoring Mr. Kreckel's directional drilling proposal and shows that Mr. Kreckel was correct when he said that directional drilling could be done here.	SUWA's comment does not accurately reflect the rationale for dismissing Mr. Kreckel's suggested well pad locations, nor does SUWA's comment accurately reflect BLM's rationale for analyzing Alternative D in the Tumbleweed II EA. Alternative D specifically responds to issues raised by Southern Utah Wilderness Alliance (SUWA) and Mr. Ken Kreckel about directional drilling during the comment period for the 2007 Tumbleweed EA (*Tumbleweed Exploratory Drilling EA* (*EA UT-080-05-201*)).The text that SUWA refers to (EA page 30) would be more correctly paraphrased by the following: "*the well pad locations recommended by Mr. Kreckel would not allow Stewart Petroleum to access their targeted reserves and [thus] would not meet the purpose and need for the project. However, the BLM and Stewart have determined that additional directional drilling from alternate well pad locations would be technically and economically feasible… The locations of the well pads as proposed under* ***Section 2.4*** *are based on the operator's proprietary seismic data for the Tumbleweed Unit, as well as knowledge gained and lessons learned during the drilling and completion of the TUF #18-9.*" Alternative D complies with case law requiring alternatives to the Proposed Action to be both "non-speculative . . . and bounded by some notion of feasibility." Also, page 5 of Mr. Kreckel's comments on the 2007 Tumbleweed EA stated that the BLM "*should adopt [Mr. Kreckel's alternative] or a similar directional alternative*". Mr. Kreckel's comments also stated that, "*as the operator is the one who is proposing operations…the operator should bear the responsibility of showing why a directional alternative is not feasible, or suggesting one of its own*." Alternative D satisfies Mr. Kreckel's suggestion for a "similar" directional alternative. Alternative D achieves SUWA's and Mr. Kreckel's goal of reducing surface disturbance and impacts to wilderness characteristics, but does so in a way that is actionable from both a technical and economic standpoint of the applicant. NEPA does not require BLM to conduct a "separate analysis of alternatives which are not significantly distinguishable from alternatives actually considered, or which have substantially similar consequences." *Headwaters, Inc. v. BLM*, 914 F.2d 1174, 1181 (9th Cir. 1990). Alternative D was developed using new drilling information that is now available as a result of the TUF #18-9 (i.e., data that became available subsequent to the completion of the 2007 Tumbleweed EA). This alternative: 1) responds to SUWA and Mr. Kreckel's suggestion that a directional drilling alternative be analyzed; 2)

Commenter	Comment	BLM Response
		is based on proprietary 3D seismic and geologic data from the TUF #18-9; and 3) is technically and economically feasible. Because Mr. Kreckel did not have access to the operator's proprietary 3D seismic and geologic data, his suggested well pad locations did not take into account the modeled locations of sub-surface natural gas reservoirs, nor did they include consideration of the technical difficulties experienced by the operator during the drilling and completion of the TUF #18-9 well. The reservoir data from the operator's 3D seismic data and "lessons learned" from the downhole issues experienced in drilling the TUF #18-9 were, however, taken into consideration by the operator and BLM when determining the potential well pad locations illustrated in Alternative D. With this new, technical information in mind, much of which was not available until after the 2007 Tumbleweed EA was published, the BLM does now contend that additional directional drilling may be feasible, not solely because it is economically feasible for the operator, but because there are more data available to develop a reasonable directional drilling alternative. BLM's inclusion of Alternative D in the Tumbleweed II EA is an example of how the NEPA process is intended to work; the BLM is charged with using the best available information. For this exploratory project, more information became available to the BLM following the operator's completion of the first exploratory well. The results of the TUF #18-9 provided additional, site-specific information that the BLM and Stewart needed in order to make informed decisions on where well pads need to be located to make additional directional drilling technically and economically feasible. These data allowed the BLM to develop and fully evaluate the directional drilling alternative that comprises Alternative D.
SUWA	The Federal Land Policy and Management Act (FLPMA) requires the BLM to ensure that its approval of the EA complies with all applicable air quality standards. See 43 U.S.C. § 1712(c)(8) (requiring BLM to "provide for compliance with applicable pollution control laws, including State and Federal air … pollution standards or implementation plans"). Regulation extends this same requirement to all BLM leases, permits, and other land use authorizations. See 43 C.F.R. § 2920.7(b)(3) (requiring that BLM "land use authorizations shall contain terms and conditions which shall … [r]equire compliance with air … quality	The BLM assumes SUWA's reference to the Big Pack EA is an error. However, the Tumbleweed II project would be in compliance with the Approved RMP as described in Section 1.4 of the EA, SUWA is also directed to Sections 2.1.14.1 and 2.1.15.1 of the EA, which clearly state the applicant would be subject to the listed air quality requirements and applicant-committed air quality measures. As disclosed in section 4.2.1.9, based on the model results and the negligible amount of project-specific emissions, the Proposed Action is not likely to violate, or otherwise contribute to any violation of any applicable air quality standard, and may only contribute a small amount to any projected future potential exceedance of any applicable air quality standards. The other alternatives would have similar impacts.

Commenter	Comment	BLM Response
	standards established pursuant to applicable Federal or State law"). The Vernal Resource Management Plan (RMP) also requires that BLM comply with Federal, State, and local air quality laws and regulations. Vernal RMP at 2-16; Record of Decision and Approved Resource Management Plan for the Vernal RMP (October 2008). All "resource management authorizations and actions" – such as BLM's approval of the development project described in the Big Pack EA – must conform to this land use plan direction. 43 C.F.R. § 1610.5-3(a); see also 43 U.S.C. § 1732(a) (Secretary "shall manage the public lands … in accordance with the land use plans").	
SUWA	The Tumbleweed II EA's $PM_{2.5}$ (particulate matter 2.5 microns in diameter or smaller) background data is severely flawed and as a result the EA understates the impacts of this air pollutant in the project area. The EA states that the current ambient concentration of $PM_{2.5}$ for the 24-hour average maximum is 25 $\mu g/m^3$. EA at 49. It attributes the source of this data to Dave Prey from the Utah Division of Air Quality (DAQ) based on "personal communications from January 11 and June 13, 2008. *Id.* However, DAQ has specifically asked BLM not to use these figures or to attribute them to DAQ. More importantly, monitoring in Vernal, Utah shows that the background levels of $PM_{2.5}$ are significantly higher than 25 $\mu g/m^3$. The BLM must abandon this figure of 25 $\mu g/m^3$ and instead adopt a background figure based on actual monitoring in the Uinta Basin, placing this background level closer 60 $\mu g/m^3$. On August 11, 2009 DAQ sent the BLM a letter asking that it not use the background figure of 25 $\mu g/m^3$ for the 24-hour average maximum of $PM_{2.5}$. *See* Letter	Project-specific $PM_{2.5}$ contributions during the development and operational phases of the Proposed Action are expected to be negligible as summarized in Tables 4-4 and 4-5. The Final EA has been modified to acknowledge new background concentrations for $PM_{2.5}$ based on coordination between the UDAQ and the BLM State Office Air Quality Specialist. The state of Utah currently does not require PM2.5 modeling for new sources and does not have an official background. The UDAQ conducted limited monitoring $PM_{2.5}$ in Vernal, Utah in December 2006. During the 2006-2007 winter season, $PM_{2.5}$ levels were measured at the Vernal monitoring station higher than the new $PM_{2.5}$ health standard that became effective in December 2006. The $PM_{2.5}$ concentrations presented in Tables 3-8, 4-4, and 4-5 of the Final EA represent 98th percentile values from the limited $PM_{2.5}$ monitoring conducted in Vernal, Utah in 2007. The smaller figure of the 24-hour averaging period (15 μg/m3) is representative of average summer concentrations, while the larger value (52 μg/m3) is representative of winter inversion conditions, based on this limited monitoring. The State of Utah is in the process of identifying areas that are experiencing high $PM_{2.5}$ levels and identifying potential strategies to improve wintertime air quality in those areas. The sources of elevated $PM_{2.5}$ concentrations during winter inversions near Vernal, Utah haven't been identified as of yet. Based on experiences and studies in other areas of the Rocky Mountain west and the emission inventory in the Uinta Basin, potential sources and controls can however be tentatively identified.

Commenter	Comment	BLM Response
	from Bryce Bird, DAQ, to Stephanie Howard, BLM (Aug. 11, 2009) (DAQ Letter) (attached hereto). The DAQ letter stated that the BLM had been citing DAQ, specifically to Dave Prey personal communications from January 11 and June 13, 2008, among others, for its $PM_{2.5}$ background concentration figures. DAQ Letter at 2. DAQ then specifically asked the BLM to stop citing these sources and this figure. *Id.* The BLM cannot use or cite to this $PM_{2.5}$ 24-hour average maximum figure in the Tumbleweed II EA. The Utah Division of Air Quality had a $PM_{2.5}$ monitor in Vernal from approximately December 2006 to December 2007 which shows that $P.M_{2.5}$ concentrations in the Uinta Basin often significantly exceed the background figure assumed in the EA. *See* DAQ, $PM_{2.5}$ Actual Concentration (24-hour average) in Micrograms per Cubic Meter, January 2007, http://www.airmonitoring.utah.gov/dataarchive/PM25JAN07.pdf, February 2007, http://www.airmonitoring.utah.gov/dataarchive/PM25Feb07.pdf (Vernal data is listed under "VL"). $P.M_{2.5}$ is extremely harmful to human health and its ambient concentration is limited by NAAQS to 35 $\mu g/m^3$. Air quality monitoring data from winter 2007 shows that $PM_{2.5}$ has reached concentrations as high as 63.3 $\mu g/m^3$. *Id.* To adequately protect human health and understand the true environmental impacts of this project the BLM must adopt a $PM_{2.5}$ baseline for purposes of modeling that is more reflective of the actual data collected in the area. This means that the EA should have used a baseline with either the highest figure from 2007 (63.3 $\mu g/m^3$) or the highest from 2009 (60.9 $\mu g/m^3$) concentration reading from the Vernal monitor. On September 3, 2009 the Environmental Protection	In Utah elevated $PM_{2.5}$ concentrations along the Wasatch Front are associated with secondarily formed particles from sulfates, nitrates, and organic chemicals from a wide variety of sources (UDAQ, 2006). In the Cache Valley of northern Utah approximately half of ambient $PM_{2.5}$ during elevated concentrations are composed of ammonium nitrate, most likely from agricultural operations, with the rest from combustion, primarily mobile sources and woodstoves (Martin, 2006). For comparison, $PM_{2.5}$ in most rural areas in the western United States is typically dominated by total carbonaceous mass and crustal materials from combustion activities and fugitive dust respectively (EPA, 2009). As the Uinta Basin is neither a major metropolitan area as found on the Wasatch Front, nor has significant agricultural activities as found in Cache Valley, the most likely causes of elevated $PM_{2.5}$ at the Vernal monitoring station are probably those common to other areas of the western US (combustion and dust) plus nitrates and organics from oil and gas activities in the Basin. Typical combustion controls include burning restrictions such as open burning and woodstove bans during poor air quality, and improvements in combustion devices such as woodstove change-out programs. Mobil combustion controls include diesel engine retrofitting (school bus retrofits for example), clean fuels (low sulfur diesel), and vehicle miles travelled reduction programs. Oil and gas industry precursor controls include nitrogen oxide engine controls such as catalytic reduction, ignition retard, and newer low emission engines (Tier II or better). Though volatile organic compound (VOC) control measures are usually not required in $PM_{2.5}$ nonattainment areas unless it is demonstrated that their presence contributes significantly to $PM_{2.5}$ concentrations, their dual application in reducing ozone precursor gases suggest it may be prudent to include VOC controls in the overall emission control package. Examples of oil and gas VOC controls include flaring, green completions, vapor recovery, dehydrator and pneumatic controls, and fugitive leak detection. The winter inversion $PM_{2.5}$ value does not represent typical conditions in the project area because the $PM_{2.5}$ monitoring location in Vernal, 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 measurably contribute to $PM_{2.5}$ concentrations in the region of the Proposed Action. Therefore,

Commenter	Comment	BLM Response
	Agency (EPA) provided SUWA with a letter indicating that during the winter of 2008 and 2009 monitors were functioning in Vernal, Utah that recorded extremely high maximum 24-hour average values for $PM_{2.5}$. *See* Letter from Stephen S. Tuber, EPA, to David Garbett, SUWA (Sep. 3, 2009) (attached hereto). This letter informed SUWA that a monitor was in Vernal during February and March of 2008 which recorded at least one exceedance of the national ambient air quality standard (NAAQS) of 35 $\mu g/m^3$ for the 24-hour average maximum concentration of $PM_{2.5}$. *Id.* at 2. In 2009, monitors operated in Vernal and Roosevelt from January 21 to March 5. *Id.* These monitors recorded four days of exceedances in Vernal and three days of exceedances in Roosevelt. *Id.* Concentrations in Vernal went as high as 60.9 $\mu g/m^3$. This information clearly shows that the background value of $PM_{2.5}$ is significantly higher than what the Tumbleweed II EA represents. The BLM must adopt this monitored data in the preparation of its EA.	the value for average summer conditions was used in analyzing $PM_{2.5}$ impacts from the Proposed Action.
SUWA	The EA completely fails to analyze potential contributions of this project to concentrations of ground-level ozone in the area. The BLM must model the likely contributions of the activities related to this project to ozone levels. The EPA has issued a new rule implementing a more stringent NAAQS standard for ozone. *See* National Ambient Air Quality Standard for Ozone, 73 Fed. Reg. 16,436 (March 27, 2008). The new NAAQS eight-hour standard for ozone set by the EPA is 75 parts per billion. Recently, the BLM released the West Tavaputs Plateau Natural Gas Full Field Development Plan Draft Environmental Impact Statement, UT-070-05-055 (February 2008) (WTP DEIS) (excerpts attached hereto). The WTP DEIS modeled resulting levels of ozone that would exceed this new NAAQS standard. *Compare* WTP DEIS at 4-18, *with* 73 Fed. Reg. at 16,436. Furthermore, 2008	Based on the limitations of modeling a project as small in size as Tumbleweed II project (as summarized below), the BLM, in cooperation with other regulatory agencies, IPAMS, and the oil and gas operators in the Uinta Basin, has obtained the best information possible to disclose potential effects from ground level ozone. As described in **Section 4.2.5.10** of the EA, the Uinta Basin Air Quality Study was conducted to estimate changes to air quality and air quality related values (AQRV) within the Uinta Basin that may result from future industrial activity, including oil and gas development. Data used as input for the UBAQS consisted of the most complete, accurate, and current emissions and meteorological data available. Emissions data included the WRAP Phases II and III inventories for oil and gas sources, in addition to other non-oil and gas emissions sources. Scaling factors, based on expected rates of development, were applied to the baseline emissions 2006 inventory, and "on-the-books" regulations were applied to the uncontrolled 2012 emissions projections to generate the final 2012 emissions projections by county for the six-county focus area of the UBAQS that comprises the Uinta Basin. The Uinta UBAQS model results indicate that average ambient concentrations of

Commenter	Comment	BLM Response
	monitoring in Dinosaur National Monument recorded ozone levels at 0.069 parts per million, which is very close to the NAAQS limit. *See* National Park Service Memorandum: Notice of December 19, 2008 Competitive Oil & Gas Lease Sale of Lands Proximal to Arches National Park, Canyonlands Park and Dinosaur National Monument (Nov. 24, 2008) at 2 (attached hereto). The EPA has also raised concerns regarding ozone analysis in the Vernal RMP. *See* Letter from Larry Svoboda, EPA, to Selma Sierra, BLM (Sept. 23, 2008) (attached hereto). The BLM must model the likely levels of ozone that will result from the project analyzed in the EA as it is possible that this project will also violate NAAQS for ozone. In addition, the EA must consider the cumulative effects of ozone emissions from all of the other ongoing and planned projects in the vicinity. The EA completely fails to undertake this analysis, dismissing ozone as an issue too large in scope for analysis in the EA. *See* EA at 7. However, the BLM has never prepared any cumulative ozone analysis in the Vernal Field Office for any project, ever. There is simply no basis for the agency to conclude that it may postpone this analysis for some other document, project, and planning phase. The EA may not rely on the Vernal RMP for ozone analysis [because] it ignored potential impacts of oil and gas activity on ozone pollution. *See generally* Letter from Vicki Stamper to Bill Stringer, BLM, Re: Comments on January 2005 Draft Resource Management Plan Amendment and Draft Environmental Impact Statement for the Vernal Field Office (March 31, 2005). The Air Quality Assessment Report for the Vernal and Glenwood Springs RMPs failed to analyze the contribution of volatile organic compounds (VOCs) or nitrous oxides (NOx) on ground level ozone and failed to do an ozone analysis.	criteria pollutants will remain below the NAAQS within the six-county Uinta Basin area. Specifically, the UBAQS results estimated that the Uinta Basin would be in attainment of the 8-hour ozone NAAQS for 2012 (UBAQS, Executive Summary and Overview, IPAMS, June 2009). In terms of cumulative effects from the Tumbleweed II project, the Proposed Action is within the modeled scope of projected development, and as such, would not violate, or otherwise contribute to any violation, of any applicable air quality standard, and it would not contribute to any projected future potential exceedances of any applicable air quality standards. Public comments received on the 2007 Tumbleweed EA asserted that the BLM failed to address potential effects of the project on air quality. In response to these comments, the BLM completed an air quality analysis for the Tumbleweed II project. In the Tumbleweed II EA, an affected environment discussion for air quality has been prepared and is included in **Section 3.2.10**, direct and indirect impacts on air quality are discussed in the alternative-specific analyses in **Chapter 4.0**, and cumulative effects, including those from ozone emissions, are discussed in **Section 4.2.5.10**. T **Table 4-10** in this section demonstrates that for regional ozone issues, when the emissions inventory for the production phase of the Proposed Action is compared to the regional emission inventory compiled during the WRAP Phase III study for the Uinta Basin, 2006 Baseline Emissions (WRAP, 2009), the VOC and NO_x emissions from the Proposed Action comprise a very small percentage of the WRAP baseline emissions. **Section 4.2.5.10** then goes on to provide an objective, detailed, and scientifically sound rationale for why project-specific cumulative ozone modeling is not appropriate for a project the size of Tumbleweed II project. Briefly, **Section 4.2.5.10** demonstrates that based on the magnitude of the projected increase in VOC emissions for the Uinta Basin from 2006 to 2012, and the inconsequential contribution that would be emitted from the Proposed Action, an accurate analysis of potential ozone impacts from the Tumbleweed II project is not feasible. Any cumulative ozone impacts from the Proposed Action would be indistinguishable from, and dwarfed by, the margin of uncertainty associated with the regional cumulative VOC and NO_x emission inventory. The potential cumulative ozone impact from the Proposed Action cannot be modeled with any accuracy due to the small level of the emissions from the Proposed Action, the size of the project, and the lack of photochemical grid model sensitivity. When compared to regional emissions inventories (such as those identified in the UBAQS results), the amounts of ozone precursors emitted from the Proposed Action are not expected to have a measurable contribution or effect on

Commenter	Comment	BLM Response
	Stamper Comments at 20-21…. Thus, the EA may not turn to any other document for an analysis of ozone pollution from this project or from the cumulative impacts of this project combined with others. The BLM must model the ozone precursors and contributions to ozone levels that will result from this project. The BLM cannot avoid this analysis any longer. Recently, two federal district court judges have called into serious question the ozone analysis conducted by BLM in the Vernal RMP and have rejected the notion that the BLM may shun ozone analysis at the site-specific development stage. *See* Order, *S. Utah Wilderness Alliance v. Allred*, Civ. Action No. 08-2187 (Urbina) at 3 (Jan. 17, 2009) (issuing a temporary restraining order in part because of a finding that the Vernal RMP had failed to consider ozone impacts because it lacked dispersion modeling) (attached hereto); Order, *S. Utah Wilderness Alliance v. Kempthorne*, Civ. Action No. 08-0411 (Oberdorfer) at 1 (Dec. 1, 2008) (rejecting the Rock House EA because the BLM had failed to sufficiently explain why it had not analyzed impacts from ozone) (attached hereto). Thus, BLM may not rely on the Vernal RMP for ozone analysis and it may not shirk such analysis at the site-specific development stage. BLM must prepare quantitative ozone dispersion modeling before proceeding with development here.	regional ozone formation. Despite the limitations of modeling project-specific ozone contributions, **Section 4.2.1.9** of the EA states that emissions of NO_x and VOC, ozone precursors, can be seen to be 28.4 tons/yr for NO_x, and 13.7 tons/yr of VOC from **Table 4-1** and **Table 4-2** (above) during the year of development. Thereafter, emissions during production would decrease to 4.3 tons/yr for NO_x, and 10.4 tons/yr of VOC. As can be seen from **Table 4.9** below, emissions during project operations are estimated to represent less than 0.05% of the projected Uinta Basin emissions for NO_x and VOC. Project emissions of ozone precursors would be dispersed and/or diluted to the extent where any local ozone impacts from the Proposed Action would be indistinguishable from background conditions. Emissions of these infinitesimal levels can be expected to have a negligible impact on ozone formation. Based on the above, the BLM has taken a hard look at air quality, including ozone related effects. The BLM has further provided a detailed, explanation as to why project-specific cumulative ozone modeling is not appropriate for a project the size of Tumbleweed II project. The evaluation of ozone related effects presented in the EA represents the best available information, and an analysis appropriate in scale and content for a nine-well project.
SUWA	Erosion and sedimentation data are old (25-35 years) and it is unclear whether they are still valid.	Studies concerning the amount of increased erosion associated with the construction of oil and gas facilities have not been conducted in the Uinta Basin or elsewhere. Therefore, as described in **Section 4.2.1.1**, the erosion and sedimentation estimates were developed for this project using the assumption that erosion on newly-disturbed soil surfaces is about triple the background erosion rate, prior to interim reclamation. The background erosion rate for the Uinta Basin was reported to be about 1.45 tons per acre per year by the BLM. This background rate has not changed since it was disclosed in the Final Environmental Impact Statement

Commenter	Comment	BLM Response
		on the Book Cliffs Resource Management Plan (BLM 1984). The following statement has been added to the text in **Section 4.2.1.1**, "*In general, 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, surface roughness, the amount of vegetative cover, and climatic conditions. As such, these estimates should be considered to be accurate within the range of +/- 100 percent. However, because the estimates were made using the same set of assumptions for each alternative, they provide a valuable way to compare the potential increased erosion that would result under the various alternatives.*" In addition, the text has been modified to state that the "natural background" erosion rate is 1.45 tons per acre per year instead of the "current" erosion rate.
SUWA	35% of the project area is estimated as including biological crusts, *see* EA at 31 (2,647 acres of the Winteridge-Moonset association occur in the 7,655 acre project area, and "it is assumed for purposes of this EA that biological soil crusts may occur wherever this association is present"), yet the EA concludes, without explanation, that damage to biological soil crusts will have no effect on reclamation. EA 54-55, 76. Such an assertion requires analysis and explanation. Biological soil crusts possess many characteristics that facilitate reclamation, including increased soil stability, increased water infiltration, and increased soil fertility, which would be rendered useless through surface disturbance. *See* http://geochange.er.usgs.gov/sw/impacts/biology/crypto/.	The following sentence has been removed from text, "*It is important to note the loss of biological crusts would have no effect on the reclamation potential of the soils in the Project Area.*" The Tumbleweed EA fully discloses the impacts of the project on sensitive soils in compliance with NEPA. See Sections 3.2.1, 4.2.1.1, 4.2.2.1, 4.2.3.1, 4.2.4.1 and 4.2.5.1, including a map of all soils in the Project Area in Figure 3-1. **Section 2.1.9 and Section 2.1.13** discuss interim reclamation, revegetation and soils. The EA fully discloses the potential impacts to soils from the Proposed Action and includes several ACEPM designed to reduce the impacts to soils and biological soil crusts. **Section 2.1.15.5** includes several specific ACEPMs for the protection of soils including: (1) full compliance with BLM's Gold Book; (2) preservation and protection of topsoil; (3) erosion control and revegetation measures; and (4) BMPs for unstable soils.
SUWA	Although the EA acknowledges direct effects of the project on soils within the project area, including erosion, sedimentation, soil and water table pollution, soil compaction, and blending of soil types, there is no discussion or analysis of indirect effects. EA at 53-55. For example, a result of soil compaction is decreased water-holding capacity in the soil, which has the reasonably foreseeable effect of desertification, which could lead to climate change.	It is difficult at times to differentiate between direct and indirect effects, which may be the same effect varied only by time or space, and the terms are often used interchangeably. However, the first and seventh paragraphs of **Section 4.2.1.1** have been modified to include indirect effects on soils, including the reduction of water holding capacity and the loss of topsoil productivity from increased erosion, removal of biological crusts, and contamination. The following has been added to the first paragraph of **Section 4.2.1.1**, "*Surface disturbance and removal of vegetation, including biological soil crusts, could also cause indirect effects on soils by reducing their water holding capacity. The loss of water holding capacity*

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	http://pubs.usgs.gov/gip/deserts/desertification/. Reasonably foreseeable indirect effects, though more remote in space and time than direct impacts, are due the same analytical emphasis under NEPA (40 CFR 1508.8)	*and impacts on microorganisms from increased erosion, removal of biological soil crusts, and contamination could also indirectly lead to the loss of topsoil productivity and the ability of these soils to support vegetation.*" The seventh paragraph of **Section 4.2.1.1** has been revised to read, "*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 liquid hydrocarbons from wellheads, conveyance pipelines, produced water sumps, and oil storage tanks. Other potential sources of soil contamination include leaks of saline water, liquid hydrocarbons, and hydro-fracturing chemicals from reserve pits, and spills and leaks of fuels and lubricants from vehicles and drilling equipment. Petroleum released to surface soils infiltrates the soil and can migrate vertically until the water table is encountered. Direct impacts from such a spill or leak on soils could include loss of vegetation, disruption of microbial communities, and changes to physical soil characteristics. Depending on the size and type of spill, the indirect effects on soils would primarily consist of the potential loss of soil productivity.*"Also, climate change is addressed in **Sections 3.2.9** and **4.2.5.10** of the EA. However, as described in the USGS article referenced by SUWA in their comment (see excerpts below), there is a lack of scientific consensus about the causes of desertification. In addition, reclamation potential for the area is fair as described in Section 3.2.3.2, which is supported by BLM field observations of two reclaimed well sites near the project area which were plugged and abandoned in the 1960s as cited in that section. Therefore, specific references to desertification have not been added to this EA. *In these marginal areas [desert transition zones], human activity may stress the ecosystem beyond its tolerance limit, resulting in degradation of the land. By pounding the soil with their hooves, livestock compact the substrate, increase the proportion of fine material, and reduce the percolation rate of the soil, thus encouraging erosion by wind and water. Grazing and the collection of firewood reduces or eliminates plants that help to bind the soil.* *This degradation of formerly productive land-- desertification--is a complex process. It involves multiple causes, and it proceeds at varying rates in different climates. Desertification may intensify a general climatic trend toward greater*

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		aridity, or it may initiate a change in local climate. *Desertification does not occur in linear, easily mappable patterns. Deserts advance erratically, forming patches on their borders. Areas far from natural deserts can degrade quickly to barren soil, rock, or sand through poor land management. The presence of a nearby desert has no direct relationship to desertification.* *…Scientists still question whether desertification, as a process of global change, is permanent or how and when it can be halted or reversed.* *…In 1988 Ridley Nelson pointed out in an important scientific paper that the desertification problem and processes are not clearly defined. There is no consensus among researchers as to the specific causes, extent, or degree of desertification. Contrary to many popular reports, desertification is actually a subtle and complex process of deterioration that may often be reversible.*
SUWA	The discussion of alternatives lacks meaningful analysis regarding their various potential effects on soils. What analysis there is assumes that impacts to soils from the project are directly proportional to surface disturbance, without scientific justification, despite the fact that direct effects of the project include pollution into the soil and water table, and soil compaction and blending, among others. EA 75-76, 78. For example, compaction and blending reduce the reclamation potential of soils, EA 54, therefore impacts of various amounts of soil compaction and blending are not simply troublesome insofar as surface disturbance is concerned.	The Tumbleweed EA fully discloses the impacts of the project on sensitive soils in compliance with NEPA. See Figure 3-1 and Sections 3.2.1, 4.2.1.1, 4.2.2.1, 4.2.3.1, 4.2.4.1 and 4.2.5.1 for a map and description of project area soils, as well alternative-specific impact analyses to soil resources. These sections include discussion on the potential for soil compaction, blending. In addition, the Tumbleweed EA fully discloses the impacts of the project on water quality in compliance with NEPA – see Sections 3.2.2, 4.2.1.2, 4.2.2.2, 4.2.3.2, 4.2.4.2 and 4.2.5.2. Related analyses on effects of soil erosion on surface water are included in Section 4.2.1.2, 4.2.2.2, 4.2.3.2, 4.2.4.2, and 4.2.5.3. The primary impact on soils from the Proposed Action or action alternatives would result from the disturbance/removal/excavation of surface soils and removal of vegetation because the Proposed Action has been designed to minimize the potential for contamination of soils through the use of lined reserve pits and secondary containment around all storage tanks that contain oil, glycol, and produced water. Therefore, contamination of soils could potentially occur but is not anticipated. The direct impacts to soils are directly proportional to the amount of surface disturbance under each alternative (47.7 acres for the Proposed Action, 77.5 acres for Alternative C, and 38.2 acres for Alternative D). Further, the difference between the acreage of surface disturbance between the alternatives is minimal (Alternative C would result in 29.8 acres more disturbance than the Proposed

