

**United States Department of the Interior
Bureau of Land Management**

**Colorado River Valley Field Office
2300 River Frontage Road
Silt, Colorado 81652
970-876-9000**

**Environmental Assessment
DOI-BLM-CO-N040-2018-0078-EA**

***TEP Rocky Mountain LLC
SG 11-22 Project***

**Federal Lease COC58673 (Surface Lease)
Federal Lease COC27874**

August 2018



It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

CONTENTS

1.	PURPOSE AND NEED FOR ACTION.....	1
2.	ALTERNATIVES ANALYZED.....	1
2.1	Proposed Action.....	1
2.2	No Action Alternative.....	6
2.3	Summary of Lease Stipulations	6
2.4	Plan Conformance Review.....	6
3.	AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES	7
3.1	Access and Transportation.....	9
3.2	Air Quality	10
3.3	Geology and Minerals.....	14
3.4	Invasive Non-Native Plants	18
3.5	Noise.....	20
3.6	Socioeconomics and Environmental Justice	21
3.7	Soils.....	23
3.8	Special Status Species.....	24
3.9	Vegetation.....	30
3.10	Visual Resources.....	31
3.11	Wastes, Hazardous or Solid.....	33
3.12	Water Resources – Surface Water and Groundwater.....	35
3.13	Wildlife.....	38
4.	CUMULATIVE IMPACTS	40
4.1	Existing Oil and Gas Developments	40
4.2	Summary of Cumulative Impacts	40
4.3	Air Resources.....	41
5.	AGENCIES AND PERSONS CONSULTED.....	43
6.	BLM INTERDISCIPLINARY REVIEW.....	44
7.	REFERENCES CITED.....	44

TABLES

Table 1.	Project Surface Disturbance Estimate.....	4
Table 2.	Potentially Affected Resources.....	7
Table 3.	Traffic Associated with Drilling and Completion Activities	9
Table 4.	Estimated Air Emissions for the 33 Federal Wells on the SG 11-22 and SG 23-22 Pads	11
Table 5.	Modeled Cumulative Near-Field Air Quality	13
Table 6.	Concentration Contributions Relative to Overall Emissions	13
Table 7.	Geologic Formations within the Study Area.....	14
Table 8.	Constituents of Typical Hydraulic Fracturing Operation in Tight Gas Formations	17
Table 9.	COGCC Maximum Permissible Noise Levels.....	20
Table 10.	Top Industry Sectors of Garfield County, Second Quarter 2016.....	21
Table 11.	Project Area Soil.....	23
Table 12.	Potential for Occurrence and Adverse Effects on Threatened or Endangered Animals	24
Table 13.	Potential for Occurrence and Adverse Effects on BLM Sensitive Animals	27
Table 14.	Maximum GHG Emissions from 33 Federal Wells on the SG 11-22 and SG 23-22 Pads.....	43
Table 15.	BLM Interdisciplinary Team Authors and Reviewers.....	44

FIGURES

Figure 1. SG 11-22 Plan of Development..... 2
Figure 2. ROW Exhibit Displaying Bottomholes within Federal Leases 3
Figure 3. Construction Layout for SG 11-22 Pad 5

APPENDIX

Appendix. Surface Use and Drilling Conditions of Approval

1. PURPOSE AND NEED FOR ACTION

The purpose of the action is to enable TEP Rocky Mountain LLC (“TEP”) to exercise its valid existing right to develop the leased Federal fluid mineral resource associated with Federal leases COC27874 and COC58673. Under the provisions of the Federal Land Policy and Management Act of 1976 (FLPMA), the BLM is charged with managing public lands for multiple uses, including the processing of land use applications. Proposed Actions are reviewed and processed under the National Environmental Policy Act of 1969 (NEPA) to ensure no undue degradation or impacts to public lands. Under the Mineral Leasing Act, the Mining and Minerals Policy Act of 1970, the National Materials and Minerals Policy, Research, and Development Act of 1980, and the Federal Onshore Oil and Gas Leasing Reform Act of 1987, the BLM has been charged specifically with responding to applications to access leased mineral rights. Instead of structuring the development of the lease as a series of individual actions, the current BLM policy specifies the use of multi-well development plan proposals to manage Federal lease development more effectively.

2. ALTERNATIVES ANALYZED

2.1 PROPOSED ACTION

Twenty new Federal directional wells would be drilled, completed, and produced on the proposed SG 11-22 well pad, located on BLM land atop an open sagebrush ridge below Mount Callahan that overlooks the Colorado River valley and Una Bridge area (**Figure 1**). The project area is located approximately 4 air-miles southwest of Parachute, Garfield County, Colorado. The legal description of the pad is Township 7 South (T7S), Range 96 West (R96W), Section 22, NW¹/₄NW¹/₄, Sixth Principal Meridian. The elevation at the proposed site is 6,090 feet above mean sea level.

Drilling would be scheduled from mid-December 2018 through mid-March 2019, with well completion work expected to finish in May 2019. Federal wells proposed to be developed from the SG 11-22 pad would include seven drilled into the underlying lease (COC58673) and 13 drilled into an adjacent lease (COC27874). A BLM site right-of-way (ROW) would be required to allow use of the SG 11-22 pad to access the 13 off-lease wells (**Figure 2**). Specific details regarding ROW acreage for the SG 11-22 pad site and the lengths of the ancillary road and pipelines are listed in **Table 1**. No public access is available to the site, since the existing field development road crosses private land at its juncture with U.S. Highway 6 west of the Una Bridge junction.

The SG 23-22 project, originally approved by the BLM in 2013 and re-permitted in 2018 under NEPA DOI-BLM-CO-N040-2018-0076-CX, provides the initial segment of road accessing the SG 23-22 pad located on private land south of the SG 11-22 project site.

The SG 11-22 access road closely follows an existing two-track alignment that was initially constructed in the 1973 to access Mountain Bell’s Grand Valley Microwave Repeater Station. The SG 11-22 pad site sets directly north of the steel structure and building remaining from the defunct microwave repeater facility. Qwest Corporation (Qwest) is the holder of the current ROW (COC112731) for the facility; BLM has requested the site undergo extensive equipment and material removal and decommissioning in the near future. It is assumed that the road improvements planned by TEP will enable Qwest to remove the remaining steel infrastructure and out-building as part of its ROW relinquishment process. With the construction of the well pad, physical access to the repeater facility would be provided to Qwest by TEP, either across the new pad or along a slightly altered existing route directly south of the pad.

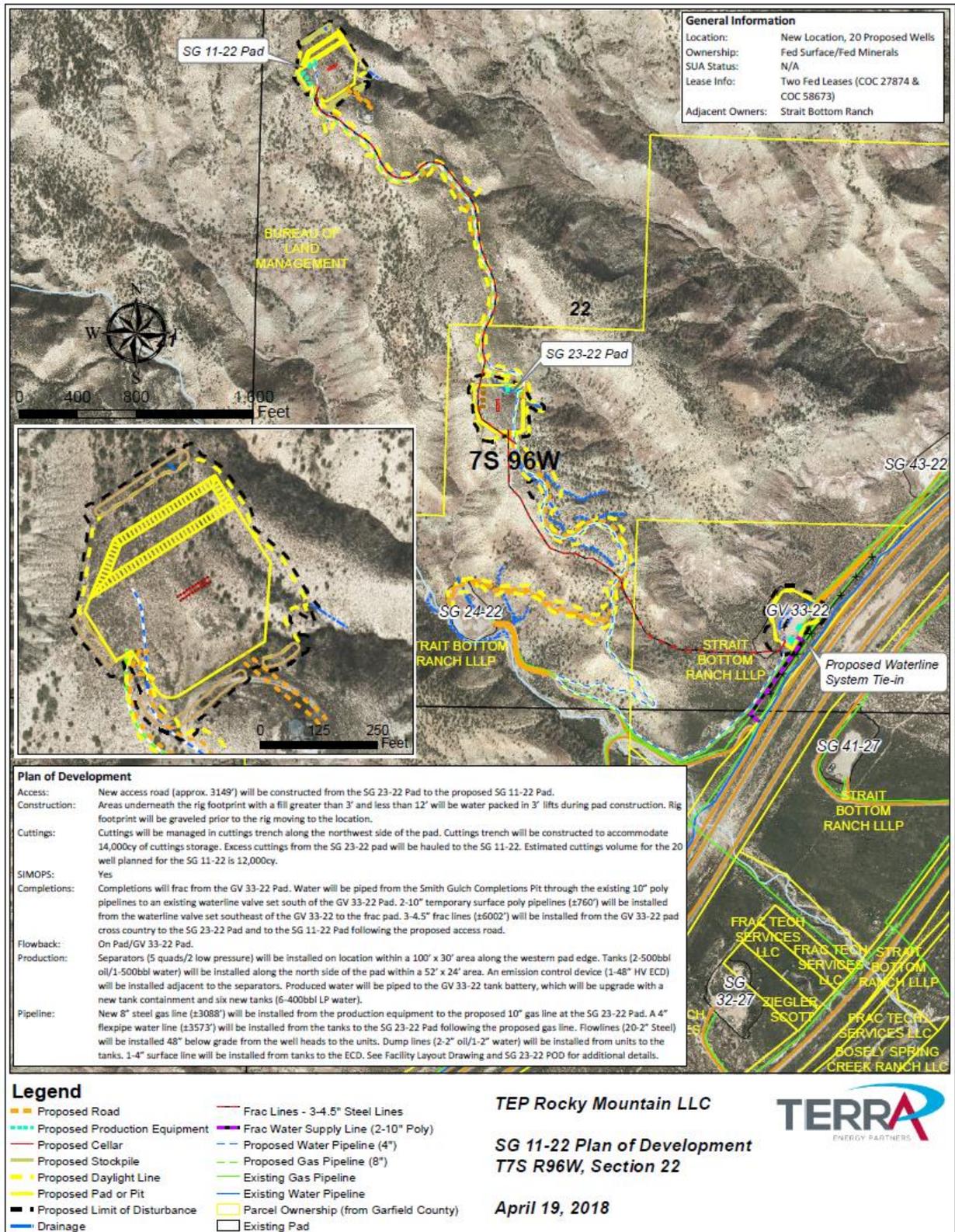
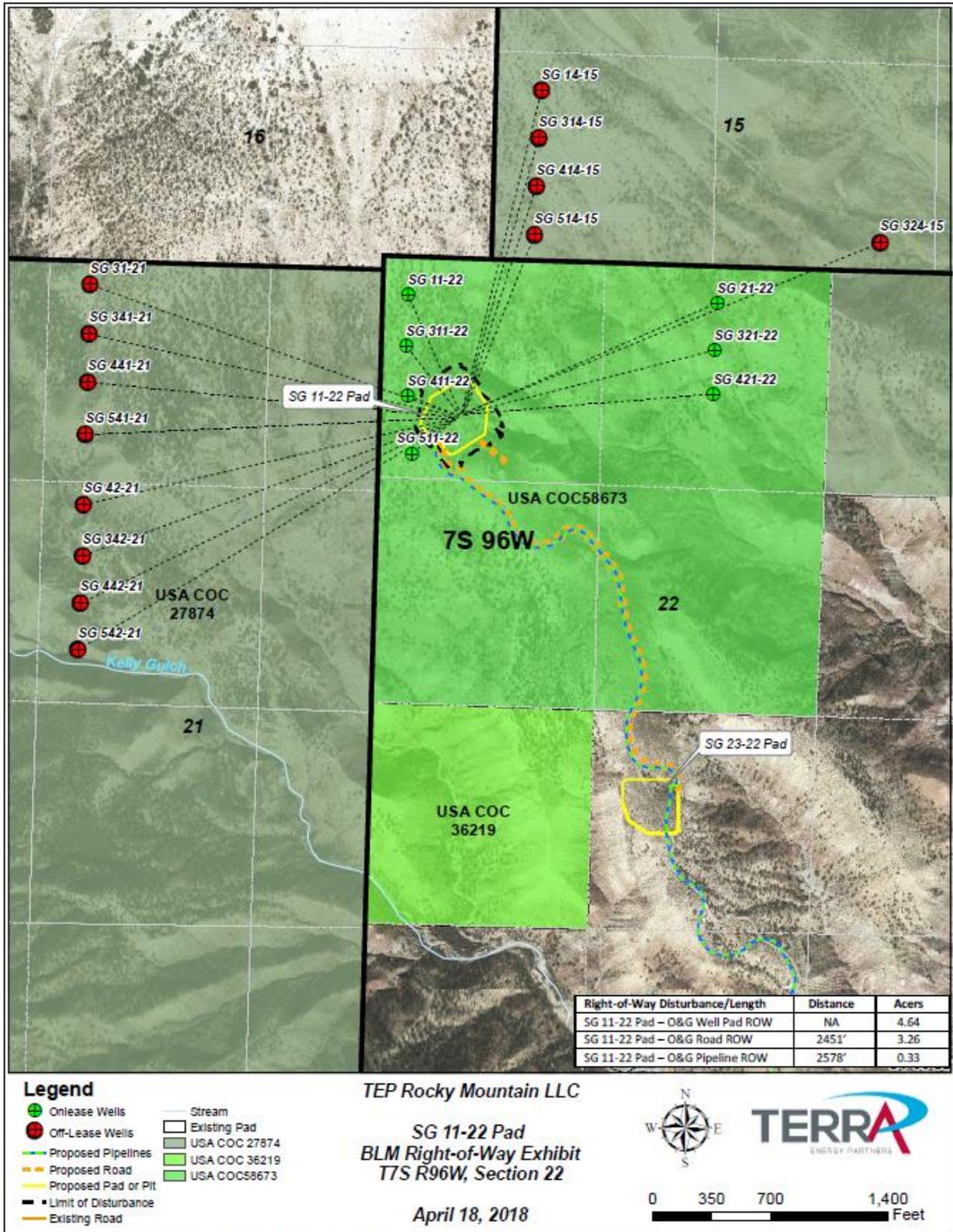


Figure 1. SG 11-22 Plan of Development



T:\Projects\Ficance\Grand Valley\SG 11-22\11-22\11-22_BLM_ROW_Exhibit.mxd atankersley 4/18/2018 6:37:38 PM

Figure 2. ROW Exhibit Displaying Bottomholes within Federal Leases

Table 1. Project Surface Disturbance Estimate

<i>Project Component</i>	<i>Surface Ownership</i>	<i>Length (feet)</i>	<i>Existing Disturbance (acres) (Fed + Pvt)</i>	<i>New Disturbance (acres) (Fed/Pvt)</i>	<i>Short-term Disturbance (acres) (Fed/Pvt)</i>	<i>Long-term Disturbance (acres) (Fed/Pvt)</i>
SG 11-22 Drill Pad ¹	BLM	N/A	0.14 + 0	4.50 + 0	4.64 + 0	1.47 + 0
SG 11-22 Access Road	BLM + Private	2,451 + 698 [= 3,149]	0.45 + 0.10 [= 0.55]	2.81 + 0.69 [= 3.50]	3.26 + 0.79 [= 4.05]	1.25 + 0.32 [= 1.57]
SG 11-22 (8-inch gas line and 4-inch water line) ²	BLM + Private	2,578 + 660 [= 3,238]	0.03 + 0	0.29 + 0.05 [= 0.34]	0.33 + 0.05 [= 0.38]	N/A
Disturbance Totals			0.62 + 0.10 [= 0.72]	7.60 + 0.74 [= 8.34]	8.23 + 0.84 [= 9.07]	2.72 + 0.32 [= 3.04]

¹ The 0.14 acre of existing disturbance on Federal surface represents a portion of an existing two-track crossing the pad footprint.
² The gas and water lines would be collocated for 3,238 feet from the SG 11-22 pad to connections at SG 23-22 pad. Most of the pipeline disturbance would occur within the new road disturbance corridor.

The pad, disturbing 4.64 acres of BLM land, would be located on a relatively gentle south-facing slope within a sagebrush/grass opening atop a prominent ridge. Cuttings would be tested and stored in a trench to be excavated along the north edge of the pad; the trench would be designed to store cuttings generated from wells on the SG 11-22 and SG 23-22 pads (**Figures 1 and 3**). Separators would be staged along the western edge of the pad site.