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		Action , and Alternative D would result in 9.5 acres less disturbance than the Proposed Action). Proposed reclamation is discussed in detail in **Section 2.1.13**.
SUWA	The Tumbleweed II EA has failed to inventory cultural resources within five of the proposed eight well pads and associated access roads and pipeline corridors in the project area. Indeed, based on such incomplete inventories, the EA declares that the project will have no direct impacts on known cultural resources. However, such a statement seems disingenuous in the face of the recently undesignated area that was the Main Canyon ACEC. The Main Canyon area has been identified as having numerous sites associated with Northern Ute migration, and there are historical inscriptions in the area. Given that several of the well pads and their accompanying access roads and pipeline corridors have not been inventoried, it seems likely that the proposed project could impact cultural resources.	BLM is fully compliant with requirements to complete Class III cultural resource surveys for all well pads (and all other areas proposed for surface disturbance) prior to site-specific application approval and surface disturbance being initiated. This requirement was clearly defined in **Section 2.1.14.2** of the EA, which specifically states: "*In accordance with the National Historic Preservation Act (NHPA) of 1966, as amended, the Archaeological Resources Protection Act (ARPA) of 1979, and the Native American Graves Protection and Repatriation Act (NAGPRA), prior to any project-related surface disturbance, all locations proposed for surface disturbance would be examined by an archaeologist approved by the appropriate SMA to determine the presence of cultural resources (i.e., Class III cultural resource inventories with 100 percent pedestrian field survey would be completed). Consultation would be completed with the Utah State Historic Preservation Office (SHPO) prior to the onset of development, as set out in existing regulations. If any cultural resources eligible for listing to the National Register of Historic Places (NRHP) are identified, recommendations would be made to avoid or recover such resources. To date, Class III inventories have been completed for the TUF #18-9, #17-4, and #17-12 proposed well pads and associated access roads and pipeline corridors. Additional Class III survey work would be completed following project approval and prior to any surface-disturbing activities.* *If cultural resources are uncovered during surface-disturbing activities, Stewart would suspend operations at the site and immediately contact the appropriate AO, who would arrange for a determination of eligibility in consultation with the Utah SHPO and if necessary, would recommend a recovery or avoidance plan.*" This pre-disturbance survey and avoidance process is a fairly standard operating practice for oil and gas projects within the VFO, which has been explained in numerous previous NEPA documents. Furthermore, the existing TUF #18-9 is an excellent example of how this process works. Prior to construction of the TUF #18-9 well pad and associated road/pipeline corridor, the previous leaseholder (Bill Barrett Corporation) funded the completion of Class III cultural resource surveys

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		for the then proposed well pad and associated access road and pipeline. The fieldwork was conducted by Keith Montgomery (Principal Investigator of Montgomery Archaeological Consultants) on June 4, 2004, under the auspices of U.S.D.I. (FLPMA) Permit No. 04-UT-60122 and State of Utah Antiquities Project (Survey) No. U-04-MQ-0508b,s. Mr. Montgomery's survey of the TUF #18-9 (formerly called the #9-18-15-21) involved an intensive, 100 percent cover, pedestrian survey of the areas proposed for disturbance and no cultural resources were identified. In addition, the EA has been modified at **Section 4.2.1.8** to reflect the potential for cultural resources to be located in portions of the Tumbleweed II Project Area that, to date, have not yet been inventoried.
SUWA	Although the Tumbleweed II EA mentions that the proposed project will affect noise within the project area, there is no discussion or analysis of the effects of noise pollution on wildlife. Recent studies show that "certain unnatural sounds—particularly loud, repetitive noises" interfere with animals' ability to breed, evade predators, and find habitats. Scott Streater, "Solitude Becomes Exhibit A in Battle Over National Parks Management," New York Times, Oct. 8, 2009; See also Scott Streater, "Land Letter," available at www.eenews.net/public/landletter/2008/08/07/1.	The sources referenced in SUWA's comment letter are news stories from "Land Letter"; a Washington, D.C.-based, online, weekly newsletter. While these opinion articles authored by Mr. Streater refer to ongoing scientific studies by the National Park Services or in-progress journal articles, Mr. Streater's news stories by themselves do not represent peer-reviewed, scientific papers. However, the BLM does not discount, nor does it ignore, the potential for noise-related effects on wildlife. The analyses within the EA clearly recognize that noise from oil and gas development has the potential to affect wildlife. This potential issue is first addressed in **Section 1.7.5**, Issues #3 and #6, which state: "*The alternatives could result in a temporary decrease in reproductive success and nutritional condition of wildlife caused by increased energy expenditure that could occur due to physical responses to noise and visual disturbance during construction, drilling, and completion.* *The removal of vegetation and visual and noise disturbances during construction, drilling, completion, and operational activities could potentially affect fish and wildlife including special status species.*" The wildlife impact analyses in **Chapter 4** address that as a physical response to noise and visual disturbances, the project could temporarily decrease wildlife reproductive success and nutritional condition by increasing energy expenditure. Increased energy expenditure could result as a physical response to noise and visual disturbances. However, as the Tumbleweed II project is exploratory in nature, and

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		human disturbances (i.e., increased traffic, noise, and human presence) associated with construction, drilling, and completion activities would be short-term in nature, the above-mentioned impacts could affect individual animals, but would not likely result in population-level declines in the Tumbleweed Project Area. For wells that are productive, ongoing operational activities associated with the Proposed Action (e.g., pumper visits, workovers, etc.) could result in visual and noise related impacts on wildlife populations within the Tumbleweed Project Area that could last for the 20 to 30 year life of the project. Yet, because of the small scale of the project, potential effects from project-related noise or otherwise, would likely be limited to individual animals, and would not result in population-level declines. Furthermore, application of winter surface disturbance and drilling restrictions (December 1 – April 30) would reduce impacts to elk and mule deer winter habitat values. In addition, **Section 2.1.15.8** of the Tumbleweed II EA includes specific ACEPMs to protect wildlife, sage-grouse, raptors and Mexican Spotted Owl.
SUWA	The EA concludes, without analysis, that impacts to wildlife, including loss, disturbance, and fragmentation of habitat; displacement from habitat; and visual, audible, and human disturbances will last only as long as the duration of the project. EA 60. Additionally, the Draft EA concludes, again without analysis, that direct losses to crucial habitats and foraging areas will not negatively impact wildlife because the project is temporary. EA 60-61.	Based on the cited page numbers, we believe SUWA is referring to the impact analyses for pronghorn antelope, bighorn sheep, and bison. However, SUWA has incorrectly and inadequately captured the wildlife analyses included in the EA. The analyses on pages 60-61 of the Tumbleweed II EA, as well as the other species-specific wildlife analyses in the EA, state that human disturbances (i.e., increased traffic, noise, human presence) caused by construction, drilling, and completion activities may be short-term in nature. However, the analyses go on to say that ongoing operational activities associated with the Proposed Action (e.g., pumper visits, workovers, etc.) could result in small-scale visual and noise related impacts on wildlife populations within the Tumbleweed Project Area that could last for the 20 to 30 year life of the project. The analyses for elk, mule deer, pronghorn antelope, and bighorn sheep also disclose that habitat loss and fragmentation, as well as visual and noise disturbances, could result in reduced habitat use by Rocky Mountain bighorn sheep within and near disturbed areas, increased animal densities in adjoining habitats, and increased stress from intra- and inter-specific competition. These species-specific analyses then conclude that individual animals could be adversely affected by the project, but given the temporary nature of most impacts and BLM's discretion to implement seasonal closures (for elk or mule deer), or because of the periodical occurrence of these species (pronghorn antelope, bighorn sheep) within the Tumbleweed Project Area, the Proposed Action is not likely to negatively impact the species at a population level.

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		In addition, Section 2.1.15.8 of the Tumbleweed II EA includes specific ACEPMs to protect wildlife, sage-grouse, raptors and Mexican Spotted Owl.
SUWA	There is no analysis of indirect or cumulative impacts to wildlife, which is particularly alarming in the section in special status species. EA 62-65, 83-84. For species more susceptible to Federal listing, there needs to be analysis of the cumulative effects of the proposed project in conjunction with other projects before concluding that the project will not lead toward Federal listing of special status species or have negligible impact. EA 63, 83-84.	The fish and wildlife analyses do indeed disclose the direct and indirect effects of the project within **Sections 4.2.1.5** and **4.2.1.6**, including detailed discussions of potential effects on special status species that have the potential to occur in the project area (e.g., greater sage-grouse, Mexican spotted owl, golden eagle, and Colorado River endangered fish species). While direct and indirect effects are well defined in 40 CFR 1508.8, in practice, the difference between a direct impact vs. an indirect impact, especially in the context of wildlife populations and habitats, can be subjective and frequently interchangeable. Therefore, the wildlife and special status species analyses in **Sections 4.2.1.5** and **4.2.1.6** do disclose some direct vs. indirect impacts, but by no means does the analysis focus on discriminating between those two types of impacts. Instead the analysis focuses on evaluating and disclosing the potential effects, as well as providing mitigation to avoid or reduce those effects. For example, the introductory paragraph of **Section 4.2.1.5** points out that surface disturbance associated with the proposed project could indirectly affect wildlife habitat quality and quantity as a result of the potential for increased levels of weed infestation. Yet any loss of change in the quality or quantity of habitat could also be construed as a direct impact. Thus, the BLM's fish and wildlife analyses focus on the direct and indirect effects of the project without trying to define which impact falls under which subjective category. The BLM acknowledges that the golden eagle discussion in **Section 4.2.1.6** of the EA did not adequately refer back to the operator's commitment to conduct raptor nest inventories and to avoid construction or drilling activities within species-specific buffers of active raptor nests during the nesting season (see **Section 2.1.15.8**). These protective measures are one of the primary reasons that the project is not likely to adversely affect raptor nesting activity (direct or indirect). A reference to these measures has been added to the golden eagle discussion to better clarify why they project would not likely result in a trend towards Federal listing of the golden eagle. However, the bald eagle, Mexican spotted owl, and greater sage-grouse discussions in **Section 4.2.1.6** included reasoned and rationale descriptions for why impacts (regardless of whether they are considered direct or indirect) to the species would not be adverse and/or would not contribute to a trend towards Federal listing of the species. These discussions specifically speak to the potential effects that could

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		occur if not for mitigation measures, either volunteered to by the operator or required by the BLM or other agency, that are intended to reduce, avoid, or minimize direct and indirect effects on the species. For example, the Mexican spotted owl analysis concludes with the following statements, "*Based on these continuing survey and PAC commitments, and that no MSO were documented during the 2008 and 2009 surveys, the Proposed Action would likely have no effect on breeding, nesting or foraging MSO. Furthermore, as the Proposed Action would not include any development within the Willow Creek and Upper Bottom Canyon corridors, potential impacts to designated MSO habitat would be minimal. Specifically, under the Proposed Action, 0.1 acre of good habitat and 0.2 acre of fair habitat would be disturbed as a result of construction activities. Based on the above assessment, BLM has determined that the Proposed Action* ***"may affect, is not likely to adversely affect"*** *the MSO*." As for cumulative impacts, **Section 4.2.5.6** and **4.2.5.7** of the EA concisely but accurately disclose the potential cumulative effect that the Tumbleweed II project could have on fish and wildlife species and habitats, including special status species. The cumulative impact analyses provide reasoned, rationale explanations as to why the Tumbleweed II project would have minor cumulative effects on fish and wildlife populations or habitats; primarily because the project itself would largely result in small or minor effects on individual animals, whose incremental contribution to cumulative effects would also be small.
SUWA	In the discussion of alternatives, the estimated impact on wildlife for all of the options is directly proportional to surface disturbance without analysis explaining why. EA 77-79. There is no meaningful discussion of the impacts of the proposed alternatives in a way that clarifies, for the public and the decision maker, the comparative impacts of the proposed alternatives. EA 77-79.	The BLM's comparison of the Proposed Action to the No Action alternative very clearly discloses that under the No Action alternative project-related impacts on wildlife would not occur. The remaining alternative analyses focus on comparisons of the action alternatives: comparisons of Alternative C (Buried Pipelines) and Alternative D (Directional Drilling) against the Proposed Action. In the context of potential effects to wildlife populations and habitats, the design features of the action alternatives are similar or identical. The potential change agents or causes of potential effect to wildlife from the action alternatives are largely limited to surface disturbance. For example, as discussed in **Chapter 2.0**, the number of wells drilled would be identical under the Proposed Action, Alternative C, or Alternative D. Therefore, temporary visual- or noise-related disturbances from drilling activities and potential effects on big game species would be very similar or identical in nature regardless of the action alternative. Similarly, as discussed in **Chapter 2.0**, water use would be identical

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		under any of the three action alternatives. Therefore, potential depletion effects on the Colorado River endangered fish species would also be similar or identical regardless of the action alternative. Absent any other measureable or marked difference between potential effects, the key difference between the action alternatives in relation to wildlife is the difference in acreage of surface disturbance (i.e., wildlife habitat loss). The wildlife impact analyses in **Sections 4.2.3.5**, **4.2.3.6**, **4.2.4.5**, and **4.2.4.6** concisely, but accurately disclose these comparative differences in surface disturbance and associated differences in wildlife habitat loss.
SUWA	The Tumbleweed II EA lacks any analysis of cumulative or indirect impacts on vegetation. For example, the EA explains that it could take more than 50 years for disturbed vegetation to re-grow, but there is no analysis of the effect this will have at the ecosystemic level. See 40 CFR 1508.8. Moreover, dismissing the additional impacts on vegetation of this project within the context of other Vernal drilling operations as incremental and minor defeats the purpose of the requirement that cumulative impacts be analyzed. See 40 CFR 1508.7 ("Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.").	**Section 4.2.1.3** of the EA describes, in detail, the potential direct and indirect effects of the Proposed Action on vegetation resources. SUWA did not provide a definition as to what they believe constitutes an ecosystemic level impact. 40 CFR 1508.8 only defines direct and indirect impacts. For purposes of impact analysis within this EA, the BLM assumes that the "ecosystemic level" impact referred to by SUWA is the biotic or abiotic resource effects that influence the ecosystem of which it is a part. Biotic and abiotic impacts, and their influence on the ecosystem of which they are part (for example: vegetation communities, wildlife communities, and soils and watershed and the interaction of each on and with the others) are fully disclosed in Chapter 4. In addition, reclamation potential for the area is fair as described in Section 3.2.3.2, which is supported by BLM field observations of two reclaimed well sites near the project area which were plugged and abandoned in the 1960s as cited in that section. Therefore, it is not expected that the impacts from this project would impact ecosystems beyond what is currently disclosed in the EA. **Section 4.2.5.4** of the EA provides a succinct but accurate description of potential cumulative effects on vegetation. This section discussed how Alternatives A, C, or D would disturb relatively small areas (47.7, 77.5, and 38.3 acres, respectively) of vegetation. However, any increase in surface disturbance must be acknowledged as incrementally and cumulatively adding to vegetation disturbance within the Vernal planning area. Specifically, the total estimated cumulative disturbance of 44,091 acres in the 1,691,116 acre-Vernal planning area would increase by 0.09 percent to 0.18 percent due to project construction, depending on the action alternative selected. Assuming successful implementation of Applicant-Required Measures and ACEPMs (see **Section 2.1.15.6**), vegetation losses from the 47.7 acres of disturbance under the Proposed Action (77.5 acres under Alternative C, 38.2 acres under Alternative D) would be minor. Each acre of vegetation disturbance would subsequently and incrementally adds to cumulative vegetation impacts in the Vernal Planning Area; however, these project-specific cumulative contributions

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		would be minor.
SUWA	The discussion of alternatives once again determines, without explanation, that the degree of impact to vegetation is directly proportional to surface disturbance, despite the fact that disturbing vegetation will likely make even non-disturbed areas more susceptible to noxious and invasive weeds. EA 75-78.	In the context of potential effects to vegetation resources, the design features of the action alternatives (Alternatives A, C, and D) are similar or identical (see Section 2.1.15.6). The potential change agents or causes of potential effect to vegetation from the action alternatives are largely limited to surface disturbance. However, **Section 4.2.3.3** of the EA has been revised to recognize that the potential for weed infestation would be higher under Alternative C given the increase in surface disturbance and construction activities associated with burying pipelines.
SUWA	According to the EA, Willow Creek, which is just west of the Project Area, is considered a 303(d) impaired water body under the Clean Water Act. EA 34. There is no analysis of how the proposed project will impact the amount of Total Dissolved Solids in Willow Creek, nor is there analysis of the cumulative impacts of the project with other drilling projects in the area. The BLM is required by FLPMA to ensure that the approval of this activity will not lead to further impairment of Willow Creek. The BLM must model the potential water pollution from this project to assure the public that approval will not lead to further impairment of Willow Creek.	**Section 4.2.1.2** of the EA acknowledges that sediment loading to Willow Creek would increase by about 0.23 percent and that TDS could be expected to increase by a similar percentage. Section 303(d) of the Clean Water Act requires States to identify water-quality limited water bodies and prepare a Total Maximum Daily Load (TMDL) analysis for those stream and lakes. However, the State is not required to ensure that no further impairment occurs. **Section 4.2.5.3** of the EA has been revised to indicate that the Proposed Action could incrementally increase TDS loading to Willow Creek.
SUWA	Although the Draft EA evaluates the effects of the Project on surface water, there is no discussion of the impact of the project on groundwater or the water table. EA 55. Such an omission is particularly salient in a project utilizing hydraulic fracturing, given the risk of chemical injection into the water table.	Compliance with "Onshore Oil and Gas Order No. 2, Drilling Operations" will assure that the project will not adversely affect groundwater quality. State-of-the-art drilling and well completion techniques would be conducted, as approved, to protect and/or isolate all usable water zones, potentially productive zones, lost circulation zones, and abnormally pressured zones. Using these techniques, the possibility of adverse degradation of groundwater quality by the Proposed Action is considered to be negligible and detailed analysis is therefore not required in the EA.
SUWA	There is no mention within the EA of reserve pits or pollution containment systems, or their respective direct and indirect impacts on water and ecosystems.	Several sections of the EA discuss the construction of reserve pits and their containment systems. The third paragraph in **Section 2.1.2** states, "*To avoid impacts to soils and shallow groundwater, the reserve pit would be lined with 12-milimeter (minimum) plastic nylon reinforced material. The liner would overlay a felt liner pad if rock is encountered during excavation. The pit liner would overlap the pit walls and be covered with dirt and/or rocks to hold it in place. The reserve pit liners would have minimum burst strength equal to or greater than 300 pounds, puncture strength*

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		equal to or greater than 160 pounds, and grab tensile strength exceeding 150 pounds. Each liner would be resistant to deterioration by hydrocarbons, and all liners would be tested in accordance with American Society for Testing and Materials standards." The fourth paragraph in **Section 2.1.2** states, "*To assure stability, the reserve pit would be constructed on the cut side of the pads. The pit would not be constructed in a natural drainage, where flood hazards exist, or where surface run-off could enter the pit or damage the pit walls.*" The fourth paragraph in **Section 2.1.5** states, "*Upon completion of drilling, any hydrocarbons in the reserve pit would be removed as soon as possible and processed or disposed of at an appropriate offsite commercial facility. Cuttings generated during the drilling process would be buried in the reserve pit following the evaporation or removal of free liquids.*" The first paragraph in **Section 2.1.11** states: "*As mentioned previously, any hydrocarbons remaining in the reserve pit would be removed as soon as possible and processed or disposed of at an appropriate offsite commercial facility. All drilling mud/water would be hauled off-site to a licensed, commercial disposal facility. Cuttings generated during the drilling process would be buried in the reserve pit following removal of any excess liquids. On Federal lands, this would occur within 90-days of completing the well per BLM regulations.*" **Section 4.2.1.1** of the EA has been modified to discuss potential impacts to soils from leaks of produced water, fracing fluids, and hydrocarbons from reserve pits. The seventh paragraph has been changed to read, "*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 liquid hydrocarbons from wellheads, conveyance pipelines, produced water sumps, and oil storage tanks. Other potential sources of soil contamination include leaks of saline water, liquid hydrocarbons, and hydro-fracturing chemicals from reserve pits, and spills and leaks of fuels and lubricants from vehicles and drilling equipment. Petroleum released to surface soils infiltrates the soil and can migrate vertically until the water table is encountered. Direct impacts from such a spill or leak on soils could include loss of vegetation, disruption of microbial communities, and changes to physical soil characteristics. Depending on the size and type of spill, the indirect*

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		effects on soils would primarily consist of the potential loss of soil productivity." **Section 4.2.1.2** of the EA has been modified to discuss potential impacts to water resources from leaks of produced water, fracing fluids, and hydrocarbons from reserve pits. The second paragraph has been changed to read, "*The Proposed Action would not result in direct surface disturbance to any Tumbleweed Project Area drainages, other than the slightly increased sedimentation described above. There is a slight chance that development and production activities could lead to contamination of nearby surface water resources. Sources of potential surface water contamination include leaks from wellheads, pipelines, and oil storage tanks; leaks from tanker trucks; leaks of produced water, fracing fluids, and liquid hydrocarbons from reserve pits; leaching of contaminants from impacted soils near these facilities; and fuel spills. To reduce the potential for hydrocarbon contamination of Tumbleweed Project Area drainages, several environmental protection measures would be implemented as described in* ***Section 2.1.14****. All pipelines would be designed to minimize the potential for spills and leaks and would be permitted through the APD or ROW grant process as appropriate. All storage tanks and production facilities that contain oil, glycol, produced water, or other potentially hazardous fluids would be surrounded by secondary means of containment for the entire contents of the largest single tank in use plus freeboard for precipitation or other appropriate containment and/or diversionary structures or equipment so that any discharge from a primary containment system, such as a tank or pipe, would not drain, infiltrate, or otherwise escape to groundwater or surface waters before cleanup is completed. In addition, a Spill Prevention, Control, and Countermeasure (SPCC) Plan, which outlines the methodology to be used in the event of a spill, would be prepared and would be maintained onsite at all times. The SPCC Plan would describe how to contain a spill and how to facilitate rapid clean up of any spill prior to its contamination of either surface or subsurface waters. In the unlikely event that a release or spill occurs, steps would be immediately initiated to stop and contain the spill/leak and to remediate the impacted materials, thus reducing the likelihood of impacts to nearby drainages, and subsequently the Green River."*
SUWA	The analysis of impacts under Alternatives C and D perfunctorily addresses the impacts of the alternatives by concluding that the degree of impact is directly proportional to the amount of surface disturbance without reasonable or scientific explanation. EA 76,	The BLM's comparison of the Proposed Action to the No Action alternative very clearly discloses that under the No Action alternative project related impacts on surface water resources would not occur. In the context of potential effects to water resources, the primary effect on surface

Commenter	Comment	BLM Response
	78.	water resources from the action alternatives (i.e., Proposed Action, Alternative C, or Alternative D) would be increased erosion and sedimentation. The amount of increased erosion and sedimentation is assumed to be directly proportional to the amount of new surface disturbance. Because the number of wells drilled would be identical under the Proposed Action, Alternative C, and Alternative D, the causes of potential effect to surface water resources from the action alternatives is largely limited to surface disturbance. In general, 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, surface roughness, the amount of vegetative cover, and climatic conditions. In addition, sediment delivery to drainages is dependent on a number of factors which cannot be quantified, including the exact slope length and steepness, surface roughness, the type and degree of vegetative cover, and climatic conditions. However, because the estimates were made using the same set of assumptions for each alternative, they provide a valuable and meaningful way to compare the potential increased erosion that would result under each of the various action alternatives. Further, the difference between the acreage of surface disturbance between the alternatives is minimal (Alternative C would result in 29.8 acres more disturbance than the Proposed Action, and Alternative D would result in 9.5 acres less disturbance than the Proposed Action).
SUWA	Although the Vernal Field Office Approved RMP declined to designate the Main Canyon ACEC or the Book Cliffs SRMA, BLM must analyze the effects of the proposed project on ACECs and SRMAs. See EA at 6-7. ACEC and SRMAs are public resources in the same way vegetation, soils, or wildlife are public resources. The decision not to designate an ACEC or SRMA does not affect the BLM's duty to analyze impacts to those resources, in the same way that a decision to open an area to oil and gas drilling does not eliminate BLM's duty to analyze impacts on vegetation, soils, or wildlife.	Public comments received by the BLM on the draft 2007 Tumbleweed EA requested that the BLM include analysis of impacts to the former potential Main Canyon ACEC, and former potential Book Cliffs SRMA. In response, the BLM included detailed information within the final 2007 Tumbleweed EA (BLM 2007a) on how proposed development could impact these areas. This analysis can be found in the *Tumbleweed Exploratory Drilling EA (UT-080-05-201)* (BLM 2007a), which is included in the public record for this project. Because an assessment of impacts to these areas has already been included in the Approved RMP, and management decisions have already been made for these areas within the Approved RMP, potential effects to the former potential Main Canyon ACEC or Book Cliffs SRMA are not included within the Tumbleweed II EA. However, potential impacts to individual resource components of the former potential ACEC and SRMA (e.g., cultural resources, recreation, etc.) are analyzed in the Tumbleweed II EA as appropriate within the resource-specific sections of this EA.
SUWA	Although the Vernal Field Office Approved RMP	An analysis of impacts from the alternatives on non-WSA lands with wilderness

Commenter	Comment	BLM Response
	declined to manage non-WSA lands with wilderness characteristics as wilderness, BLM cannot decline to analyze the effects of the proposed project on lands with wilderness characteristics. See EA at 6-7. Lands with wilderness characteristics are a public resource in the same way vegetation, soils, or wildlife are public resources. The decision not to manage areas with wilderness characteristics as wilderness does not affect the BLM's duty to analyze impacts to that resource, in the same way that a decision to open an area to oil and gas drilling does not eliminate BLM's duty to analyze impacts on vegetation, soils, or wildlife.	characteristics has been added to the final EA – see Sections 3.2.11, 4.2.1.11, 4.2.2.11, 4.2.3.11, 4.2.4.11, and 4.2.5.12.
Stewart Petroleum	BLM should assess the impacts of the Proposed Action on existing wilderness characteristics regardless of the management prescriptions, goals, and objectives BLM chooses in its FLPMA-directed Vernal RMP.	An analysis of impacts from the alternatives on non-WSA lands with wilderness characteristics has been added to the final EA – see Sections 3.2.11, 4.2.1.11, 4.2.2.11, 4.2.3.11, 4.2.4.11, and 4.2.5.12.
SUWA	The Tumbleweed II EA fails to quantify or identify preexisting and ongoing impacts. Cumulative impacts analysis clearly requires that past and present actions be included in the analysis as well. The EA should include analysis and quantification of past and present impacts as well as cumulative future impacts, specifically it should also analyze the impacts from off-road vehicle use in the area of the project.	**Section 4.2.5** focuses on cumulative effects from past, present, and reasonably foreseeable impacts. This section specifically discusses cumulative impacts as the incremental effect to specific resources or issues that would occur under Alternatives A, C, or D, in conjunction with other cumulative actions. **Section 4.2.5.1** provides discussion on past and present oil and gas activities in the Uinta Basin, both of which serve as introductions to the outlook for reasonably foreseeable development in the Tumbleweed Project Area and the greater Uinta Basin. Other activities discussed in the context of cumulative effects include livestock grazing, vegetative management through prescribed burning, and recreational projects. **Sections 4.2.5.2** through **4.2.5.11** provide resource and issue-specific analyses of cumulative effects. The Cumulative Impact Analysis Area (CIAA) for each of these resources is defined within the respective section. As discussed in the **Sections 3.2.10 and 4.2.1.7**, OHV use within the Tumbleweed Project Area is "limited" to designated roads and trails. New and improved roads would increase opportunities for OHV use within the limited use area. All new or upgraded roads would terminate at proposed well pads. In addition, no roads would be constructed in canyons and no new loop routes would be created. Therefore, it is expected that increased OHV use in the Tumbleweed Project Area would be minimal.
SUWA	The Tumbleweed II EA fails to comply with the NHPA	The BLM has complied with requirements under the NHPA. **Section 3.2.8** of the

Commenter	Comment	BLM Response
	because it fails to: (1) accurately identify the proposed project's "area of potential of effects," and (2) assess adverse effects to historic properties from the proposed project.	EA describes the affected environment for cultural resources within the Tumbleweed Project Area. As per regulations set forth under 36 CFR 800, the APE for the Tumbleweed II project is defined as the individual areas surveyed for Class III inventories. **Section 3.2.8** of the EA has been modified to clarify this point. **Sections 4.2.1.8**, **4.2.2.8**, **4.2.3.8**, **4.2.4.8**, and **4.2.5.9** of the EA evaluate and disclose the potential direct, indirect, and cumulative effects of the project for each of the alternatives. Based on Class III surveys conducted to date, and pre-disturbance Class III survey requirements outlined in **Section 2.1.14.2**, the BLM does not anticipate any adverse effects to historic properties from this project. As discussed in **Table 5-1** of the EA, Section 106 consultation was formally initiated between the BLM and SHPO on December 3, 2008, and consultation for this project is considered to be closed for those portions of the project that have had a Class III survey completed (i.e., the proposed well pads, roads, and pipeline corridors for the TUF #18-9, #17-4, and #17-12). Each of these cultural reports included a recommendation of "no historic properties affected". Section 106 consultation will be re-initiated on a site-specific level as appropriate, following receipt of any site-specific applications and prior to any surface disturbance at new locations and if previously unknown sites are found during surface-disturbing activities. Cultural survey reports that have been completed to date for the Tumbleweed II Project Area are available in the project record for this EA.
SUWA	BLM is required to consult with the State Historic Preservation Office (SHPO) and Native American tribes regarding the potential effects of an undertaking such as the Proposed Action. See 36 C.F.R. §§ 800.3 and 800.4. In addition, should BLM determine that the Proposed Action will result in a "no historic properties affected" finding, the documentation supporting such a finding must be made available to the public for inspection. Id. § 800.4(d)(1). The BLM has not made any information regarding historic properties available for public inspection.	The BLM must then make a good faith effort to identify the historic properties which exist within the APE. Id. § 800.4(b). The BLM satisfied this requirement through completion a Class I literature reviews and requirements for Class III surveys of areas proposed for surface disturbance (some of which have already been completed) with subsequent requirements for avoidance if cultural sites or artifacts are discovered (see **Section 2.1.14.2**). As summarized in each of the cultural reports completed to date for the site-specific Class III surveys, a recommendation of "no historic properties affected" has been proposed for this project pursuant to Section 106, CFR 800. As stated in **Table 5-1** of the EA, Section 106 consultation was formally initiated between the BLM and SHPO on December 3, 2008, and consultation for this project is considered to be closed for those portions of the project that have had a Class III survey completed (i.e., the proposed well pads, roads, and pipeline corridors for the TUF #18-9, #17-4, and #17-12), as each of these reports included a recommendation of "no historic properties affected". Section 106 consultation will

Commenter	Comment	BLM Response
		be re-initiated on a site-specific level as appropriate, following receipt of any site-specific applications and prior to any surface disturbance at new locations, and if previously unknown sites are found during surface-disturbing activities. Cultural survey reports that have been completed to date for the Tumbleweed II Project Area are available in the project record for this EA. As also stated in **Table 5-1**, Native American Tribal consultation was formally initiated by the BLM on December 8, 2008. The following tribes were contacted: White Mesa Ute, Ute Mountain Ute, Ute, Southern Ute, Hopi, Navajo Nation, Laguna Pueblo, Zia Pueblo, Santa Clara Pueblo, Eastern Shoshone, and Northwest Band of Shoshone. The Laguna Pueblo responded on December 18, 2008, and stated that no significant impacts would occur, but requested that they be notified if additional sites are found. No other responses were received. See **Appendix F** of the Tumbleweed II EA for consultation documentation from interested Native American Tribes. Consultation for this project is considered to be closed. Native American consultation will be re-initiated on a site-specific level as appropriate, following receipt of any site-specific applications and prior to any surface disturbance at new locations, and if previously unknown sites are found during surface-disturbing activities.