Improving the two-track into a 3,149-foot serviceable development road from the SG 23-22 pad to the new well site would create 4.05 acres of short-term disturbance with 3.26 acres occurring on BLM-administered land. The road would be constructed to a width of 25 feet, including 4-foot-wide ditches on both sides. An 8-inch-diameter natural gas welded steel pipeline and 4-inch-diameter flexpipe water line would be buried primarily in the road disturbance corridor for a length of 3,238 feet between the two pads (**Figure 1**). The total project disturbance would amount to 9.07 acres, with 8.23 acres occurring on BLM land; long-term disturbance would be 3.04 acres, with 2.72 acres on BLM land (**Table 1**).

The two buried pipelines would connect with the corresponding gas and water gathering systems installed to serve the SG 23-22 wells. Produced water would be delivered to the existing GV 33-22 pad via pipeline and either stored in tanks or directly released into TEP's existing water collection system for recycling. Condensate would be stored on the SG 11-22 pad in two 500-bbl steel tanks; a third 500-bbl tank would serve as a blowdown tank. Truck transport visits would occur periodically at the pad during oil sales.

The existing GV 33-22 pad, expanded as a frac pad (i.e., to support hydraulic fracturing operations) and tank farm for the SG 23-22 project, would continue to serve as the remote location for well completion support on the SG 11-22 wells (**Figure 1**). Water for frac stages would be delivered to the GV 33-22 pad using TEP's buried recycled water collection system and the nearby Smith Gulch storage facility. From the GV 33-22 pad to the SG 11-22 pad, temporary surface frac lines would be laid cross-country west of the GV 33-22 pad and along the SG 23-22 and SG 11-22 access roads. Two 10-inch poly surface lines (760 feet in length) would be installed from the GV 33-22 pad to the waterline valve set southeast of the GV 33-22 to connect to TEP's buried water system that would supply the water volumes from the Smith Gulch storage facility for the frac stages. Three 4½-inch surface frac lines (6,002 feet in length) would be installed cross-country from the GV 33-22 pad to the SG 23-22 pad and to the SG 11-22 pad following the proposed access road.

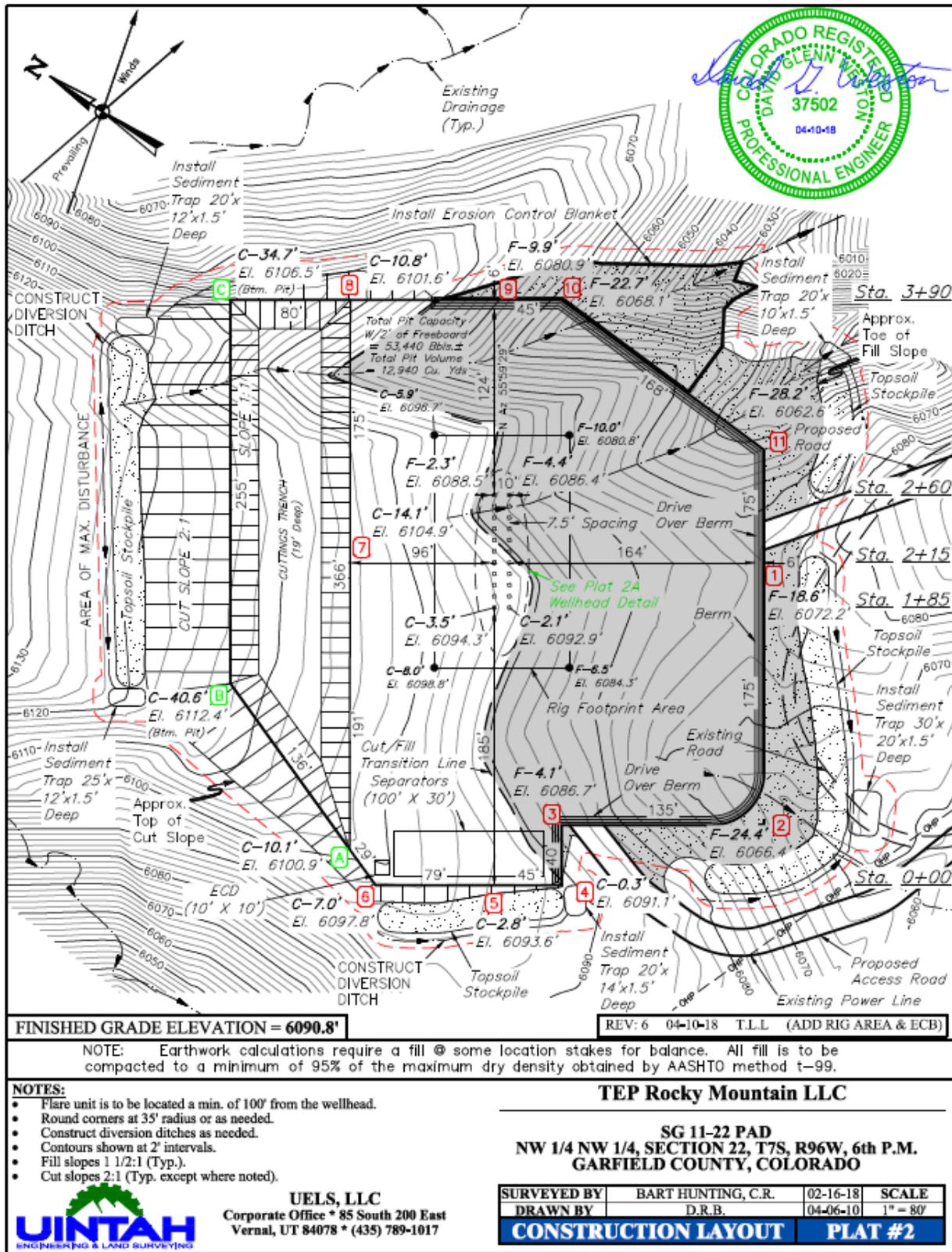


Figure 3. Construction Layout for SG 11-22 Pad

Because of its relatively recent date, the cultural resource block inventory conducted for the Kelly Gulch area in 2010 remains valid; no sites or cultural values were identified that could be affected by the Proposed Action. Biological resource surveys completed by WestWater Engineering (WWE) in June 2018 updated botanical findings initially noted in an earlier survey report for the Lower Kelly Gulch area (WWE 2010). No specific special status plant concerns were noted for the SG 11-22 project; noxious weed presence was documented along the private access road near the Interstate 70 (I-70) corridor.

Four unoccupied raptor nests were observed during the spring 2018 survey period. Before commencing construction or drilling activities during the raptor nesting season, TEP would conduct a raptor survey within specified buffer distance from surface-disturbing components for the SG 11-22 project.

2.2 NO ACTION ALTERNATIVE

Although the BLM cannot deny the right to drill and develop the existing Federal leases proposed as the target of the Proposed Action, the BLM can deny associated Applications for Permit to Drill (APDs) to prevent unnecessary and undue degradation, and can deny the discretionary ROW grant for use of the SG 11-22 pad to develop off-lease resources. Selection by the BLM of the No Action Alternative would constitute denial of the APDs and site ROW associated with the Proposed Action.

All elements of the Proposed Action would require Federal approval; no fee (private) wells are being planned on the SG 11-22 well site. Invoking a strict denial of Federal well development, whether on-lease APDs or an off-lease site ROW, would essentially result in no further actions to analyze under the No Action Alternative. The drill cuttings developed from Federal and fee wells on the nearby SG 23-22 pad would have to be stored in a different location, since the cuttings trench on the SG 11-22 pad would not be built for cuttings storage. No other action would be undertaken with this alternative.

2.3 SUMMARY OF LEASE STIPULATIONS

Federal wells proposed on the SG 11-22 pad would access the targeted Federal oil and gas leases COC58673 and COC27874 from the BLM location.

Federal Lease Stipulations. The stipulations listed on lease COC58673 include:

- timing limitation (TL) to protect big game winter habitat (December 1 through April 30)
- controlled surface use (CSU) to protect fragile soils
- controlled surface use to protect scenic values of Class II VRM areas

Resource Management Plan Stipulations. The following stipulations would apply to the site ROW to be issued for the “off lease” Federal wells to be drilled and developed on the SG 11-22 pad:

- NSO (No Surface Occupancy)-22 for VRM Class II with slopes greater than 30%
- CSU-1 for slopes greater than 30% and fragile soils
- CSU-9 for VRM Class II

In additional, under its regulatory authority per 43 CFR 3160, the BLM applies Conditions of Approval (COAs) to mitigate environmental impacts. The **Appendix** presents surface-use and drilling COAs to be applied to any APDs and to the site ROW approved under this EA.

2.4 PLAN CONFORMANCE REVIEW

The Proposed Action and No Action Alternative are subject to and have been reviewed for conformance with the following plans (43 CFR 1610.5, BLM 1617.3):

Name of Plan: Colorado River Valley Field Office (CRVFO) Record of Decision and Approved Resource Management Plan (ROD/ARMP), approved June 12, 2015

Decision Language: Page 106, LRT-GOAL-01, LRT-OBJ-01: “Provide for the development of transportation systems, utilities, communication sites, and renewable energy resources when such needs are consistent with other resource values.”

Page 111, Goal (MIN-GOAL-01): “Provide opportunities for leasing, exploration, and development of fluid minerals using balanced multiple-use management to meet local and national energy needs.”

Page 111, Oil and Lands and Realty, MIN-OBJ-01: “Facilitate orderly, economic, and environmentally sound exploration and development of oil and gas resources...using the best available technology.”

Page 111, Management Action (MIN-MA-01): “Manage approximately 603,100 acres of Federal mineral estate as open to oil and gas leasing and development.”

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section provides a description of the human and natural environmental resources that could be affected by the Proposed Action and presents comparative analyses of the affected environment stemming from the implementation of the actions under the Proposed Action and other alternatives analyzed. **Table 2** lists the potentially affected resources analyzed in this EA.

Table 2. Potentially Affected Resources			
<i>Resources</i>	<i>Not Present on Location</i>	<i>No Impact</i>	<i>Potentially Affected</i>
Access and Transportation			X
Air Quality			X
Cultural Resources	X		
Fossil Resources	X		
Geology and Mineral Resources			X
Invasive Non-Native Plants			X
Native American Religious Concerns	X		
Noise			X
Prime or Unique Farmlands	X		
Range Management	X		
Recreation	X		
Rights-of-Way	X		
Socioeconomics and Environmental Justice			X
Soils			X
Special Designations (ACECs, SMAs, NCAs, WSA, WSRs, etc.)	X		
Special Status Animals	X		
Special Status Plants			X
Vegetation			X
Visual Resources			X
Wastes, Hazardous or Solid			X
Water Resources, Surface and Ground			X
Wild and Scenic River	X		
Wild Horses and Burros	X		

Table 2. Potentially Affected Resources			
<i>Resources</i>	<i>Not Present on Location</i>	<i>No Impact</i>	<i>Potentially Affected</i>
Wilderness or Wilderness Study Areas	X		
Wildlife			X

The following elements, identified as not being present or not affected, are not carried forward for additional analysis in this EA, for the reason specified for each:

- Cultural Resources – A cultural resource inventory identified as BLM# 1111-04 (GF.LM.R483) was completed specifically for the Kelly Gulch Block Area Project by Grand River Institute in 2011, and surveyed 2450 acres including all of the current project area. No eligible Cultural Resources were identified in the SG 11-22 Project vicinity. Protective mitigation measures for cultural resource discovery/finds are included in the Surface COAs (**Appendix**).
- Fossil Resources – The proposed pad is sited on ridge top with existing two-track serving the general area related to the Qwest microwave repeater site. The area is covered by extensive vegetation with no outcrops nearby. No scientifically significant fossils were identified in surveys of nearby areas. Therefore, no further surveys or monitoring are required. Protective mitigation measures for fossil discovery/finds are included in the Surface COAs (**Appendix**).
- Native American Religious Concerns – No Native American cultural resources were identified in this project area, and no historic properties are currently known to be located within the project APE. Protective mitigation measures for cultural resource discovery/finds are included in the Surface COAs (**Appendix**).
- Prime or Unique Farmlands – None present
- Range Management – The proposed SG 11-22 well pad, access road, and pipelines would be constructed within the higher elevations of the BLM Kelly Gulch Sheep Allotment. The steep canyon terrain surrounding the SG 11-22 project area tends to restrict grazing use. The steep topography, coupled with the presence of a shepherd to help distribute and control livestock use during the allotment’s period of use from December 1 through March 31, would collectively reduce project reclamation impacts from the livestock grazing to an insignificant level. The grazing permit has a flexible schedule that limits grazing use to a maximum 38-day continuous grazing period within the 4-month season of use.

Aside from the existing I-70 right-of-way fence and locked access gate on private land along the north-side frontage road, no range improvements are known to exist within the proposed project vicinity. A standard Surface COA requires the operator to repair any damaged range improvements or install fencing and/or gates as needed when the SG 11-22 project is implemented (**Appendix**).

- Recreation – None present
- Rights-of-Way – A communication site ROW (COC112731) issued to Qwest Corp for the Grand Valley Microwave Repeater Station and access road was renewed in April 2013. Another linear ROW (COC1123951) issued to Public Service of Colorado (Xcel) for power transmission line serving the Qwest repeater station expired in February 2016. The existing ROW does not conflict with the Proposed Action. In fact, the improved road would provide Qwest an improved access route to conduct site removal and cleanup of the old microwave site. A COA listed in the **Appendix** requires TEP to coordinate with Qwest and Xcel on road use and maintenance.

- Special Designations – None present
- Special Status Plants – No threatened, endangered, candidate, or BLM sensitive plant species that have the potential to occur in the project vicinity were found during surveys conducted by WestWater Engineering in late April through early May 2018 (WWE 2018).
- Wild Horses and Burros – None present
- Wild and Scenic Rivers – None present
- Wilderness or Wilderness Study Areas – None present

The following subsections describe the affected environment (current conditions) and direct and indirect environmental consequences (impacts) of the Proposed Action and No Action Alternative. Potential adverse impacts to the environmental elements addressed in this EA would be avoided, minimized, or offset by design features incorporated into the Proposed Action by TEP in collaboration with the BLM, and by general and site-specific COAs included in the **Appendix**. Cumulative impacts are summarized in **Section 4**.

3.1 ACCESS AND TRANSPORTATION

Affected Environment

The project area is approximately 4 air-miles west of Parachute, Garfield County, Colorado. The project area can be accessed from I-70 at the West Parachute exit by traveling southwest on U.S. Highway 6 (south-side frontage road) past Una Bridge turnoff (Road 300), taking the next graveled road north under the I-70 underpass and traveling easterly on private field development road that parallels the Interstate on its north side. The access to the project area is entirely along private field development road with locked access gate; no public motorized access is available to the project. No specific traffic counts are available for the public roads serving the project area.

Environmental Consequences

Proposed Action

The Proposed Action would result in a substantial increase in this traffic. Truck traffic would be greatest during rig-up, drilling, and completion activities. As shown in **Table 3**, the overall traffic count for each well included in the Proposed Action would be approximately 1,160 vehicles of the types typically associated with the drilling and completion of directional wells.

<i>Vehicle Class</i>	<i>Trips per Well ¹</i>	<i>Portion of Total ¹</i>
18-wheel tractor trailers	88	7.6%
10-wheel trucks	216	18.6%
6-wheel trucks	452	39.0%
Pickup trucks	404	34.8%
Total	1,160	100.0%

¹ Data shown are for traffic associated with directional well drilling and completion operations. Trips by different vehicle types are not necessarily distributed evenly during the drilling and completion process. Drilling and completion activities would occur year-round, with a single drilling for a period of 1 to 2 years.

Once each well is producing, traffic would decrease dramatically to occasional visits in pickups for monitoring or maintenance activities. Produced water generated during the life of each well would be initially stored in the tanks staged on the pad, then collected and delivered to TEP's water treatment and recycling facilities via TEP's buried water pipeline system. Condensate would be collected in onsite storage tanks requiring periodic truck visits to measure, sell, and remove the oil from the tanks. The well may have to be recompleted once per year, requiring 3 to 5 truck trips per day for approximately 7 days.

Degradation of field development roads may occur due to travel by heavy equipment, which also results in fugitive dust emissions (**Section 3.2**) and elevated noise levels (**Section 3.5**). Mitigation measures applied as COAs (see **Appendix**) would ensure that adequate dust abatement and road maintenance occur.

No Action Alternative

The No Action Alternative would constitute denial of the Federal APDs and site ROW described in the Proposed Action, meaning that none of the proposed Federal directional wells would be drilled or developed and the proposed pad, road improvements and pipelines would not be constructed. Therefore, impacts to access and transportation would not occur under the No Action Alternative.