5.3 EA PREPARATION

The list of BLM reviewers and non-BLM preparers for the Tumbleweed Exploratory Drilling Project EA is provided in **Table 5-3**.

Table 5-3. List of Preparers

BLM Preparers		
Name	**Title**	**Responsibilities**
Stephanie Howard	Environmental Coordinator	NEPA and Project Management, Proposed ACECs, Areas with Wilderness Characteristics, Recreation Resources
Brandon McDonald	Wildlife Biologist	Fish and Wildlife, Special Status Species
Clayton Newberry	Botanist	Vegetation
Steve Strong	Natural Resource Specialist	Soil Resources
Mark Stavropolous	Supervisory Range Specialist	Rangeland Management and Wild Horses
Blaine Phillips	Archaeologist	Cultural Resources
Matt Baker	Petroleum Engineer	Directional Drilling Review/Analysis
Non-BLM Preparers		
Sue Nall, USACE	Environmental Engineer	Water Resources
Diane Coltharp, Uintah County	Uintah County Public Lands Coordinator	County Transportation Plan
Bekee Megown, USFWS Drew Crane, USFWS	Wildlife Biologists	T&E Species and Section 7 Consultation under the ESA
Buys & Associates Preparers		
Name	**Title**	**Responsibilities**
Dawn Martin, Buys & Associates, Inc.	NEPA Project Manager	Project Management
Kirby Carroll, Buys & Associates, Inc.	Senior Ecologist	Wildlife, Vegetation, Rangeland Management, Special Status Species,
Dave Nicholson Buys & Associates, Inc.	Senior Geologist/Hydrologist	Soils, Water Resources, Paleontology
Jody Patterson Montgomery Archaeological Consultants	Archaeologist	Cultural Resources
Melissa Bridendall, Buys & Associates, Inc.	Biologist	Wildlife, Technical Review and Editing
Daniel Pring Buys & Associates, Inc.	Air Quality Specialist	Air Quality
Montgomery Archaeological Consultants	Cultural Resource Specialists	Cultural Resources
Nicole Peace Buys & Associates, Inc	GIS Specialist	GIS
Kendell Johnson Buys & Associates, Inc.	Word Processer	Copy Editing, Document Preparation

BLM IDT for the Tumbleweed EA is reflected in the IDT Checklist in **Appendix A**.

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6.2 ACRONYMS AND ABBREVIATIONS USED IN THIS EA

- A -		
ACEC		Area of Critical Environmental Concern
ACEPM		Applicant-Committed Environmental Protection Measure
APE		Area of Potential Effect
ADT		Average Daily Traffic
Authorized Officer		Authorized Officer
APD		Application for Permit to Drill
APE		Area of Potential Effect
AUM		Animal Unit Month
- B -		
BCC		Birds of Conservation Concern
BLM		Bureau of Land Management
BMP		Best Management Practice
BPU		Big Pack Unit
- C -		
$CaCO_3$		Calcium Carbonate
CEQ		Council of Environmental Quality
CFR		Code of Federal Regulations
cfs		Cubic Feet per Second
CIAA		Cumulative Impact Analysis Area
CO		Carbon Monoxide
COA		Condition of Approval
CWA		Clean Water Act
- D -		
DAQ		Division of Air Quality
DR		Decision Record
- E -		
EA		Environmental Assessment
EIS		Environmental Impact Statement
ENBB		Environmental Notice Bulletin Board
EPA		Environmental Protection Agency
ESA		Endangered Species Act
- F -		
FLPMA		Federal Land Policy and Management Act
FO		Field Office

FONSI		Finding of No Significant Impact
- G -		
GIS		Geographic Information System
- H -		
HAP		Hazardous Air Pollutants
- I -		
IDT		Interdisciplinary Team
- J -		
- K -		
- L -		
- M -		
MBTA		Migratory Bird Treaty Act
MCL		Maximum Contaminant Levels
mg/L		Milligrams per Liter
MOAC		Montgomery Archaeological Consultants
MSDS		Materials Safety Data Sheet
MSO		Mexican Spotted Owl
- N -		
NAAQS		National and Utah Ambient Air Quality Standards
NEPA		National Environmental Policy Act
NHC		North Hill Creek
NI		Not Impacted
NP		Not Present
NRCS		Natural Resource Conservation Service
NRHP		National Register of Historic Places
NSO		No Surface Occupancy
- O -		
OHV		Off-highway Vehicle
Onsite		Onsite Inspections per Onshore Order #1
OSHA		Occupational Safety and Health Act
- P -		
PAC		Protected Activity Center
PIF		Partners in Flight
PUP		Pesticide Use Proposal
PWDBO		Programmatic Water Depletion Biological Opinion
- Q -		
- R -		
RCRA		Resource Conservation and Recovery Act of 1976
RFD		Reasonable Foreseeable Development

RMP		Resource Management Plan
ROD		Record of Decision
ROW		Right-of-way
- S -		
SAR		Sodium Adsorption Ratio
SARA		Superfund Amendments and Reauthorization Act
SDR		State Director Review
SHPO		State Historic Preservation Office
SITLA		School and Institutional Trust Lands Administration
SMA		Surface Management Agency
SPCC		Spill Prevention, Control and Countermeasure
SRMA		Special Recreation Management Area
SUPO		Surface Use Plan of Operations
SUWA		Southern Utah Wilderness Alliance
- T -		
TDS		Total Dissolved Solids
TSS		Total Suspended Solids
TRCP		Theodore Roosevelt Conservation Partnership
- U -		
UDOGM		Utah Division of Oil, Gas and Mining
UDWR		Utah Division of Wildlife Resources
USACE		United States Army Corps of Engineers
USDI		U.S. Department of the Interior
USDI		U.S. Department of the Interior
USFS		U.S. Forest Service
USFWS		U.S. Fish and Wildlife Service
USGS		U.S. Geological Survey
- V -		
VRM		Visual Resource Management
- W -		
WSA		Wilderness Study Area
- X -		
- Y -		
- Z -		

APPENDIX A

IDT CHECKLIST

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INTERDISCIPLINARY TEAM ANALYSIS RECORD CHECKLIST

Project Title: Stewart Petroleum Corporation's Tumbleweed II Exploratory Natural Gas Drilling Project

NEPA Log Number: DOI-BLM-UTG010-2009-0090-EA

File/Serial Number: UTU-74858, UTU-72667, UTU-72018, UTU-72059, and UTU-84256

Project Leader: Stephanie Howard

DETERMINATION OF STAFF: (Choose one of the following abbreviated options for the left column)

NP = not present in the area impacted by the proposed or alternative actions.
NI = present, but not affected to a degree that detailed analysis is required.
PI = present with potential for significant impact analyzed in detail in the EA; or identified in a DNA as requiring further analysis.
NC = (DNAs only) actions and impacts not changed from those disclosed in the existing NEPA documents cited in Section C of the DNA form.

Determi-nation	Resource / Issue	Rationale for Determination*	Signature	Date
PI	**Air Quality**	Well development includes emissions from earth-moving equipment, vehicle traffic, drilling, and completion activities. During well production there are continuous emissions from separators, oil storage tanks, dehydration units, and daily tailpipe and fugitive dust emissions from operations traffic.	Stephanie Howard	03/05/07
NP	**Areas of Critical Environmental Concern**	None present as per Vernal Field Office RMP and ROD and GIS layer review.	Stephanie Howard	04/07/10
PI	**Cultural Resources**	Based on applicant committed measures to avoid all eligible cultural resources, no direct impacts are expected as a result of the Proposed Action. Indirect impacts could occur from increased access and human activity within the Tumbleweed II Project Area.	Blaine Phillips	03/05/07
NP	**Environmental Justice**	No minority or economically disadvantaged communities or populations are present which could be affected by the Proposed Action or alternatives.	Stephanie Howard	04/07/10
NP	**Farmlands (Prime or Unique)**	None present in the Vernal Field Office.	Stephanie Howard	04/07/10
NP	**Floodplains**	No mapped floodplains present as per Vernal Field Office GIS.	Karl Wright	03/05/07
PI	**Invasive, Non-native Species**	A pre-construction noxious weed inventory would be necessary to disclose what is present in the Tumbleweed II Project Area. Weed free certified seed would be needed for reclamation. Potential for invasive plants and weeds to occur or increase in density when soils are displaced or disturbed. A Pesticide Use Permit (PUP) will be necessary to apply chemicals on public lands for weed control.	Mark Stavropolous	03/05/07
NI	**Native American Religious Concerns**	Tribal consultation was completed for three of the proposed wells in this EA and no religious concerns were raised within this Area of Potential Effect (APE). See Table 5-1 for additional information on Native American consultation.	Blaine Phillips	03/05/07

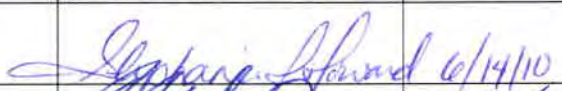
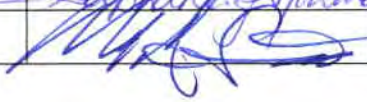
Determi-nation	Resource / Issue	Rationale for Determination*	Signature	Date
PI	**Threatened, Endangered or Candidate Animal Species**	Mexican Spotted Owl habitat is present within the Project Area. Water depletion is anticipated to occur and would impact Colorado pikeminnow, humpback chub, razorback sucker, bonytail.	Brandon McDonald	03/05/07
NP	**Threatened, Endangered or Candidate Plant Species**	No T&E species occurrence in Tumbleweed II Project Area.	Clayton Newberry	03/05/07
NI	**Wastes (hazardous or solid)**	All trash would be picked up and disposed of at an approved site, most likely the Uintah County landfill. No potentially harmful materials or substances would be left on or in the vicinity of the Tumbleweed II Project Area. No chemicals subject to SARA title III in amounts greater than 10,000 pounds would be used. No extremely hazardous substances as defined in 40 CFR 355 in threshold planning quantities would be used.	Stephanie Howard	03/05/07
PI-Surface NI-Ground	**Water Quality (surface/ground)**	*Surface*: Increased erosion due to roads, which could cause sediment to enter the Green River. Potential for spills of chemicals into the Green River. Ground: Compliance with "Onshore Oil and Gas Order No. 2, Drilling Operations" will assure that the project will not adversely affect groundwater quality. Due to the state-of-the-art drilling and well completion techniques, the possibility of adverse degradation of groundwater quality or prospectively valuable mineral deposits by the Proposed Action will be negligible. Well completion must be accomplished in compliance with "Onshore Oil and Gas Order No. 2, Drilling Operations". These guidelines specify the following: … *proposed casing and cementing programs shall be conducted as approved to protect and/or isolate all usable water zones, potentially productive zones, lost circulation zones, abnormally pressured zones, and any prospectively valuable deposits of minerals. Any isolating medium other than cement shall receive approval prior to use.*	John Mayers	03/05/07
NP	**Wetlands/Riparian Zones**	None present as per the Vernal Field Office GIS Database.	Karl Wright	03/05/07
NP	**Wild and Scenic Rivers**	None present.	Stephanie Howard	04/07/10
PI	**Wilderness**	No Wilderness Areas are present in the Project Area. The Winter Ridge WSA is 3 miles to the east of the proposed project, but is not impacted by the proposed project. However, an analysis of potential effects to the Wolf Point non-WSA lands with wilderness characteristics has been added to the EA as a stand-alone resource.	Stephanie Howard	04/07/10

Determi-nation	Resource / Issue	Rationale for Determination*	Signature	Date
PI	**County Transportation Plan**	Please have the applicant put in Chapter 2 that they will contact the Uintah County Building, Planning and Zoning Department for the necessary County permits, the Road Department when crossing, or encroaching upon County roads for permits and regulations, and the Public Lands Department when upgrading of a County road is necessary. A road maintenance agreement between the County and the Company could also be done. If you have any other questions, please let me know.	Diane Coltharp	05/22/07
PI	**Fish and Wildlife including Special Status Species other than FWS Candidate or Listed species (e.g. Migratory Birds)**	Sage grouse nesting and leking area. Migratory birds. Crucial habitat for deer and elk.	Brandon McDonald	03/05/07
NI	**Fuels/Fire Management**	Proposed Action would not hinder suppression actions/access.	Steve Strong	03/05/07
NI	**Geology/Mineral Resources**	Compliance with existing BLM construction restrictions on slopes and construction design will cause the possibility of the project initiating landslides, other mass movements, or flooding to be unlikely. Natural gas, oil, gilsonite, oil shale, and tar sand are the only mineral resources that could be impacted by the project. Production of natural gas or oil would deplete reserves, but the proposed project allows for the recovery of natural gas and oil per 43 CFR 3162.1(a), under the existing Federal lease. Compliance with "Onshore Oil and Gas Order No. 2, Drilling Operations" will assure that the project will not adversely affect gilsonite, oil shale, or tar sand deposits. Due to the state-of-the-art drilling and well completion techniques, the possibility of adverse degradation of tar sand or oil shale deposits by the Proposed Action will be negligible. Well completion must be accomplished in compliance with "Onshore Oil and Gas Order No. 2, Drilling Operations". These guidelines specify the following: *proposed casing and cementing programs shall be conducted as approved to protect and/or isolate all usable water zones, potentially productive zones, lost circulation zones, abnormally pressured zones, and any prospectively valuable deposits of minerals. Any isolating medium other than cement shall receive approval prior to use.*	M. Wegweiser	03/05/07
NI	**Lands/Access**	All BLM and County roads would be maintained at present standards and new roads would be constructed to gold book standards and per site specific proposals. No existing land uses would be changed or modified by the implementation of the Proposed Action; therefore, there would be no adverse affect. Right-of-way holders are present in the project area of sections 17, 19, 20, & 21. R/W holders shall be notified by BLM upon site specific proposals.	Cindy McKee	

Determi-nation	Resource / Issue	Rationale for Determination*	Signature	Date
PI	**Livestock Grazing**	Cattleguard maintenance/upgrade, increased traffic impact, increased trespass of cattle on sheep allotments due to additional roads (breach of topographic boundaries). Fence maintenance due to pipelines.	Mark Stavropolous	03/05/07
NI	**Paleontology**	Renegade Tongue of the Wasatch Formation contains at least one known site within 1 mile of a portion of the Proposed Action.	M. Wegweiser	03/05/07
PI	**Rangeland Health Standards and Guidelines**	Utah Rangeland Health Standard #1 requires that "upland soils exhibit permeability and infiltration rates that sustain or improve site productivity, considering the soil type, climate and landform". Increased soil erosion and soil compaction could potentially result in a failure to achieve Rangeland Health Standard #1. The spread of invasive weeds could cause a reduction in desired species which could move the allotments in a direction of not meeting Utah Rangeland Health Standard #3 (Desired species, including native, threatened, endangered, and special-status species, are maintained at a level appropriate for the site and species involved). See the resource specific sections for more details.	Mark Stavropolous	03/05/07
PI	**Recreation**	Area still retains broad panoramas of natural landscapes. Increase roads would provide increased access to motorized uses. Maintenance and service vehicle use would increase along with subsequent dust, noise, and increased wildlife collisions. Limited entry elk and deer hunts. Successful drawing for this Book Cliffs Bitter Creek South unit is approx. 15 years. High expectations of harvesting a mature 5 year+ old elk bull. Landowner tags presently selling for $12,000 bull elk and $5,000 for buck deer. The Proposed Action and indirect impacts of increased vehicle traffic could increase the difficulty in locating deer and elk and therefore diminish hunting success (probably more cumulative than directly related to this project).	Stephanie Howard	04/07/10
PI	**Sagebrush Restoration Project**	BLM recently completed restoration work in the Tumbleweed II Project Area.	Steve Strong	03/05/07
NI	**Socioeconomics**	The local economy would not be affected.	Stephanie Howard	03/05/07
PI	**Soils**	Removal and disturbance of soils. Disturbance of soils could lead to increased erosion, sediment yield, and impacts to biological soil crusts.	Steve Strong	03/05/07
PI	**Vegetation including Special Status Species other than FWS Candidate or Listed species**	Disturbance and removal of native vegetation.	Clayton Newberry	03/05/07

Determi-nation	Resource / Issue	Rationale for Determination*	Signature	Date
PI	**Visual Resources**	The Tumbleweed II Project Area is designated Visual Resource Management (VRM) Class III in the Vernal Field Office ROD and Approved RMP (BLM 2008a). The Wolf Point area was found to have naturalness in a April 25, 2007 VFO interdisciplinary review	Stephanie Howard	12/5/08
PI	**Waters of the U.S. (USACE)**	A few ephemeral drainages are located in the Tumbleweed II Project Area. Several will be crossed for access roads and pipelines. These crossings appear to qualify for Nationwide General Permit.	Sue Nall	03/05/07
PI	**Wild Horses and Burros**	Disturbance of vegetation could reduce available AUMS for wild horses. Construction activities could temporarily cause wild horses to forage in adjacent, undisturbed areas, causing increased grazing impacts. Pipeline could impact the gathering of horses.	Dusty Carpenter	12/05/08
PI	**Woodland/Forestry**	Commercial woodlands and forests are present.	Steve Strong	03/05/07
NP	**BLM natural areas**	None present per Vernal Field Office RMP/ROD, 2008.	Stephanie Howard	12/5/08

FINAL REVIEW:

Reviewer Title	Signature	Date	Comments
NEPA/Environmental Coordinator		6/14/10	
Authorized Officer		6/14/10	

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APPENDIX B

TUMBLEWEED EA PROJECT HISTORY

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In 2005, the BLM's Decision Record and FONSI for the *Bill Barrett Corporation Tumbleweed 3D Seismic Survey Environmental Assessment* (BLM 2005a) approved 3D seismic exploration in the Tumbleweed Unit. In October 2005, Bill Barrett Corporation (BBC) completed 3D seismic surveys of the Tumbleweed Unit. In January 2007, Stewart purchased the TUF leases from BBC.

Using the results of the seismic surveys to determine locations for exploratory drilling, Stewart originally proposed to drill six exploratory wells in the project area. The *Tumbleweed Exploratory Drilling Project* (EA UT-080-05-201 – BLM 2007a), which included an analysis of Stewart's proposed wells, roads, and pipelines was completed and made available for a 30-day public comment period beginning on June 15, 2007. During the public comment period, the BLM received seven comment letters from various interested parties including the U.S. Fish and Wildlife Service (USFWS), Southern Utah Wilderness Alliance (SUWA), the Utah Division of Air Quality (UDAQ), the Theodore Roosevelt Conservation Partnership (TRCP), the Utah Division of Wildlife Resources (UDWR), the Hopi Tribe, and Mr. Ken Kreckel. All substantive comments that were received by the BLM during the public comment period were individually responded to or were used to modify the alternatives and analysis. After responding to comments and modifying the document, the Tumbleweed Exploratory Drilling Project EA was completed, and a FONSI and Decision Record (DR) were issued by the BLM on September 21, 2007.

After the FONSI/DR was signed by the BLM Vernal FO on September 21, 2007, an Application for Permit to Drill (APD) for the TUF #18-9, which was one of the six wells originally analyzed in EA UT-080-05-201, was approved on September 25, 2007. Stewart, the operator of unit, constructed the well pad and associated access road within the Tumbleweed II Project Area, and initiated drilling operations on October 10, 2007. On October 26, 2007, SUWA submitted a request for State Director Review (SDR) of the Vernal Field Office September 21, 2007 FONSI/DR. On November 16, 2007, the State Director remanded the Vernal Field Office decision. However, because construction and drilling of the TUF #18-9 was initiated prior to the State Director's decision to remand the EA, the BLM permitted Stewart to continue with drilling and completion activities.

Following successful completion of the TUF #18-9, Stewart Petroleum filed for APD approval of the TUF #18-8 and TUF #19-1, both of which were proposed to be directionally drilled from the existing TUF #18-9 well pad. The BLM Vernal Field Office granted Stewart approval under the second statutory categorical exclusion (CX) created under the Section 390 of the Energy Policy Act on September 22, 2008.

Section 390 of the Energy Policy Act of 2005 prescribes five separate CXs from NEPA for oil and gas operations. The second statutory CX provides for exclusion from the NEPA process provided wells meet the following criteria:

> *(b)(2) Drilling an oil or gas well at a location or well pad site at which drilling has occurred previously within 5 years prior to the date of spudding the well.*

SUWA filed a request for SDR of the Vernal Field Office's determination to use Section 390 CXs for these two directional wells. In their request for immediate stay, SUWA argued the BLM specifically violated the direction of the State Director in approving these CXs; violated NEPA and the 2005 Energy Policy Act (EPAct) in approving these wells because there are extraordinary circumstances that rebut the ability of the BLM to categorically exclude these decisions from NEPA; and violated NEPA and EPAct in approving these wells because there is no preexisting NEPA document that adequately considered the impacts of these wells. After review, the BLM Vernal Field Office rescinded the CXs for the TUF #19-1 and #18-8.

After the BLM's CX decisions for the TUF #19-1 and #18-8 CXs were rescinded, Stewart, upon advice from the BLM, chose to incorporate these two directional wells within their Proposed Action and initiate a new EA for their exploratory project. While revising the Proposed Action and based on review of proprietary seismic data, Stewart also decided to remove two of the originally proposed well locations (TUF #5-18 and #17-14) and replace those locations with three new locations (TUF #17-4, #17-12, and #9-11).

Considerable time has passed since a decision on the *Tumbleweed Exploratory Drilling EA (UT-080-05-201)* (BLM 2007a) was remanded and the CXs for the TUF #19-1 and #18-8 directional wells were rescinded by the BLM. When UT-080-05-201 was completed, policies for exploration, development, and land use decisions within the Tumbleweed II Project Area were guided by the terms, conditions, and decisions of the *Final EIS on the Book Cliffs RMP* (BLM 1984) and the *ROD and Rangeland Program Summary for the Book Cliffs RMP* (BLM 1985).

On October 31, 2008 the Vernal Field Office released the Record of Decision and Approved RMP (Approved RMP) (BLM 2008a). Within the Approved RMP, neither the potential Main Canyon ACEC nor the potential Book Cliffs SRMA were designated. Because an assessment of impacts to these areas has already been included in the Approved RMP, and management decisions have already been made for these areas within the Approved RMP, potential effects to the former potential Main Canyon ACEC, and potential Book Cliffs SRMA were not included within this current Tumbleweed II EA. Potential impacts to individual resource components of these areas (e.g., cultural resources, recreation, etc.) are analyzed as appropriate within the resource-specific sections of this EA.

Similarly, because approximately 68 percent of the Wolf Point area has been leased for oil and gas development, the BLM determined that wilderness characteristics of this area could not be protected, preserved, or maintained and thus, the BLM did not carry the Wolf Point area forward for management as non-WSA lands with wilderness characteristics within the Approved RMP. Under the Vernal RMP, the Wolf Point area lands are to be managed for multiple use, including oil and gas development. These lands are not to be managed for the protection or preservation of wilderness characteristics. However, an analysis of potential effects on wilderness characteristics has been added to the final EA.

The Approved RMP also contains new stipulations to protect wildlife and other resources within the Tumbleweed II Project Area that were not included within the previous land use plan, and were therefore, not taken into consideration in the original Tumbleweed EA. These stipulations have been incorporated as appropriate into the ACEPMs and mitigation measures of this current Tumbleweed II EA.

Based on the above-mentioned changes to the Proposed Action, and the mid-document land use plan change, the environmental analysis for Stewart's proposal was revised to reflect the changed circumstances. In order to properly address these issues, the BLM determined that a new EA would be prepared and published, and the project would be assigned a new NEPA number. Accordingly, this document has been assigned NEPA number DOI-BLM-UTG010-2009-0090-EA. All comments submitted for the previously published EA UT-080-05-201 which are still applicable, within the context of the new RMP, were taken into account as this document was written.

As previously mentioned, the TUF #18-9 was drilled and completed in 2007. However, given that the 2007 Decision Record approving that well was remanded, the surface disturbance, direct, indirect, and cumulative impacts of that existing well pad, well, and associated facilities are fully analyzed as part of the Proposed Action of this new EA.

APPENDIX C

SPECIAL STATUS SPECIES

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SUMMARY OF POTENTIAL FOR AND/OR OCCURRENCE OF SPECIAL STATUS PLANT AND WILDLIFE SPECIES FOR STEWART PETROLEUM CORPORATION'S TUMBLEWEED II PROJECT AREA

Species	Status	Habitat Association	Potential for Occurrence Within the Proposed Project Area and Cumulative Effects Area[1]	Eliminated From Detailed Analysis (Yes/No)
Wildlife Species				
Bonytail *Gila elegans*	FE	Is endemic to the Colorado River system within main channels of large rivers, and favors swift currents.	None. Potential habitat does not occur in the Tumbleweed II Project Area.	**No**
Colorado pikeminnow *Ptychocheilus lucius*	FE	Known from the Colorado River system. Uses large swift rivers.	None. Potential habitat does not occur in the Tumbleweed II Project Area.	**No**
Humpback chub *Gila cypha*	FE	Is endemic to the Colorado River system within deep, swift-running rivers, with canyon-shaded environments.	None. Potential habitat does not occur in the Tumbleweed II Project Area.	**No**
Razorback sucker *Xyrauchen texanus*	FE	Endemic to large rivers of the Colorado River system.	None. Potential habitat does not occur in the Tumbleweed II Project Area.	**No**
Black-footed ferret *Mustela nigripes*	FE	Semi-arid grasslands and mountain basins. It is found primarily in association with active prairie dog colonies that contain suitable burrow densities and colonies that are of sufficient size.	None. The distribution of this species is limited to a nonessential experimental population reintroduced into Coyote Basin, Uintah County starting in 1999.	Yes
Canada lynx *Lynx lynx canadensis*	FT	Primarily occurs in Douglas-fir, spruce-fir, and subalpine forests at elevations above 7,800 feet above mean sea level (amsl). The lynx uses large woody debris, such as downed logs and windfalls.	None. If extant in Utah, this species most likely occurs in montane forests in the Uinta Mountains.	Yes
Mexican spotted owl *Strix occidentalis lucida*	FT; PIF	In Utah, found primarily in rocky canyons. Nests in caves or crevices. Roosts on ledges or in trees in canyons. The species prefers mesic (moister/cooler) canyons with mixed conifer or riparian components. Breeding and nesting season: March through August.	Moderate. Willow Creek Canyon may provide suitable nesting habitat for the species.	**No**
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	FC; PIF	Riparian obligate and usually occurs in large tracts of cottonwood/willow habitats. However, this species also has been documented in lowland deciduous woodlands, alder thickets, deserted farmlands, and orchards. Breeding season: late June through July.	None. Potential habitat does not occur in the Tumbleweed II Project Area.	Yes
Bluehead sucker *Catostomus discobolus*	CAS	Occupies a wide range of aquatic habitats ranging from cold, clear mountain streams to warm, turbid rivers.	None. Potential habitat does not occur in the Tumbleweed II Project Area.	**No**

Species	Status	Habitat Association	Potential for Occurrence Within the Proposed Project Area and Cumulative Effects Area[1]	Eliminated From Detailed Analysis (Yes/No)
Flannelmouth sucker *Catostomus latipinnis*	CAS	Adults occur in riffles, runs, and pools in streams and large rivers, with the highest densities usually in pool habitat. Young live in slow to moderately-swift waters near the shoreline areas.	None. Potential habitat does not occur in the Tumbleweed II Project Area.	**No**
Roundtail chub *Gila robusta*	CAS	Adults inhabit low to high-flow areas in the Green River; young occur in shallow areas with minimal flow.	None. Potential habitat does not occur in Tumbleweed II Project Area.	**No**
Colorado River cutthroat trout *Oncorhynchus clarkii pleuriticus*	CAS	Requires cool, clear water and well-vegetated streambanks for cover and bank stability; instream cover in the form of deep pools and boulders and logs also is important; adapted to relatively cold water, thrives at high elevations. Most remaining populations are fluvial or resident. Occurs also in lakes.	None. Potential habitat does not occur in the Tumbleweed II Project Area.	Yes
Northern goshawk *Accipiter gentilis*	CAS	Generally found in a wide variety of forest types including deciduous, coniferous, and mixed forests. Typically mature and old growth forests and generally selects larger tracts of forest over smaller tracts. In the western U.S., characteristically nests in coniferous forests including those dominated by ponderosa pine, lodgepole, or in mixed forests dominated by various coniferous species including: Douglas-fir, cedar, hemlock, spruce, and larch. Western birds also nest in deciduous forests dominated by aspen, paper birch, or willow.	None: No northern goshawk nests or suitable habitat have been identified within the Tumbleweed II Project Area.	Yes
Bald eagle *Haliaeetus leucocephalus*	WSC; BGEPA	In Utah, breeding occurrences are limited to 10 locations within four counties (Carbon, Daggett, Duchesne, Grand, and Salt Lake counties). Winter habitat typically includes areas of open water, adequate food sources, and sufficient diurnal perches and night roosts.	Moderate. Bald eagles utilize ungulate winter ranges that provide carrion. Bald eagles are sometimes seen near the Tumbleweed II Project Area during winter months, usually in early November through late March.	**No**
American white pelican *Pelecanus erythrorhynchos*	WSC; PIF	Inhabits areas of open water including large rivers, lakes, ponds, and reservoirs with surrounding habitats ranging from barren to heavily-vegetated sites. Typically nests on isolated islands in lakes or reservoirs.	None. In Utah, the species is known to nest on islands associated with Great Salt and Utah lakes. In northeastern Utah, the species occurs as a transient on larger water bodies.	Yes

Species	Status	Habitat Association	Potential for Occurrence Within the Proposed Project Area and Cumulative Effects Area[1]	Eliminated From Detailed Analysis (Yes/No)
Greater sage-grouse *Centrocercus urophasianus*	FC	Inhabits upland sagebrush habitat in rolling hills and benches. Breeding occurs on open leks (or strutting grounds), and nesting and brooding occurs in upland areas and meadows in proximity to water and generally within a 2-mile radius of the lek. During winter, sagebrush habitats at submontane elevations commonly are used.	High. The species is widespread, but declining, with extant populations in Uintah and Daggett counties. Leks occur near the Tumbleweed II Project Area.	**No**
Ferruginous hawk *Buteo regalis*	WSC; PIF	Resides mainly in lowland open desert terrain characterized by barren cliffs and bluffs, pinyon-juniper woodlands, sagebrush-rabbitbrush, and cold desert shrub. Nesting habitat includes promontory points and rocky outcrops.	Low. This species is known to occur in the West Desert and the Uinta Basin as a summer resident and a common migrant. No ferruginous hawk nests have been documented within the Tumbleweed II Project Area.	**No**
Western burrowing owl *Athene cunicularia*	WSC	Inhabits desert, semi-desert shrubland, grasslands, and agriculture areas. Nesting and shelter habitat primarily consists of flat, dry, and relatively open terrain; short vegetation; and abandoned mammal burrows (within northeastern Utah primarily in association with prairie dog complexes).	None. Burrowing owls nest in desert/grassland habitats and are found in close association with prairie dog colonies in Northeastern Utah. Habitat for this species does not occur in the Tumbleweed II Project Area.	Yes
Mountain plover *Charadrius montanus*	WSC; PIF	In the Uinta Basin, small mountain plover populations breed in shrub-steppe habitat where vegetation is sparse and sagebrush communities are dominated by *Artemesia* spp. with components of black sage and grasses. Nest locations also vary with respect to topography (nests are located on flat, open ground; on the top or at the base of slopes; or very close to large rocky outcroppings).	None. The only known breeding population of mountain plover in Utah is located on Myton Bench.	Yes
White-tailed prairie dog *Cynomys leucurus*	WSC	Inhabits grasslands, plateaus, plains, and desert shrub habitats. White-tailed prairie dog s form colonies or "towns" and spend much of their time in underground burrows and hibernating during the winter months.	None. Suitable habitat does not occur within the Tumbleweed II Project Area.	Yes

Species	Status	Habitat Association	Potential for Occurrence Within the Proposed Project Area and Cumulative Effects Area[1]	Eliminated From Detailed Analysis (Yes/No)
Short-eared owl *Asio flammeus*	WSC	Inhabits arid grasslands, agricultural areas, marshes, and occasionally open woodlands. In Utah, cold desert shrub and sagebrush-rabbitbrush habitats also are utilized. Typically a ground nester.	None. The species breeds in northern Utah and occurs as a migrant potentially throughout the State. It is known to occur in Uintah County, with occurrence probable in Duchesne County. Habitat for this species does not occur in the Tumbleweed II Project Area.	Yes
Lewis's woodpecker *Melanerpes lewis*	WSC; PIF	Inhabits open habitats including pine forests, riparian areas, and pinyon-juniper woodlands. Breeding habitat typically includes ponderosa pines and cottonwoods in stream bottoms and farm areas. The species inhabits agricultural lands and urban parks, montane and desert riparian woodlands, and submontane shrub habitats.	Low to None. In Utah, the species is widespread, but is an uncommon nester along the Green River. Breeding by this species has been observed in Ouray and Uintah counties, and along Pariette Wash.	Yes
Three-toed woodpecker *Picoides tridactylus*	WSC; PIF	Prefers coniferous forest, primarily spruce and balsam fir. It inhabits areas where dead timber remains after fires or logging. It is found less frequently in mixed forest, and occasionally in willow thickets along streams. Also found in high elevation aspen groves, bogs, and swamps.	None: The species occurs in the northern portion of Uintah County, generally inhabiting coniferous forests above 8, 000 feet. Habitat does not occur in the Tumbleweed II Project Area.	Yes
Grasshopper sparrow *Ammodramus savannarum*	WSC; PIF	Prefers grasslands of intermediate height and are often associated with clumped vegetation interspersed with patches of bare ground. Other habitat requirements include moderately-deep litter and sparse coverage of woody vegetation.	None: In Utah, breeding populations have only been found in the northern portion of the state (in Uintah, Duchesne, and Daggett counties). Habitat is not present within the Tumbleweed II Project Area.	Yes
Long-billed curlew *Numenius americanus*	WSC; PIF	Inhabits shortgrass prairies, alpine meadows, riparian woodlands, and reservoir habitats. Breeding habitat includes upland areas of shortgrass prairie or grassy meadows with bare ground components, usually near water.	None. Widespread migrant in Utah. Breeding birds are fairly common but localized, primarily in central and northwestern Utah. Potential nesting has been reported in Uintah County, but has not been confirmed. Habitat does not occur in the Tumbleweed II Project Area.	Yes

Species	Status	Habitat Association	Potential for Occurrence Within the Proposed Project Area and Cumulative Effects Area[1]	Eliminated From Detailed Analysis (Yes/No)
Bobolink *Dolichonyx oryzivorus*	WSC; PIF	Inhabits mesic and irrigated meadows, riparian woodlands, and subalpine marshes at lower elevations (2,800 to 5,000 feet amsl). Suitable breeding habitat for this ground nester includes tall grass, flooded meadows, prairies, and agricultural fields; forbs and perch sites also are required.	None. The species breeds in isolated areas of Utah, primarily in the northern half of the State. No breeding by this species has been documented within the proposed Tumbleweed II Project Area.	Yes
Big free-tailed bat *Nyctinomops macrotis*	WSC	Rocky areas in rugged country. The species has been observed in lowlands of river floodplain-arroyo association; also in shrub desert and woodland habitats. Roosts in rock crevices (vertical or horizontal) in cliffs; also in buildings, caves, and occasionally tree holes. Winter habits unknown.	Low: The species primarily occurs in the southern portion of Utah, although individuals may rarely occur in northern Utah. The species has been documented in the northeastern portion of Utah from Daggett County into Wyoming. Although uncommon to Uintah County, bats may occupy marginal roosting habitat and woodland areas in the Tumbleweed II Project Area.	**No**
Fringed myotis *Myotis thysanodes*	WSC	The species is widely distributed throughout Utah, but is not very common in the State. The fringed myotis inhabits caves, mines, and buildings, most often in desert and woodland areas.	None: An uncommon resident in Utah, this species primarily occurs in the southern portion of Utah and is not expected to be present in the Tumbleweed II Project Area.	Yes
Spotted bat *Euderma maculatum*	WSC	Inhabits desert shrub, sagebrush-rabbitbrush, pinyon-juniper woodland, and ponderosa pine and montane forest habitats. The species also uses lowland riparian and montane grassland habitats. Suitable cliff habitat typically appears to be necessary for roosts/hibernacula. Spotted bats typically do not migrate and use hibernacula that maintain a constant temperature above freezing from September through May.	None: The species potentially occurs throughout Utah; however, no occurrence records exist for the extreme northern or western parts of the State. Known occurrences have been reported in northeastern Uintah County. However, as habitat for this species generally occurs south and outside of the Tumbleweed II Project Area, the species is not expected to be present in Tumbleweed II Project Area.	Yes

Species	Status	Habitat Association	Potential for Occurrence Within the Proposed Project Area and Cumulative Effects Area[1]	Eliminated From Detailed Analysis (Yes/No)
Townsend's big-eared bat *Corynorhinus townsendii*	WSC	Inhabits a wide r ange o f h abitats from s emi-desert shrublands a nd pi nyon-juniper woodlands t o ope n montane forests. R oosting o ccurs i n mines a nd c aves, i n abandoned bu ildings, on r ock c liffs, a nd oc casionally i n tree cavities. Foraging occurs well after dark over water, along margins of vegetation, and over sagebrush.	Low: T he s pecies oc curs throughout much o f Utah i ncluding D uchesne a nd Uintah c ounties. O ne individual was collected at the O uray N ational Wildlife Refuge i n 1980. The s pecies may pot entially oc cur in T umbleweed II P roject A rea where p inyon-juniper woodlands are present.	**No**
Western (Boreal) toad *Bufo boreas*	WSC	Commonly found t hroughout most o f U tah a nd c an b e found i n a va riety o f habitats, i ncluding s low-moving streams, wetlands, d esert sp rings, p onds, lakes meadows, and woodlands.	None: T he s pecies i s co mmonly spread throughout central and northern Utah. The only known occurrence in the U inta B asin e xists within th e northwest por tion of Uintah C ounty. Habitat is n ot p resent within t he Tumbleweed II Project Area.	Yes
Corn snake *Elaphe guttata*	WSC	Habitat i ncludes pi ne woodlands, br ushy fields, ope n hardwood f orests, mangrove t hickets, ba rnyards, abandoned bu ildings, a nd a reas n ear s prings, ol d t rash dumps, and caves.	None: T he species o ccurs south an d outside of t he T umbleweed I I P roject Area.	Yes
Smooth green snake *Opheodrys vernalis*	WSC	Habitat i ncludes meadows, g rassy marshes, moist g rassy fields a t forest e dges, mountain s hrublands, s tream borders, bogs, open moist woodland, abandoned farmland, and vacant lots.	None: T he s pecies o ccurs north an d outside of t he T umbleweed I I P roject Area.	Yes
Prairie falcon *Falco mexicanus*	PIF	Habitat includes alpine, cliff, cropland/hedgegrow, desert, and grassland/herbaceous areas.	Low to M oderate: P rairie falcon n ests could occur on cliff ledges within the vicinity o f the T umbleweed I I P roject Area.	**No**
Swainson's hawk *Buteo swainsonii*	PIF	Inhabits grasslands, deserts, agricultural areas, shrublands, marshlands, and riparian forests. Nests in trees in or near open areas. Breeding season: April 1 – July 15.	Low. T his species o ccurs in t he Uinta Basin as a n u ncommon s ummer resident a nd c ommon migrant. I t requires t rees o f moderate he ight for nesting. N o S wainson's hawk nests have been documented within the Tumbleweed II Project Area.	Yes
Black-chinned hummingbird *Archilochus alexandri*	PIF	Habitat includes dry lo wlands a nd foothills with p inyon-juniper woodlands.	Low. P inyon-juniper woodlands in t he Tumbleweed I I P roject A rea may have potential habitat for this species.	**No**

Species	Status	Habitat Association	Potential for Occurrence Within the Proposed Project Area and Cumulative Effects Area[1]	Eliminated From Detailed Analysis (Yes/No)
Broad-tailed hummingbird *Selasphorus platycercus*	PIF	Habitat includes open woodland, especially pinyon-juniper, pine-oak, and conifer-aspen association; brushy hillsides; montane scrub and thickets.	None: The species could potentially occur in pinyon-juniper woodland areas adjacent to but outside of the Tumbleweed II Project Area, near Willow Creek.	Yes
Brewer's sparrow *Spizella breweri*	PIF	Habitat includes desert and shrubland/chaparral.	Low to Moderate: In the Tumbleweed II Project Area, the species may occupy patches of tall, dense sagebrush with more bare ground and less herbaceous cover than the surrounding habitat.	**No**
Cassin's finch *Carpodacus cassinii*	PIF	Habitat includes open coniferous forest. In migration and winter, habitat also includes deciduous woodland, secondary growth, scrub, brushy areas, and partly-open situations with scattered trees.	None: Pinyon-juniper woodlands within the Tumbleweed II Project Area are lower in elevation than those utilized by the species. Therefore, habitat is not present within the Tumbleweed II Project Area.	Yes
Cassin's kingbird *Tyrannus vociferan*	PIF	Habitat includes sparse woods and dry scrub areas.	None: The species is a common summer resident in southern Utah; however, no occurrence records exist for Uintah County.	Yes
Clark's nutcracker *Nucifraga columbiana*	PIF	Habitat includes open coniferous forest, forested edge and clearings, primarily in mountains, but wandering into various habitats; in winter also in lowlands.	Low: This non-migratory species is found in mountainous areas throughout Utah, descending to lower elevations (e.g., pinyon-juniper woodlands) in winter. Therefore, the species could winter in pinyon-juniper woodland areas within the Tumbleweed II Project Area.	**No**
Gray flycatcher *Empidonax wrightii*	PIF	Habitat includes arid areas of sagebrush or pinyon-juniper woodlands.	Low. The Tumbleweed II Project Area may have potential habitat for this species.	**No**
Gray vireo *Vireo vicinior*	PIF	Habitat includes dry shrubby areas, chaparral, and sparse woodlands.	Low. The Tumbleweed II Project Area may have potential habitat for this species.	**No**

Species	Status	Habitat Association	Potential for Occurrence Within the Proposed Project Area and Cumulative Effects Area[1]	Eliminated From Detailed Analysis (Yes/No)
Green-tailed towhee *Pipilo chlorurus*	PIF	Habitat is usually low shrubs, sometimes interspersed with trees. Avoids typical forest, other than open pinyon-juniper woodlands. In pinyon-juniper, associated with sagebrush (*Artemesia* spp.) dominated openings with high shrub species richness.	Low: A common breeder in northeastern Utah, the species may occupy shrubland and pinyon-juniper woodland areas in the Tumbleweed II Project Area.	**No**
Juniper titmouse *Parus inornatus*	PIF	Habitat includes sparse pinyon-juniper and oak woodlands.	High. The Tumbleweed II Project Area has large areas of potential habitat for this bird species.	**No**
Mountain bluebird *Sialia currucoides*	PIF	Habitat includes subalpine meadows, grasslands, shrub-steppe, savanna, and pinyon-juniper woodlands; in south usually at elevations above 1,500 meters (4,900 feet). In winter and migration, also inhabits desert, brushy areas and agricultural lands.	Low: In Utah, breeding typically occurs in high mountain valleys. Although less common in Utah than in previous years, the species may sporadically occupy pinyon-juniper woodland areas in the Tumbleweed II Project Area.	**No**
Pinyon jay *Gymnorhinus cyanocephalus*	PIF	Habitat includes semi-arid foothills with pinyon-juniper woodlands.	High. The Tumbleweed II Project Area has large areas of potential habitat for this species.	**No**
Sage sparrow *Amphispiza belli*	PIF	Habitat includes dry sagebrush/scrublands with sparse vegetation.	High. Portions of the Tumbleweed II Project Area have suitable habitat for sage sparrows.	**No**
Sage thrasher *Oreoscoptes montanus*	PIF	Habitat includes desert and shrubland/chaparral.	Moderate: The species may nest in sagebrush communities in the Tumbleweed II Project Area.	**No**
Virginia's warbler *Vermivora virginiae*	PIF	Habitat includes dry woodlands, scrub oak brushlands, canyons, and ravines.	Low. The Tumbleweed II Project Area may have potential habitat for this species.	Yes
White-throated swift *Aeronautes saxatalis*	PIF	Habitat includes cliffs and canyons.	Low. Areas along Willow Creek may have potential habitat for this species.	**No**
Wilson's phalarope *Phalaropus tricolor*	PIF	Habitat includes grassland/herbaceous riparian and wetlands.	None: Habitat is not present within the Tumbleweed II Project Area.	Yes
Golden eagle[2] *Aquilla chrysaetos*	BGEPA	Found in mountainous areas, canyons, shrublands, and grasslands, and in shrub-steppe habitats in winter.	Moderate: Nesting and foraging habitat is found throughout the area. Golden eagle nests golden eagles may forage or could establish nests within the Tumbleweed II Project Area.	**No**

Species	Status	Habitat Association	Potential for Occurrence Within the Proposed Project Area and Cumulative Effects Area[1]	Eliminated From Detailed Analysis (Yes/No)
Plant Species				
Arabis vivariensis Park rock cress	S	Webber Formation. Sandstone and limestone outcrops in mixed desert shrub and pinyon-juniper communities. 5,000-6,000 feet.	None: No potential habitat. The geological formation and soils associated with this species do not occur in the Tumbleweed II Project Area.	Yes
Astragalus equisolensis Horseshoe milkvetch	0	Duchesne River Formation soils in sagebrush, shadscale, horsebrush and mixed desert shrub communities. The species is endemic to a single location in central Uintah County. 4,790-5,185 feet.	None: No potential habitat. Only known populations occur in north-central portion of Uintah County, and therefore outside of the Tumbleweed II Project Area.	Yes
Astragalus hamiltonii Hamilton milkvetch	S	Lapoint and Dry Gulch members of the Duchesne River Formation, Mowry Shale, Dakota Sandstone and the Wasatch Formation soils in pinyon-juniper and desert shrub communities. 5,240-5,800 feet.	None: No potential habitat. Known populations of this species occur in north-central Uintah County, north and outside of the Tumbleweed II Project Area.	Yes
Cirsium ownbeyi Ownbey thistle	S	East flank Uinta Mountains. In mesic sites within canyons in mixed sagebrush, juniper, and riparian communities. 5,500-6,200 feet.	None: No potential habitat. Known populations of this species occur in north Uintah County, north and outside of the Tumbleweed II Project Area.	Yes
Cleomella palmeriana. var. *goodrichii* Goodrich cleomella	S	Uintah County. Diamond Mountain. Mancos Shale, Tropic Shale and Morrison formations. On eroded slopes of heavy clay in salt desert communities. 4,000-6,000 feet.	None: No potential habitat. The geological formation and soils associated with this species do not occur in the Tumbleweed II Project Area. This species is found in the northeastern portion of Uintah County, which is north and outside of the Tumbleweed II Project Area.	Yes
Erigeron untermannii Untermann fleabane	S	Duchesne and Uintah counties. West Tavaputs Plateau. Calcareous shales and sandstones of the Uinta and Green River formations in pinyon-juniper, mountain mahogany, limber and bristlecone pine, and sagebrush communities. 7,000-7,810 feet.	None: No potential habitat. Known populations occur west and outside of the Tumbleweed II Project Area.	Yes

Species	Status	Habitat Association	Potential for Occurrence Within the Proposed Project Area and Cumulative Effects Area[1]	Eliminated From Detailed Analysis (Yes/No)
Habenaria zothecina Alcove bog-orchid	S	Uintah County. Navajo or Nugget Sandstone Formation. Seeps, hanging gardens, and riparian areas. Surrounding habitat is mixed desert shrub, pinyon-juniper, and oak brush. 4,360-8,690 feet.	None: No potential habitat. The geological formation and soils associated with this species do not occur in the Tumbleweed II Project Area.	Yes
Hymenoxys lapidicola Rock hymenoxis	S	Sandy soils on ledges and soil-filled crevices in the Weber Formation associated with Blue Mountain. 5, 700-8,100 feet.	None: No potential habitat. The geological formation and soils associated with this species do not occur in the Tumbleweed II Project Area.	Yes
Lepidium barnebyanum Barneby's pepperplant	FE	Tribal land, Duchesne County. West Tavaputs Plateau, Indian Canyon. Uinta Formation. Occurs on white shale outcrops and ridges. Barren inclusions in pinyon-juniper communities. 6,200-6,350 feet.	None: No potential habitat. Known populations occur outside of Uintah County, and therefore outside of the Tumbleweed II Project Area.	Yes
Lepidium huberi Huber pepperplant	S	Uintah County. Uinta Mountain foothills, Book Cliffs. Chinle, Park City, and Weber formations. Alluvial soils, eroding parent material (outcrop breaks, rock crevices).	None: No potential habitat. The geological formation and soils associated with this species do not occur in the Tumbleweed II Project Area.	Yes
Mentzelia goodrichii Goodrich blazingstar	S	Steep shale slopes of the Green River Formation, with scattered juniper, pinyon, limber pine, and mountain mahogany. 8,100-8,800 feet.	None: No potential habitat. Known populations occur outside of Uintah County, and therefore outside of the Tumbleweed II Project Area.	Yes
Penstemon acaulis Stemless penstemon	S	Daggett County. Semi-barren substrates in the Browns Park Formation. Pinyon-juniper and sagebrush-grass communities. 5,840-7,285 feet.	None: No potential habitat. The geological formation and soils associated with this species do not occur in the Tumbleweed II Project Area.	Yes
Penstemon gibbensii Gibbens penstemon	S	Brown's Park in Daggett County. Sandy and shaley (Green River Shales) buffs and slopes with juniper, thistle, *Eriogonum*, *Elymus*, serviceberry, rabbitbrush and *Thermopsis* spp. 5,500-6,400 feet.	None: No potential habitat. Known populations occur outside of Uintah County, and therefore outside of the Tumbleweed II Project Area.	Yes

Species	Status	Habitat Association	Potential for Occurrence Within the Proposed Project Area and Cumulative Effects Area[1]	Eliminated From Detailed Analysis (Yes/No)
Penstemon goodrichii Goodrich penstemon	S	Lapoint-Tridell-Whiterocks area. Lapoint and Dry Gulch members of the Duchesne River Formation on blue gray to reddish bands of clay badlands. 5,590-6,215 feet.	None: No potential habitat. The geological formation and soils associated with this species do not occur in the Tumbleweed II Project Area. This species is found within isolated geographic areas (Lapoint-Tridell-Whiterocks area), north of the Tumbleweed II Project Area.	Yes
Penstemon grahamii Graham's beardtongue	S	East Duchesne and Uintah counties. Evacuation Creek and Parachute Creek members of the Green River Shale. Shaley knolls in sparsely-vegetated desert shrub and pinyon-juniper communities. 4,600-6,700 feet.	None: No potential habitat. Known populations of this species occur in central Uintah County, north and outside of the Tumbleweed II Project Area.	Yes
Penstemon scariosus var. *albifluvis* White River penstemon	FC	Evacuation Creek and Parachute Creek members of the Green River Shale on sparsely-vegetated shale slopes in mixed desert shrub and pinyon-juniper communities. 5,000-6,000 feet.	None: No potential habitat. Known populations occur near the White River, northeast and outside of the Tumbleweed II Project Area.	Yes
Schoencrambe argillacea Clay reed-mustard	FT	Bookcliffs. On the contact zone between the upper Uinta and Green River Shale in mixed desert shrub of Indian ricegrass and pygmy sagebrush. 5,000-5,650 feet.	None: No potential habitat. The geological formations and elevation associated with this species do not occur in the Tumbleweed II Project Area.	Yes
Schoencrambe suffrutescens Shrubby reed-mustard	FE	Evacuation Creek and lower Parachute Creek members of the Green River Formation on calcareous shales in pygmy sagebrush, mountain mahogany, juniper, and mixed desert shrub communities. 5,400-6,000 feet.	None: No potential habitat. Known populations of this species occur in south-central Uintah County, north and outside of the Tumbleweed II Project Area.	Yes
Sclerocactus brevispinus Pariette cactus	FT	Duchesne County. Pariette Wash south of Myton. Wagonhound Member of the Uinta Formation. Alkaline clays hadscale, mat-saltbush, greasewood community. 4,700-5,400 feet.	None: No populations, potential or suitable habitat occurs for this species in this area. This species has only been identified on the western edge of Uintah County, outside of the Tumbleweed II Project Area.	Yes

Species	Status	Habitat Association	Potential for Occurrence Within the Proposed Project Area and Cumulative Effects Area[1]	Eliminated From Detailed Analysis (Yes/No)
Sclerocactus wetlandicus Uinta Basin hookless cactus	FT	Gravelly hills and terraces on Quaternary and Tertiary alluvium soils in cold desert shrub communities. 4, 700-6,000 feet.	None: No potential habitat. Known populations of this species occur in south-central Uintah County, north and outside of the Tumbleweed II Project Area. Elevations associated with this species do not occur in the Tumbleweed II Project Area.	Yes
Spiranthes diluvialis Ute ladies'-tresses	FT	Streams, bogs, and open seepages in cottonwood, salt cedar, willow and pinyon-juniper communities on the south and east slope of the Uintah Range and its tributaries, and the Green River from Browns Park to Split Mountain. Potentially in the upper reaches of streams in the Book Cliffs. 4,400-6,810 feet.	None: The species occurs north of U.S. Highway 40, and therefore outside of the Tumbleweed II Project Area.	Yes
Thelesperma caespitosum Uinta greenthread	S	Duchesne County. White shale benches in sagebrush-grassland or mixed forb communities. 5,000-6,000 feet.	None: No potential habitat. Known populations occur outside of Uintah County, and therefore outside of the Tumbleweed II Project Area.	Yes

Federally Listed Species:

- FE = Federally listed as endangered;
- FT = Federally listed as threatened;
- FC = Federally listed as candidate

State Sensitive Wildlife Species:

- CAS = State Conservation Agreement Species;
- WSA = Wildlife Species of Concern

Other Status (Wildlife):

- BGEPA = Bald and Golden Eagle Protection Act
- PIF = Partners in Flight species of concern, Colorado Plateau, Utah Mountains, potentially in the Vernal Field Office.

Other Status (Plants):

- S = Bureau-sensitive
- 0 = Non-status, removed from status, potential status

APPENDIX D

EMISSIONS INVENTORY

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Buys & Associates, Inc.
Environmental Consultants

Project: Tumbleweed EA
Date: 4/1/2009

1. Well Pad/Road Construction Emissions (Dozers and Backhoes

Assumptions:

Well Pad/RoadArea	12.49	acres initial disturbance per pad (Proposed Action)
Hours of Construction	10	days per well pad (Proposed Action)
	10	hours/day
	100	hours per well pad
Watering Control Efficiency	50	percent (Assumption)
Soil Moisture Content	7.9	percent (AP-42 Table 11.9-3, 10/98)
Soil Silt Content	6.9	percent (AP-42 Table 11.9-3, 10/98)

Equations: From AP-42 tables 11.9-1 and 11.9-3
Bulldozing Overburden Emissions, Western Surface Coal Mining, 10/98
AP-42 Table 13.2.3-1 Recommended Emission Factors for Construction Operations

Emissions (TSP lbs/hr) = $5.7 * (\text{soil silt content \%})^{1.2} * (\text{soil moisture content \%})^{-1.3} *$ Control Efficiency

Emissions (PM_{15} lbs/hr) = $1.0 * (\text{soil silt content \%})^{1.5} * (\text{soil moisture content \%})^{-1.4} *$ Control Efficiency

$PM_{2.5}$ Multiplier = 0.105 * TSP (AP-42 Table 11.9-1, 10/98)

PM_{10} Multiplier = 0.75 * PM_{15} (AP-42 Table 11.9-1, 10/98)

Emissions = 1.97 lbs TSP/hour/piece of equipment

Emissions = 0.50 lbs PM_{15}/hour/piece of equipment

	Dozer and Backhoe Emissions [a]		
	lbs/hr	**tons/well**	**tons/yr [b]**
TSP	7.88	0.3941	2.76
PM_{15}	2.01	0.1004	0.70
PM_{10}	1.51	0.0753	0.53
$PM_{2.5}$	0.83	0.0414	0.29

[a] Assumes one dozer and one backhoe. Backhoe emissions are conservatively estimated as equivalent to Dozer emissions.

[b] Assumes maximum development scenario

2. Well Pad/Road Construction Emissions (Grader)

Assumptions:

Grading Length	3.67	Miles	(Note = Grader Road length + Grader Pad Length)
			Grader road length = Access road length x 3 (# of 10-ft swath for 32' ROW)
			Grader Pad Length = (10 ft swath for 350 ft * 16 lengths) = 5,600 ft
Hours of Construction	6		day grading per well pad and road (Estimate)
	10		hours/day
	60		hours per well pad
Watering Control Efficiency	50		percent (Assumption)
Average Grader Speed	7.1		mph (Typical value AP-42 Table 11.9-3, 10/98)
Distance Graded	3.67		miles

Equations: From AP-42 tables 11.9-1 and 11.9-3
Bulldozing Overburden Emissions, Western Surface Coal Mining, 10/98
AP-42 Table 13.2.3-1 Recommended Emission Factors for Construction Operations

Emissions (TSP lbs) = $0.040 * (\text{Mean Vehicle Speed})^{2.5} * \text{Distance Graded} * \text{Control Efficiency}$

Emissions (PM_{15} lbs) = $0.051 * (\text{Mean Vehicle Speed})^{2.0} * \text{Distance Graded} * \text{Control Efficiency}$

PM_{10} Multiplier = $0.6 * PM_{15}$ (AP-42 Table 11.9-1, 10/98)

$PM_{2.5}$ Multiplier = $0.031 * TSP$ (AP-42 Table 11.9-1, 10/98)

Emissions = 9.87 lbs TSP/well

Emissions = 4.72 lbs PM_{15}/well

	Grader Construction Emissions			
	lbs/well pad	**lbs/hr**	**tons/well pad**	**tons/yr [a]**
TSP	9.87	0.16	0.2962	2.07
PM_{15}	4.72	0.08	0.0000	0.00
PM_{10}	2.83	0.05	0.0709	0.50
$PM_{2.5}$	0.31	0.01	1.53E-04	1.07E-03

[a] Assumes maximum development scenario

Buys & Associates, Inc. **Environmental Consultants**	Project: Tumbleweed EA Date: 4/1/2009

3. Well Pad/Road Construction Heavy Equipment Tailpipe Emissions

Assumptions:

Hours of Operation 100 hours/site (Proposed Action)

Development Rate 7 new pads per year (Proposed Action)

Load Factor 0.4 (Assumed typical value)

Backhoe Size 129 hp (Mid-sized typical value + Class 125)

Dozer Size 686 hp (Largest D6 series+Class 988)

Motor Grader Size 158 hp (Largest D12 series)

Equations:

$$\text{Emissions (tons/year)} = \frac{\text{Emission Factor (g/hp-hr)} * \text{Rated Horsepower (hp)} * \text{Operating Hours (hrs)} * \text{Load Factor (Dimensionless)}}{453.6\ \text{(g/lb)} * 2000\ \text{(lb/tons)}}$$

Heavy Const. Vehicles	Backhoe			Dozer			Grader		
	E. Factor [a] (g/hp-hr)	Emissions (lb/hr)	Emissions[e] (tons/yr)	E. Factor [a] (g/hp-hr)	Emissions (lb/hr)	Emissions[e] (tons/yr)	E. Factor [b] (g/hp-hr)	Emissions (lb/hr)	Emissions[e] (tons/yr)
NOx	8.15	0.927	0.324	8.15	4.930	1.726	7.14	0.995	0.348
CO	2.28	0.259	0.091	2.28	1.379	0.483	1.54	0.215	0.075
VOC [c]	0.37	0.042	0.015	0.37	0.224	0.078	0.36	0.050	0.018
PM_{10} [d]	0.5	0.057	0.020	0.5	0.302	0.106	0.63	0.088	0.031
$PM_{2.5}$ [d]	0.5	0.057	0.020	0.5	0.302	0.106	0.63	0.088	0.031
SO_2	0.22	0.025	0.009	0.22	0.133	0.047	0.22	0.031	0.011
Formaldehyde	0.22	0.025	0.009	0.22	0.133	0.047	0.12	0.017	0.006

Heavy Const. Vehicles	Total	
	Emissions (lb/hr)	Emissions[e] (tons/yr)
NOx	6.852	2.398
CO	1.853	0.649
VOC [c]	0.316	0.111
PM_{10} [d]	0.447	0.156
$PM_{2.5}$ [d]	0.447	0.156
SO_2	0.189	0.066
Formaldehyde	0.175	0.061

a AP-42 Volume II, Mobile Sources, Nonroad Vehicles, Table 11-7.1 Off-highway truck
b AP-42 Volume II, Mobile Sources, Nonroad Vehicles, Table 11-7.1 Motor Grader
c Emission Factor represents total Hydrocarbon Emissions
d All emitted particulate matter assumed to be $PM_{2.5}$
e Assumes maximum development scenario

4. Pipeline Installation Tailpipe Emissions (Pipelayer)

Assumptions:

Hours of Operation 20 hours/site (Proposed Action)

Development Rate 7 new pads per year (Proposed Action)

Load Factor 0.4 (Typical value)

Pipelayer Size 240 hp (Typical value)

Equations:

$$\text{Emissions (tons/year)} = \frac{\text{Emission Factor (g/hp-hr)} * \text{Rated Horsepower (hp)} * \text{Operating Hours (hrs)} * \text{Load Factor (Dimensionless)}}{453.6\ \text{(g/lb)} * 2000\ \text{(lb/tons)}}$$

Heavy Const. Vehicles	Pipelayer		
	E. Factor [a] (g/hp-hr)	Emissions (lb/hr)	Emissions[e] (tons/yr)
NOx	8.15	1.725	0.121
CO	2.28	0.483	0.034
VOC [c]	0.37	0.078	0.005
PM_{10} [d]	0.5	0.106	0.007
$PM_{2.5}$ [d]	0.5	0.106	0.007
SO_2	0.22	0.047	0.003
Formaldehyde	0.22	0.047	0.003

[a] AP-42 Volume II, Mobile Sources, Nonroad Vehicles, Table 11-7.1 Off-highway truck

[b] AP-42 Volume II, Mobile Sources, Nonroad Vehicles, Table 11-7.1 Motor Grader

[c] Emission Factor represents total Hydrocarbon Emissions

[d] All emitted particulate matter assumed to be $PM_{2.5}$

[e] Assumes maximum development scenario

5. Interim Reclamation Fugitive Dust Emissions

Assumptions:

Hours of Reclamation	2	days per well pad (Estimate)
	8	hours/day
	16	hours per well pad
Pieces of Equipment	1	- Dozer
Watering Control Efficiency	50	percent (assumption)
Soil Moisture Content	7.9	percent (AP-42 Table 11.9-3, 10/98)
Soil Silt Content	6.9	percent (AP-42 Table 11.9-3, 10/98)

Equations: From AP-42 tables 11.9-1 and 11.9-3
Bulldozing Overburden Emissions, Western Surface Coal Mining, 10/98

Emissions (TSP lbs/hr) = 5.7 * (soil silt content %)$^{1.2}$ * (soil moisture content %)$^{1.3}$* Control Efficiency
Emissions (PM15 lbs/hr) = 1.0 * (soil silt content %)$^{1.5}$ * (soil moisture content %)$^{1.4}$ * Control Efficiency

PM_{10} Multiplier = 0.75 * PM_{15} (AP-42 Table 11.9-1, 10/98)
$PM_{2.5}$ Multiplier = 0.105 * TSP (AP-42 Table 11.9-1, 10/98)

Emissions = 1.97 lbs TSP/hour/piece of equipment

Emissions = 0.50 lbs PM_{15}/hour/piece of equipment

	Fugitive Dust Emissions[a]		
	lbs/hr	**tons/well pad**	**tons/yr [b]**
TSP	1.97	0.0158	0.11
PM_{15}	1.51	0.0060	0.04
PM_{10}	1.13	0.0090	0.06
$PM_{2.5}$	0.21	0.0017	0.01

[a] Assumes maximum construction rate specified by Proponent

Note: The majority of new pipeline will be installed adjacent to proposed access roads and will not result in significant additional surface disturbance.