3.2 AIR QUALITY

Affected Environment

The project area is located in western Colorado, in central Garfield County, and is within the Western Slope Region for air quality planning (Colorado Department of Public Health and Environment [CDPHE] 2017). The Western Slope Region includes nine counties on the western border of Colorado. Air quality concerns in this region are primarily related to ranching, agriculture, mining, energy development, and tourism.

Climate of the project area is a cold semi-arid, mid-continental regime, typified by sunny days, clear nights, and large daily temperature changes. The climate and topography of the region are conducive to the formation of temperature inversions. The nearest long-term meteorological measurements were collected at Rifle, Colorado (1910 to 2009), at an elevation of 5,320 feet above mean sea level (amsl) (Western Regional Climate Center [WRCC] 2017a). The annual average total precipitation at Rifle, Colorado, is 11.6 inches, with annual totals ranging from 6.9 inches (1960) to 21.8 inches (1985). The region has cool temperatures, with the average daily temperature ranging between 9 degrees Fahrenheit (°F) and 37°F in January to between 52°F and 90°F in July. The frost-free period generally occurs from late-May to late-September. The closest comprehensive wind measurements were collected at the Rifle Colorado Remote Automated Weather Station (RAWS) from 1984 to present (WRCC 2017b), at an elevation of 6,120 feet amsl. The annual mean wind speed at the Rifle site is 4.8 miles per hour (mph).

Several air quality monitors are in the general area, measuring particulate matter less than 10 microns in effective diameter (PM₁₀), particulate matter less than 2.5 microns in effective diameter (PM_{2.5}), ozone (O₃), and nitrogen dioxide (NO₂). The monitoring data have trends that comply with the current NAAQS. Air quality impacts from pollutant emissions are limited by regulations, standards, and implementation plans established under the Clean Air Act (CAA), as administered by the CDPHE Air Pollution Control Division (APCD) under authorization of the U.S. Environmental Protection Agency (EPA).

Federal air quality regulations adopted and enforced by the CDPHE-APCD limit incremental emission increases to specific levels defined by the classification of air quality in an area. The Prevention of Significant Deterioration (PSD) program is designed to limit the incremental increase of specific air pollutant concentrations above a legally defined baseline level. Under the PSD program, Class I areas are protected by Federal Land Managers through management of Air Quality Related Values (AQRVs), such as visibility, aquatic ecosystems, flora, fauna, and others. The CRVFO is flanked on three sides by Class

I areas, including the Flat Tops, Eagles Nest, and Maroon Bells-Snowmass Wilderness areas. Due to their proximity, these areas would be the most likely to be impacted by any future Federal oil and gas development in the CRVFO. Only the Flat Tops and Maroon Bells-Snowmass Wilderness areas have visibility monitoring data (BLM 2015a). The data show significant improvements in visibility trends for both the clearest and haziest days at the Maroon Bells-Snowmass Wilderness Area. The Flat Tops data are limited and a long-term trend is not discernable.

A nearby Clean Air Status and Trends Network (CASTNET) monitoring site (GTH161) measures total nitrogen deposition. The data trends suggest that the mean deposition flux is stable at approximately 2.02 kilograms per hectare per year (kg/ha-yr). A National Atmospheric Deposition Program (NADP) site (CO92) monitors wet chemistry deposition within the CRVFO at Sunlight Peak; the monitoring data's trend appears to be stable with an annual average wet nitrogen deposition of approximately 1.7 kg/ha-yr. The Flat Tops Wilderness Area NADP monitor has been inactive since 2010, but the available data have an overall flat wet deposition trend. Absent additional site-specific data, nitrogen deposition in the CRVFO is below the defined critical loading levels.

In accordance with Section V of BLM Colorado's Comprehensive Air Resource Protection Protocol (CARPP) (2015b), the Colorado State Office Air Resource Specialists prepared the 2015 Annual Report as a comprehensive assessment tool to assist in the preparation of project-level NEPA for oil and gas development projects (BLM 2015a). The 2015 Annual Report provides up-to-date information on oil and gas development (current regulations, rates for drilling and production, emissions inventories, etc.) and the state of the atmosphere (air pollutant concentration trends, air quality related values, etc.) for each applicable Colorado Field Office or Planning Area. The report also places this information in the context of the Colorado Air Resource Management Modeling Study (CARMMS), which provides cumulative analyses for multiple projected oil and gas development scenarios in Colorado out to year 2021 (CARMMS 1.5) and year 2025 (CARMMS 2.0) (BLM 2016, BLM 2017).

Environmental Consequences

Proposed Action

In accordance with Section III.B of the CARPP, a detailed emissions inventory was prepared for the Proposed Action, as well as the proposed development on the nearby SG 23-22 pad (**Table 4**). The emissions inventory includes emissions from development (construction, drilling, and completion activities) and production activities. The following pollutants were inventoried where an appropriate basis, methodology, and sufficient data exist: carbon monoxide (CO), nitrogen oxides (NO_x, including NO₂), PM_{2.5}, PM₁₀, sulfur oxides (SO_x, including sulfur dioxide [SO₂]), volatile organic compounds (VOCs), carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and hazardous air pollutants (HAPs).

Table 4. Estimated Air Emissions for the 33 Federal Wells on the SG 11-22 and SG 23-22 Pads										
<i>Parameter</i>	<i>Criteria Pollutants or Precursors</i>						<i>Greenhouse Gases (GHGs)</i>			<i>HAPs</i>
	<i>PM₁₀</i>	<i>PM_{2.5}</i>	<i>VOC</i>	<i>NO_x</i>	<i>CO</i>	<i>SO_x</i>	<i>CO₂</i>	<i>CH₄</i>	<i>N₂O</i>	
Development Emissions (tons/year)	1.73	1.09	35.2	50.0	70.6	0.516	8,390	79.3	2.90	0.003
Production Emissions (ton/year)	0.298	0.220	14.1	3.18	2.82	0.069	3,040	130	0.296	1.43

The emissions inventory was developed using reasonable but conservative scenarios for each activity. Production emissions were calculated based on full production activity of the wells. Potential emissions

were calculated assuming the minimum/basic legally required control measures, site-specific voluntary operator controls, operational parameters, and equipment configurations data provided by the operator.

Lead and ozone are noticeably absent from the emissions inventory. Emissions of lead from oil and gas activities are extremely low in western Colorado and are therefore not analyzed. Ozone precursors are shown in the emissions inventory instead of ozone. Ozone is not directly emitted like other criteria pollutants. Ozone formation and prediction is complex, generally results from significant quantities of various VOCs and NO_x emissions within a region, and has the potential to be transported across long ranges. Thus, potential ozone impacts are cumulatively assessed in **Section 4.3**.

The proposed developments would have a temporary localized impact to air quality and would mostly occur during well drilling and completion. Road use, drilling, well completion, and equipment operation would affect air quality. Air quality would be impacted by emissions associated with the transportation of drilling and completion equipment. Fugitive dust and vehicle emissions would be generated from the mobilization of equipment necessary for well drilling and completion and erecting the drill rig. During drilling and completions work, air quality would be affected by emissions from generators and engines to run equipment, onsite and offsite vehicle traffic, and fugitive gases. This phase would also produce short-term emissions of other criteria pollutants, HAPs, and GHGs from vehicle and equipment exhausts.

Once well development is complete, the daily activities at the site would reduce to operational and maintenance checks, which may be as frequent as daily visits. Emissions would result from process heaters and vehicle exhausts from the maintenance and process technician visits.

In addition, the well pad would likely produce fugitive emissions of well gas, which contains mostly methane and a minor fraction of VOCs and HAPs. Fugitive emissions may result from pressure relief valves and from losses from any flanges, seals, valves, or other infrastructure connections. Most operations would be subject to portions of the current pollution control regulations. Thus, control equipment may be installed to mitigate fugitive emissions. Some control equipment would produce emissions of criteria pollutants, HAPs, and GHGs via combustion.

A near-field ambient air quality impact assessment was performed to quantify and evaluate maximum potential pollutant impacts (**Table 2**). The BLM Colorado near-field modeling tool with a 10-kilometer radius domain was applied since the nearest ambient receptor is more than 2,000 feet south of the proposed development area. The BLM Colorado near-field modeling tool is based on CARMMS 2.0, using a photo-chemical 4-kilometer-spaced grid to predict Year 2025 concentrations for three fluid mineral development scenarios in Colorado – low, medium, and high.

Future development estimates are based on either projecting the past 5-year average development pace forward (low) or applying the most recent BLM Field Office's reasonably foreseeable development (medium and high). The medium scenario applies the same well count projections as the high but assumes additional emissions restrictions, while the high scenario assumes current development practices, emissions controls, and regulations. The modeled cumulative near-field air quality of the development area is captured by the CARMMS 2.0 low scenario. In other words, the total Federal oil and gas emissions of the low scenario across the near-field domain are large enough to account for the proposed developments, as well as other foreseeable future Federal fluid mineral development in the area through 2025. As shown in **Table 5**, in the low scenario, the maximum emission concentrations from all sources across the near-field domain are less than the National Ambient Air Quality Standards (NAAQS).

When apportioning the proposed project emissions to cumulative emissions in the modeling domain, a single cell in the 4-kilometer-spaced grid of the CARMMS 2.0 is selected with modeled emissions that most closely resemble those of the proposed developments (**Table 6**).

Table 5. Modeled Cumulative Near-Field Air Quality				
<i>Parameter</i>	<i>Total Development Maximum Federal Emissions</i>	<i>Total Federal Emissions across the Near-field Domain, Low Scenario</i>	<i>Maximum Concentrations from All Sources across the Entire Near-field Domain, Low Scenario</i>	<i>NAAQS</i>
1-hour NO ₂	53.2 tpy	59.4 tpy	40.9 ppb	100 ppb
8-hour O ₃	102 tpy	149 tpy	67.4 ppb	70 ppb
24-hour PM ₁₀	2.03 tpy	4.39 tpy	10.2 µg/m ³	150 µg/m ³
24-hour PM _{2.5}	1.31 tpy	1.77 tpy	4.50 µg/m ³	35 µg/m ³
Annual PM _{2.5}	1.31 tpy	1.77 tpy	3.21 µg/m ³	12 µg/m ³

Note: Concentration data are also available for CO and SO₂; however, they are not modelled here due to their exceptionally small impacts relative to their impact thresholds (e.g., NAAQS).
 ppb = parts per billion
 µg/m³ = micrograms per cubic meter
 tpy = tons per year

Table 6. Concentration Contributions Relative to Overall Emissions						
<i>Parameter</i>	<i>Total Development Maximum Federal Emissions</i>	<i>Federal Emissions from Grid Cell Similar to Project</i>	<i>Project's Concentration Contribution</i>	<i>Significant Impact Level</i>	<i>Total Emissions from All Sources in Grid Cell</i>	<i>National Ambient Air Quality Standard</i>
1-hour NO ₂	53.2 tpy	53.6 tpy	6.96 ppb	4 ppb	17.6 ppb	100 ppb
8-hour O ₃	102 tpy	104 tpy	1.04 ppb	1 ppb	63.6 ppb	70 ppb
24-hour PM ₁₀	2.03 tpy	2.03 tpy	0.197 µg/m ³	5 µg/m ³	24.1 µg/m ³	150 µg/m ³
24-hour PM _{2.5}	1.31 tpy	1.36 tpy	0.127 µg/m ³	1.2 µg/m ³	3.26 µg/m ³	35 µg/m ³
Annual PM _{2.5}	1.31 tpy	1.36 tpy	0.123 µg/m ³	0.2 µg/m ³	1.82 µg/m ³	12 µg/m ³

As the difference in the modeled emissions decreases between the selected grid cell and the developments, the influence of other factors (e.g., other Federal development in the area) is also assumed to decrease, thereby isolating the developments' emissions from other emissions in the area in order to determine reasonable estimates of the developments' contribution concentrations. With the exception of NO₂, the modeled developments' concentration contributions approximate or are less than their respective Significant Impact Levels (SILs). The 1-hour NO₂ concentration contribution from the developments is 6.96 ppb in contrast to the 4 ppb SIL. However, the total 1-hour NO₂ emission from all sources within the comparable grid cell is 17.6 ppb, which is a less than 20% of the NAAQS. The total ozone emission from all sources within the comparable grid cell is 63.6 ppb, which is less than the 70-ppb NAAQS.

Impacts would be minimized by dust abatement and reclaiming (temporary, interim, or final) disturbed surfaces as quickly as feasible. Other design measures would include, but not be limited to:

- closed-loop drilling
- green completions
- road maintenance
- automated tank gauging and telemetry equipment that allows remote monitoring of wells thereby minimizing traffic

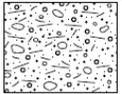
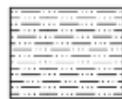
No Action Alternative

The No Action Alternative would constitute denial of the Federal APDs and site ROW described in the Proposed Action, meaning that none of the proposed Federal directional wells would be drilled or developed and the proposed pad, road improvements and pipelines would not be constructed. Therefore, impacts to air quality would not occur under the No Action Alternative.

3.3 GEOLOGY AND MINERALS

Affected Environment

The project area is located near the eastern margin of the Colorado Plateau physiographic province (Fenneman 1946), a region characterized by dissected plateaus of strong relief. A broad, asymmetric, southeast-northwest trending structural basin, the Piceance Basin contains stratified sediments ranging in age from Cambrian through middle Tertiary up to 20,000 feet thick. The basin lies between the White River uplift to the northeast, the Gunnison uplift to the south, and the Uncompahgre swell to the west (George 1927, Weiner and Haun 1960). **Table 7** lists the geologic formations within the project area.

Table 7. Geologic Formations within the Study Area					
<i>Map Symbol</i>	<i>Lithologic Pattern</i>	<i>Formation Name</i>	<i>Age</i>	<i>Characteristics</i>	<i>Location</i>
Qas		Alluvial and Eolian Deposits	Holocene	Yellow/brown fine sand and silt, generally well sorted.	Outwash and Slopes.
Two		Wasatch Formation (Including Ft. Union and Ohio Creek)	Eocene	Variegated claystone, siltstone, and mudstone with conglomerate.	Bedrock, Exposures and Outcrops
Source: Hail (1982)					

Bedrock exposures in the project area consist of a sandstone unit of the Tertiary Wasatch Formation. The Wasatch Formation consists of variegated siltstone, claystone, and sandstones and ranges from 1,000 to 2,500 feet thick. The Wasatch Formation is underlain unconformably by the Mesaverde Group. The Mesaverde Group is composed of mudstones and sandstones with interlayered coal beds and ranges in thickness from about 3,000 to over 7,000 feet. The Mesaverde Group has also been referred to as the Mesaverde Formation, which includes informal subdivisions based on gas productivity characteristics. In the proposed development area, the Wasatch Formation is mantled by unconsolidated sedimentary surface deposits of Quaternary age in the form of landslide, alluvium, and debris-fan deposits. The thickness of these unconsolidated sediments is uncertain, but the depth to the underlying Wasatch Formation may be determined during construction excavation.

The Mesaverde Group is the target zone of the proposed drilling program. Comprised of the Williams Fork and Iles Formations, sediments of the Mesaverde Group are marine sandstones transitional to non-marine beds of coal, shale, and sandstone. These sediments were deposited marginal to the great Cretaceous seaway. The oscillating shoreline of this sea, due to the rise and fall of sea level, left behind a complex of transgressive and regressive sedimentary sequences of nearshore and offshore sediments that define the Mesaverde Group.

Production is derived from three reservoir intervals, which include the Wasatch, Williams Fork, and Iles Formations. The latter two make up the Upper Cretaceous Mesaverde Group. The proposed drilling program would target the sandstone sequences of the Upper Williams Fork Formation, which provide

most of the natural gas production volumes (Lorenz 1989). The upper portions of the Williams Fork include fluvial point bar, floodplain, and swamp deposits. The Lower Williams Fork Formation includes delta front, distributary channel, strandplain, lacustrine, and swamp environments (Hemborg 2000), while the sandstones and coalbeds of the Iles Formation were deposited in a wave-dominated coastal setting (Johnson 1989, Lorenz, 1989). The source rocks are interbedded and thermally mature gas-prone shales, mudstones, siltstones, and coals. The reservoir rocks are the fine to medium-grained Williams Fork sandstones, varying in thickness from less than 10 feet to more than 50 feet (Spencer and Wilson 1988), creating an interbedded relationship between source and reservoir. The trapping mechanism of the gas is both stratigraphic and diagenetic.

No commercial deposits of coal, uranium, precious metals, limestone, sand and gravel, gypsum, or other leasable, locatable, or salable minerals are believed to occur within or beneath the project area. While there are extensive deposits of oil shale in the region, they are not commercially viable at this time.

Environmental Consequences

Proposed Action

If the proposed wells prove economic, initial production rates would be expected to be highest during the first few years of production, then decline during the remainder of the economic lives of the wells. Substantial reserves have been known since the late 1950 to be trapped the tight sands of these reservoirs, but only within the last decade, and particularly within the last few years, has the integrated application of new technologies turned the tight gas sands of the Mesaverde Group into a profitable play (Kuuskraa 1997). Natural fracture detection, advanced log analysis, more rigorous well completions and recompletions, and denser spacing have increased the amount of recoverable gas within these reservoirs.

Natural gas production from the proposed wells would contribute to the draining of hydrocarbon-bearing reservoirs within the Mesaverde Group in this area, an action consistent with BLM objectives for mineral production. Hydraulic fracturing would be utilized to create fractures within the formation to allow gas production from the wells. In recent years, public concern has been voiced regard potential impacts of hydraulic fracturing from “micro-earthquakes” and from contamination of freshwater aquifers.

Potential Impacts of Hydraulic Fracturing During Oil and Gas Well Completions

For decades, oil and gas companies and independent geophysicists have used state of the art equipment to monitor microseismic activity—defined as a “faint” or “very slight” tremor—during hydraulic fracturing to optimize well completions and to gather information about fracture dimensions and propagation (Warpinski 2011). These data give an indication about the magnitude of seismic activity associated with hydraulic fracturing, dimensions of resultant fractures in geologic formations, and probability for induced fractures to extend into nearby aquifers, if present. Research indicates that microseismic activity created by hydraulic fracturing occurs at Richter magnitude 1 or less (Warpinski and Zimmer 2012). In comparison, a magnitude 3 earthquake is the threshold that can be felt at the ground surface. The Richter magnitude scale is base-10 logarithmic, meaning that a magnitude 1 tremor is 1/100th the amplitude of a magnitude 3 tremor. The National Academy of Sciences reviewed more than 100,000 oil and gas wells and waste water disposal wells around the world and concluded that “incidences of felt induced seismicity appear to be very rare,” with only one such documented occurrence (National Academy of Sciences 2012).

The dimensions of induced fractures have been measured with field monitoring equipment (including microseismic “listeners”) and in laboratory tests and have been compared to three-dimensional (3D) hydraulic fracture models. Researchers have successfully validated these models for fracturing in “tight gas” reservoirs including those in the Piceance Basin. Results of the analyses show that fractures

resulting from completions of oil and gas wells can be predicted (Zhai and Sharma 2005, Green et al. 2009, Palisch et al. 2012) and that the length of fractures in relation to depth of the well can be estimated.

Hydraulically induced fracture orientation in relation to the wellbore depends upon the downhole environment (i.e., rock mechanics, minimum and maximum principle stress directions, rock physical properties, etc.) and the wellbore trajectory. In vertical or normal directional wells such as in the Mesaverde formation—the predominant hydrocarbon-producing formation in the CRVFO area—fracture growth is primarily lateral or outward from the wellbore, with minimal secondary fractures extending at some angle away from the lateral fractures. In horizontal wells such as being used to develop deep marine shales, fracture growth from the wellbore is mainly determined by the orientation of the wellbore in relation to the principal stresses of the rock. Fracture growth toward the surface is limited by barriers such as variations in stress and lithology, as is also the case in vertical and normal directional wells. In some horizontal wells, fracture growth is similar to that in vertical or normal directional wells due to wellbore trajectory along the maximum principal stress direction. Analysis of data from thousands of wells indicates fracture extent (length) of less than 350 feet in the vast majority of cases, with outliers of 1,000 to 2,000 feet (Maxwell 2011, Davies et al. 2012). The extreme outlier lengths are associated with fractures in thick deposits of lithologically uniform marine shales.

The potential height of hydraulically induced fractures in horizontal drilling is reduced in layered sediments in which a propagating fracture encounters a change in rock type or a bedding plane within a formation or a contact between formations. When these features are encountered, the fracture either terminates or to a lesser extent reorients along the generally horizontal bedding plane or formation contact instead of continuing upward across it. In the CRVFO area, natural gas production is primarily from vertically stacked, lenticular tight sands of the Mesaverde formation using vertical and directional wells. These tight-sand lenses are a few tens of feet thick or less. More recently, advances in horizontal drilling technology have allowed enhanced development of deeper marine shales such as the Niobrara formation. These tight-shale deposits are a few hundreds to thousands of feet thick in the CRVFO area compared to many hundreds or thousands of feet in some other gas-producing regions. The thickness of hydrocarbon-bearing strata in this area limits the vertical growth of primary and secondary fractures resulting from hydraulic stimulation.

Based on a review of available information on microseismic monitoring and fracture dimensions, Fisher and Warpinski (2011) concluded that fractures from deep horizontal wells are not a threat to propagate across the long distances (thousands of feet) needed to reach fresh-water aquifers much closer to the surface. This conclusion applies to the CRVFO area and to much shallower potable groundwater sources consisting of unconsolidated alluvium (streambed deposits) associated with the Colorado River and major tributaries. In general, alluvial water wells in the CRVFO extend to depths of less than 200 feet, with few in the range of 400 feet. Typical water levels in these wells range from 50 to 100 feet deep. Impacts to water quality of these shallow fresh-water wells is highly improbable as a result of hydraulic fracturing, which occurs at depths of 5,000 to 11,000 feet below ground surface.

In addition to vertical separation of several thousand feet between the upper extent of fractures and fresh-water aquifers are requirements by the BLM and COGCC for proper casing and cementing of wellbores to isolate the aquifers penetrated by a wellbore. BLM requires that surface casing be set from 800 to 1,500 feet deep, based on a geological review of the formations, aquifers, and groundwater. Cement is then pumped into the space between the casing and surrounding rock to prevent fluids from moving up the wellbore and casing annulus and coming in contact with shallow rock layers, including fresh-water aquifers. BLM petroleum engineers review well and cement design and final drilling and cementing logs to ensure that the cement has been properly placed. When penetration of groundwater and freshwater aquifers is anticipated, BLM inspectors may witness the cementing of surface casing and subsequent pressure testing to ensure that the annular space between the casing and borehole wall is properly sealed.

No single list of chemicals currently used in hydraulic fracturing exists for western Colorado, and the exact combinations and ratios used by operators are considered proprietary. However, the general types of compounds and relative amounts used are well known and relatively consistent (**Table 8**).

Table 8. Constituents of Typical Hydraulic Fracturing Operation in Tight Gas Formations				
<i>Additive Type*</i>	<i>Typical Example*</i>	<i>Percent by Volume**</i>	<i>Function*</i>	<i>Common Use of Example Compound</i>
Acid	Hydrochloric acid	0.123	Dissolves mineral cement in rocks and initiates cracks	Swimming pool chemical and cleaner
Biocide	Glutaraldehyde	0.001	Eliminates bacteria in the water that produce corrosive or poisonous by-products	Disinfectant; sterilizer for medical and dental equipment
Breaker	Ammonium persulfate	0.010	Allows delayed breakdown of the gel	Used in hair coloring, as a disinfectant, and in manufacture of household plastics
Clay stabilizer	Potassium chloride	0.060	Creates a brine carrier fluid that prohibits fluid interaction with formation clays	Used in low-sodium table salt substitutes, medicines, and IV fluids
Corrosion inhibitor	Formic acid	0.002	Prevents corrosion of the well casing	Used as preservative in livestock feed; used as lime remover in toilet bowl cleaners
Crosslinker	Borate salts	0.007	Maintains fluid viscosity as temperature increases	Used in laundry detergents, hand soaps, and cosmetics
Friction reducer	Polyacrylamide	0.088	“Slicks” the water to minimize friction	Used as a flocculent in water treatment and manufacture of paper
Gelling agent	Guar gum	0.056	Thickens the water to help suspend the sand propping agent	Used as a thickener, binder, or stabilizer in foods
Iron control	Citric acid	0.004	Prevents precipitation of metal oxides	Used as flavoring agent or preservative in foods
Surfactant	Lauryl sulfate	0.085	Increases the viscosity of the fluid	Used in soaps, shampoos, detergents, and as foaming agents
pH adjusting agent	Sodium hydroxide, acetic acid	0.011	Adjusts pH of fluid to maintain the effectiveness of other components	Sodium hydroxide used in soaps, drain cleaners; acetic acid used as chemical reagent, main ingredient of vinegar
Scale inhibitor	Sodium polycarboxylate	0.043	Prevents scale deposits in the pipe	Used in dishwashing liquids and other cleaners
Winterizing agent	Ethanol, isopropyl alcohol, methanol	--	Added as necessary as stabilizer, drier, and anti-freezing agent	Various cosmetic, medicinal, and industrial uses
Total Additives		0.49		
Total Water and Sand		99.51		
*FracFocus Chemical Disclosure Registry, fracfocus.org/chemical-use/what-chemicals-are-used				
**DOE 2009				

Since hydraulic fracturing is tailored to the downhole environment, and companies are aware of the concerns involving hydraulic fracturing, the chemicals listed in the table may or may not be used. Therefore, the information provided here is general information. Although a variety of chemicals additives are used in hydraulic fracturing—the examples in **Table 8** being drawn from a total of 59 listed on the FracFocus website—the vast bulk of fluid injected into the formation during the process is water

mixed with sand, representing 99.51% of the total by volume in the typical mixture shown. The sand is as a proppant, or propping agent, to help keep the newly formed fractures from closing.

Following completion of hydraulic fracturing, the pressure differential between the formation—a result of several thousand feet of overlying bedrock—and the borehole that connects with the surface causes most of the injected fluids to flow toward the borehole and then upward to the surface along with the hydrocarbon fluids released from the formation. The composition of this mixture, called flowback water, gradually shifts over a period of several days to a few months as injected fluids that have not yet migrated back to the wellbore or reacted with the native rock are carried out of the formation.

In 2011, the COGCC published an analysis of hydraulic fracturing technology use in the state and potential risks to human health and the environment. The introduction to that report included the following paragraph:

“Hydraulic fracturing has occurred in Colorado since 1947. Nearly all active wells in Colorado have been hydraulically fractured. The COGCC serves as first responder to incidents and complaints concerning oil and gas wells, including those related to hydraulic fracturing. To date, the COGCC has not verified any instances of groundwater contaminated by hydraulic fracturing.”

Based on the information summarized above, the CRVFO has concluded that properly implemented hydraulic fracturing of oil and gas wells drilled within its boundaries to access Federal fluid minerals or for accessing private fluid minerals from BLM surface lands does not represent a significant adverse impact to human health and the environment.

No Action Alternative

The No Action Alternative would constitute denial of the Federal APDs and site ROW described in the Proposed Action, meaning that none of the proposed Federal directional wells would be drilled or developed and the proposed pad, road improvements and pipelines would not be constructed. Therefore, impacts to geology and minerals would not occur under the No Action Alternative.

3.4 INVASIVE NON-NATIVE PLANTS

Affected Environment

State-listed noxious weeds are designated by the Colorado Department of Agriculture. Management of these weeds is regulated under the Colorado Noxious Weed Act, Title 35, Article 5.5, which establishes three separate lists of noxious weeds: List A – species designated for eradication; List B – species designated for development and implementation of management plans to stop their continued spread; and List C – species designated for development and implementation of management plans to facilitate more effective weed management on private and public lands.

Botanical surveys conducted in late April and early May 2018 identified State-listed noxious weeds occurring within the project area (WWE 2018). The project area is not heavily infested by noxious weeds, with most recorded along existing private roads and pipelines near the valley floor (WWE 2018). Occurrences within the project area or adjacent areas would be able to be controlled by use of standard weed control practices.

WestWater observed three State B-List noxious weeds: musk thistle (*Carduus nutans*), whitetop or hoary cress (*Cardaria draba*), and tamarisk (*Tamarix ramosissima*), the last a tall shrub or small tree. A single occurrence of musk thistle and three tamarisk trees were observed along the lease road near I-70. Five State C-List species were identified, with cheatgrass (*Bromus tectorum*) widely established throughout the project area, with field bindweed (*Convolvulus arvensis*), halogeton (*Halogeton glomeratus*), and redstem

filaree (*Erodium cicutarium*) scattered along existing roads. One occurrence of an additional C-List species, common burdock (*Arctium minus*), was observed near the mouth of Kelly Gulch and the private lease access road.

Environmental Consequences

Proposed Action

Under the Proposed Action, 9.07 acres of short-term surface disturbance would occur with long-term disturbance estimated at 3.04 acres. The SG 11-22 well pad would account for 4.64 acres of initial disturbance on BLM land with the pad size being reduced to 1.47 acres at time of interim reclamation.

Previous construction of the Qwest microwave repeater station and access road in early 1970s provided a niche for invasion and establishment of non-native plant species. Removal of native vegetation removes the competition from native plants for resources, including water and soil nutrients, opening up niches for invasive species (Parendes and Jones 2000). Linear disturbances, such as roads, provide corridors of connected habitat along which invasive plants can easily spread (Gelbard and Belnap 2003).

Construction of well pads, roads, and pipelines, and well development and production operations, require travel by vehicles and heavy equipment. This often results in the transport of seeds of invasive plants on the vehicle undercarriage or tires into disturbed habitats along access roads and at pads (Schmidt 1989, Zwaenepoel et. al. 2006).

Noxious weeds and other invasive species are well adapted to colonize and dominate in disturbed ground. They generally do not require well-developed soils, can out-compete native species for resources, produce prodigious quantities of seeds, and have seeds that can survive for many years or even decades within the soil. When weeds establish on a site, they can also significantly alter the composition of the soil microbial community of bacteria and fungi, making it increasingly more difficult over time for native species to reestablish on the site (Hierro et. al. 2006, Reinhart and Callaway 2006, Vinton and Goergen 2006, Vogelsang and Bever 2009). Due to the quantity and longevity of weed seeds and the effects of weeds on the soil, once these invasive species have established on a site they can be extremely difficult to eliminate.

Neighboring vegetation would also become more vulnerable to invasion by noxious weeds and other non-native species. Herbicide treatments of noxious weeds can also result in negative effects or mortality to native plants if they are co-occurring or located nearby (BLM 2007b). Implementation of standard COAs for noxious weeds and interim reclamation (**Appendix A**) would reduce the risk of noxious weed establishment and spread through the combination of chemically treating noxious weeds while also seeding with desired plant species.

The project area includes areas previously disturbed, although the existing road and the Qwest repeater facility are relatively weed-free except for cheatgrass establishment. To mitigate the invasive species, the operator would regularly monitor and promptly control noxious weeds or other invasive non-native plant species (**Appendix A**). Establishment of desirable plant species is also crucial in preventing invasive non-native plant species establishment and spread. As discussed, the operator would conduct interim reclamation at this location and reestablish native vegetation using the BLM's low elevation salt-desert shrub seed mix.

No Action Alternative

The No Action Alternative would constitute denial of the Federal APDs and site ROW described in the Proposed Action, meaning that none of the proposed Federal directional wells would be drilled or developed and the proposed pad, road improvements and pipelines would not be constructed. Therefore, impacts from noxious weeds and invasive plants would not be attributable to oil and gas development under the No Action Alternative.

3.5 NOISE

Affected Environment

The project area is near I-70, in a rural setting with oil and gas development, grazing, and wildlife habitat. Existing noises are generally from oil and gas development activities, vehicular traffic, livestock, and wildlife. Oil and gas pads are distributed throughout the general area. Nine well pads exist within 1 mile of the SG 11-22 pad. The nearest ambient receptor is 1.25 mile (6,620 feet) southeast of the proposed SG 11-22 pad.