Buys & Associates, Inc.
Environmental Consultants

Project: Tumbleweed EA
Date: 4/1/2009

6a. Development Traffic Fugitive Dust Emissions (Non-mancamp based travel)

- Note Drill crews would be housed in nearby mancamp, as an Applicant-Commited Environmental Protection Measure)

Calculation AP-42, Chapter 13.2.2
November 2006

Paved Roads

$E (PM_{10}) / VMT = 0.016 * (sL/2)^{0.65} * (W/3)^{1.5} - 0.00047 * (1-(P/(365*4))$

$E (PM_{10}) / VMT = 0.0024 * (sL/2)^{0.65} * (W/3)^{1.5} - 0.00036 * (1-(P/(365*4))$

Silt Loading (sL) 0.33 grains/square foot

W = average weight in tons of vehicles traveling the roac

Precipitation Days (P) 73 days per year**

Round Trip Miles 62 miles***

***Estimate of round trip miles on paved roads from Vernal

Unpaved Roads

$E (PM_{10}) / VMT = 1.5 * (S/12)^{0.9} * (W/3)^{0.45} * (365-P)/365)*(1-0.5)$

$E (PM_{2.5}) / VMT = 0.15 * (S/12)^{0.9} * (W/3)0.45 * (365-P)/365)*(1-0.5)$

Silt Content (S) 8.5 % AP-42, Table 13.2.2-1 Construction Sites

W = average weight in tons of vehicles traveling the road

Precipitation Days (P) 73 days per year**

Round Trip Miles 98 miles‡

(1-0.5) is for 50% efficiency of operator committed dust suppression for drilling and completion applied to 8 miles (of the 98) estimated average round trip miles in the project area

**(WRCC data for Nutters Ranch Annual >0.01, UT 1963-1986)

http://www.wrcc.dri.edu/summary/Climsmut.html

‡Estimate of round trip miles on unpaved roads from Vernal

Number of well pads = 7
Construction (days/pad and road) = 10

Vehicle Type	Average Weight (lbs)	Round Trips per Well		PM_{10} (lb/VMT)	PM_{10}/Pad (lbs/well)	PM_{10}/Pad (lb/day)	$PM_{2.5}$ (lb/VMT)	$PM_{2.5}$/Pad (lbs/well)	$PM_{2.5}$/Pad (lb/day)
Semi: Hvy Equip Hauler	120,000	4							
Haul Trucks: Material/Fuel/Water	40,000	6	**Unpaved**	2.50	2821.4	282.1	0.25	282.1	28.2
Pickup Truck: Crew[a]	7,000	2	**Paved**	0.15	113.6	11.36	0.02	16.8	1.7
Mean Vehicle Weight/Round Trip	61,167	12	**Total**		2935.0	293.5		298.9	29.9

[a] Assume 1 round trip per well per crew during initial deployment

PM_{10}/Annual Pads (tons/yr): 10.3

$PM_{2.5}$/Annual Pads (tons/yr): 1.0

Number of Vertical Wells = 6
Drilling (days/well) = 21
-Vertical Wells

Vehicle Type	Average Weight (lbs)	Round Trips per Well		PM_{10} (lb/VMT)	PM_{10}/Pad (lbs/well)	PM_{10}/Pad (lb/day)	$PM_{2.5}$ (lb/VMT)	$PM_{2.5}$/Pad (lbs/well)	$PM_{2.5}$/Pad (lb/day)
Semi: Hvy Equip Hauler	60,000	60							
Haul Trucks: Equipment/Fuel/Water	40,000	46	**Unpaved**	1.20	12909.0	614.7	0.24	1290.9	61.5
Pickup Truck: Crew[b]	7,000	8	**Paved**	0.13	951.9	45.3	0.02	140.1	6.7
Mean Vehicle Weight/Round Trip	56,281	114	**Total**		13860.8	660.0		1431.0	14.1

[b] Assume 1 trip per well per crew approximately every 10 days

PM_{10}/Annual Wells (tons/yr): 41.6

$PM_{2.5}$/Annual Wells (tons/yr): 4.3

Number of Directional Wells = 3
Drilling (days/well) = 31
-Directional Wells

Vehicle Type	Average Weight (lbs)	Round Trips per Well		PM_{10} (lb/VMT)	PM_{10}/Pad (lbs/well)	PM_{10}/Pad (lb/day)	$PM_{2.5}$ (lb/VMT)	$PM_{2.5}$/Pad (lbs/well)	$PM_{2.5}$/Pad (lb/day)
Semi: Hvy Equip Hauler	60,000	60							
Haul Trucks: Equipment/Fuel/Water	40,000	68	**Unpaved**	1.20	15737.2	507.7	0.24	1573.7	50.8
Pickup Truck: Crew[c]	7,000	12	**Paved**	0.13	1142.4	54.4	0.02	168.1	5.4
Mean Vehicle Weight/Round Trip	55,454	140	**Total**		16879.6	562.1		1741.8	56.2

[c] Assume 1 trip per well per crew approximately every 10 days

PM_{10}/Annual Wells (tons/yr): 25.3

$PM_{2.5}$/Annual Wells (tons/yr): 2.6

Total number of wells = 9
Completion (days/well) = 21

Vehicle Type	Average Weight (lbs)	Round Trips per Well		PM_{10} (lb/VMT)	PM_{10}/Pad (lbs/well)	PM_{10}/Pad (lb/day)	$PM_{2.5}$ (lb/VMT)	$PM_{2.5}$/Pad (lbs/well)	$PM_{2.5}$/Pad (lb/day)
Pickup: Completion Rig Crew[d]	7,000	2	**Unpaved**	0.93	700.2	33.3	0.19	70.0	3.3
Pickup Truck: Crew[d]	40,000	6	**Paved**	0.06	28.2	1.3	0.01	4.0	0.2
Mean Vehicle Weight/Round Trip	31,750	8	**Total**		728.3	34.7		74.1	3.5

[d] Assume 1 trip per well per crew approximately every 10 days

PM_{10}/Annual Wells (tons/yr): 3.3

$PM_{2.5}$/Annual Wells (tons/yr): 0.3

Number of well pads = 7
Interim Reclamation (days/well) = 2

Vehicle Type	Average Weight (lbs)	Round Trips per Well		PM_{10} (lb/VMT)	PM_{10}/Pad (lbs/well)	PM_{10}/Pad (lb/day)	$PM_{2.5}$ (lb/VMT)	$PM_{2.5}$/Pad (lbs/well)	$PM_{2.5}$/Pad (lb/day)
Pickup: Crew	7,000	5	**Unpaved**	1.22	690.4	345.2	0.12	69.0	34.5
Haul Trucks: Equipment	40,000	1	**Paved**	0.01	5.1	2.55	1.67E-03	0.6	0.3
Mean Vehicle Weight/Round Trip	12,500	6	**Total**		695.5	347.8		69.7	34.8

PM_{10}/Annual Wells (tons/yr): 2.4

$PM_{2.5}$/Annual Wells (tons/yr): 0.2

Annual Development Traffic Fugitive Dust Emissions, Non-mancamp based travel (tons/year)	**PM_{10}**	**$PM_{2.5}$**
	82.9 (tons/yr)	**8.5** (tons/yr)

Construction Material round trip estimates includes trips to account for soil/gravel loading/unloading emissions per AP-42 Table 13.2.3-1 Recommended Emission Factors for Construction Operations
Drilling and Completion water and fuel trucks per well based on 2 acre-feet /well (Ch2) 60-percent for completion with 160 bbl per truck and fuel trucks every three days.

Buys & Associates, Inc.
Environmental Consultants

Project: Tumbleweed EA
Date: 4/1/2009

6b. Development Traffic Fugitive Dust Emissions (Travel from Mancamp to Well Sites)

- Note Drill crews would be housed in nearby mancamp, as an Applicant-Commited Environmental Protection Measure)

Calculation AP-42, Chapter 13.2.2
November 2006

Paved Roads

No paved roads anticipated between the well sites and the man camp

Unpaved Roads

E (PM_{10}) / VMT = 1.5 * $(S/12)^{0.9}$ * $(W/3)^{0.45}$ * (365-P)/365)*(1-0.5)

E ($PM_{2.5}$) / VMT = 0.15 * $(S/12)^{0.9}$ * (W/3)0.45 * (365-P)/365)*(1-0.5)

Silt Content (S) 8.5 % AP-42, Table 13.2.2-1 Construction Sites

W = average weight in tons of vehicles traveling the road

Precipitation Days (P) 73 days per year**

Round Trip Miles 10 miles (estimated)

(1-0.5) is for 50% efficiency of operator committed dust suppression for drilling and completion applied to 8 miles of the estimated average round trip miles in the project area.

**(WRCC data for Nutters Ranch Annual >0.01, UT 1963-1986)

Number of well pads = 7
Construction (days/pad and road) = 10

Vehicle Type	Average Weight (lbs)	Round Trips per Well
Pickup Truck: Crew	7,000	16

	PM_{10} (lb/VMT)	PM_{10}/Pad (lbs/well)	PM_{10}/Pad (lb/day)	$PM_{2.5}$ (lb/VMT)	$PM_{2.5}$/Pad (lbs/well)	$PM_{2.5}$/Pad (lb/day)
Unpaved	0.94	90.5	9.1	0.09	9.1	0.9
Total		90.5	9.1		9.1	0.9

PM_{10}/Annual Pads (tons/yr): 0.32

$PM_{2.5}$/Annual Pads (tons/yr): 0.03

Number of Vertical Wells = 6
Drilling (days/well) = 21
-Vertical Wells

Vehicle Type	Average Weight (lbs)	Round Trips per Well
Pickup Truck: Rig Crew	7,000	88

	PM_{10} (lb/VMT)	PM_{10}/Pad (lbs/well)	PM_{10}/Pad (lb/day)	$PM_{2.5}$ (lb/VMT)	$PM_{2.5}$/Pad (lbs/well)	$PM_{2.5}$/Pad (lb/day)
Unpaved	0.94	497.9	23.7	0.09	49.8	2.4
Total		497.9	23.7		49.8	2.4

PM_{10}/Annual Wells (tons/yr): 1.5

$PM_{2.5}$/Annual Wells (tons/yr): 0.1

Number of Directional Wells = 3
Drilling (days/well) = 31
-Directional Wells

Vehicle Type	Average Weight (lbs)	Round Trips per Well
Pickup Truck: Rig Crew	7,000	88

	PM_{10} (lb/VMT)	PM_{10}/Pad (lbs/well)	PM_{10}/Pad (lb/day)	$PM_{2.5}$ (lb/VMT)	$PM_{2.5}$/Pad (lbs/well)	$PM_{2.5}$/Pad (lb/day)
Unpaved	0.94	497.9	16.1	0.09	49.8	1.6
Total		497.9	16.1		49.8	1.6

PM_{10}/Annual Wells (tons/yr): 0.7

$PM_{2.5}$/Annual Wells (tons/yr): 0.1

Total number of wells = 9
Completion (days/well) = 21

Vehicle Type	Average Weight (lbs)	Round Trips per Well
Pickup: Completion Rig Crew	7,000	18
Haul Trucks: Equipment/Fuel/Water	40,000	65
Mean Vehicle Weight/Round Trip	32,777	
Total Round Trips	83	

	PM_{10} (lb/VMT)	PM_{10}/Pad (lbs/well)	PM_{10}/Pad (lb/day)	$PM_{2.5}$ (lb/VMT)	$PM_{2.5}$/Pad (lbs/well)	$PM_{2.5}$/Pad (lb/day)
Unpaved	1.89	943.2	44.9	0.19	94.3	4.5
Total		943.2	44.9		94.3	4.5

PM_{10}/Annual Wells (tons/yr): 4.2

$PM_{2.5}$/Annual Wells (tons/yr): 0.4

	PM_{10}		$PM_{2.5}$	
Annual Development Traffic Fugitive Dust Emission, Mancamp based travel (tons/year)	**6.8**	**(tons/yr)**	**0.7**	**(tons/yr)**
Annual Development Traffic Fugitive Dust Emissions, Non-mancamp based travel (tons/year)	**82.9**	**(tons/yr)**	**8.5**	**(tons/yr)**
Total Annual Development Fugitive Dust Emissions	**89.7**		**9.2**	

Construction Material round trip estimates includes trips to account for soil/gravel loading/unloading emissions per AP-42 Table 13.2.3-1 Recommended Emission Factors for Construction Operations Drilling and Completion water and fuel trucks per well based on 2 acre-feet /well (Ch2) 60-percent for completion with 160 bbl per truck and fuel trucks every three days.

Buys & Associates, Inc. **Environmental Consultants**	Project: Tumbleweed EA Date: 4/1/2009

7. Wind Erosion Fugitive Dust Emissions

Assumptions

Threshold Friction Velocity U_t* 1.02 m/s (2.28 mph) for well pads (AP-42 Table 13.2.5-2 Overburden - Western Surface Coal Mine
1.33 m/s (2.97 mph) for roads (AP-42 Table 13.2.5-2 Roadbed material)

Initial Disturbance Area 33.5 acres total initial disturbance for roads/pipelines (Proposed Action)
135,569 square meters total initial disturbance for roads/pipelines

9.1 acres total initial disturbance for well pads (Proposed Action)
36,826 square meters total initial disturbance for well pads

43 acres total disturbance

Exposed Surface Type Flat

Meteorological Data: 2002 Grand Junction (obtained from NCDC website)

Fastest Mile Wind Speed U_{10}^{+} 20.1 meters/sec (45 mph) reported as fastest 2-minute wind speed for Grand Junction (2002)

Number soil of disturbances 2 for well pads (Assumption, disturbance at construction and reclamation)
Constant for dirt roads

Development Period 1 years (Proposed Action)

Equations

Friction Velocity $U^* = 0.053\ U_{10}^{+}$

Erosion Potential P (g/m^2/period) = $58*(U^*-U_t^*)^2 + 25*(U^*-U_t^*)$ for $U^*>U_t^*$, P = 0 for $U^*< U_t^*$

Emissions (tons/year) = Erosion Potential(g/m^2/period)*Disturbed Area(m^2)*Disturbances/year*(k)/(453.6 g/lb)/2000 lbs/ton/Develop Period

Particle Size Multiplier (k)		
30 um	**<10 um**	**<2.5 um**
1.0	0.5	0.075

Maxium U_{10}^{+} Wind Speed (m/s)	Maximum U* Friction Velocity m/s	Well U_t* Threshold Velocity[a] m/s	Well Pad Erosion Potential g/m^2	Road U_t* Threshold Velocity[a] m/s	Road Erosion Potential g/m^2
20.12	1.07	1.02	1.28	1.33	0.00

Wind Erosion Emissions

Particulate Species	Wells (tons/year)	Roads/Pipelines (tons/year)
TSP	0.104	0.000
PM_{10}	0.052	0.000
$PM_{2.5}$	0.008	0.000

8. Well Construction Tailpipe Emissions

Assumptions:

Average Round Trip Distance 98.0 miles (Estimated from project area and existing road system)

Hours of Construction 100 hours per site (Proponent)

Number of Heavy Diesel Truck Trips 10 (Proponent)

Number of Pickup Trips 2 (Proponent)

Diesel Fuel sulfur content 0.05 % (Typical value)

Diesel Fuel density 7.08 lbs/gallon (Typical value)

Heavy Haul Diesel Fuel Efficiency 10 miles/gallon (Typical value)

Heavy Duty Pickup Fuel Efficiency 15 miles/gallon (Typical value)

Equations:

For NOx, CO and VOC:

$$\text{Emissions (tons/year)} = \frac{\text{Emission Factor (g/mile)} * \text{\# Trips} * \text{Trip Distance (miles)}}{453.6\ \text{(g/lb)} * 2000\ \text{(lb/tons)}}$$

The NOx, CO and VOC emission factors for the above equation are from AP-42, while the SO_2 emissions are calculated on a mass balance basis utilizing the following equation:

$$SO_2\ \text{E. Factor (g/mi)} = \frac{\text{Fuel Density (lb/gal)} * 453.6\ \text{(g/lb)} * \text{Fuel Sulfur Content} * 2\ (S / SO_2)}{\text{Vehicle Fuel Efficiency (miles/gal)}}$$

Construction Vehicles	Heavy Haul Trucks			Heavy Duty Pickups			Total [d]	
	E. Factor [a] (g/mile)	Emissions (lb/hr)	Emissions (tons/yr/well)	E. Factor [b] (g/mile)	Emissions (lb/hr)	Emissions (tons/yr/well)	Emissions (lb/hr)	Emissions (tons/yr)
NOx	8.13	0.176	0.009	3.03	0.013	0.001	0.189	0.085
CO	17.09	0.369	0.018	33.64	0.145	0.007	0.515	0.232
VOC [c]	4.83	0.104	0.005	1.84	0.008	0.000	0.112	0.051
SO_2	0.32	0.007	3.47E-04	0.21	0.001	4.63E-05	0.008	0.004
CH_4 [e]	0.230	0.005	2.48E-04	0.184	0.001	3.98E-05	0.006	0.003

[a] AP-42 Table 7.1.2 - H.D. Diesel Powered Vehicles, High Altitude, 1991 - 1997 Model Year, 50,000 miles (6/95)

[b] AP-42 Table 4.1A.2 - H.D. Gasoline Vehicles, High Altitude, 1991 - 1997 Vehicle Year, 50,000 miles (6/95)

[c] Emission factor is for total Hydrocarbons.

[d] Assumes maximum development scenario

[e] AP-42 Append. H Tables 7.10A.2 and 4.10A.2 H.D. Methane Offsets, High Altitude, 1986+ and 1988+ Vehicle Year

9. Drilling Tailpipe Emissions

Assumptions:

Average Round Trip Distance 98.0 miles (Estimated from project area and existing road system)

Hours of Operation 584.0 hours per site (Proposed Action)

Number of Heavy Diesel Truck Trips 106 (Proponent)

Number of Pickup Trips 8 (Proponent)

Diesel Fuel sulfur content 0.05 % (Typical value)

Diesel Fuel density 7.08 lbs/gallon (Typical value)

Heavy Haul Diesel Fuel Efficiency 10 miles/gallon (Typical value)

Heavy Duty Pickup Fuel Efficiency 15 miles/gallon (Typical value)

Equations:

For NOx, CO and VOC:

$$\text{Emissions (tons/year)} = \frac{\text{Emission Factor (g/mile)} * \text{\# Trips} * \text{Trip Distance (miles)}}{453.6\ \text{(g/lb)} * 2000\ \text{(lb/tons)}}$$

The NOx, CO and VOC emission factors for the above equation are from AP-42, while the SO_2 emissions are calculated on a mass balance basis utilizing the following equation:

$$SO_2\ \text{E. Factor (g/mi)} = \frac{\text{Fuel Density (lb/gal)} * 453.6\ \text{(g/lb)} * \text{Fuel Sulfur Content} * 2\ (S / SO_2)}{\text{Vehicle Fuel Efficiency (miles/gal)}}$$

Drilling Vehicles	Heavy Haul Trucks			Heavy Duty Pickups			Total [d]	
	E. Factor [a] (g/mile)	Emissions (lb/hr)	Emissions (tons/yr/well)	E. Factor [b] (g/mile)	Emissions (lb/hr)	Emissions (tons/yr/well)	Emissions (lb/hr)	Emissions (tons/yr)
Criteria Pollutants & VOC								
NOx	8.13	0.319	0.093	3.03	0.009	0.003	0.33	0.86
CO	17.09	0.670	0.196	33.64	0.100	0.029	0.77	2.02
VOC [c]	4.83	0.189	5.53E-02	1.84	5.45E-03	1.59E-03	0.19	0.51
SO_2	0.32	1.26E-02	3.68E-03	0.21	6.34E-04	1.85E-04	1.32E-02	3.48E-02
Greenhouse Gases								
CH_4 [e]	0.230	9.02E-03	2.63E-03	0.184	5.45E-04	1.59E-04	9.56E-03	2.51E-02

[a] AP-42 Append. H Table 7.1.2 - H.D. Diesel Powered Vehicles, High Altitude, 1991 - 1997 Model Year, 50,000 miles (6/95)

[b] AP-42 Append. H Table 4.1A.2 - H.D. Gasoline Vehicles, High Altitude, 1991 - 1997 Vehicle Year, 50,000 miles (6/95)

[c] Emission factor is for total Hydrocarbons - Methane Offset

[d] Assumes construction rate specified by Proponent

[e] AP-42 Append. H Tables 7.10A.2 and 4.10A.2 H.D. Methane Offsets, High Altitude, 1986+ and 1988+ Vehicle Year

10. Completion Tailpipe Emissions

Assumptions:

Average Round Trip Distance 98.0 miles (Estimated from project area and existing road system)

Hours of Operation 210 hours per site (Proponent)

Number of Heavy Diesel Truck Trips 6 (Proponent)

Number of Pickup Trips 2 (Proponent)

Diesel Fuel sulfur content 0.05 % (Typical value)

Diesel Fuel density 7.08 lbs/gallon (Typical value)

Heavy Haul Diesel Fuel Efficiency 10 miles/gallon (Typical value)

Heavy Duty Pickup Fuel Efficiency 15 miles/gallon (Typical value)

Equations:

For NOx, CO and VOC:

$$\text{Emissions (tons/year)} = \frac{\text{Emission Factor (g/mile)} * \text{\# Trips} * \text{Trip Distance (miles)}}{453.6\ \text{(g/lb)} * 2000\ \text{(lb/tons)}}$$

The NOx, CO and VOC emission factors for the above equation are from AP-42, while the SO_2 emissions are calculated on a mass balance basis utilizing the following equation:

$$SO_2\ \text{E. Factor (g/mi)} = \frac{\text{Fuel Density (lb/gal)} * 453.6\ \text{(g/lb)} * \text{Fuel Sulfur Content} * 2\ (S / SO_2)}{\text{Vehicle Fuel Efficiency (miles/gal)}}$$

Completion Vehicles	Heavy Haul Trucks			Heavy Duty Pickups			Total [d]	
	E. Factor [a] (g/mile)	Emissions (lb/hr)	Emissions (tons/yr/well)	E. Factor [b] (g/mile)	Emissions (lb/hr)	Emissions (tons/yr/well)	Emissions (lb/hr)	Emissions (tons/yr)
NOx	8.13	0.050	0.005	3.03	0.006	0.001	0.056	0.053
CO	17.09	0.105	0.011	33.64	0.069	0.007	0.175	0.165
VOC [c]	4.83	0.030	0.003	1.84	0.004	0.000	0.034	0.032
SO_2	0.32	0.002	0.000	0.21	0.000	0.000	0.002	0.002
CH_4 [e]	0.230	0.001	0.000	0.184	0.000	0.000	0.002	0.001

a AP-42 Table 7.1.2 - H.D. Diesel Powered Vehicles, High Altitude, 1991 - 1997 Model Year, 50,000 miles (6/95)
b AP-42 Table 4.1A.2 - H.D. Gasoline Vehicles, High Altitude, 1991 - 1997 Vehicle Year, 50,000 miles (6/95)
c Emission factor is for total Hydrocarbons.
d Assumes maximum development scenario
e AP-42 Append. H Tables 7.10A.2 and 4.10A.2 H.D. Methane Offsets, High Altitude, 1986+ and 1988+ Vehicle Year

11. Interim Reclamation Tailpipe Emissions

Assumptions:

Average Round Trip Distance 98.0 miles (Estimated from project area and existing road system)

Hours of Operation 20 hours per site (Assumption)

Number of Heavy Diesel Truck Trips 1 (Assumption)

Number of Pickup Trips 5 (Assumption)

Diesel Fuel sulfur content 0.05 % (Typical value)

Diesel Fuel density 7.08 lbs/gallon (Typical value)

Heavy Haul Diesel Fuel Efficiency 10 miles/gallon (Typical value)

Heavy Duty Pickup Fuel Efficiency 15 miles/gallon (Typical value)

Equations:

For NOx, CO and VOC:

$$\text{Emissions (tons/year)} = \frac{\text{Emission Factor (g/mile)} * \text{\# Trips} * \text{Trip Distance (miles)}}{453.6\ \text{(g/lb)} * 2000\ \text{(lb/tons)}}$$

The NOx, CO and VOC emission factors for the above equation are from AP-42, while the SO_2 emissions are calculated on a mass balance basis utilizing the following equation:

$$SO_2\ \text{E. Factor (g/mi)} = \frac{\text{Fuel Density (lb/gal)} * 453.6\ \text{(g/lb)} * \text{Fuel Sulfur Content} * 2\ (S / SO_2)}{\text{Vehicle Fuel Efficiency (miles/gal)}}$$

Development Vehicles	Heavy Haul Trucks			Heavy Duty Pickups			Total [d]	
	E. Factor [a] (g/mile)	Emissions (lb/hr)	Emissions (tons/yr/well)	E. Factor [b] (g/mile)	Emissions (lb/hr)	Emissions (tons/yr/well)	Emissions (lb/hr)	Emissions (tons/yr)
Criteria Pollutants & VOC								
NOx	8.13	0.088	8.78E-04	3.03	0.164	1.64E-03	0.25	1.76E-02
CO	17.09	0.185	1.85E-03	33.64	1.817	1.82E-02	2.00	0.14
VOC [c]	4.83	5.22E-02	5.22E-04	1.84	0.099	9.94E-04	0.15	1.06E-02
SO_2	0.32	3.47E-03	3.47E-05	0.21	1.16E-02	1.16E-04	1.50E-02	1.05E-03
Greenhouse Gases								
CH_4 [e]	0.230	2.48E-03	2.48E-05	0.184	9.94E-03	9.94E-05	1.24E-02	8.70E-04

[a] AP-42 Append. H Table 7.1.2 - H.D. Diesel Powered Vehicles, High Altitude, 1991 - 1997 Model Year, 50,000 miles (6/95)

[b] AP-42 Append. H Table 4.1A.2 - H.D. Gasoline Vehicles, High Altitude, 1991 - 1997 Vehicle Year, 50,000 miles (6/95)

[c] Emission factor is for total Hydrocarbons - Methane Offset

[d] Assumes construction rate specified by Proponent

[e] AP-42 Append. H Tables 7.10A.2 and 4.10A.2 H.D. Methane Offsets, High Altitude, 1986+ and 1988+ Vehicle Year

12. Drill Rig Engine Emissions

Assumptions:

Hours of Operation 584.0 hours/well (Proposed Action)

Development Rate 9 wells per year (Proposed Action)

Load Factor 0.4 (Assumed typical value)

Rig Size 1725 hp (Proponent Estimate x 1.5 to account for mud pumps)

Diesel Fuel Sulfur Content 0.05 % (typical value)

Equations:

$$\text{Emissions (tons/year)} = \frac{\text{Emission Factor (lb/hp-hr)} * \text{Rated Horsepower (hp)} * \text{Operating Hours (hrs)} * \text{Load Factor (Dimensionless)}}{\text{2000 (lb/tons)}}$$