Environmental Consequences

Proposed Action

The Proposed Action would increase the frequency of noise. Noise levels would increase during well drilling and completions, and periodic maintenance activities. The noise would be most noticeable along the roads used to haul equipment and at the pad location. Drilling, completion, and operation of oil and gas wells and production facilities are subject to COGCC’s noise control regulations (COGCC 2014). Oil and gas operations at any well site, production facility, or gas facility are to comply with COGCC’s maximum permissible noise levels (**Table 9**) at a distance of 350 feet from the noise source. During the daytime, noise levels may be increased 10 dBA for a period not to exceed 15 minutes in any 1-hour period. The allowable noise level for periodic, impulsive, or shrill noises is reduced by 5 dBA from the levels shown. Operations involving pipeline or gas facility installation or maintenance, the use of a drilling rig, completion rig, workover rig, or stimulation are subject to the maximum permissible noise levels for industrial zones.

Table 9. COGCC Maximum Permissible Noise Levels		
Zone	Noise Level at 350 feet from the Source (dBA)	
	Daytime (7:00 A.M. to 7:00 P.M.)	Nighttime (7:00 P.M. to 7:00 A.M.)
Residential/Agricultural/Rural	55	50
Light Industrial	70	65
Industrial	80	75
COGCC 2014		

Traffic noise would be elevated with implementation of the Proposed Action. The greatest increase would be along access roads during the drilling and completion phases. To minimize truck traffic, the project would install gas gathering and water pipelines to transport gas and water, and telemetry equipment would be used to monitor well conditions remotely. Based on La Plata County data (2002), approximately 71 dBA of noise (at 350 feet) would be created by each fuel and water truck. Less noise would be created by smaller trucks and passenger vehicles, such as pickup trucks and sport utility vehicles. Although the duration of increased noise from this source would be short, it would occur repeatedly during the drilling and completion phases.

Noise impacts would decrease during the production phase but would remain as background noise. During maintenance and well workover operations, noise levels would temporarily increase above those associated with routine well production.

The No Action Alternative would constitute denial of the Federal APDs and site ROW described in the Proposed Action, meaning that none of the proposed Federal directional wells would be drilled or

developed and the proposed pad, road improvements, and pipelines would not be constructed. Therefore, noise-related impacts would not occur under the No Action Alternative.

3.6 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Affected Environment

The project area is located in Garfield County, which has a land area of 2,958 square miles (Garfield County 2016a). The county seat is Glenwood Springs; other municipalities include Carbondale, New Castle, Silt, Rifle, Parachute, and Battlement Mesa. I-70 (I-70) traverses the county east to west with a network of county and private roads servicing the project area. The western portion of Garfield County contains the majority of the County’s oil and gas development. The eastern portion is more heavily influenced by socioeconomic trends related to locally available tourism and recreation resources, as well as those nearby in Aspen, Beaver Creek, and Vail.

The population of the county grew an annual average of approximately 2.5% from 2000 to 2009, but decreased to an annual average growth of 0.8% from 2010 to 2015 due to the national economic downturn, resulting in a net increase of 27% from 44,240 to 58,082 residents (Colorado Department of Local Affairs [CDOLA] 2016). The population in Garfield County is forecasted to nearly double to 112,684 residents in 2050 (CDOLA 2015). According to the most recent census that was conducted in 2010, Garfield County has a population density of 19 people per square mile, with approximately 75% of residing in urban areas and 25% residing in rural areas (U.S. Census Bureau 2012).

The total civilian preliminary labor force (not seasonally adjusted) for Garfield County was 29,463 people in October 2016; the unemployment rate was 3.2% (Colorado Department of Labor and Employment [CDLE] 2016). In the second quarter of 2016, the industry groups with the highest percentage of people employed in the County were Health Care and Social Assistance (13%), Accommodation and Food Services (12%), Construction (12%), Retail Trade (12%), and Education Services (11%). **Table 10** lists the top 10 industries in Garfield County for the second quarter of 2016.

Table 10. Top Industry Sectors of Garfield County, Second Quarter 2016		
Rank	Job Sector	Employees
1	Health Care and Social Assistance	3,328
2	Accommodation and Food Services	3,135
3	Construction	3,123
4	Retail Trade	3,115
5	Education Services	2,732
6	Public Administration	1,779
7	Administration, Support, Waste Management, and Remediation	1,318
8	Professional, Scientific, and Technical Services	1,095
9	Mining	1,002
10	Transportation and Warehousing	766
Total		21,393
Mean Total Number of People Employed in the County		25,832
County’s Employed Labor Force in the Top Ten Industry Sectors		83%
Source: Garfield County 2016a		

Annual personal income in Garfield County has also risen, growing from \$1.38 billion in 2000 to \$2.94 billion in 2015 (U.S. Bureau of Economic Analysis 2016). Annual personal income decreased from \$2.47 billion in 2008 to \$2.04 billion in 2010, but has been steadily increasing since 2010. Similarly, annual per capita income decreased from \$44,490 in 2008 to \$36,387 in 2010, but has annually increased at a mean rate of 6% from \$36,387 in 2010 to \$50,556 in 2015.

Based on the 2010 U.S. Census, Garfield County has 23,301 housing units (Garfield County 2016b). Approximately one-third of the population rents and the other two-thirds are homeowners. Housing prices vary; however, all of the municipalities except Parachute have median housing prices higher than the State. The communities of Parachute, Rifle, Silt, and New Castle (the western portion of Garfield County) are considered to have the most affordable housing. The communities of Glenwood Springs and Carbondale have the least affordable housing, largely influenced by more limited space for residential development and greater proximity to resort facilities. The County's vacancy rate, 3.65%, is very low.

Garfield County's current economy is similar to its historic economy, i.e., based on natural resource development, agriculture, regional services, and tourism. The population and development is concentrated in the Roaring Fork and Colorado River valleys, balancing the expanse of public lands (comprising 60% of the County) and lightly populated areas. Natural resource development, specifically natural gas, in the western portion of the County is a major contributor of the economy.

Production of natural gas in Garfield County increased dramatically between 2000 and 2012, from 70 billion cubic feet (BCF) in 2000 to 702 BCF in 2012 (COGCC 2016). This natural gas boom was partly driven by a rise in prices. Gas prices declined since 2012, consequently decreasing natural gas production in the County. Natural gas production in the County has been decreasing annually since 2012. In 2015, the County produced 556 BCF of natural gas. The State of Colorado issued 2,269 permits to drill in 2015, which was a decrease from the 4,190 permits issued in 2014 (COGCC 2015). Garfield County was the second-most active county in the State, issuing 495 permits to drill in 2015 (down from 1,066 permits in 2014).

Property tax revenue, payments in lieu of taxes (PILT), and Federal mineral royalties benefit State and local governments. Property tax revenue from oil and gas development is a major source of public revenue in Garfield County. In 2015, the oil and gas assessed valuation in Garfield County was approximately \$2.4 billion, or about 70% of the total property tax assessed valuation (Garfield County 2016c). The PILT are distributed by the Federal government to local governments to offset losses in property taxes due to nontaxable Federal lands within their boundaries and compensate for the costs to support such lands. In Fiscal Year 2016, Garfield County received approximately \$3 million (U.S. Department of the Interior 2016). Federal mineral royalties are levied on oil and gas produced from Federal mineral leases. Lessees pay royalties equal to 12.5% of the wellhead value of oil and gas produced from public land. About half of the royalties are distributed to State and local governments.

The NEPA process requires a review of the environmental justice issues as established by Executive Order 12898 (February 11, 1994). The order established that each Federal agency identify any "disproportionately high and adverse human health or environment effects of its programs, policies, and activities on minority and low-income populations." In accordance with guidance from the CEQ, minority populations should be identified when either the minority population of the affected area exceeds 50%, or the minority population of the affected areas is 10% greater than the surrounding area. Low-income populations should be identified when the low-income population of the affected areas is 10% greater than the surrounding area. In consideration of the Proposed Action, minority and low-income populations were not meaningfully greater than the surrounding area; therefore, environmental justice is not analyzed further.

Environmental Consequences

Proposed Action

The Proposed Action would have minor positive impacts on the local economy of Garfield County through the creation of additional job opportunities in the oil and gas industry and in supporting trades and services. In addition, Garfield County would receive additional tax and royalty revenues. The Proposed Action could result in negative social impacts including changing the character of the area, reducing scenic quality, increasing dust levels especially during construction, and increasing traffic.

No Action Alternative

The No Action Alternative would constitute denial of the Federal APDs and site ROW described in the Proposed Action, meaning that none of the proposed Federal directional wells would be drilled or developed and the proposed pad, road improvements and pipelines would not be constructed. Therefore, neither positive nor negative socioeconomic impacts would be realized under the No Action Alternative. No impacts to minority and low-income populations would be expected to occur with the no Action Alternative.

3.7 SOILS

Affected Environment

The proposed project area is located on a south-facing ridge with fragile soils at an elevation ranging from approximately 5,640 to 6,120 feet above mean sea level. The gradient ranges from level to steep. As shown in **Table 11**, the project area comprises two soil map units of loams and rock outcrops. Pedestaled vegetation and sedimentation are apparent.

Table 11. Project Area Soil		
<i>Mapping Unit</i>	<i>Description</i>	<i>Infrastructure</i>
62, Rock outcrop-Torriorthents complex, very steep	Unweathered bedrock and fine sandy loam on hillslopes, escarpments, and plateaus. Originates from very stony colluvium or alluvium derived from calcareous shale. Non-saline to very slightly saline. Well drained. High to very high runoff class. Very low available water storage in profile. Very low to moderately high saturated hydraulic conductivity.	Well pad and half of access road
66, Torriorthents-Camborthids-Rock outcrop complex, steep	Fine sandy loam, clay loam, and unweathered bedrock on mountainsides. Originates from stony, basaltic alluvium derived from sandstone and shale. Non-saline to very slightly saline. Well drained. High to very high runoff class. Low to very low available water storage in profile. Very low to moderately high saturated hydraulic conductivity.	Half of access road
Source: Soil Survey Staff 2017		

Environmental Consequences

Proposed Action

Table 1 on page 4 of the EA estimates potential surface disturbance from the Proposed Action. Surface disturbance would be minimized by utilizing existing disturbance (existing two-track and GV 33-22 pad) as much as possible and collocating the majority of the proposed pipelines in the proposed access road. Soil loss may increase and soil productivity may decrease without implementation of design measures,

best management practices (BMPs), and COAs, such as stormwater management, routine pad and road maintenance, closed-loop drilling, topsoil management, traffic reduction from automated tank gauging and telemetry equipment, timely reclamation (interim and final), and remediation of contaminated soils, if any. Special practices (hydro-mulching, straw mat application on steeper slopes, fertilizing, contour furrowing, watering, terracing, water barring, and replacing topsoil) would be implemented as necessary to facilitate soil stabilization and production (**Appendix**).

During interim and final reclamation, the operator would be responsible for revegetating the disturbance area until self-sustaining communities of desirable plants are established, and for monitoring and controlling infestations of noxious weeds and other invasive non-native plants. Most of the surface disturbance would be temporary and thus reclaimed and revegetated. The COAs presented in the **Appendix** for salvaging and handling of soils, revegetation, and control of weeds are expected to result in minimal long-term loss of soil and soil productivity in the project area.

After the well production has ceased and wells are plugged and abandoned, the operator would reclaim the pad and access road to approximate the original surrounding topography. After stripping the topsoil from areas needing earthwork reshaping, the site would be recontoured to the natural slope or topography of the site using appropriate earthmoving equipment. Compacted areas of the pad surface and roadways would be ripped. Topsoil would be redistributed across the reshaped slopes of the site. A seedbed would be prepared with consideration of soil roughening on the steeper slopes to inhibit erosion.

Since the project area has fragile soils and slopes greater than 30%, a CSU would apply to protect soil resources and ensure reclamation success. While the proposed pad layout is largely based on avoidance of steep slopes and drainages, the BLM has also developed general and site-specific surface-use COAs (**Appendix**), including a well pad containment berm, stormwater management, placement of cleared juniper trees at the toe of fill slopes, and road construction details.

No Action Alternative

The No Action Alternative would constitute denial of the Federal APDs and site ROW described in the Proposed Action, meaning that none of the proposed Federal directional wells would be drilled or developed and the proposed pad, road improvements and pipelines would not be constructed. Therefore, impacts to soils would not occur under the No Action Alternative.

3.8 SPECIAL STATUS SPECIES

3.8.1 Federally Listed, Proposed, or Candidate Threatened or Endangered Animal Species

Affected Environment

According to the USFWS, Federally listed or proposed threatened or endangered animal species with the potential to occur in the project vicinity include one mammal, two bird, and five fish species (USFWS 2014). **Table 12** provides information on these species, including a brief description of their habitat requirements and potential for presence or adverse impacts.

Table 12. Potential for Occurrence and Adverse Effects on Threatened or Endangered Animals				
<i>Species and Status</i>	<i>Distribution in Region</i>	<i>Preferred Habitats</i>	<i>Potentially Present?</i>	<i>Potentially Affected?</i>
Canada lynx (<i>Lynx canadensis</i>) – Threatened	Dispersed use in in upper montane and subalpine zones of Colorado mountains.	Subalpine spruce-fir forests; also lodgepole pine and aspen to as low as upper montane.	No	No

Table 12. Potential for Occurrence and Adverse Effects on Threatened or Endangered Animals				
<i>Species and Status</i>	<i>Distribution in Region</i>	<i>Preferred Habitats</i>	<i>Potentially Present?</i>	<i>Potentially Affected?</i>
Yellow-billed cuckoo (<i>Coccyzus americanus</i>) – Threatened, Western Distinct Population Segment	Major rivers and tributaries of western, northwestern, and south-central Colorado.	Large cottonwood stands with tall shrub understory along rivers.	No	No
Mexican spotted owl (<i>Strix occidentalis lucida</i>) – Threatened	No historic occurrence in area; present in southwestern Colorado and southern Front Range.	Rocky cliffs in canyons with closed-canopy coniferous forests.	No	No
Razorback sucker (<i>Xyrauchen texanus</i>) – Endangered	Colorado River and major tributary rivers, including mainstem Colorado River upstream to town of Rifle.	General: Deep, slow runs, pools, and eddies. Spawning: silt to gravel substrates in shallow water and seasonally flooded overbank areas.	No	Yes
Colorado pikeminnow (<i>Ptychocheilus lucius</i>) – Endangered			No	Yes
Humpback chub (<i>Gila cypha</i>) -- Endangered	Mainstem Colorado River and major tributaries – upstream to Black Rocks near Utah state line.	Rocky runs, riffles, and rapids in swift, deep rivers.	No	Yes
Bonytail chub (<i>Gila elegans</i>) – Endangered			No	Yes
*Green Lineage Colorado River cutthroat trout (<i>Oncorhynchus clarkii</i> ssp.) – Threatened	Identified in 60 streams in Colorado River Basin including CRVFO area.	Clean, cool headwaters streams and ponds isolated from other strains of cutthroat trout.	No	No
*Green Lineage = Relict populations of cutthroat trout indigenous to the Colorado/Gunnison/Dolores River drainages. Currently protected under the ESA pursuant to prior listing of the greenback cutthroat trout (<i>O. c. stomias</i>) pending completion of genetic and morphometric studies and taxonomic reassessment of native cutthroat trout in Colorado.				

Environmental Consequences

Proposed Action

Canada Lynx, Mexican Spotted Owl, and Western Yellow-billed Cuckoo. These species (including the distinct population segment for the cuckoo) are not expected to occur in the project vicinity based on documented occurrences and habitat types present. Therefore, the Proposed Action would have “**No Effect**” on these species.

Razorback Sucker, Colorado Pikeminnow, Humpback Chub, and Bonytail Chub. These four species of Federally listed big-river fishes occur within the Colorado River drainage basin near or downstream from the project area. Designated Critical Habitat for the razorback sucker and Colorado pikeminnow includes the Colorado River and its 100-year floodplain west (downstream) from the town of Rifle, south of the project area. The nearest known habitat for the humpback chub and bonytail is in the Colorado River approximately 50 miles downstream from the project area. Only one population of humpback chub, at Black Rocks west of Grand Junction, is known to exist in Colorado.

The endangered Colorado River fishes could potentially be affected by the consumptive use of water taken from the Colorado River Basin to support activities associated with the Proposed Action. Depletions in flows in the Colorado River and major tributaries are a major source of impacts to these fishes due to changes in the flow regime that reduce the availability and suitability of spawning sites and habitats needed for survival and growth of the larvae. Principal sources of depletion in the Colorado River Basin include withdrawals for agricultural or industrial uses, withdrawals for municipal water supplies, and evaporative losses from reservoirs.