SO_2 E. Factor (lb/hp-hr) = Fuel sulfur content * 0.00809

	Drill Rig Emissions					
Species	E. Factor (g/hp-hr)	E. Factor (lb/hp-hr)	Emissions (lb/hr)	Emissions[h] (tons/yr)	Tier 0 E. Factor [a] (lb/hp-hr)	**Emissions Reduction [i] (tons/yr)**
Criteria Pollutants & VOC						
NOx [Tier II]	4.8	0.010582	7.3	19.2	0.024	24.3
CO [Tier II]	2.6	5.73E-03	3.955	10.39		
VOC [a,b]		7.05E-04	0.486	1.28		
PM_{10} [Tier II]	0.15	3.31E-04	0.228	0.60		
$PM_{2.5}$ [a,d]		4.79E-04	0.331	0.87		
SO_2 [a]		4.05E-04	0.279	0.73		
Hazardous Air Pollutants						
Benzene [e]		1.97E-06	1.36E-03	3.58E-03		
Toluene [e]		7.15E-07	4.93E-04	1.30E-03		
Xylenes [e]		4.91E-07	3.39E-04	8.91E-04		
Formaldehyde [e]		2.01E-07	1.39E-04	3.64E-04		
Acetaldehyde [e]		6.41E-08	4.43E-05	1.16E-04		
Acrolein [e]		2.01E-08	1.38E-05	3.64E-05		
Naphthalene [f]		3.31E-07	2.28E-04	6.00E-04		
Total PAH [f,g]		5.40E-07	3.72E-04	9.78E-04		
Greenhouse Gases						
CO_2 [a]		1.16	800	2103		
CH_4 [a,b]		7.05E-04	0.486	1.28		

[Tier II] Tier II Emission Factors, hp>750

[a] AP-42 Volume I, Large Stationary Diesel Engines Table 3.4-1, 10/96

[b] Emission Factor represents total Hydrocarbon Emissions

[d] Total particulate emission factor is 0.0007, $PM_{2.5}$ fraction determined from Table 3.4-2

[e] AP-42 Volume I, Large Stationary Diesel Engines Table 3.4-3, 10/96 converted using boiler conversion factor from Appendix A

[f] AP-42 Volume I, Large Stationary Diesel Engines Table 3.4-4, 10/96 converted using boiler conversion factor from Appendix A

[g] PAH (Polycyclic Aromatic Hydrocarbons) includes naphthalene and are a HAP because they are polycyclic organic matter (POM)

[h] Assumes maximum development scenario

[i] Based on Applicant-Committed Environmental Protection Measures

13. Well Fracturing Pump and Generator Engines

Assumptions:

Average Hours of Operation 8 Hours/Well

Development Rate 9 wells per year (Proposed Action)

Load Factor 0.65

Frac Pump Engine Horsepower 725 Horsepower
Temporary Generator Horsepower 300 Horsepower

Diesel Fuel Sulfur Content 0.05 % (typical value)

Equations:

$$\text{Emissions (tons/year)} = \frac{\text{Emission Factor (lb/hp-hr)} * \text{Rated Horsepower (hp)} * \text{Operating Hours (hrs)} * \text{Load Factor (Dimensionless)}}{\text{2000 (lb/tons)}}$$

SO_2 E. Factor (lb/hp-hr) = Fuel sulfur content * 0.00809

Species	Frac Pump Engine Emissions		
	E. Factor (lb/hp-hr)	Emissions (lb/hr)	Emissions[i] (tons/yr)
Criteria Pollutants & VOC			
NOx [a]	0.024	11.310	0.41
CO [a]	5.50E-03	2.592	0.09
VOC [a,b]	7.05E-04	0.332	1.20E-02
PM_{10} [a,c]	5.73E-04	0.270	9.72E-03
$PM_{2.5}$ [a,d]	4.79E-04	0.226	8.13E-03
SO_2 [a]	4.05E-04	0.191	6.86E-03
Hazardous Air Pollutants			
Benzene [e]	1.97E-06	9.31E-04	3.35E-05
Toluene [e]	7.15E-07	3.37E-04	1.21E-05
Xylenes [e]	4.91E-07	2.31E-04	8.33E-06
Formaldehyde [e]	2.01E-07	9.46E-05	3.41E-06
Acetaldehyde [e]	6.41E-08	3.02E-05	1.09E-06
Acrolein [e]	2.01E-08	9.45E-06	3.40E-07
Naphthalene [f]	3.31E-07	1.56E-04	5.61E-06
Total PAH [f]	5.40E-07	2.54E-04	9.15E-06
Greenhouse Gases			
CO_2 [a]	1.16	547	19.68
CH_4 [a]	7.05E-04	0.332	1.20E-02

Species	Generator Engine Emissions		
	E. Factor (lb/hp-hr)	Emissions (lb/hr)	Emissions[i] (tons/yr)
Criteria Pollutants			
NOx [g]	0.031	6.045	0.22
CO [g]	6.68E-03	1.303	0.05
VOC [b,g]	2.47E-03	0.482	1.73E-02
PM_{10} [g]	2.20E-03	0.429	1.54E-02
$PM_{2.5}$ [g]	2.20E-03	0.429	1.54E-02
SO_2 [g]	2.05E-03	0.400	1.44E-02
Hazardous Air Pollutants			
Benzene [h]	2.37E-06	4.63E-04	1.67E-05
Toluene [h]	1.04E-06	2.03E-04	7.31E-06
Xylenes [h]	7.25E-07	1.41E-04	5.09E-06
Formaldehyde [h]	3.00E-06	5.86E-04	2.11E-05
Acetaldehyde [h]	1.95E-06	3.81E-04	1.37E-05
Acrolein [h]	2.35E-07	4.59E-05	1.65E-06
1,3-Butadiene [h]	9.95E-08	1.94E-05	6.99E-07
Naphthalene [h]	2.16E-07	4.21E-05	1.52E-06
Total PAH [h]	4.28E-07	8.34E-05	3.00E-06
Greenhouse Gases			
CO_2 [g]	1.15	224	8.07
CH_4 [b,g]	2.47E-03	0.482	1.73E-02

[a] AP-42 Volume I, Large Stationary Diesel Engines Table 3.4-1, 10/96

[b] Emission Factor represents total Hydrocarbon Emissions

[c] Total particulate emission factor is 0.0007, PM_{10} fraction determined from Table 3.4-2

[d] Total particulate emission factor is 0.0007, $PM_{2.5}$ fraction determined from Table 3.4-2

[e] AP-42 Volume I, Large Stationary Diesel Engines Table 3.4-3, 10/96 converted using boiler conversion factor from Appendix A

[f] AP-42 Volume I, Large Stationary Diesel Engines Table 3.4-4, 10/96 converted using boiler conversion factor from Appendix A

[g] AP-42 Table 3.3-1, Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines, 10/96

[h] AP-42 Table 3.3-2 Speciated Organic Compound Emission Factors for Uncontrolled Diesel Engines, 10/96 converted using boil conversion factor from Appendix A

[i] Assumes maximum development scenario

14. Average Produced Gas Characteristics

Inlet Wet Gas Sample Dated August 23, 2006 from Miller Dyer Flat Rock Field used with permission

Gas Heat Value (wet): 1028.1 Btu/scf

C1-C2 Wt. Fraction: 0.8772
VOC Wt. Fraction: 0.0612
Non-HC Wt. Fraction: 0.0616
Total: 1.0000

COMPONENT	MOLE PERCENT	COMPONENT MOLE WEIGHT (lb/lb-mole)	NET MOLE WEIGHT (lb/lb-mole)	WEIGHT FRACTION	GROSS HEATING VALUE (BTU/scf)	NET DRY HEATING VALUE (BTU/scf)	LOWER HEATING VALUE (BTU/scf)	NET LOW HEATING VALUE (BTU/scf)
Methane	92.5150	16.043	14.842	0.830	1010.000	934.402	910.0	841.887
Ethane	2.8340	30.070	0.852	0.048	1769.800	50.156	1618.0	45.854
Propane	0.7530	44.097	0.332	0.019	2516.200	18.947	2316.0	17.439
i-Butane	0.2620	58.123	0.152	0.009	3252.100	8.521	3005.0	7.873
n-Butane	0.2030	58.123	0.118	0.007	3262.400	6.623	3013.0	6.116
i-Pentane	0.1350	72.150	0.097	0.005	4000.900	5.401	3698.0	4.992
n-Pentane	0.0590	72.150	0.043	0.002	4008.800	2.365	3708.0	2.188
Hexanes	0.2380	86.177	0.205	0.011	4756.200	11.320	4404.0	10.482
Heptanes	0.0211	100.204	0.021	0.001	5502.500	1.161	5100.0	1.076
Octanes+	0.0229	114.231	0.026	0.001	6249.100	1.431		0.000
Nonanes	0.0000	128.258	0.000	0.000	6996.400	0.000		0.000
Decanes	0.0000	142.285	0.000	0.000	7743.200	0.000		0.000
Benzene	0.0310	78.120	0.024	0.001	3715.500	1.152		0.000
Toluene	0.0260	92.130	0.024	0.001	4444.600	1.156		0.000
Ethylbenzene	0.0020	106.160	0.002	0.000	5191.500	0.104		0.000
Xylenes	0.0100	106.160	0.011	0.001	5183.500	0.518		0.000
n-Hexane	0.0454	86.177	0.039	0.002	4756.200	2.160		0.000
Helium	0.0000	4.003	0.000	0.000	0.000	0.000	0.0	0.000
Nitrogen	0.8970	28.013	0.251	0.014	0.000	0.000	0.0	0.000
Carbon Dioxide	1.9200	44.010	0.845	0.047	0.000	0.000	0.0	0.000
Oxygen	0.0210	32.000	0.007	0.000	0.000	0.000	0.0	0.000
Hydrogen Sulfide	0.0000	34.080	0.000	0.000	637.100	0.000	588.0	0.000
TOTAL	100.00		17.89	1.00		1045.41		937.91

Relative Mole Weight (lb/lb-mole) = [Mole Percent * Molecular weight (lb/lb-mole)] / 100

Weight Fraction = Net Mole Weight / Total Mole Weight

Buys & Associates, Inc. Environmental Consultants	Project: Tumbleweed EA Date: 4/1/2009

15. Well Development Venting

Assumptions: Following completion, wells are vented prior to connnection to the gathering pipeline

Venting Period 24 hours (Assumption)

Amount of Vented Gas: 0.1 MMscf (Assumption)

Development Rate: 9 Wells per year (Project Proponents)

COMPONENT	MOLECULAR WEIGHT (lb/lb-mole)	MOLE PERCENT	RELATIVE MOLE WEIGHT (lb/lb-mole)	WEIGHT Fraction	COMPONENT FLOW RATE (Mscf/day)	COMPONENT FLOW RATE (lb/hr)	COMPONENT FLOW RATE (tons/yr)
Methane	16.043	92.515	14.842	0.830	92.515	162.962	17.600
Ethane	30.07	2.834	0.852	0.048	2.834	9.357	1.011
Propane	44.097	0.753	0.332	0.019	0.753	3.646	0.394
i-Butane	58.123	0.262	0.152	0.009	0.262	1.672	0.181
n-Butane	58.123	0.203	0.118	0.007	0.203	1.295	0.140
i-Pentane	72.15	0.135	0.097	0.005	0.135	1.069	0.116
n-Pentane	72.15	0.059	0.043	0.002	0.059	0.467	0.050
Hexanes	86.177	0.238	0.205	0.011	0.238	2.252	0.243
Heptanes	100.204	0.021	0.021	0.001	0.021	0.232	0.025
Octanes	114.231	0.023	0.026	0.001	0.023	0.287	0.031
Nonanes	128.258	0.000	0.000	0.000	0.000	0.000	0.000
Decanes +	142.285	0.000	0.000	0.000	0.000	0.000	0.000
Benzene	78.12	0.031	0.024	0.001	0.031	0.266	0.029
Toluene	92.13	0.026	0.024	0.001	0.026	0.263	0.028
Ethylbenzene	106.16	0.002	0.002	0.000	0.002	0.023	0.003
Xylenes	106.16	0.010	0.011	0.001	0.010	0.117	0.013
n-Hexane	86.177	0.045	0.039	0.002	0.045	0.430	0.046
Helium	4.003	0.000	0.000	0.000	0.000	0.000	0.000
Nitrogen	28.013	0.897	0.251	0.014	0.897	2.759	0.298
Carbon Dioxide	44.01	1.920	0.845	0.047	1.920	9.278	1.002
Oxygen	32	0.021	0.007	0.000	0.021	0.074	0.008
Hydrogen Sulfide	34.08	0.000	0.000	0.000	0.000	0.000	0.000
VOC SUBTOTAL		**1.808396**	**1.095**	**0.061**	**1.808**	**12.020**	**1.298**
HAP SUBTOTAL		**0.114405**	**0.100**	**0.006**	**0.114**	**1.098**	**0.119**
TOTAL		**100.00**	**17.892**	**1.000**	**100**	**196.449**	**21.216**

16. Completion Flare Emissions

Assumptions

Hours of Operation 1 days (Typical)

Amount of Gas Flared 2.5 MMscf/well (Assumption)

Average Gas Heat Content 1028 Btu/scf (Wellsite Gas Composition)

Average Gas VOC Content 0.061 weight % (Wellsite Gas Composition)

Average Mole Weight 17.9 lb/lb-mole (Wellsite Gas Composition)

Development rate 9 gas wells per year

Equations

NOx/CO Emissions (lb/well) = Emission Factor (lb/MM Btu) * Gas Amount (MMscf/well) * Heat Content (Btu/scf)

PM/HAP Emissions (lb/well) = Emission Factor (lb/MMscf) * Gas Amount (MMscf/well)

$$\text{Flare Gas Wt. (lb/well)} = \frac{\text{Flare Gas Volume (MMscf/well)} * 10^6 \text{ (scf/MMscf)} * \text{Mole Weight (lb/lb-mole)}}{379.49 \text{ (scf/mole)}}$$

VOC Emissions (lb/well) = Flare Gas Wt. (lb/well) * VOC wt. % * 0.02 (Assumes 98% destruction Efficiency)

Species	Emission Factor (lb/MMBtu)	Well Emissions (lb/well)	Well Emissions (lb/hr/well)	Total Emissions [e] (tons/yr)
Criteria Pollutants & VOC				
NO_x [a]	0.068	174.8	7.28	0.79
CO [a]	0.37	951.0	39.62	4.28
VOC	-	1.4	0.06	0.01
SO_x [b]	0.00	0.0	0.00	0.00
TSP [c]	7.6	19	0.792	0.086
PM_{10} [c]	7.6	19	0.792	0.086
$PM_{2.5}$ [c]	7.6	19	0.792	0.086
Hazardous Air Pollutants				
Benzene [d]	0.0021	0.00525	0.0002	2.36E-05
Toluene [d]	0.0034	0.0085	0.0004	3.83E-05
Hexane [d]	1.8	4.5	0.1875	0.020
Formaldehyde [d]	0.075	0.1875	0.0078	8.44E-04
Greenhouse Gases				
CO_2 [c]	120,000	300,000	12,500	1,350
CH_4 [a]	0.14	359.8	14.99	1.62

a AP-42 Table 13.5-1, Emission Factors for Flare Operations, 9/91
b Assumes produced gas contains no sulfur
c AP-42 Table 1.4-2, Emission Factors for Natural Gas Combustion, 3/98 (All Particulates are $PM_{1.0}$)
d AP-42 Table 1.4-3, Emission Factors for Organic Compounds from Natural Gas Combustion, 3/98
e Assumes proposed development rate

17. Well Site Flare Emissions

Assumptions

Hours of Operation 8760 hrs/year
Development Total = 9 gas wells

Individual Well Emissions

Input Description	Flow Rate scf/hr	Heat Content btu/scf	Fuel Rate (MMBtu/hr)	Hours Of Operation (hrs/yr)	NOx Emissions (tons/yr)	CO Emissions (tons/yr)	VOC* Emissions (tons/yr)
Stock Tanks	**60.9**	**1334**	**0.081**	**8760**	**0.024**	**0.132**	
Pilot Light	**50**	**1028**	**0.051**	**8760**	**0.015**	**0.083**	**0.032**
				Totals	**0.040**	**0.215**	**0.032**

Emissions (tpy) = EF (lb/MMBtu) x Fuel Use (MMBtu/yr) / 2000 (lb/ton)

*VOC emissions from stock tanks reported on tank emission page

Project Emissions (at full development)

	NOx Emissions (tons/yr)	CO Emissions (tons/yr)	VOC Emissions (tons/yr)
Totals	**0.36**	**1.93**	**0.28**

Emission Factors from AP-42, 13.5-4, 9/91

Emissions Component	Emissions Factor (lb/MMBtu)
TOC (assumed for VOC)	0.14
CO	0.37
NOx	0.068

18. Wellsite Heater Emissions

Assumptions

Separator Heater Size 1000 Mbtu/hr
Wells Requiring Separators: 9

Firing Rate 8,760 hours/year

Fuel Gas Heat Value 1028 Btu/scf (Gas Analyses from Wellsite)

Fuel Gas VOC Content 0.061 by weight (Gas Analyses from well site)

Equations

$$\text{Fuel Consumption (MMscf/yr)} = \frac{\text{Heater Size (MBtu/hr)} * 1{,}000\ (\text{Btu/MBtu}) * \text{Hours of Operation (hrs/yr)}}{\text{Fuel Heat Value (Btu/scf)} * 1{,}000{,}000\ (\text{scf/MMscf})}$$

$$\text{NOx/CO/TOC Emissions (tons/yr)} = \frac{\text{AP-42 E.Factor (lbs/MMscf)} * \text{Fuel Consumption (MMscf/yr)} * \text{Fuel heating Value (Btu/scf)}}{2{,}000\ (\text{lbs/ton}) * 1{,}000\ (\text{Btu/scf - Standard Fuel Heating Value})}$$

Species	Wellsite Heater Emissions			
	Emission Factor (lb/MMscf)	Well Emissions (lb/hr/well)	Total Emissions (tons/yr)	Total Emissions (tons/yr)
Criteria Pollutants & VOC				
NO_x [a]	100	0.097	0.426	3.83
CO [a]	84	0.082	0.358	3.22
TOC [c]	11	0.011	0.047	0.42
VOC	5.5	0.005	0.023	0.21
SO_x [b]	0.00	0.000	0.000	0.00
TSP [c]	7.6	0.007	0.032	0.29
PM_{10} [c]	7.6	0.007	0.032	0.29
$PM_{2.5}$ [c]	7.6	0.007	0.032	0.29
Hazardous Air Pollutants				
Benzene [d]	0.0021	0.000	8.95E-06	0.00
Toluene [d]	0.0034	0.000	1.45E-05	0.00
Hexane [d]	1.8	0.002	0.008	0.07
Formaldehyde [d]	0.075	7.29E-05	3.20E-04	2.88E-03
Dichlorobenzene [d]	1.2E-03	0.000	5.11E-06	0.00
Naphthalene [d]	6.1E-04	0.000	2.60E-06	0.00
POM 2 [d,e,f]	5.9E-05	0.000	2.51E-07	0.00
POM 3 [d,g]	1.6E-05	0.000	6.82E-08	0.00
POM 4 [d,h]	1.8E-06	0.000	7.67E-09	0.00
POM 5 [d,i]	2.4E-06	0.000	1.02E-08	0.00
POM 6 [d,j]	7.2E-06	0.000	3.07E-08	0.00
POM 7 [d,k]	1.8E-06	0.000	7.67E-09	0.00
Greenhouse Gases				
CO_2 [c]	120,000	116.720	511	4601.09
CH_4 [c]	2.3	2.2E-03	9.80E-03	8.8E-02

[a] AP-42 Table 1.4-1, Emission Factors for Natural Gas Combustion, 7/98

[b] Assumes produced gas contains no sulfur

[c] AP-42 Table 1.4-2, Emission Factors for Natural Gas Combustion, 7/98 (All Particulates are PM1.0)

[d] AP-42 Table 1.4-3, Emission Factors for Organic Compounds from Natural Gas Combustion, 7/98

Technology Transfer Network website for the 1999 National-Scale Air Toxics Assessment at

benzo(g,h,i)perylene, fluoranthene, fluorene, phenanthrene, and pyrene.

[g] - POM 3 includes: 7,12-Dimethylbenz(a)anthracene.

[h] - POM 4 includes: 3-Methylchloranthrene.

[i] - POM 5 includes: Benzo(a)pyrene and dibenzo(a,h)anthracene.

indeno(1,2,3-cd)pyrene.

[k] - POM 7 includes: Chrysene.

19. Storage Tank Flash/Working/Standing Emissions

Assumptions:

Average Condensate Production Rate : 10.0 bbls condensate per day per well

Size of Development: 9 Producing Wells
7 Well pads with tanks

Separator Conditions : 970 psi and 83 F

API Gravity of Sales Oil: 46 estimate

Calculations:

Condensate tank flashing/working/breathing emissions estimated with E&P Tanks 2.0
Stewart Petroleum Liquid Sample Dated 9/10/08.

Emissions: Uncontrolled (before Applicant Committed Environmental Protection Measures

Component	Wellsite Flash/Work/Breathing (lb/hr/well)	Wellsite Flash/Work/Breathing (tons/year/well)	Total Emissions (tons/yr)
Total VOC	4.968	21.76	195.8
Hazardous Air Pollutants			
Benzene	0.168	0.737	6.63
Toluene	0.002	0.009	0.08
Ethylbenzene	0.001	0.004	0.04
Xylenes	0.011	0.047	0.42
n-Hexane	0.077	0.336	3.02
Greenhouse Gases			
CO_2	0.437	1.916	13.4
CH_4	5.968	26.141	183.0

[a] Assumes maximum development scenario

Emissions: Controlled

Emissions controlled with combustion device (95% reduction)

Component	Wellsite Flash/Work/Breathing (lb/hr/well)	Wellsite Flash/Work/Breathing (tons/year/well)	Controlled Total Emissions (tons/yr)	Emissions Reduction [b] (tons/yr)
Total VOC	0.248	1.09	9.8	186.0
Hazardous Air Pollutants				
Benzene	0.008	0.037	0.33	6.3
Toluene	0.002	0.009	0.08	0.0
Ethylbenzene	0.000	0.000	0.00	0.0
Xylenes	0.001	0.002	0.02	0.4
n-Hexane	0.004	0.017	0.15	2.9
Greenhouse Gases				
CO_2	0.437	1.916	13.4	0.0
CH_4	0.298	1.307	9.1	173.8

[b] Based on Applicant-Committed Environmental Protection Measures

20. Operations Tailpipe Emissions

Assumptions:

Number of New Pumpers:	1	(Assumption)
Pumper Mileage:	2,640	miles/pumper/month (Estimate)
Total Annual New Pumper Mileage:	31,680	miles/year
Number of Condensate Haul Truck Round Trips:	0.22	trips per day (Based on Peak Production Proposed Action)
Average Round Trip Mileage for Condensate Transport:	160	miles (Estimate based on distance from Ft. Duchesne)
Total Annual Condensate Truck Mileage:	13,031	miles/year
Number of Water Haul Truck Round Trips:	0.003	trips per day (Proponent)
Average Round Trip Mileage for Water Transport:	160	miles (Estimate based on distance from Ft. Duchesne)
Total Annual Water Truck Mileage:	160	miles/year
Daily Hours of Operation:	12	hours per day (Assumption)
Annual Hours of Operation:	4368	hours per year
Fuel sulfur content	0.05	% (Typical value)
Fuel density	7.08	lbs/gallon (Typical value)
Heavy Duty Pickup Fuel Efficiency	15	miles/gallon (Typical value)
Heavy Haul Diesel Fuel Efficiency	10	miles/gallon (Typical value)

Equations:

For NOx, CO and VOC:

$$\text{Emissions (tons/year)} = \frac{\text{Emission Factor (g/mile)} * \text{Vehicle Miles Traveled (miles/yr)}}{453.6\ \text{(g/lb)} * 2000\ \text{(lb/tons)}}$$

The NOx, CO and VOC emission factors for the above equation are from AP-42, while the SO_2 emissions are calculated on a mass balance basis utilizing the following equation:

$$SO_2\ \text{E. Factor (g/mi)} = \frac{\text{Fuel Density (lb/gal)} * 453.6\ \text{(g/lb)} * \text{Fuel Sulfur Content} * 2\ (S / SO_2)}{\text{Vehicle Fuel Efficiency (miles/gal)}}$$

Pumper Vehicles	Heavy Duty Pickups			Heavy Haul Trucks			Total	
	E. Factor [a] (g/mile)	Emissions (lb/hr)	Emissions (tons/yr)	E. Factor [b] (g/mile)	Emissions (lb/hr)	Emissions (tons/yr)	Emissions (lb/hr)	Emissions (tons/yr)
NOx	3.03	0.048	0.106	8.13	5.40E-02	0.118	0.10	0.22
CO	33.64	0.538	1.175	17.09	1.13E-01	0.248	0.65	1.42
VOC [c]	1.84	0.029	0.064	4.600	3.05E-02	0.067	6.00E-02	0.13
SO_2	0.21	3.42E-03	0.007	0.32	2.13E-03	0.005	5.56E-03	1.2E-02
CH_4 [d]	0.184	2.94E-03	0.006	0.230	1.53E-03	0.003	4.47E-03	9.8E-03

[a] AP-42 Append H Table 4.1A.2 - H.D. Gasoline Vehicles, High Altitude, 1991 - 1997 Vehicle Year, 50,000 miles (6/95)

[b] AP-42 Append. H Table 7.1.2 - H.D. Diesel Powered Vehicles, High Altitude, 1991 - 1997 Model Year, 50,000 miles (6/95)

[c] Emission factor is for total Hydrocarbons - Methane Offset

[d] AP-42 Append. H Tables 7.10A.2 and 4.10A.2 H.D. Methane Offsets, High Altitude, 1986+ and 1988+ Vehicle Year

21. Operations Traffic Fugitive Dust Emissions

Calculation AP-42, Chapter 13.2.2
November 2006

365 days (Estimate)

Unpaved Roads

E (PM_{10}) / VMT = 1.5 * $(S/12)^{0.9}$ * $(W/3)^{0.45}$ * (365-p)/365)

E ($PM_{2.5}$) / VMT = 0.15 * $(S/12)^{0.9}$ * $(W/3)^{0.45}$ * (365-p)/365)

Silt Content (S) 6.9 % AP-42, Table 11.9-3

W = average weight in tons of vehicles traveling the road

Round Trip Miles 98 Estimate from Vernal*

Precipitation Days (p) 73 days per year**

Vehicle Type	Ave. Weight (lbs)	Round Trips per Day
Pickup Truck: Crew	7,000	1.0
Haul Truck: Oil	48,000	0.22
Haul Truck: Water	48,000	0.003
Average Mean Weight/round trip (W)	14,554 lbs	

Paved Roads

E (PM_{10}) / VMT = 0.016 * $(sL/2)^{0.65}$ * $(W/3)^{1.5}$ - 0.00047 * (1-(p/(365*4))

E ($PM_{2.5}$) / VMT = 0.0024 * $(sL/2)^{0.65}$ * $(W/3)^{1.5}$ - 0.00036 * (1-(p/(365*4))

Silt Loading (sL) 0.33 grains/square foot

W = average weight in tons of vehicles traveling the road

Round Trip Miles 62 Estimate from Vernal*

Precipitation Days (p) 73 days per year**

Round trips/day = 1.2

	PM_{10} (lb/VMT)	Total PM_{10} (lbs/yr)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/VMT)	Total $PM_{2.5}$ (lbs/yr)	$PM_{2.5}$ (lb/day)
Unpaved	1.09	47645	130.5	0.11	4765	13.1
Paved	0.02	481	1.3	2.32E-03	64	0.2
Total		48126	132		4829	13

	PM_{10}	$PM_{2.5}$
Annual Operations Traffic Fugitive Dust Emissions (tpy)	**24.1**	**2.41**

*Round trip distance represents the round trip estimate within project area plus distance from Vernal

**(WRCC data for Nutters Ranch, UT 1906-2007) http://www.wrcc.dri.edu/summary/Climsmut.html

22. Well Development Emissions Sumary

Pollutant	Well Development Emissions (tons/year)[a]					Total Emissions (tons/yr)
	Construction	Drilling	Completion	Interim Reclamation	Wind Erosion	
Criteria Pollutants & VOC						
NO_x	2.60	20.0	1.46	1.76E-02		24.14
CO	0.91	12.4	4.58	0.14		18.1
VOC	0.17	1.79	1.37	1.1E-02		3.33
SO_2	0.07	0.77	2.6E-02	1.1E-03		0.87
PM_{10}	11.78	69.7	7.64	2.50	0.05	91.7
$PM_{2.5}$	1.53	8.00	0.87	0.26	7.78E-03	10.7
Hazardous Air Pollutants						
Benzene		3.58E-03	0.03			0.03
Toluene		1.30E-03	0.03			0.03
Ethylbenzene			2.52.E-03			2.52.E-03
Xylene		8.91E-04	1.26.E-02			1.3E-02
n-Hexane			0.07			0.07
Formaldehyde	0.06	3.64E-04	8.68E-04			0.06
Acetaldehyde		1.16E-04	1.48E-05			1.31E-04
Acrolein		3.64E-05	1.99E-06			3.84E-05
1,3-Butadiene			6.99E-07			6.99E-07
Naphthalene		6.00E-04	7.13E-06			6.07E-04
Total PAH, POM 1 [b]		9.78E-04	1.22E-05			9.91E-04
Total HAPs	0.06	0.01	0.14			0.21
Greenhouse Gases						
CO_2		2,103	1,379			3482
CH_4	0.00	1.3	19.2	8.70E-04		20.6

a Emissions for Peak Field Development

b Polycyclic Aromatic Hydrocarbons (PAH), Polycyclic Organic Matter (POM)

23. Total Project Production Related Emissions Summary

Pollutant	Project Production Emissions (tons/year)[a]			
	Wellsite Storage Tanks + Flare	***Wellsite Heaters***	***Operations Vehicle***	**Total Well Production**
Criteria Pollutants & VOC				
NO_x	0.4	3.83	0.11	4.3
CO	1.9	3.22	1.17	6.3
VOC	10.1	0.21	0.06	10.4
SO_2		0.0	7.48E-03	7.5E-03
PM_{10}		0.29	24.1	24.4
$PM_{2.5}$		0.29	2.41	2.71
Hazardous Air Pollutants				
Benzene	0.33	8.1E-05		0.3
Toluene	0.08	1.3E-04		0.1
Ethylbenzene	0.00			0.0
Xylene	0.02			0.0
n-Hexane	0.15	0.07		0.2
Formaldehyde		2.9E-03		2.9E-03
Dichlorobenzene		4.6E-05		4.6E-05
Naphthalene		2.3E-05		2.3E-05
POM 2[b]		2.3E-06		2.3E-06
POM 3[c]		6.1E-07		6.1E-07
POM 4[d]		6.9E-08		6.9E-08
POM 5[e]		9.2E-08		9.2E-08
Benzo(b)fluoranthene/POM6[f]		2.8E-07		2.8E-07
Chrysene/POM7[g]		6.9E-08		6.9E-08
Total HAPs	***0.59***	***0.07***		***0.7***
Greenhouse Gases				
CO_2	13.41	4601		4615
CH_4	9.15	0.09	9.77E-03	9.25

[a] - Emissions for Peak Field Development

[b] - POM 2 includes: Acenaphthene, acenaphtylene, anthracene, 2-Methylnaphthalene, benzo(e)pyrene benzo(g,h,i)perylene, fluoranthene, fluorene, phenanthrene, and pyrene.