Because the Proposed Action would result in the use of water taken originating from the Colorado River Basin, this project falls under BLM Colorado's Programmatic Biological Assessment (PBA) for water-depleting activities associated with BLM's management of the Federal fluid minerals program in the Colorado River Basin in Colorado.

In response to BLM's PBA, the U. S. Fish and Wildlife Service (FWS) issued a Programmatic Biological Opinion (PBO)(ES/GJ-6-CO-08-F-0006 TAILS 65413-2008-F-0073-R001) on December 26, 2017, concurring with BLM's effect determination of "**May Affect, Likely to Adversely Affect**" for the endangered Colorado river fishes due to water depletions for the Colorado River Basin in northwestern Colorado in connection with development of Federal fluid mineral leases. However, the FWS also determined that water depletions associated with Federal fluid minerals development from within the Colorado River Basin that fall under the umbrella of the PBO are not likely to jeopardize the continued existence of the four endangered big-river fishes, and not likely to destroy or adversely modify designated critical habitat.

A Recovery Implementation Program Recovery Action Plan (RIPRAP) for Endangered Fish Species in the Upper Colorado River Basin was initiated in January 1988. Under a 1993 Section 7 Consultation Agreement (Agreement), the FWS and other parties agreed that the Recovery Program serves as the reasonable and prudent alternative to avoid jeopardy and aid in recovery efforts for these endangered fishes resulting from water depletions from the Colorado River Basin. The PBO addresses water depletions associated with Federal fluid minerals development, including water used for well drilling, well completions, and dust abatement on roads. Other activities that may fit under the umbrella of this programmatic consultation include fresh water use associated with hydrostatic pipeline testing and seismic exploration work.

The PBO tiers to the Agreement and RIPRAP, which include reasonable and prudent alternatives developed by the FWS that allow BLM to authorize Federal oil and gas wells that result in fresh water depletions while avoiding the likelihood of jeopardy to the endangered fishes and avoiding destruction or adverse modification of their critical habitat. As a reasonable and prudent alternative, FWS authorized BLM to solicit a one-time monetary contribution to the Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (Recovery Program) in an amount proportional to the estimated average annual acre-feet depleted by Federal fluid minerals activities in the Colorado River Basin in Colorado.

While the Proposed Action provides an estimate of anticipated fresh water to be used, the BLM obtains, compiles, and analyzes reported data on consumptive freshwater use. For well completion activities, reported water use data for all Federal wells will be obtained from the Colorado Oil and Gas Conservation Commission (COGCC). The COGCC requires operators to report all water used (fresh and recycled) for well completions in the state of Colorado. In addition, as a COA on all Federal APDs, the BLM requires operators to report freshwater use for drilling of Federal wells, as well as for use in hydrostatic pressure-testing of pipelines. All fresh water used for Federal fluid minerals development will be compiled annually by BLM for all Federal wells completed during a given calendar year. The data will then be analyzed to determine fresh water use amounts by river sub-basin (Colorado, Dolores, Green, Gunnison,

White, and Yampa). The resulting reports on all fresh water used for Federal fluid minerals development will be provided to the FWS annually on or before April 30 of the year following data collection.

Because the fresh-water use for this project fits under the umbrella of the 2017 PBO, including conservation measures identified by FWS, and actual freshwater use will be reported pursuant to the PBO, no further consultation on water depletions for this project, and no analysis of effects of the depletions, are provided here.

Other potential impacts to these species include inflow of chemical pollutants related to oil and gas activities. The inflow of chemical pollutants could impact the fish if concentrations are sufficient to cause acute effects. Spills or other releases of chemical pollutants resulting from oil and gas activities are infrequent in the CRVFO area due to the various design requirements imposed by BLM and the State of Colorado. In the event of a spill or accidental release into a drainage that could flow to the Colorado River, the operator would be required to implement its *Spill Prevention, Control, and Countermeasures (SPCC) Plan*, including such cleanup and mitigation measures as required by BLM or the State. For these reasons, and because any spills would be rapidly diluted to levels below that are not deleterious, or even detectable, the potential for adverse impacts from chemical releases is not considered significant.

Based on the above, the BLM has determined that inflow of sediments and chemicals into the Colorado River would have “**No Effect**” on the endangered big river fishes. In the unlikely event of a spill with the potential to affect, or documented occurrence of an effect, the USFWS would initiate discussions with the involved parties to identify appropriate remedies.

No Action Alternative

The No Action Alternative would constitute denial of the Federal APDs described in the Proposed Action, meaning that none of the proposed Federal directional wells would be drilled or developed. However, development of the eight proposed fee wells would still occur. As a result, impacts to Federally listed threatened or endangered fish and wildlife species would be incrementally less than under the Proposed Action.

3.8.2 BLM Sensitive Animal Species

Affected Environment

Table 13 lists BLM sensitive vertebrate wildlife species that are known to occur in the region and, if present, could potentially be adversely affected by the Proposed Action. Species noted as present or potentially affected are described following the table.

Table 13. Potential for Occurrence and Adverse Effects on BLM Sensitive Animals		
<i>Species</i>	<i>Habitat Description</i>	<i>Known or Potential Presence and Potential to be Affected</i>
Townsend’s big-eared bat (<i>Corynorhinus townsendii</i>) Fringed myotis (<i>Myotis thysanodes</i>) Spotted bat (<i>Euderma maculatum</i>)	Townsend’s big-eared bats and fringed myotis occur as scattered populations at moderate elevations on the western slope of Colorado. Habitat associations are not well defined. These bats forage for aerial insects over pinyon-juniper, montane conifer, and semi-desert shrubland communities. They roost in caves, rock crevices, mines, buildings, and tree cavities. They are widely scattered in distribution and usually occur in small groups. Townsend’s big-	The project area provides appropriate foraging habitat but limited roost sites. No roosts or hibernacula for any of these species are documented in the project area.

Table 13. Potential for Occurrence and Adverse Effects on BLM Sensitive Animals		
<i>Species</i>	<i>Habitat Description</i>	<i>Known or Potential Presence and Potential to be Affected</i>
	<p>eared bats are not abundant anywhere in its range due to patchy distribution and limited availability of suitable roosting.</p> <p>Spotted bats have been detected in Colorado in ponderosa pine woodlands or montane forests, pinyon-juniper woodlands, and riparian vegetation; over sand and gravel bars; and in open semidesert shrublands. This species need access to water and suitable cracks and crevices in rocky cliffs for roosting. Limited information is available for the spotted bat in the CRVFO.</p>	
Northern goshawk (<i>Accipiter gentilis</i>)	Mature subalpine or upper montane conifer and aspen forests; may move to lower montane and foothills conifers (including pinyon-juniper) in winter.	Possible winter foraging
Bald eagle (<i>Haliaeetus leucocephalus</i>)	Nests along forested rivers and lakes; winters in upland areas, often with rivers or lakes nearby.	Known nest found along Colorado River. Foraging and roosting possible.
Golden Eagle (<i>Aquila chrysaetos</i>)	Nesting/Roosting: cliffs and trees. Forages widely over open habitats, including grasslands and sagebrush, particularly in areas with abundant rabbits. Suitable mixes of sagebrush and cliffs can support high concentrations.	Possible
American peregrine falcon (<i>Falco peregrinus anatum</i>)	Open country near cliff habitat, often near water such as rivers, lakes, and marshes; nests on ledges or holes on cliff ledges and crags.	Possible
Brewer's sparrow (<i>Spizella breweri</i>)	Bimodal distribution, including expanses of big sagebrush and salt-desert shrublands at lower elevations; sometimes snowberry and other short shrubs in unwooded areas of higher elevations.	Suitable nesting habitat within survey area
Midget faded rattlesnake (<i>Crotalus oreganus concolor</i>)	Rock outcrops for refuge and hibernation, often near riparian corridors, generally below 7,500 feet	Habitat present
Roundtail chub (<i>Gila robusta</i>)	Deep pools and eddies in mid- to large-sized rivers and streams throughout the Colorado River Basin.	Occurs downstream in the Colorado River.
Bluehead sucker (<i>Catostomus discobolus</i>)	Perennial waters from headwater streams to large rivers.	Occurs downstream in the Colorado River.
Flannelmouth sucker (<i>Catostomus latipinnis</i>)	Perennial waters from headwater streams to large rivers.	Occurs downstream in the Colorado River.

Environmental Consequences

Proposed Action

Bats. The project area provides suitable foraging habitat for four species of BLM sensitive bats: Townsend's big-eared bat, fringed myotis, and spotted bat. No caves or other suitable roosting sites occur in the project area.

Northern Goshawk. This large accipiter ("bird hawk") nests in upper montane or subalpine conifer or aspen forests, and individuals often move into lower elevation pinyon-juniper habitats in winter in search of small birds and diurnal small mammals. Raptor surveys did not result in the location of any goshawk nests. Any use of the project area would be infrequent and transitory.

Bald Eagle. Although bald eagles nest and roost along the Colorado River north of the project area, the potential for use of the actual project area is moderate. Any such use would most likely be by individuals hunting across large expanses of open upland habitats during winter. The project area would represent a small portion of such potential winter hunting habitat, and the reclaimed grass-forb community would provide better habitat for prey than the current shrubland types.

Golden Eagle. Golden eagles live in open and semi-open country featuring native vegetation across most of the Northern Hemisphere. They avoid developed areas and uninterrupted stretches of forest. They are found primarily in mountains up to 12,000 feet, in canyon and rimrock terrain, and on riverside cliffs and bluffs. Golden eagles nest on cliffs and steep escarpments in grassland, chaparral, shrubland, forest, and other vegetated areas. The most likely use of the project area would be for foraging.

Peregrine Falcon. This cliff-nesting species feeds primarily on waterfowl on rivers and lakes and, less frequently, on other birds such as upland fowl and larger songbirds of open country. No nests are known in the project area, and foraging areas consisting expanses of unwooded habitats are limited. Any use of the project area would be infrequent and transitory.

Brewer's Sparrow. This migratory songbird is mostly associated with big sagebrush at lower or middle elevations or, less frequently, with open areas of short shrubs such as snowberry and dwarf willows in the upper subalpine. Since there will not be any surface disturbing activities, breeding Brewer's sparrows would be largely protected from disruption. However, loss of effective habitat in the marginally suitable sagebrush habitats could potentially affect one to a few nesting pairs.

Midget Faded Rattlesnake. This small viper is considered a small, pale-colored subspecies of the common and widespread western rattlesnake, although some authorities consider it a distinct species. Movement patterns of midget faded rattlesnakes are not well known, but they are believed to be limited to a few hundred meters from den sites. The limited distribution and small home range make this snake susceptible to impacts from human disturbance (Parker and Anderson 2007). Threats include direct mortality from vehicles traveling on roads and pads, off-highway vehicle use throughout the landscape, capture by collectors, and livestock grazing. As access increases into previously undeveloped areas, the risk of encounters with humans would increase, resulting in some cases of mortality or collection.

Roundtail Chub, Flannelmouth Sucker, and Bluehead Sucker. Parachute Creek supports the roundtail chub, flannelmouth sucker, and bluehead sucker. As with the ecologically similar Colorado River endangered fishes described above, the roundtail chub and flannelmouth and bluehead suckers are adapted to naturally high sediment loads and therefore would not be affected by increased sediment transport to the Colorado River. Protective COAs for water quality would minimize this potential (see **Appendix**). However, these species are vulnerable to alterations in flow regimes in the Colorado River (including evaporative losses from dams and depletions from withdrawal of water for irrigation or municipal water supplies) that affect the presence of sandbars and seasonally flooded overbank areas

needed for reproduction. The amount of depletion in flows associated with this project is not expected to have a significant adverse impact on the survival or reproductive success of these species.

No Action Alternative

The No Action Alternative would constitute denial of the Federal APDs and site ROW described in the Proposed Action, meaning that none of the proposed Federal directional wells would be drilled or developed and the proposed pad, road improvements and pipelines would not be constructed. Therefore, potential for adverse impacts to BLM sensitive fish and wildlife species would not be realized under the No Action Alternative.

3.9 VEGETATION

Affected Environment

The project area lies within terrain of steeply eroded, arid, primarily south-facing slopes within the Wasatch formation, grading down into flat to gently rolling hills near the Colorado River. Deep ephemeral drainages flow in southerly directions, sometimes carrying soils and rock from the foothills of Mount Callahan through the storm water structures at I-70 and into the Colorado River. The surrounding upper slopes range from barren to well vegetated, with numerous rocky outcrops ranging from 10 to 100+ feet in height. The project elevation ranges from approximately 5,150 to 6,100 feet. Vegetation types include salt desert scrub and arid grassland habitats at the lower elevations, shifting up into Utah juniper woodland at the upper elevations of the south-facing foothills of Mount Callahan.

Lower and mid-slope elevation areas around the proposed SG 11-22 well site, access road improvements, and buried pipelines are within salt desert scrub/arid grassland habitats. Dominant shrub species include broom snakeweed (*Gutierrezia sarothrae*), bud sagebrush (*Artemisia spinescens*), fourwing saltbush (*Atriplex canescens*), Gardner's saltbush (*Atriplex gardneri*), greasewood (*Sarcobatus vermiculatus*), rubber rabbitbrush (*Ericameria nauseosa*), and siltbush (*Zuckia brandegeei*). Common native perennial grasses include bottlebrush squirreltail (*Elymus elymoides*), galleta grass (*Pleuraphis jamesii*), and purple three-awn (*Aristida purpurea*), all cool-season bunchgrasses.

Common native forbs include a variety of species typically associated with soils, terrain, and elevations such as characterize the project area. Common invasive species include two non-native annual grasses (cheatgrass and annual wheatgrass) and a non-native annual forb (redstem filaree).

Steep hillsides above the existing well pads at or near the valley floor and across the lower segment of the existing SG 23-22 access road have large barren patches with sparsely vegetated areas dominated by black sagebrush (*Artemisia nova*), siltbush, Wyoming big sagebrush, winterfat (*Krascheninnikovia lanata*), and saline wildrye (*Leymus salinus*), the last a native perennial cool-season bunchgrass. Patches on the upper hillsides and near the SG 11-22 pad site were previously seeded with nonnative crested wheatgrass (*Agropyron desertorum*), which now dominates these areas and forms a near monoculture.

At the higher elevations in the vicinity of the SG 11-22 well site, pinyon-juniper woodlands consist mostly of Utah juniper (*Juniperus osteosperma*) trees averaging 8 to 12 feet in height. Mountain mahogany (*Cercocarpus montanus*) and Utah serviceberry (*Amelanchier utahensis*) are scattered on north- and east-facing slopes. Other dominant species include green Mormon-tea (*Ephedra viridis*), roundleaf snowberry (*Symphoricarpos rotundifolius*), and Wyoming sagebrush (*Artemisia tridentata* ssp. *wyomingensis*).

Environmental Consequences

Proposed Action

Under the Proposed Action, 9.07 acres would be disturbed in the short-term to construct the project components and 3.04 acres would remain in use until final reclamation is implemented. Vegetation lost in these areas would be a mix of native desert shrub, sagebrush, and pinyon-juniper woodland vegetation, in addition to seeded nonnative reclamation species and nonnative invasive species. After construction, drilling, and completion operations have been conducted, the 9.07 acres of initial disturbance would be reclaimed per interim reclamation practices outlined in Appendix A. Final reclamation COAs related to the 3.04 acres of long-term disturbance are also presented in Appendix A. BLM seed mix would be used to reclaim the project components occurring on BLM land; on private land, the composition of plant species used for reclamation would be at the discretion of the landowner.

Adjacent native vegetation would not be directly impacted, but could be indirectly impacted by increased dust deposition on plant leaves and the establishment of noxious weeds and other non-native plants. Dust levels could be expected to increase above ambient levels in the short term from pad construction, well drilling, new road improvements, and new pipeline installation. The proposed removal of native vegetation would increase the site vulnerability to invasion and establishment of noxious weeds and other non-native invasive plant species, particularly with the existing widespread establishment of noxious weeds such as cheatgrass and other non-native species.

Cumulative impacts from the project development and the related plant habitat loss, in combination with nearby oil and gas developments and I-70 traffic, could also indirectly impact adjacent vegetation through negative effects on pollinators. Pollinators depend on both appropriate floral communities and on appropriate nesting habitat. Roads and well pad construction can negatively impact pollinators by creating barriers, modifying or eliminating habitat, and causing direct mortality through collisions with vehicles.

No Action Alternative

The No Action Alternative would constitute denial of the Federal APDs and site ROW described in the Proposed Action, meaning that none of the proposed Federal directional wells would be drilled or developed and the proposed pad, road improvements and pipelines would not be constructed. Therefore, impacts to vegetation would not occur under the No Action Alternative.

3.10 VISUAL RESOURCES

Affected Environment

The Proposed Action would occur almost entirely on BLM land with the use and improvement of the existing Qwest microwave repeater road north of the SG 23-22 well pad (private surface, private minerals) along nearly the entire access road alignment to the SG 11-22 pad being proposed directly north of the repeater station. The proposed SG 11-22 site would be shielded from view within the landscape by the prominent high point that supports Qwest's steel-structured repeater station.

Mount Callahan, directly north of the project area, is a dominant topographic feature to adjacent communities along the I-70 corridor, including Parachute. The project area consists of finger-like ridges extending south and east from Mount Callahan. The ridges are dissected by drainages that terminate immediately north of the I-70 Corridor. The Proposed Action would occur within Kelly Gulch and on two of the finger-like ridges adjacent to Kelly Gulch. The area is characteristic of light industrial and oil and gas development. Vegetation consists of low elevation salt-desert shrublands, arid grasslands, and scattered patches of Utah juniper established across exposed tan and coral/salmon-colored soils.

The objective for VRM Class II, as defined in the BLM's Manual H-8410-1 – Visual Resource Inventory is *to retain the existing character of the landscape* (BLM 1986). The level of change to the characteristic landscape should be low. Modifications may be seen but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

As shown in Section 2.3 Summary of Lease Stipulations, the SG 11-22 project is subject to lease stipulations and the SG 11-22 site right-of-way is subject to RMP stipulations related to the protection of Class II VRM objectives. The existing Qwest repeater access road, slated for improvement to serve the planned operations on the new SG 11-22 pad, is the primary project element that would be visible from county road vantages south of Colorado River. The location of the project high above I-70 does not readily allow high-speed travelers a casual vantage from the valley floor.

The bulk of the existing repeater access road would be improved for drill rig traffic along its original alignment save for a short 700-foot segment on private land directly north of the existing SG 23-22 pad. By using the existing road, the road grades would be steeper than desired (maximum 15%), but would minimize the overall visual impacts by restricting the disturbance to the existing roadway corridor.

The new 700-foot road segment would facilitate drive-through access across the SG 23-22 pad and use a switchback with a steady 15% grade off the northeast pad corner to re-connect with the existing road alignment on the ridge north of the SG 23-22 pad. There is a particular southwest-facing cutslope on the existing road between Stations 21+00 and 29+00 that can presently be seen from various key observation points (KOPs) along Garfield County Roads 300 and 306.

Environmental Consequences

Proposed Action

The Proposed Action would create 9.07 acres of new short-term surface disturbance, but over the long-term, the disturbance would amount to 3.04 acres and would be associated with the pad working surfaces and the maintainable portions of the access roads. Short-term visual impacts due to pipeline installation, access road, and pad construction, drilling and completion activities would occur within the project area. Construction of the project would create contrast within the landscape by removing existing vegetation, exposing bare ground, and creating distinct lines and forms within the landscape. The well pads, surface facilities and surface pipelines would increase the presence of drilling rigs, heavy equipment (e.g., dozers, graders, etc.), and vehicular traffic with an associated increase in dust, light pollution, and well flaring.

Project review by a landscape architect found that the existing repeater access road above the SG 23-22 pad is the best road alternative to access the new SG 11-22 well site tucked behind the existing Qwest repeater station (Perdue 2018). The existing roadway, with a surrounding mosaic of stark, light-colored, poorly vegetated slopes intermixed with patches of Utah juniper trees and vegetated hillsides that create obvious contrasts in the landscape, blends into the middleground vantage apparent from the various KOPs. The present road alignment also avoids slopes that exceed 30% with only a short 250-foot segment between 23+50 and 26+00 falling within the slope restriction; the 250-foot segment has remained in stable condition with little erosion issues since its initial construction in the early 1970's. The summary of the landscape review found the use and upgrade of the existing roadway not to be readily discernable to the casual observer when viewed at the middle distance KOPs. The differences, provided the narrowest construction width possible is used across the 800-foot cut-slope segment, would be exceptionally marginal from a visual perspective (Perdue 2018)

Although the planned road improvements would re-disturb road cuts and fills making the existing road more apparent, COAs such as magnesium chloride applications for dust abatement on the graveled roadway would mitigate the visual contrast (**Appendix**). Soil roughening and installing storm water structures to control erosion, conducting soil tests and adding soil amendments to the reclamation

practices, and hydroseeding/mulching across the entire project disturbances, especially along the 800-foot southwest-facing cut-slope, would eventually establish native vegetation including a shrub component that would help mitigate the project's visual contrasts. Standard Best Management Practices (BMPs) related to reclamation, facility paint colors, and screening the production facilities from view would also help mitigate the visual impacts of the project.

No Action Alternative

The No Action Alternative would constitute denial of the Federal APDs and site ROW described in the Proposed Action, meaning that none of the proposed Federal directional wells would be drilled or developed and the proposed pad, road improvements and pipelines would not be constructed. Therefore, impacts to the viewshed would not occur under the No Action Alternative.

3.10 WASTES, HAZARDOUS OR SOLID

Affected Environment

No hazardous materials are known to have been used, stored, or disposed at sites included in the project area. The most pertinent of the Federal laws regulating hazardous materials contamination are:

- Oil Pollution Act (Public Law 101-380, August 18, 1990). This law prohibits discharge of pollutants into waters of the U.S., which by definition would include any tributary or dry wash that eventually connects with the Colorado River.
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (Public Law 96-510 of 1980). This law provides for liability, compensation, cleanup, and emergency response for hazardous substances released into the environment. It also provides national, regional, and local contingency plans. Applicable emergency operations plans in place include the *National Contingency Plan* (40 CFR 300, required by Section 105 of CERCLA), the *Region VIII Regional Contingency Plan*, the *Colorado River Sub-Area Contingency Plan* (these three are EPA plans), the *Mesa County Emergency Operations Plan* (developed by the Mesa County Office of Emergency Management), and the *BLM GJFO Hazardous Materials Contingency Plan*.
- Resource Conservation and Recovery Act (RCRA) (Public Law 94-580, October 21, 1976). This law regulates the use of hazardous substances and disposal of hazardous wastes. Note: While oil and gas lessees are exempt from RCRA, ROW holders are not exempt from this legislation. RCRA strictly regulates the management and disposal of hazardous wastes. Most of the drilling and production wastes that would be generated by the Proposed Action would be exempt from the RCRA hazardous waste regulations (e.g., produced water, produced gas). However, the exemption would not mean that these wastes present no hazard to human health and the environment, nor would the exemption relieve the operator from corrective action to address releases of exempt wastes.

In addition, BLM Instruction Memoranda WO-93-344 and CO-97-023 require that all NEPA documents list and describe any hazardous and/or extremely hazardous materials that would be produced, used, stored, transported, or disposed in connection with a project. Practices commonly used in oil and gas developments are dictated by various Federal and State laws and regulations and the BLM standard lease terms and stipulations that would accompany any authorization resulting from this analysis.

Environmental Consequences

Proposed Action

Pollutants potentially spilled or otherwise accidentally released during the construction phase of the project would include diesel fuel, hydraulic fluid, and lubricants associated with the operation of heavy equipment. These materials would be used during construction of the pads, roads, and pipelines and for refueling and maintaining the vehicles and equipment. Potentially harmful substances used in the construction and operation phases would be kept onsite in limited quantities and trucked to and from the site as required. No hazardous substance, as defined by 40 CFR 355 would be used, produced, stored, transported, or disposed of in amounts above threshold quantities. Waste generated by construction activities would not be exempt from hazardous waste regulations under the oil and gas exploration and production exemption of RCRA. Exempt wastes include those associated with well production and transmission of natural gas through the gathering lines and the natural gas itself.

With the exception of produced hydrocarbons, ethylene glycol (antifreeze), lubricants, and amine compounds, chemicals subject to reporting under Title III of the Superfund Amendments and Reauthorization Act in quantities of 10,000 pounds or more would not be used, produced, stored, transported, or disposed of during construction or operation of the facilities. None of the chemicals used in construction meets the criteria for an acutely hazardous material/substance or the quantities criteria per BLM Instruction Memorandum No. 93-344. In addition, no extremely hazardous substance, as defined in 40 CFR 355, would be produced, used, stored, transported, or disposed of during construction or operation of the facilities in amounts above threshold permissible quantities.

Solid waste (human waste, garbage, etc.) would be generated during construction activities and, to a larger extent, during drilling and completion operations since the workforce would increase during those activities. Trailers housing workers would be outfitted with self-contained sewage collection system; regular trash collection would occur throughout the drilling and well completion process.

Because of the use or production of solid and hazardous wastes, the potential exists for accidental contamination of surface water or groundwater. While uncommon, an accident could occur that would result in a release of one or more of these materials directly or indirectly into surface waters or in a way that poses a potential for transport to groundwater. For example, improper casing and cementing of the boreholes could result in the contamination of groundwater resources. Releases are also possible from tanks used for storage on the pads, from haul trucks used to transport materials to and from the pads, or from pipelines. Storage tanks on the pad are required to be placed within an area of secondary containment equal to 110% of the volume of the enclosed tanks.

In the event of any release of a hazardous substance to the environment in reportable quantities, the responsible party is required to implement a *Spill Prevention, Control, and Countermeasures (SPCC) Plan* and is liable for cleanup and monetary damages. Depending on the scope of the accident, the SPCC Plan or the GJFO contingency plan would apply. These laws, regulations, standard lease stipulations, and contingency plans and emergency response resources are expected to mitigate any potential hazardous or solid waste issues associated with the Proposed Action.

No Action Alternative

The No Action Alternative would constitute denial of the Federal APDs and site ROW described in the Proposed Action, meaning that none of the proposed Federal directional wells would be drilled or developed and the proposed pad, road improvements and pipelines would not be constructed. Therefore, potential impacts associated with use, storage, and releases of hazardous or solid wastes would not occur under the No Action Alternative.

3.11 WATER RESOURCES – SURFACE WATER AND GROUNDWATER

3.11.1 Surface Water and Waters of the U.S.

Affected Environment

The project area is within the small portion of the Pete and Bill Creek - Colorado River subwatershed (12-digit hydrologic unit code [HUC] 140100051402) north of the Colorado River. The project area drains to the intermittent Kelly Gulch and an unnamed tributary of the Colorado River, which lies about 0.9 air-mile to the southeast.

Kelly Gulch is part of Stream Segment 12b of the Lower Colorado River Basin (all tributaries and wetlands to the Colorado River from a point immediately below the confluence of Parachute Creek to a point immediately below the confluence with Roan Creek), which is classified as Aquatic Life Cold 2 (not capable of sustaining a wide variety of cold water biota, including sensitive species, due to physical habitat, water flows or levels, or uncorrectable water quality conditions that result in substantial impairment of the abundance and diversity of species), Recreation P (potential primary contact use), Water Supply, and Agriculture (CDPHE 2018a). Stream Segment 12b is neither on the State's Section 303(d) List of Impaired Waters nor the Monitoring and Evaluation List (CDPHE 2018b).

No potentially jurisdictional wetlands or other waters of the U.S. were identified in the project area.

Environmental Consequences

Proposed Action

Potential impacts to surface water quality associated with the Proposed Action would result from surface-disturbing activities (interim and final reclamation), traffic, waste management, and the use, storage and transportation of fluids (i.e., chemicals, condensate, and produced water). Surface-disturbing activities destabilize soils, which may increase erosion and thus sedimentation in surface waters. Impacts would be minimized by implementing stormwater BMPs, controlling erosion, and reclaiming disturbed surfaces quickly. Long-term water resource protection could be achieved by continued road and pad maintenance to reduce erosion, remediation of contaminated soils, and minimization of the size of the long-term pad footprint through interim reclamation measures (**Appendix**). Special practices (hydro-mulching, straw mat application on steeper slopes, fertilizing, contour furrowing, watering, terracing, water barring, and replacing topsoil) would be implemented as necessary to facilitate soil stabilization and production (**Appendix**).

Several project design features would minimize surface water impacts. The operator would use approximately 9.1 acre-feet of water to drill and complete each directional well. About 94% of the water would be recycled and re-used. The remaining 6% of the water would be fresh. Sources of water would include the Smith Gulch 31-32-796 facility (recycled/reused water) and Parachute Creek (fresh water from a private water right north of the Town of Parachute). The actual amounts of fresh water and reused/recycled water used during construction, drilling, and completion of each well would be reported to the BLM (see the COA in the **Appendix**).

Tank batteries would be placed within secondary containment to prevent the offsite migration of accidentally spilled condensate or produced water. Secondary containment would consist of corrugated steel containment rings. Construction of the containment rings surrounding the tank batteries would be conducted to prevent lateral movement of fluids through an impermeable barrier attached to the rings and laid under the tanks. Secondary containment would be sized to contain a minimum of 110% of the storage capacity of the largest tank within the barrier. All loading lines would be placed inside the containment barrier. TEP would have automated tank gauging and telemetry equipment that allow remote monitoring of wells.

Stormwater would be managed through berms, ditches, and sediment traps. Berms would be established on the sides of the pad to prevent stormwater from flowing off the pad and into nearby drainages. From the berms, stormwater would be directed through channels to off-pad sediment traps. The channels to the sediment traps, and the overflow areas from the traps, would be lined with riprap to dissipate energy and control erosion.

As stated in the **Appendix**, roads would be constructed and maintained to follow the standards as described in the *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development* (U.S. Department of the Interior and U.S. Department of Agriculture [USDI and USDA] 2007).

Oil and gas waste management practices have the potential to contaminate soils and surface water. Contamination of soils could cause long-term reduction in site productivity resulting in increased erosion and potential sediment and contaminant delivery to nearby waterways during runoff. Use, storage, and transportation of fluids, such as produced water, hydraulic fracturing fluids, and condensate, may result in spills that could migrate to water resources. Elements of the Proposed Action are designed to mitigate risks to surface waters associated with the release and migration of drilling fluids, produced water, and condensate. A closed-loop drilling system would recycle drilling fluids. A traditional reserve pit would not be constructed. Flowback water would be contained in temporary tanks during completion operations and recycled for re-use or trucked offsite to an approved commercial disposal facility. Green completion techniques would be used.

In the event of an accidental release on the pad, produced water and condensate would be confined for cleanup in a containment area to prevent migration to surrounding soils or surface waters. Implementation of the COAs for mitigating impacts to surface waters (**Appendix**) would minimize risks of adverse impacts associated with development and ongoing production activities, including requirements for road construction and maintenance, drill cuttings management, reclamation, topsoil stockpile placement, and a pad containment berm, among others.

No Action Alternative

The No Action Alternative would constitute denial of the Federal APDs and site ROW described in the Proposed Action, meaning that none of the proposed Federal directional wells would be drilled or developed and the proposed pad, road improvements and pipelines would not be constructed. Therefore, potential impacts associated with surface water quality would not occur under the No Action Alternative.

3.11.2 Groundwater

Affected Environment

The Lower Piceance Structural Basin contains both alluvial and bedrock aquifers (Colorado Geological Survey 2003). Unconsolidated alluvial aquifers are the most productive aquifers in the region (EPA 2004) and are defined as narrow, thin deposits of sand and gravel formed primarily along stream courses, in this case, along the Colorado River and its tributaries. Alluvial well depths are generally less than 200 feet and water levels typically range between 100 to 150 feet. Well yield is dependent upon the intended use of the well, well construction design, sediment type and saturated thickness. Domestic use wells are limited to 15 gallons per minute (gpm) administratively, while municipal wells are designed and constructed for maximum potential yield.

The principal bedrock aquifers of the Piceance Basin are the Uinta Formation and the Parachute Creek Member of the Green River Formation, and are defined as the upper and lower Piceance Basin aquifer systems. The Uinta Formation consists of discontinuous layers of sandstone, siltstone, and marlstone and is less permeable than the hydrologically connected upper Parachute Creek Member (Robson and Saulnier 1981). The uppermost Uinta Formation also contains a shallow, perched aquifer that is separate

from the upper aquifer unit (Cole et al. 1995). The upper Piceance Basin aquifer is underlain by the Mahogany confining unit, and correlates with the Mahogany Zone, the principal oil shale unit of the Piceance Basin. The Mahogany Zone separates the upper aquifer from the lower. The lower aquifer consists of the fractured marlstone of the lower part of the Parachute Creek Member. The thickness of the upper and lower aquifer units average 700 and 900 feet, respectively (CGS 2003). Beneath these two aquifer systems is a confining unit which consists of the lower two members of the Green River Formation, and the Wasatch Formation. Although considered a confining unit, some fresh water wells are completed in the discontinuous water-bearing sands of the Wasatch Formation, but these water-bearing intervals are considered localized.