[c] - POM 3 includes: 7,12-Dimethylbenz(a)anthracene.

[d] - POM 4 includes: 3-Methylchloranthrene.

[e] - POM 5 includes: Benzo(a)pyrene and dibenzo(a,h)anthracene.

[f] - POM 6 includes: Benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene.

[g] - POM 7 includes: Chrysene.

24. Total Project Emissions Summary

Pollutant	Well Development (tons/year)					Well Production (tons/year)	Total Emissions[i] (tons/year)
	Construction	Drilling	Completion	Interim Reclamation	Wind Erosion		
Criteria Pollutants & VOC							
NO_x	2.60	20.05	1.46	0.02		4.3	28.4
CO	0.91	12.4	4.58	0.14		6.3	24.4
VOC	0.17	1.79	1.37	0.01		10.4	13.7
SO_2	0.07	0.77	0.03	1.05E-03		7.5E-03	0.9
PM_{10}	11.78	69.7	7.6	2.50	0.05	24.4	116.1
$PM_{2.5}$	1.53	8.00	0.87	0.26	7.78E-03	2.7	13.4
Hazardous Air Pollutants							
Benzene	0	3.58E-03	0.03	0		0.3	0.4
Toluene	0	1.30E-03	0.03	0		0.1	0.1
Ethylbenzene	0	0	2.52E-03	0		0.00	0.0
Xylene	0	8.91E-04	0.01	0		0.0	0.0
n-Hexane	0	0	0.07	0		0.2	0.3
Formaldehyde	6.12E-02	3.64E-04	8.68E-04	0		2.9E-03	0.1
Acetaldehyde	0	1.16E-04	1.48E-05	0		0	0.0
Acrolein	0	3.64E-05	1.99E-06	0		0	0.0
1,3-Butadiene	0	0	6.99E-07	0		0	0.0
Dichlorobenzene	0	6.00E-04	7.13E-06	0		4.6E-05	0.0
Naphthalene	0	6.00E-04	7.13E-06	0		2.3E-05	0.0
PAH[a] -POM 1[b]	0	9.78E-04	1.22E-05	0		0	0.0
POM 2[c]	0	0	0	0		2.3E-06	0.0
POM 3[d]	0	0	0	0		6.1E-07	0.0
POM 4[e]	0	0	0	0		6.9E-08	0.0
POM 5[f]	0	0	0	0		9.2E-08	0.0
Benzo(b)fluoranthene/POM6[g]	0	0	0	0		2.8E-07	0.0
Chrysene/POM7[h]	0	0	0	0		6.9E-08	0.0
Total HAPs	***6.12E-02***	***0.01***	***0.14***	***0***		***0.7***	***0.9***
Greenhouse Gases							
CO_2	0	2103	1378.75	0		4,615	8,097
CH_4	0.00	1.30	19.25	8.70E-04		9.2	30

[a] Polycyclic Aromatic Hydrocarbons (PAH) defined as a HAP by Section 112(b) of the Clean Air Act because it is Polycyclic Organic Matter (POM) AP42 Table 1.4-3 footnotes.

[b] - POM grouped according to subgroups described at EPA's Technology Transfer Network website for the 1999 National-Scale Air Toxics Assessment at http://www.epa.gov/ttn/atw/nata1999/nsata99.html

[c] - POM 2 includes: Acenaphthene, acenaphtylene, anthracene, 2-Methylnaphthalene, benzo(e)pyrene, benzo(g,h,i)perylene, fluoranthene, fluorene, phenanthrene, and pyrene.

[d] - POM 3 includes: 7,12-Dimethylbenz(a)anthracene.

[e] - POM 4 includes: 3-Methylchloranthrene.

[f] - POM 5 includes: Benzo(a)pyrene and dibenzo(a,h)anthracene.

[g] - POM 6 includes: Benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene.

[h] - POM 7 includes: Chrysene.

[i] Emissions for Peak Field Development

APPENDIX E

FIGURES

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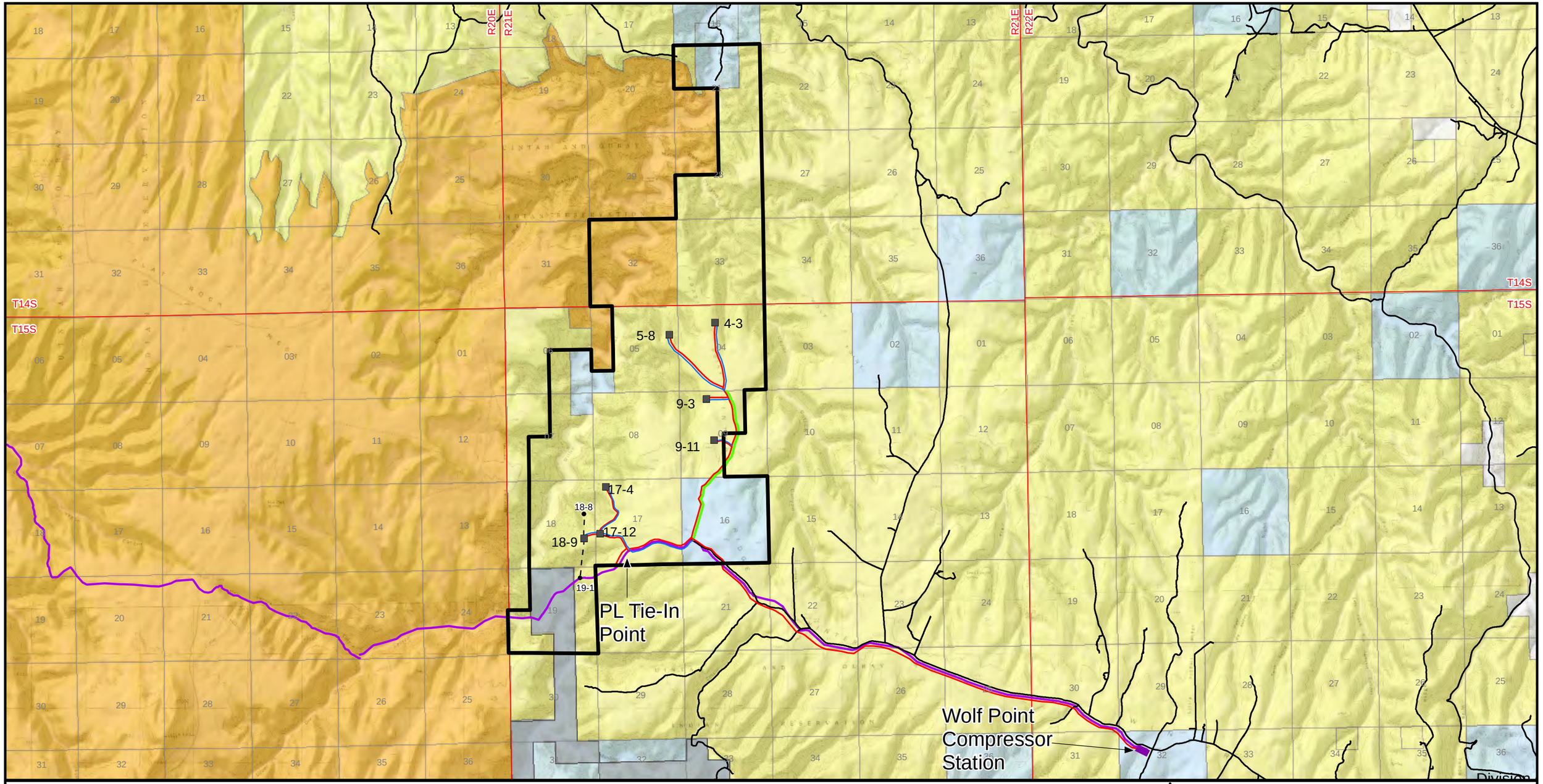


Legend

- Project Area Boundary
- Proposed Well Pad
- Directional Drilling Route
- Bottomhole Location
- Compressor Station
- Proposed Road
- Proposed Pipeline
- Existing Road to be Upgraded
- Existing Road
- Existing Winter Ridge Pipeline

Surface Ownership

- Federal
- Private
- State
- Tribal
- Division of Wildlife Resources

N
W E
S

0 0.5 1 1.5 2 Miles

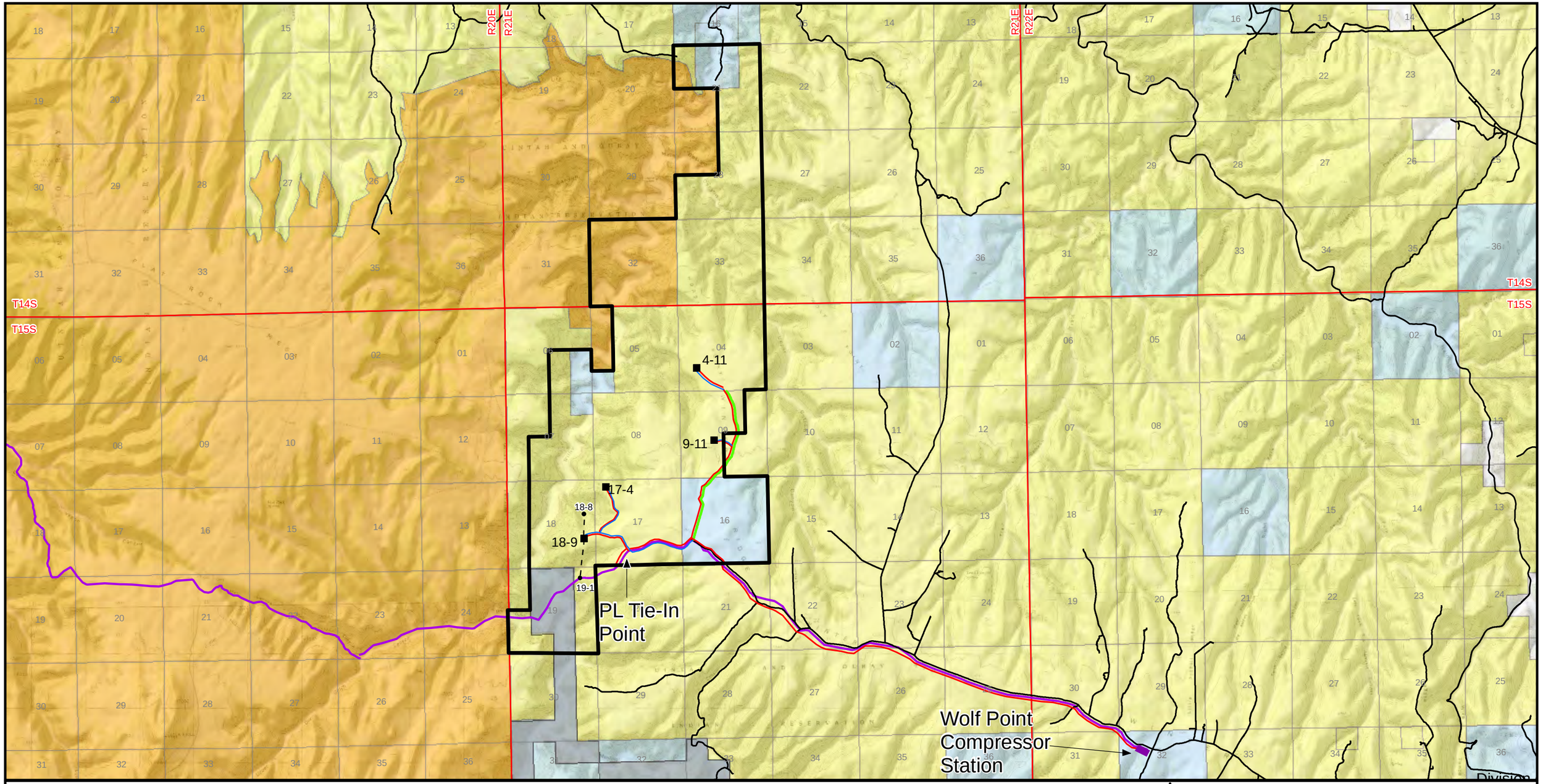
Tumbleweed II Exploratory Natural Gas Drilling Project

Proposed Action

Stewart Petroleum Corporation

Date: April 2010 | Buys & Associates, Inc.

Figure 2-1



Legend

- Project Area Boundary
- Proposed Well Pad
- Directional Drilling Route
- Bottomhole Location
- Compressor Station
- Proposed Road
- Proposed Pipeline
- Existing Road to be Upgraded
- Existing Road
- Existing Winter Ridge Pipeline

Surface Ownership

- Federal
- Private
- State
- Tribal
- Division of Wildlife Resources *Division of Wildlife*

N W E S

0 0.5 1 1.5 2 Miles

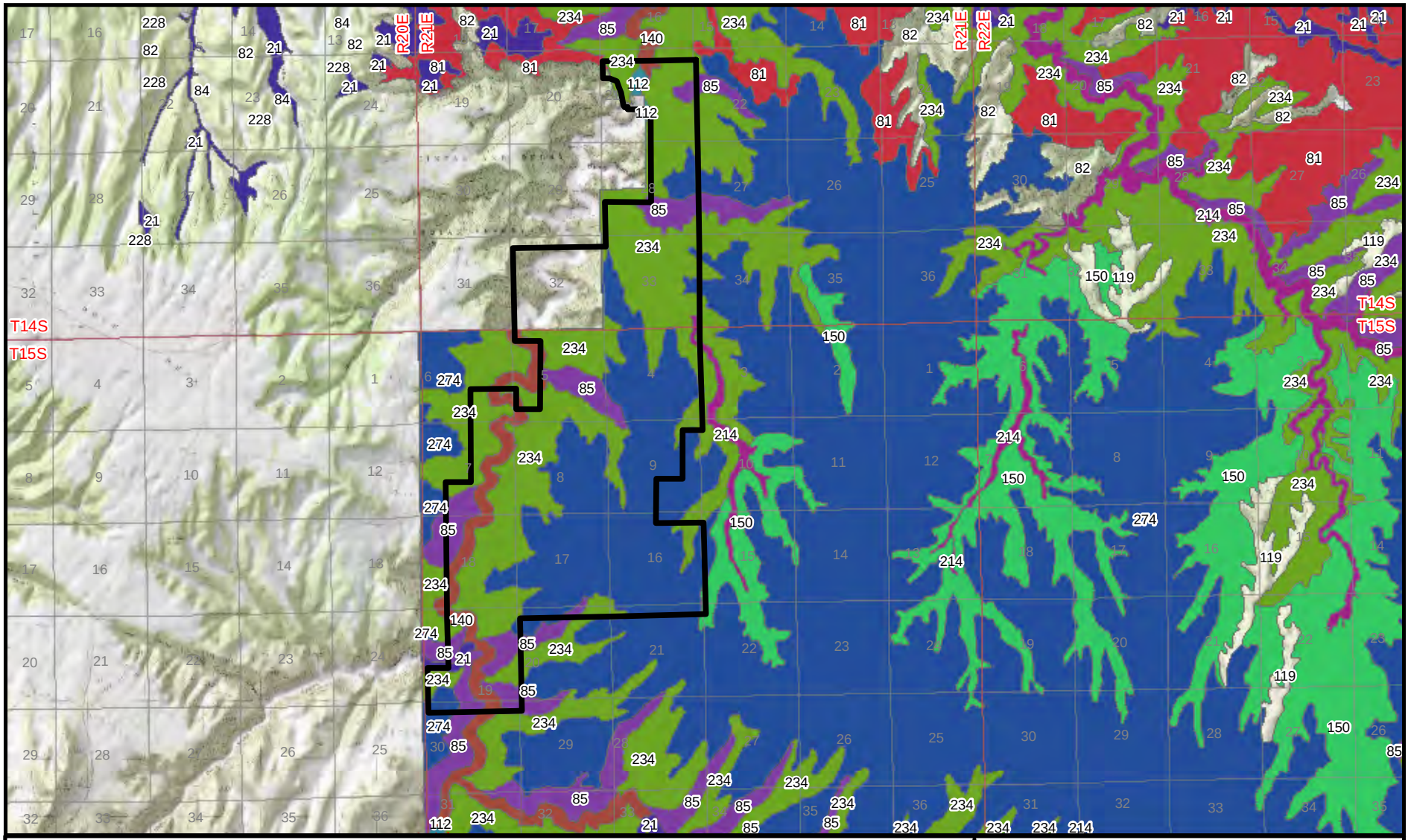
Tumbleweed II Exploratory Natural Gas Drilling Project

Alternative D

Stewart Petroleum Corporation

Date: April 2010 | Buys & Associates, Inc.

Figure 2-2



Legend

Project Area Boundary

Map Unit, Soil Name

- 112, Iceslew silt loam, 1 to 3 percent slopes
- 140, Mikim-Hickerson association
- 150, Moonset-Saddlehorse association
- 21, Bigpack loam
- 214, Soward sandy loam
- 234, Towave-Gompers-Rock outcrop association
- 274, Winteridge-Moonset association
- 81, Gompers very channery silt loam
- 85, Gompers-Rock outcrop complex

0 0.9 1.8 2.7 3.6 Miles

N W E S

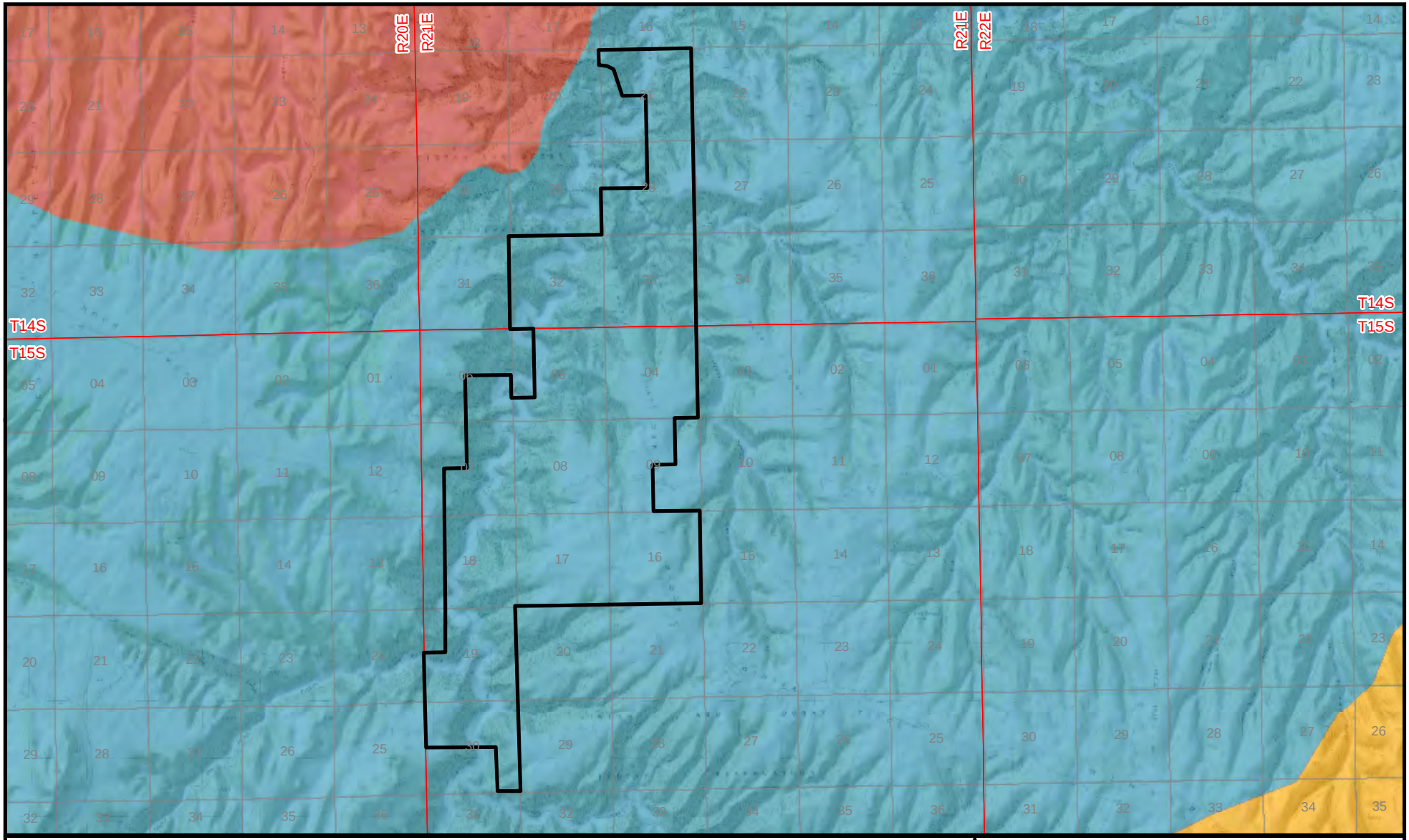
Tumbleweed II Exploratory Natural Gas Drilling Project

Soils

Stewart Petroleum Corporation

Date: January 5, 2009 | Buys & Associates, Inc.

Figure 3-1



Legend

Project Area Boundary

Seasonal Range Type

- Crucial Summer Value
- Crucial Winter Value
- Substantial Winter Value

N
W E
S

0 0.5 1 1.5 2 Miles

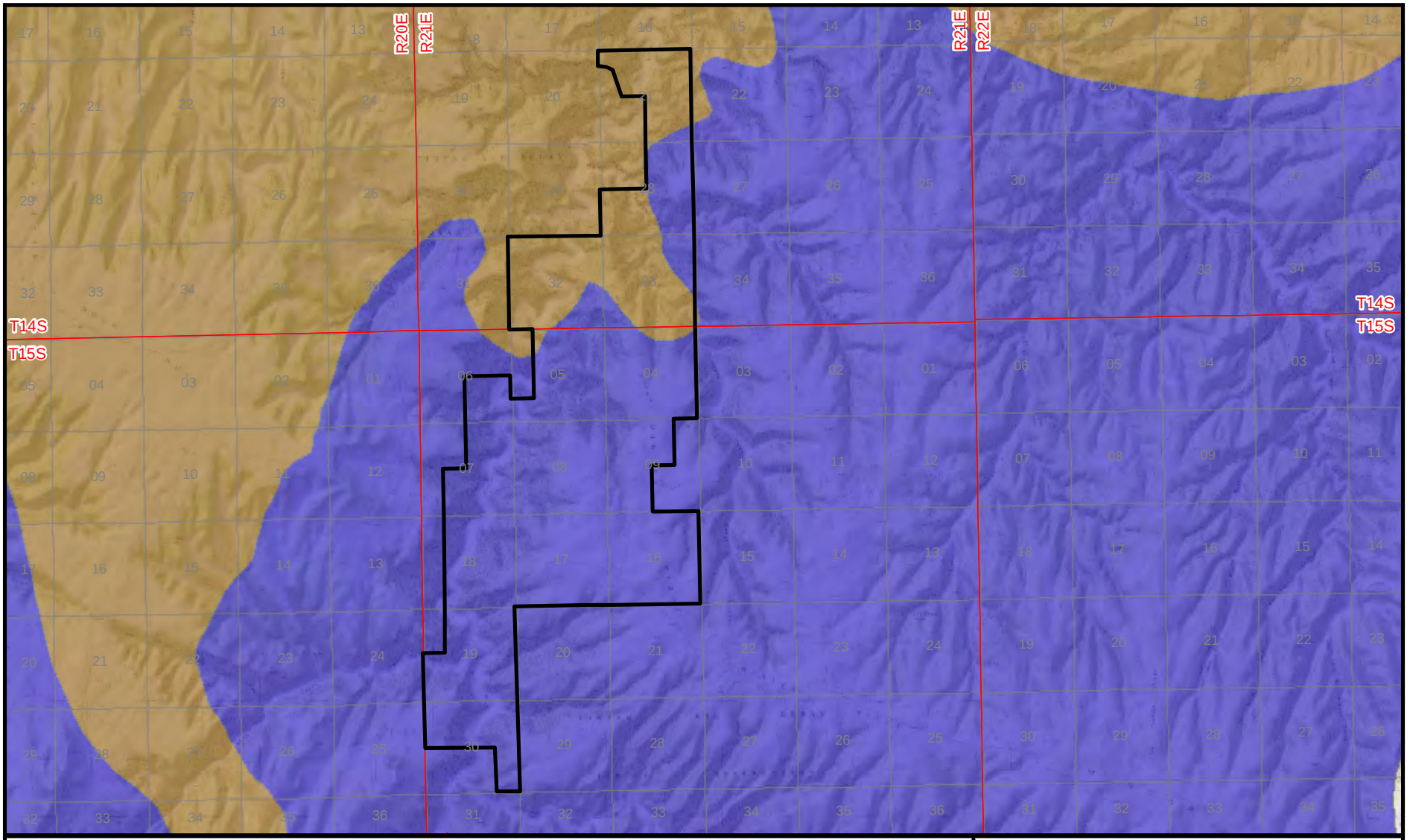
Tumbleweed II Exploratory Natural Gas Drilling Project

Rocky Mountain Elk Ranges

Stewart Petroleum Corporation

Date: April 2010 | Buys & Associates, Inc.

Figure 3-2



Legend

Project Area Boundary

Seasonal Range Type

Crucial Winter Range

Substantial Winter Range

N
W E
S

0 0.5 1 1.5 2 Miles

Tumbleweed II Exploratory Natural Gas Drilling Project

Mule Deer Ranges

Stewart Petroleum Corporation

Date: April 2010 | Buys & Associates, Inc.

Figure 3-3

R20E
R21E
R21E
R22E
T14S
T15S
T14S
T15S

Legend

- Crucial Brooding Habitat
- Project Area Boundary
- Compressor Station
- Existing Road
- Existing Winter Ridge Pipeline

Surface Ownership

- Federal
- Private
- State
- Tribal
- Division of Wildlife Resources

N
W E
S

0 0.5 1 1.5 2 Miles

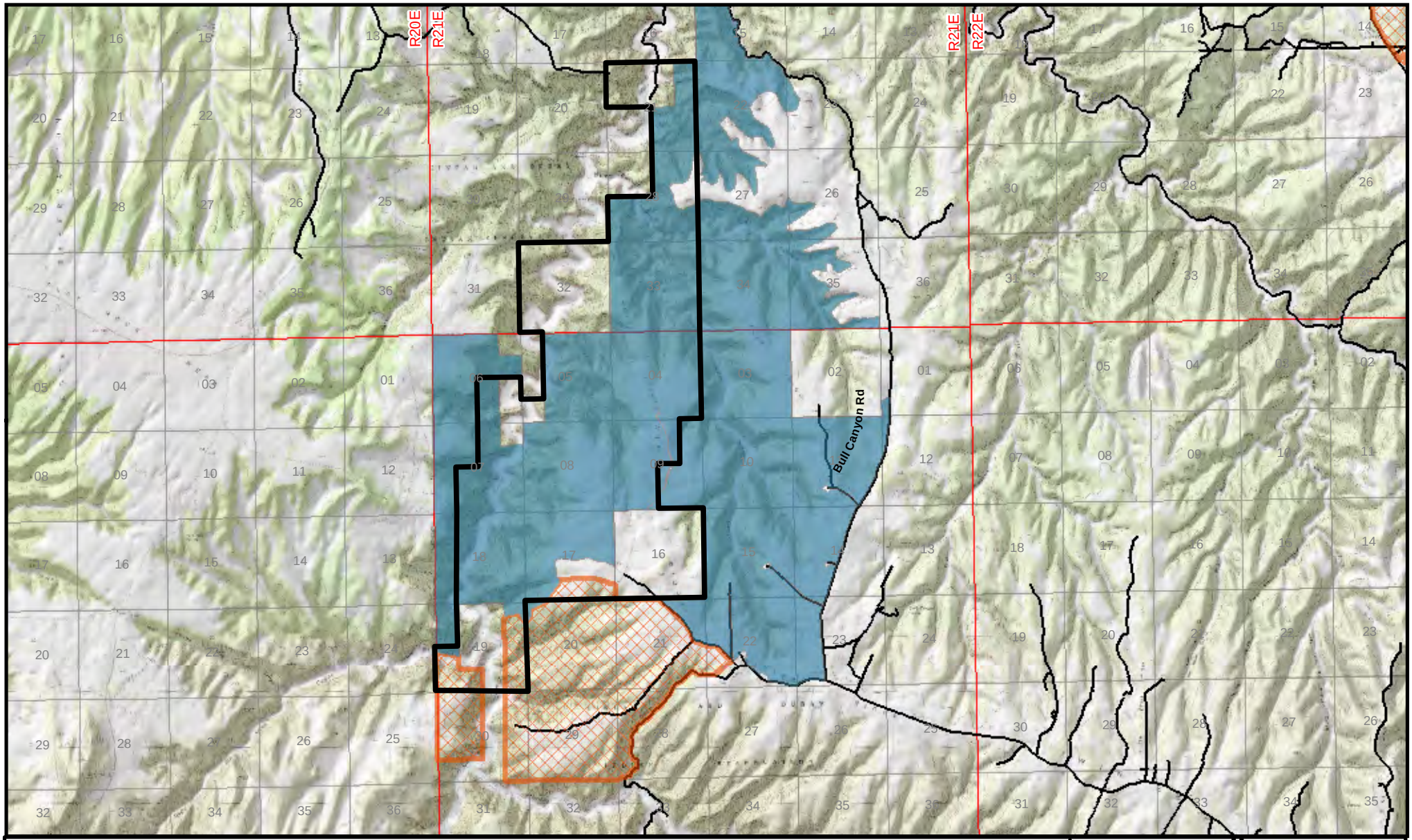
Tumbleweed II Exploratory Natural Gas Drilling Project

Sage-grouse Habitat

Stewart Petroleum Corporation

Date: April 2010 | Buys & Associates, Inc.

Figure 3-4



Legend

Project Area Boundary

Wilderness Characteristics Review Determination

Wilderness Character Present

No Wilderness Character

Existing Road

N
W E
S

0 0.4 0.8 1.2 1.6 Miles

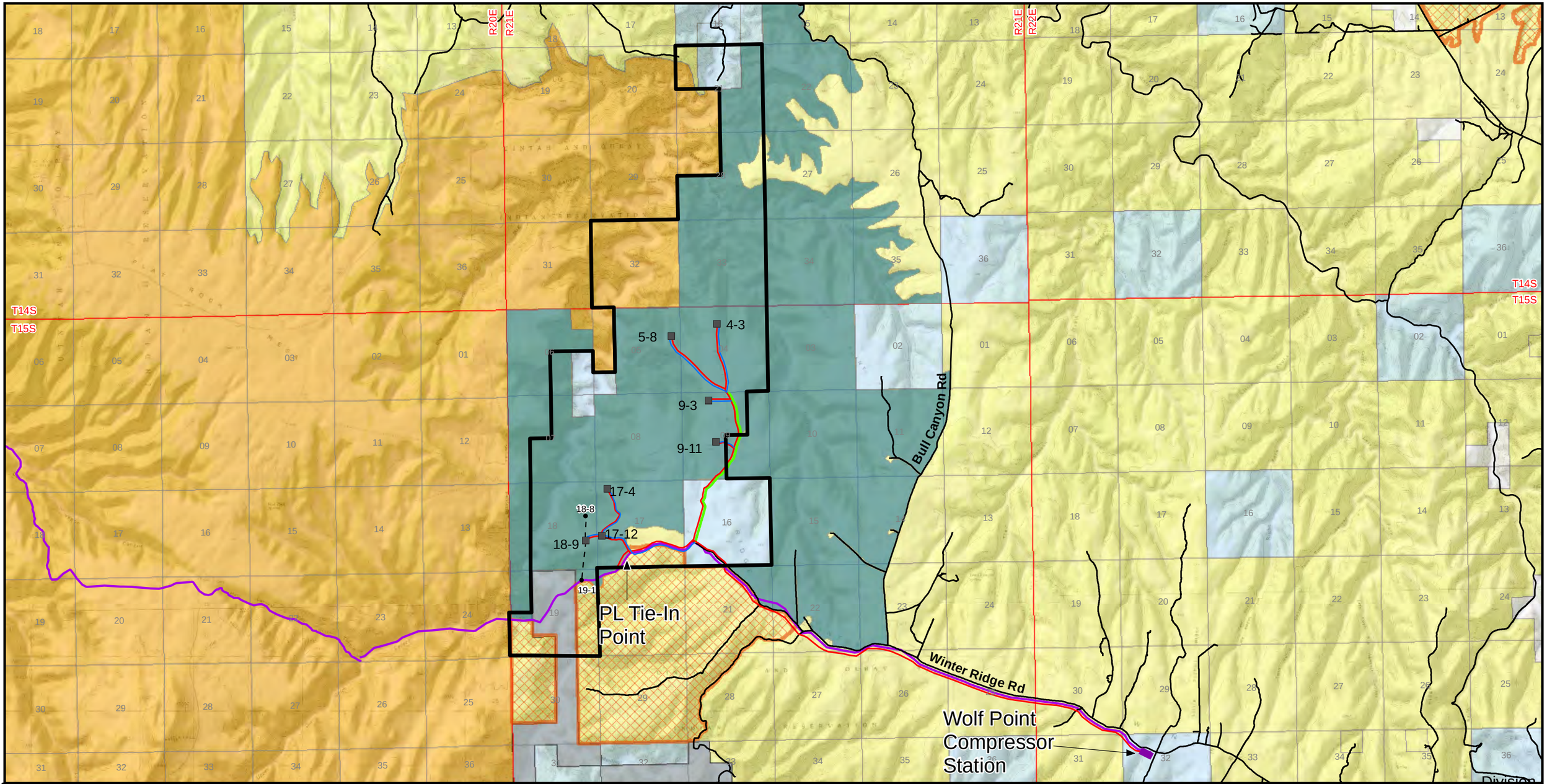
Tumbleweed II Exploratory Natural Gas Drilling Project

Wolf Point Non-WSA Lands with Wilderness Characteristics

Stewart Petroleum Corporation

Date: April 2010 | Buys & Associates, Inc.

Figure 3-5



Legend

Wilderness Characteristics Review Determination
- Wilderness Character Present
- No Wilderness Character

- Project Area Boundary
- Proposed Well Pad
- Directional Drilling Route
- Bottomhole Location
- Compressor Station
- Proposed Road
- Proposed Pipeline
- Existing Road to be Upgraded
- Existing Road
- Existing Winter Ridge Pipeline

Surface Ownership
- Federal
- Private
- State
- Tribal
- Division of Wildlife Resources

N W E S

0 0.5 1 1.5 2 Miles

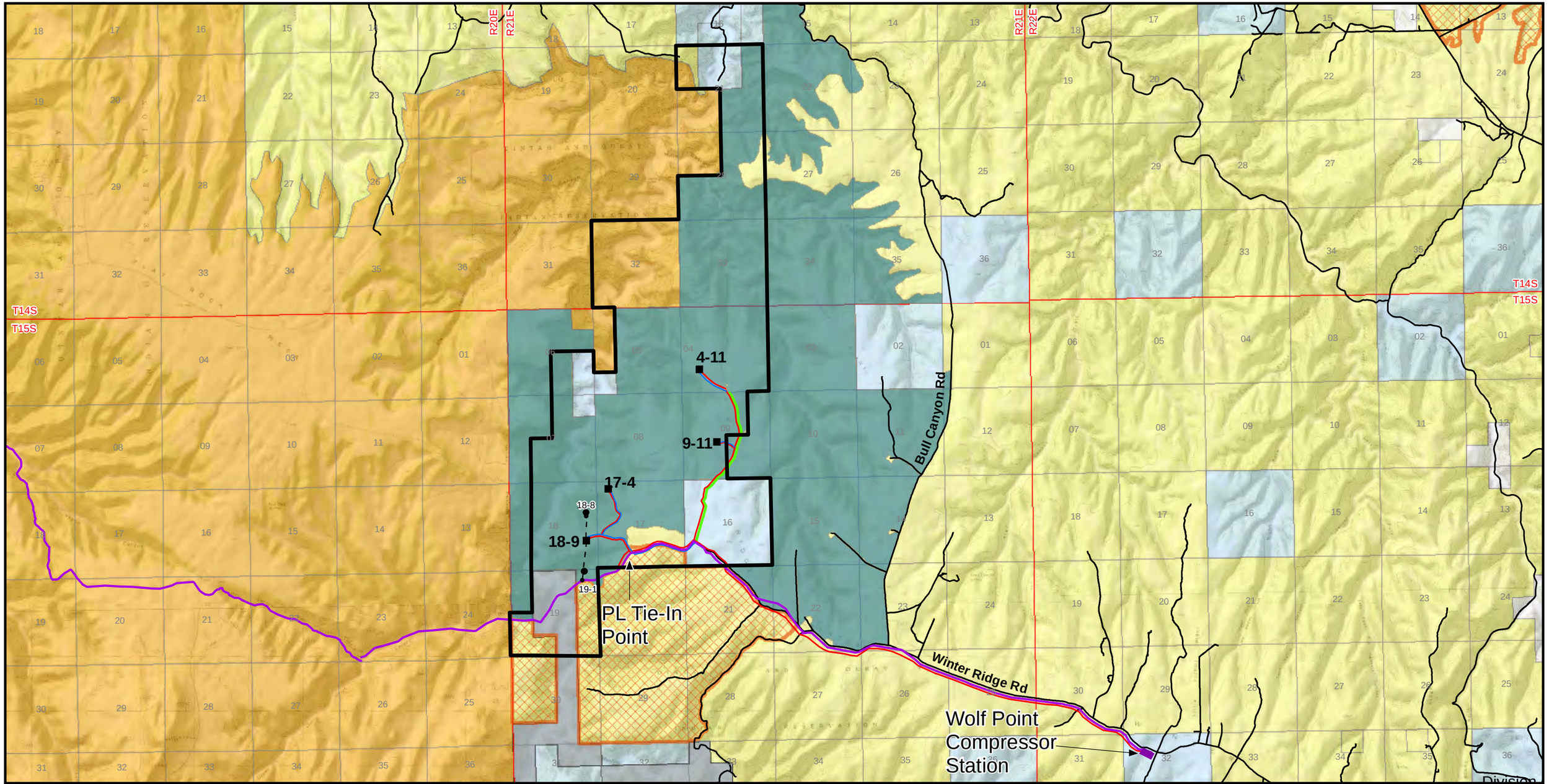
Tumbleweed II Exploratory Natural Gas Drilling Project

Proposed Action & Wolf Point Non-WSA Lands with Wilderness Characteristics

Stewart Petroleum Corporation

Date: April 2010 | Buys & Associates, Inc.

Figure 4-1



Legend

Wilderness Characteristics Review Determination
- Wilderness Character Present
- No Wilderness Character

- Project Area Boundary
- Proposed Well Pad
- Directional Drilling Route
- Bottomhole Location
- Compressor Station
- Proposed Road
- Proposed Pipeline
- Existing Road to be Upgraded
- Existing Road
- Existing Winter Ridge Pipeline

Surface Ownership
- Federal
- Private
- State
- Tribal
- Division of Wildlife Resources

N W E S

0 0.5 1 1.5 2 Miles

Tumbleweed II Exploratory Natural Gas Drilling Project

Alternative D & Wolf Point
Non-WSA Lands with Wilderness Characteristics

Stewart Petroleum Corporation

Date: April 2010 | Buys & Associates, Inc.

Figure 4-2

APPENDIX F

CONSULTATION DOCUMENTS

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United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Vernal Field Office
170 South 500 East
Vernal, UT 84078
(435) 781-4400 Fax: (435) 781-4410

IN REPLY REFER TO:
6841
UT-080

August 28, 2007

Memorandum

To: Utah Supervisor, Utah Field Office, Ecological Services,
U.S. Fish & Wildlife Services, Salt Lake City, Utah

From: Field Manager, Bureau of Land Management, Vernal, Utah

Subject: Request for concurrence with determinations of effects to endangered, threatened and candidate species and conclude Informal Consultation on Two wells (TW 18-9-15-21 and TW 14-17-15-21) within the Tumbleweed Unit (EA #UT-080-2005-201).

Attached is the draft Environmental Assessment for the proposed drilling project for review and comment. Pursuant with Section 7 of the Endangered Species Act of 1973, and in conformance with 50 CFR Part 402.14, we are requesting concurrence with the determination and conclusion of informal consultation on the project.

Informal consultation has taken place between the Service and the BLM regarding the impacts of the Proposed Action to threatened and endangered species Mexican spotted owl (*Strix occidentalis lucida).* There is also an affect to listed fish species mentioned in the EA, this action was formally consulted on resulting in a Biological Opinion for water depletion within the Green River basin (July 26, 2006). The EA includes an analysis of potential impacts to these species. This consultation is focused on affects to the Mexican spotted owl. Four other wells (3-4-15-21, 8-5-15-21, 3-9-15-21, and 15-8-15-21) are proposed within the EA, but two years of Mexican spotted owl surveys are needed before consultation can begin. The APDs for these four wells will not be approved until consultation has been completed.

Mexican spotted owl (*Strix occidentalis lucida*):

The Mexican spotted owl (MSO) is federally listed as a threatened species. The MSO ranges from southern Utah and Colorado through the mountains of Arizona, New Mexico, and west Texas into the mountains of Central Mexico. MSOs in Utah are located in the Colorado Plateau Recovery Unit (RU), as described in the MSO Recovery Plan (USFWS 1995). Potential threats to MSO in the Colorado Plateau RU include recreation,

overgrazing, road development in canyons, catastrophic fire, timber harvest in upland forests, and oil, gas, and mining development (USFWS 2006).

In Utah, MSOs are a permanent resident that nests in the deep, sheer-walled, sandstone, or rocky canyons of the Green and Colorado River basins (VDRMP 2005). In southern Utah, MSOs have not been found above 7,200 feet' (cutoff for suitable habitat is considered 8,000 feet). MSOs in Utah forage mostly in canyon bottoms and benches, as well as along mesa tops, usually within a ½ mile of cliff edges (USFWS 2006), with woodrats being their primary prey (USFWS 1995).

The preferred nesting habitat of the species includes complex, thickly forested canyons, steep walled rocky canyons, uneven-aged, multi-storied mature, and/or old growth stands that have high canopy closure. In the northern portion of its range (Utah and Colorado), most Mexican spotted owl nests are in caves or on cliff ledges in steep-walled canyons (USFWS 2001). The project area is north of the species' known distribution in Utah (Willey 1995), and east of designated critical habitat.

The annual cycle for Mexican spotted owls begins on or around March 1 when males and females come together after the winter season to mate and initiate breeding (Rinkevich et al. 1995). Eggs are laid in late March or early April (Rinckevich et al. 1995). Successful breeding produces one to three young that hatch in early May; juveniles disperse from their parents' territory in September and October. Juveniles will use canyons, as well as a variety of other habitat types that occur between canyons during their dispersal (USFWS 2006).

On public lands, if active MSO nests are documented within the project area, drilling, detonation of explosives, surface-disturbing activities, and/or noise generating activities would be prohibited within a spatial and temporal buffer determined by the BLM, in coordination with the Utah Division of Wildlife Resources (UDWR) and the US Fish and Wildlife Service (USFWS). Furthermore, if nesting activity is confirmed but a nest location is not specifically identified, BLM, in coordination with UDWR and USFWS, will delineate a Protected Activity Center (PAC) and no drilling, detonation of explosives, surface-disturbing activities, and/or noise generating activities will occur within the designated PAC. The parameters and restrictions for continuation or discontinuation of the activity would be determined through Section 7 Consultation with the USFWS. If an active nest were documented on Tribal or State land, activities would be avoided within the SMA-authorized spatial and temporal requirements for MSO through consultation with the USFWS. These timing and spatial limitations around active nests would effectively eliminate potential adverse impacts from seismic activity on breeding and nesting MSOs.

Suitable habitat for Mexican spotted owl occurs in the Project Area canyons, based on the USFWS-adopted 1997 Mexican Spotted Owl Habitat Model and the more recent 2000 update of the model. Critical habitat has not been designated in the Book Cliffs RMP area, and the nearest critical habitat occurs in Desolation Canyon. There have been no confirmed sightings of the species within the Book Cliffs RMP area. However, in July and August of 1992, unconfirmed Mexican spotted owl observations were documented

along Meadow Creek just south of the Project Area. No sightings were documented during subsequent surveys conducted by the BLM during the early 1990s. The nearest nest was documented approximately 30 miles from the Project Area.

The upper Willow Creek drainage still has many mapped habitat polygons which are rated at fair or better. Several of these polygons (2-127, 2-130, 2-132 and 2-134) are within 0.5 miles of the proposed wells. Two complete field surveys covering the habitat polygons in question were completed in 2006 by Grasslands Inc. (for the Questar Winter Ridge Pipeline) and 2007 by Environmental Industrial Services. These surveys were reviewed and found to follow established protocols for Mexican spotted owl surveys for the proposed 18-9-15-21 and 14-17-15-21 wells and associated road and pipeline corridors.

No MSO were seen or heard during the 2006 or 2007 inventories. As such, MSO survey requirements for these two proposed wells and their proposed roads and pipeline corridors have been met. If more than four years elapse between the end of the two seasons of survey and the initiation of surface disturbing activities within the 0.5 mile buffer, then another complete inventory would be required prior to any surface disturbing activities.

For the proposed 3-4-15-21, 8-5-15-21, 3-9-15-21, and 15-8-15-21 no surface disturbing activities would be allowed within "good" and "fair" habitat designations until the end of the two survey seasons in accordance with USFWS protocol. If MSO are documented, BLM would consequently follow USFWS protocol for Protected Activity Center (PAC) establishment. With the exception of canyon habitat, well pad construction and drilling would be allowed within the 0.5 mile buffer after the first season of surveys is completed, outside of the timing restriction and only if no owls have been detected. The second season of surveys would still be required for these 0.5 mile buffer areas. If no owls have been detected at the completion of the two seasons of calling surveys, the timing restriction shown in Table 2-2 would no longer be required for the areas of "good" and "fair" habitat, or the 0.5 mile buffer. However, if more than four years have elapsed between the end of the two seasons of survey and the initiation of surface disturbing activities within the 0.5 mile buffer, then another complete inventory would be required prior to any surface disturbing activities.

Based on these survey and PAC commitments, there would be no effect on breeding, nesting or foraging MSO. Furthermore, as the Proposed Action would not include any development within the Willow Creek and Upper Bottom Canyon corridors, potential impacts to designated MSO habitat would be minimal. However, since MSO could potentially utilize "fair" and "good" habitats in or near the greater Project Area for future nesting sites, any surface disturbance within a 0.5 mile buffer of designated habitat (which includes the Tumbleweed Project Area) could potentially reduce the likelihood of the areas from being selected and used by MSO in the future.

Based on this assessment, BLM has determined that the Proposed Action ***"may affect, is not likely to adversely affect"*** the Mexican Spotted Owl.

United States Department of the Interior
FISH AND WILDLIFE SERVICE
UTAH FIELD OFFICE
2369 WEST ORTON CIRCLE, SUITE 50
WEST VALLEY CITY, UTAH 84119

September 13, 2007

In Reply Refer To
FWS/R6
ES/UT
7-F-0166
6-UT-07-F-025

Memorandum

To: Field Manager, Vernal Field Office, Bureau of Land Management, Vernal, Utah

From: Utah Field Supervisor, Ecological Services, U.S. Fish and Wildlife Service, West Valley City, Utah

Subject: Conclusion of Formal Section 7 Consultation for Tumbleweed Exploratory Drilling Project (EA #UT-080-05-201)

We received your letter requesting concurrence for Stewart Petroleum Corporation's Tumbleweed Exploratory Drilling Project (EA #UT-080-05-201) on September 12, 2007. We've been coordinating with the Bureau of Land Management (BLM) on the development of the Environmental Assessment (EA) and Biological Assessment (BA) since June 14, 2007. A complete administrative record for this project is on file in our office.

Based on your letter, we concur with your "may affect, not likely to adversely affect" determinations for the Mexican spotted owl. We base our determination on the following:

- Two years of surveys have been completed for two proposed wells (18-9-15-21 and 14-17-15-21) and associated infrastructure. The results for both years were negative (Grasslands Consulting 2006 and EIS Consulting 2007).
- The following applicant committed conservation measures will be applied to the remaining four wells (3-4-15-21, 8-5-15-21, 3-9-15-21, and 15-8-15-21):
    - No surface disturbing activities would be allowed within "good" and "fair" habitat designations until the end of the two survey seasons in accordance with USFWS protocol.
    - If MSO are documented, BLM would consequently follow USFWS protocol for Protected Activity Center (PAC) establishment.
    - If no owls have been detected at the completion of the two seasons of calling surveys, the timing restriction shown in Table 2-2 (of the EA) would no longer be required for the areas of "good" and "fair" habitat, or the 0.5 mile buffer.

However, if more than four years have elapsed between the end of the two seasons of survey and the initiation of surface disturbing activities within the 0.5 mile buffer, then another complete inventory would be required prior to any surface disturbing activities.

- In addition to these applicant committed conservation measures within the EA, the applicant will not develop within 0.5 mile of good or fair habitat until two years of surveys are complete (personal communication with Dawn Martin of Buys and Associates September 13, 2007).

Due to water depletions, your office made the determination of "may affect, likely to adversely affect" for the four Colorado River endangered fish: Colorado pikeminnow, bonytail, humpback chub, and razorback sucker. Your EA stated this project tiered to the July 28, 2006 Programmatic Water Depletion Biological Opinion for Oil and Gas Development Administered or Permitted by the Bureau of Land Management (PWDBO). We provided comments to your office on July 6, 2007 stating that the project can not use the PWDBO because the depletions are considered historic. The PWDBO states that the programmatic consultation does not include historic depletions. Therefore, we are providing formal section 7 consultation for water depletions associated with the proposed project as per personal communications between Bekee Megown (U. S. Fish and Wildlife Service) and Jerry Kenzka (BLM) (September 13, 2007). In accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*), and the Interagency Cooperation Regulations (50 CFR 402), this document transmits the Fish and Wildlife Service's (Service) biological opinion for these four fish species.

Based on information provided in the EA, the project will use a total of 30.6 acre-feet of water for drilling, completion, and dust suppression. The water will be obtained from Water Right Permit #49-123 which was filed on 05/09/1921. The special use authorization number iws t 33231 (Dawn Martin personal communication July 13, 2007).

To address depletion issues, on January 21-22, 1988, the Secretary of the Interior; the Governors of Wyoming, Colorado, and Utah; and the Administrator of the Western Area Power Administration were cosigners of a Cooperative Agreement to implement the "Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin" (USFWS 1987). In order to further define and clarify the process in the Recovery Program, a section 7 agreement was implemented on October 15, 1993, by the Recovery Program participants. Incorporated into this agreement is a Recovery Implementation Program Recovery Action Plan (Plan) which identifies actions currently believed to be required to recover the endangered fishes in the most expeditious manner. Activities and accomplishments under the Recovery Program provide the reasonable and prudent alternatives which avoid the likelihood of jeopardy to the continued existence of the endangered Colorado River fishes and to avoid the likely destruction or adverse modification of critical habitat in Section 7 consultations on all impacts (except the discharge of pollutants such as trace elements, heavy metals, and pesticides) associated with historic water projects in the Upper Basin. Depletion charges or other measures will not be required from historic projects which undergo Section 7 consultation in the future.

We appreciate your commitment in conserving endangered species. Should project plans change, or if additional information on the distribution of listed or proposed species becomes

available, these determination may be reconsidered. If further assistance is needed or you have any questions, please contact Bekee Megown, at (801) 975-3330 extension 146.

cc: Dawn Martin, Buys & Associates, Inc., 300 E. Mineral Ave., Suite 10, Littleton, CO 80122

Division	Initial	Assigned
Field Manager		
Associate/ Support Services		
Fire		
Lands & Minerals		
NEPA		
Renewables		
BUREAU OF LAND MGMT, VERNAL, UTAH		
ALL EMPLOYEES		

We request your concurrence on our determination for the proposed project so as to conclude informal consultation.

If you have any questions or need additional information, please contact Scott Ackerman, Wildlife Biologist at (435) 781-4437 for Mexican spotted concerns.

email from DCrane to SHoward

From: Stephanie_Howard@blm.gov
Sent: Thursday, October 08, 2009 3:55 PM
To: Dawn Martin
Subject: Fw: summary of Tumbleweed Changes for FWS Consultation Purposes

Attachments: Tumbleweed II Changes Relevant to Sect 7 Consult.doc

Stephanie Howard
Environmental Coordinator
170 S 500 E
Vernal, UT 84078
direct: 435-781-4469
cell: 435-828-1631
fax: 435-781-4410
----- Forwarded by Stephanie Howard/VFO/UT/BLM/DOI on 10/08/2009 03:54 PM -----

Drew Crane/R6/FWS/DOI@FWS
10/07/2009 01:33 PM

To: Stephanie Howard/VFO/UT/BLM/DOI@BLM
cc:
Subject: Re: Fw: summary of Tumbleweed Changes for FWS Consultation Purposes(Document link: Stephanie Howard)

Stephanie,

It's the Service's opinion that the change in impacts to listed species you have documented below are not significant enough to require reinitiation of formal consultation for this project. The previous consultation done for the Tumbleweed EA/BA and all terms and conditions contained within would be applicable to the revised EA. Feel free to contact me if you have any questions.

Thanks

Drew Crane
Fish and Wildlife Biologist
U.S. Fish and Wildlife Service, Utah Field Office
2369 West Orton Circle Suite 50
West Valley City, UT 84119
Phone: 801-975-3330 ext 124
Fax: 801-975-3331
E-mail: drew_crane@fws.gov

Achieving sustainable native species and ecosystems through leadership, partnerships, and innovation.

email from DCrane to SHoward

Stephanie Howard/VFO/UT/BLM/DOI@BLM
To: Drew Crane/R6/FWS/DOI@FWS
cc:
10/07/2009 01:20 PM
Subject: Fw: summary of Tumbleweed Changes for FWS Consultation Purposes

Stephanie Howard
Environmental Coordinator
170 S 500 E
Vernal, UT 84078
direct: 435-781-4469
cell: 435-828-1631
fax: 435-781-4410
----- Forwarded by Stephanie Howard/VFO/UT/BLM/DOI on 10/07/2009 01:19 PM -----

Stephanie Howard/VFO/UT/BLM/DOI
To: Drew Crane/VFO/UT/BLM/DOI
cc:
08/31/2009 01:26 PM
Subject: Fw: summary of Tumbleweed Changes for FWS Consultation Purposes

Hi Drew,

Hope this helps you to determine if we need to reinitiate consultation or not. Let me know if you need more info. Thanks.

Stephanie Howard
Environmental Coordinator
170 S 500 E
Vernal, UT 84078
direct: 435-781-4469
cell: 435-828-1631
fax: 435-781-4410
----- Forwarded by Stephanie Howard/VFO/UT/BLM/DOI on 08/31/2009 01:25 PM -----

email from DCrane to SHoward

"Dawn Martin"
<dmartin@buysandassociates.com>

08/31/2009 01:09 PM

To <Stephanie_Howard@blm.gov>

cc "'Melissa Bridendall'" <mbridendall@buysandassociates.com>

Subject summary of Tumbleweed Changes for Consultation Purposes

Dear Stephanie,

You'd asked us to provide a description of the key changes between the original Tumbleweed EA (which was consulted on with the FWS) and the current Tumbleweed II EA. We agree that the project has not changed to the extent that re-initiation of consultation would be needed. In short, the key changes to the project include:

- A change in the project name and the BLM's NEPA number assigned to the EA;
- Changes to the well naming convention (wells are now named using Stewart Petroleum's naming convention);
- Change in the number of well pads (from 6 to 7 well pads) and wells (from 6 to 9 wells) under the Proposed Action;
- Increase in water depletion from 30.6 acre-feet to 45.8 acre-feet to accommodate the additional wells under the Proposed Action;
- Water right permit number has been updated / made current;
- Addition of a directional drilling alternative that analyzes development of 9 wells from 4 well pads;
- Overhaul of the Tumbleweed II EA to bring the document up to speed with the Vernal RMP;
- Results from the 2009 MSO surveys were added to the MSO discussion.

Melissa Bridendall prepared the attached summary of T&E species discussions in the EA. Specifically, she's clipped all of the Chapter 2info relevant to the MSO and the CO River Endangered fish species, Chapter 3 Affected Environment discussions for MSO and the CO River Fishes, and Chapter 4 analyses for these species under the Proposed Action and Directional Drilling Alternative.

If you (or Drew) need anything else, please let Melissa and I know.
Thanks!

-Dawn

Dawn Martin
NEPA Program Manager
Buys & Associates, Inc.
300 E. Mineral Ave., Suite 10
Littleton, CO 80122
303-781-8211 (office)

email from DCrane to SHoward

303-916-0354 (mobile)

(See attached file: Tumbleweed II Changes Relevant to Sect 7 Consult.doc)

State of Utah
JON M. HUNTSMAN, JR.
Governor
GARY R. HERBERT
Lieutenant Governor

Department of Community and Culture
PALMER DePAULIS
Executive Director

State History
PHILIP F. NOTARIANNI
Division Director

December 16, 2008

Jerry Kenczka
AFM, Lands and Minerals
Bureau of Land Management
170 South 500 East
Vernal UT 84078

RE: Tumbleweed Unit Propsed Drilling, T14-15S, R12IE

In Reply Please Refer to Case No. 08-2059

Dear Mr. Kenczka:

The Utah State Historic Preservation Office received your request for our comment on the above-referenced project on December 9, 2008.

We concur with your determination of **No Adverse Effect.**

This letter serves as our comment on the determinations you have made, within the consultation process specified in §36CFR800.4. If you have questions, please contact me at 801-533-3555 or Lhunsaker@utah.gov or Jim Dykman at 801-533-3523 or Jdykman@utah.gov

Sincerely,

Lori Hunsaker
Deputy State Historic Preservation Officer - Archaeology

THE HOPI TRIBE

Benjamin H. Nuvamsa
CHAIRMAN

Todd Honyaoma, Sr.
VICE-CHAIRMAN

December 22, 2008

Jerry Kenczka, AFM, Lands and Minerals
Attention: Gabrielle Elliot, Archaeologist
Bureau of Land Management, Vernal Field Office
170 South 500 East
Vernal, Utah 84078

Dear Mr. Kenczka,

This letter is in response your correspondence dated December 8, 2008, regarding Stewart Petroleum proposing up to six exploratory natural gas wells, production facilities, roads and pipelines. The Hopi Tribe claims cultural affiliation to prehistoric cultural groups in Utah, including the Archaic and Fremont cultural groups, and the Hopi Cultural Preservation Office supports the identification and avoidance of prehistoric archaeological sites and Traditional Cultural Properties. Therefore, we appreciate the Bureau of Land Management's continuing solicitation of our input and your efforts to address our concerns.

The Hopi Cultural Preservation Office considers the prehistoric archaeological sites of our ancestors to be Traditional Cultural Properties. We understand the project area has been surveyed for cultural resources and five identified National Register eligible properties will be avoided by project activities. We are not aware of any other Hopi Traditional Cultural Properties in this project area.

Should you have any questions or need additional information, please contact Terry Morgart at the Hopi Cultural Preservation Office at tmorgart@hopi.nsn.us. Thank you for your consideration.

Respectfully,

Leigh J. Kuwanwisiwma, Director
Hopi Cultural Preservation Office

xc: Utah State Historic Preservation Office

PUEBLO OF LAGUNA
P.O. BOX 194
LAGUNA, NEW MEXICO 87026

(505) 552-6598
(505) 552-6654
(505) 552-6655

Office of:
The Governor
The Secretary
The Treasurer

Tumbleweed
EA

December 18, 2008

Mr. Jerry Kenecka
Bureau of Land Management
Vernal Field Office
170 South 500 East
Vernal, UT 84078

Dear Mr. Keneczka:

RE: 3160 LLUTG01100

The Pueblo of Laguna appreciates your consideration to comment on the possible interest your project may have on any traditional or cultural properties.

The Pueblo of Laguna has determined that the undertaking WILL NOT have a significant impact at this time. However, in the event that any new archaeological sites are discovered and any new artifacts are removed, we request to be notified to review items. We also request photographs of items. According to our unpublished migration history, our ancestors journeyed from the north through that area and settled for periods of time before traveling to our present location. Therefore, the possibilities of some findings may exist.

We thank you and your staff for the information provided.

Sincerely,

For John E. Antonio, Sr.
Governor, Pueblo of Laguna