Below the Wasatch Formation is the Cretaceous-aged Mesaverde aquifer. The depth to the top of this aquifer beneath the project area is more than 5,000 feet below ground surface (bgs), far too deep for economic development. The Mesaverde aquifer is of regional importance, but does not provide recharge into the fresh water system within the shallower groundwater system of the project area.

Water quality of the upper Piceance Basin aquifer unit is relatively good, ranging in Total Dissolved Solid (TDS) levels from 500 to 1,000 milligrams per liter (mg/L). In the lower unit, TDS concentrations increase from 1,000 to 10,000 mg/L along basin flow paths. Waters with TDS values in excess of 1,000 mg/L are generally unsuitable for potable supply. Water suitable for drinking has a Federal secondary standard set at 500 mg/L or less (EPA 2006). The quality of the water in the Mesaverde aquifer is highly variable, with concentrations of dissolved solids ranging from less than 1,000 mg/L in many of the basin-margin areas to more than 10,000 mg/L in the central part of the Piceance Basin (EPA 2004). In general, areas of the aquifer that are recharged by infiltration from precipitation or surface water sources contain relatively fresh water. However, water quality in the Piceance Basin is generally poor overall due to the presence of nahcolite deposits and salt beds throughout the basin. Only very shallow waters such as those from the surficial Wasatch Formation are used for drinking water (Graham 2001, cited in EPA 2004).

According to the CDWR database, 11 water wells are located within a 1-mile radius of the proposed well sites, of which six are commercial or domestic water wells. The wells range from 43 feet to 97 feet in depth with flow rates of 10 to 15 gallons per minute. The proposed casing systems are sufficient to protect groundwater wells at these depths.

Proposed Action

Potential impacts to groundwater resources from the proposed development would include contamination of the groundwater with produced water, drilling mud, and petroleum constituents. Hydraulic fracturing would be incorporated to create additional pathways to facilitate gas production. Agents called “proppants,” used to prop open the fractures, are mixed with both fresh water and produced water. Typical proppants include sand, aluminum, glass, or plastic beads, with less than 1% of other compounds such as corrosion-, friction-, and scale-inhibitors (EnerMax Inc. 2007). Fracing techniques are used to create secondary porosity fractures, held open by proppants, allowing the otherwise trapped gas to migrate up the borehole for production.

Hydraulic fracturing would be conducted at 7,000 feet or more bgs. Drilling scenarios are developed to prevent fluids and produced hydrocarbons from migrating upward into fresh water zones. Geologic and engineering reviews are conducted to ensure that the cementing and casing programs are adequate to protect all downhole resources. With proper construction practices, drilling practices, and BMPs, no significant adverse impact to groundwater aquifers is anticipated to result from the project (see drilling COAs in the **Appendix**).

No Action Alternative

The No Action Alternative would constitute denial of the Federal APDs and site ROW described in the Proposed Action, meaning that none of the proposed Federal directional wells would be drilled or

developed and the proposed pad, road improvements and pipelines would not be constructed. Therefore, potential impacts to groundwater would not occur under the No Action Alternative.

3.12 WILDLIFE

Affected Environment

The project area includes pinyon-juniper woodlands, sagebrush grasslands. Given this vegetation, the project area provides cover, forage, breeding, and nesting habitat for a variety of terrestrial wildlife. The closest fish-bearing stream is the Colorado River, located more than 2 miles to the south of the project area.

Migratory Birds. Areas of sagebrush shrubland in the project area, commonly containing snowberry and rubber rabbitbrush, provide marginally suitable nesting sites for Brewer's sparrow (*Spizella breweri*), although the species is generally considered an obligate in sagebrush shrublands. Brewer's sparrow is listed by the USFWS (2014) as a Bird of Conservation Concern (BCC) species due to its relatively limited habitat flexibility, and as a BLM sensitive species (see **Section 3.8.2**).

Three BCC raptors, the bald eagle, northern goshawk, and peregrine falcon, are BLM sensitive species and were addressed in **Section 3.8.2**. Additional birds of prey present in the general project vicinity and having the potential to use the area project area as foraging and/or nesting habitat include the red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*B. swainsoni*), Cooper's hawk (*Accipiter cooperii*), sharp-shinned hawk (*A. striatus*), American kestrel (*Falco sparverius*), great horned owl (*Bubo virginiana*), and long-eared owl (*Asio otus*). Small owls potentially nesting in the area include a BCC species, the flammulated owl (*Psiloscops flammeolus*), and non-BCC species such as the western screech-owl (*Megascops kennicottii*) and saw-whet owl (*Aegolius acadicus*).

Cliff nesting habitat within the survey area consisted of small cliff bands scattered throughout the steep hillsides surrounding the project site. Two known cliff nests within the survey boundary were checked and determined to be unoccupied. Two new nests were discovered during surveys but were both determined to be unoccupied. The nests were in very close proximity to one another, and one showed evidence of a 2018 nesting attempt that may have been aborted or failed for unknown reasons. During surveys, biologists incidentally observed Cooper's hawk, red-tailed hawk, and great horned owl. None of these raptors exhibited behaviors that indicated nesting within the raptor survey area (WWE 2018).

Mammals. The project area is mapped by CPW as winter range, sever winter range, and winter concentration area for the mule deer (*Odocoileus hemionus*), and winter range for Rocky Mountain elk (*Cervus elaphus nelsoni*), both of which are recreationally important species common throughout suitable habitats in the region. Large carnivores potentially present in the project vicinity include the mountain lion (*Felis concolor*), which moves seasonally with its preferred prey, the mule deer, and the black bear (*Ursus americanus*). Two smaller carnivores, the coyote (*Canis latrans*) and bobcat (*Lynx rufus*), are also present throughout the region in open habitats and broken or wooded terrain, respectively, where they hunt for small mammals, reptiles, and ground-dwelling birds.

Reptiles and Amphibians. The project area is within elevational range of most reptile species known to occur in Garfield County. Species most likely to occur include the short-horned lizard, (*Phrynosoma hernandesi*), western fence lizard (*Sceloporus undulatus*), tree lizard (*Urosaurus ornatus*), and gopher snake (bullsnake) (*Pituophis catenifer*) in pinyon-juniper woodlands, sagebrush shrublands, or grassy clearings. Other reptiles potentially present along riparian areas are the milk snake (*Lampropeltis triangulum*), western terrestrial garter snake (*Thamnophis elegans*), and smooth green snake (*Liochlorophis vernalis*).

The area is also within the known range of Woodhouse's toad (*Anaxyrus woodhousii*), and western chorus frog (*Pseudacris triseriata*). Within the CRVFO and vicinity, Woodhouse's toad occurs primarily along

ephemeral washes that do not support fish and contain pools of water for a period of at least a few weeks every spring. The western chorus frog occurs primarily in cattail and bulrush wetlands and along the vegetated margins of seasonal or perennial ponds and slow-flowing streams.

Aquatic Wildlife. The Colorado River is located approximately 2 miles from the project area and includes a number of special status fish species, including Federally listed threatened and endangered species and BLM sensitive species (see section on Special Status Species). In addition to the special status fishes are a variety of native and non-native fish species and other aquatic organisms that occur in the Colorado River and do not qualify as special status species.

Environmental Consequences

Proposed Action

Migratory Birds. The Proposed Action would result in 9.07 acres of direct loss of nesting, roosting, perching, and foraging habitat for migratory birds. Reduced habitat effectiveness adjacent to areas where disturbance-related effects could be expected.

During drilling/completion activities, individual birds could be displaced to adjacent habitats due to noise and human presence. Effects of displacement could include increased risk of predation or failure to reproduce if adjacent habitat is at carrying capacity. Impacts at the species or local population level could include a change in abundance and composition resulting from cumulative habitat fragmentation from energy development in the larger area.

All migratory bird species are protected by the Migratory Bird Treaty Act (MBTA), which 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 implement further 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. Consistent with Executive Order 13186 and BLM Colorado guidelines, CRVFO has established as a COA (see **Appendix**) a Timing Limitation (TL) prohibiting initiation of vegetation removal or ground-disturbing activities during the period **May 15 to July 15**, the peak period for incubation and brood rearing among migratory birds in the project vicinity. The BLM may grant an exception to this COA if surveys by a qualified biologist during the nesting season of BCC species potentially present indicate no active nests within 30 meters (100 feet) of the disturbance area.

Other Terrestrial Wildlife. Direct impacts to other terrestrial wildlife from the Proposed Action may include mortality, disturbance, nest abandonment/nesting attempt failure, or site avoidance/displacement from otherwise suitable habitats. These effects could result increased noise from vehicles and operation of equipment, increased human presence, and collisions between wildlife and vehicles. Impacts would be more substantial during critical seasons such as winter (deer and elk) or the spring/summer breeding season (raptors, songbirds, amphibians). Reclamation of pipelines and temporary disturbances associated with road construction and interim reclamation of well pads would reduce this total to approximately 2.0-acres once wells are in production. Reclamation activities would benefit some wildlife species by increasing herbaceous forage. In areas where shrubs and trees would be disturbed, impacts to wildlife from loss of thermal and/or hiding cover would be long-term, lasting the 20 to 30+ years following reclamation that it would take for these woody species to reestablish.

A larger area would be subject to indirect habitat loss associated with disturbance associated with human activity, including vehicular traffic and the operation of heavy equipment. These can cause deer, elk, and other terrestrial wildlife to avoid areas of otherwise suitable habitat. When environmental factors result in sensitive wildlife remaining in an area with ongoing disturbance, they are subject to increased

physiological stress and changes in their daily activity patterns. These impacts are more significant during winter, when cold temperatures, reduced forage quality, and reduced forage availability due to snow cover deplete their energy stores accumulated during summer and fall.

Aquatic Wildlife. Implementation of the Proposed Action has the potential to result in increases in erosion and sedimentation into nearby drainages and eventually the Colorado River. Vehicular use during muddy road conditions could contribute to increased erosion and transport of sediments into nearby ephemeral washes and eventually the Colorado River. The potential increase of sedimentation into the Colorado River would be expected to be minimal given background sediment loads currently carried by the river. Sediment-intolerant aquatic wildlife could be negatively affected, as increased erosion potential would persist and impair water and habitat quality. Measures to minimize erosion and sedimentation of aquatic environments are included in the COAs (see **Appendix**).

No Action Alternative

The No Action Alternative would constitute denial of the Federal APDs and site ROW described in the Proposed Action, meaning that none of the proposed Federal directional wells would be drilled or developed and the proposed pad, road improvements and pipelines would not be constructed. Therefore, potential impacts to terrestrial and aquatic wildlife would not occur under the No Action Alternative.

4. CUMULATIVE IMPACTS

4.1 EXISTING OIL AND GAS DEVELOPMENTS

The project is located in the Kelly Gulch watershed, which drains directly into Colorado River north of Una Bridge area approximately 3 miles southwest of Parachute, Colorado. The proposed SG 11-22 well pad, staked on a flat point along the eastern boundary of the watershed, would also drain into a small minor drainage area directly northeast of the Kelly Gulch watershed. Impacts could be considered cumulative to either of the two watersheds – the primary Kelly Gulch watershed and the smaller east-side drainage.

Eight existing fee well pads supporting 50 private directional and horizontal wells, all operated by TEP, fall within the described cumulative impact area (CIA) for this project (COGCC 2018). A ninth fee location, the SG 23-22 pad, is currently being constructed with approved drilling permits for four private wells and 13 Federal directional wells. The SG 23-22 pad is being developed north and east of the SG 24-22 pad, and its access road would provide the critical link to the valley floor for the proposed SG 11-22 project development. Although no wells have yet been drilled or developed into Federal leases within the cumulative impact zone, the 13 approved APDs on the SG 23-22 pad combined with the 20 proposed APDs for the SG 11-22 project (totaling 33 potential Federal bottomholes) would represent a sizable increase in Federal lease development in the CIA. TEP has installed the road and pipeline infrastructure to support the fee well developments. The planned road and pipeline upgrades outlined in the Proposed Action for the SG 11-22 project would further expand TEP's infrastructure and allow for produced water to be piped and stored on the existing GV 33-22 pad on the valley floor.

Under the No Action Alternative, no Federal wells would be drilled or developed resulting in no change in direct, indirect or cumulative impacts from the current development scenario involving the 50 fee wells within the CIA. The current development of the SG 23-22 project on private land would increase the fee wells count by four directional wells, for a total of 54 bottomholes in private mineral estate.

4.2 SUMMARY OF CUMULATIVE IMPACTS

Adverse cumulative impacts in the region have included:

- Direct habitat loss, habitat fragmentation, and decreased habitat effectiveness

- Increased risk of adverse impacts to special status plant and animal species
- Expansion of noxious weeds and other invasive species
- Increased potential for runoff, erosion, and sedimentation of surface waters
- Increased potential for adverse impacts on fresh-water aquifers and domestic water wells
- Increased fugitive dust from construction of well pads, roads, and pipelines
- Increased gaseous emissions, including VOCs and priority pollutants, from vehicles, compressors, and other internal combustion sources and from oil and gas production facilities
- Increased potential for spills and other releases of chemical pollutants
- Increased traffic on local roads
- Increased noise, especially along access and haul roads
- Increased risk of damage to cultural and paleontological resources
- Decreased solitude and scenic quality

In addition to these potential negative (adverse) cumulative impacts have been positive (beneficial) cumulative impacts, including the increased availability of a valuable and important commodity, increased direct and indirect employment, and enrichment of Federal, State, and County/Local coffers from royalties, PILT, property taxes, and/or sales taxes. Cumulative impacts associated with the Proposed Action would include those noted above for previous oil and gas projects in the CRVFO area.

It should also be noted that new technologies and increasingly stringent Federal and State regulatory requirements have reduced the impacts of oil and gas developments in recent years. This trend is expected to continue, as evidenced by implementation of the new Colorado Air Resources Protection Protocol (CARPP), which incorporates the CARMMS process (**Section 3.2**). Using the air emissions inventory tool incorporated into CARMMS, the BLM will assess project emissions, in combination with periodically updated meteorological and regional air quality data, to determine if exceedances of standards occur that are potentially related to oil and gas and, if so, to evaluate additional mitigation.

Based on the above, the relatively small scale of the project in terms of surface disturbance and duration and the stringent environmental and operational protections imposed by BLM, COGCC, and CDPHE on both Federal and fee wells is expected to avoid significant cumulative adverse impacts in the project region as well as significant direct and indirect impacts.

4.3 AIR RESOURCES

The CARMMS assesses statewide impacts of projected oil and gas development (both Federal and fee [i.e., private]) to year 2025. In the CRVFO, 429 new Federal wells were completed from 2012 through 2015 at an annual average development rate of 107 wells, which approximates the rate analyzed in the low CARMMS scenario. The majority of the development occurred in the western portion of the CRVFO, adjacent to the I-70 corridor and extending north toward the Piceance Basin.

The CARMMS analysis does not predict any significant impacts to visibility at nearby Class I areas for any of the scenarios or reporting-year emissions levels. The two biggest issues resulting from the analysis are the estimated impacts from deposition at the Flat Tops Wilderness Area and the estimated regional ozone formation potential. The report-year metrics for deposition impacts suggest that on a quasi-cumulative basis, the CRVFO may be contributing to deposition at the Flat Tops Wilderness Area at rates that are above the deposition analysis threshold (DAT). The DAT is an individual project-level threshold that is not applicable to cumulative field office development. No such threshold currently exists for aggregated projects within a given area. The monitoring data suggest that cumulative deposition at

nearby Class I areas is currently below the critical load levels. Although the Flat Tops Class I area monitoring was discontinued several years ago, and may be too dated to be reliable.

Based on the CARMMS, the CRVFO has the highest ozone formation potential of any planning area in BLM Colorado. Even under the low CARMMS scenario, the CRVFO is showing much greater ozone potential relative to other field offices with similar emissions levels. The reason for this is not apparent in the CARMMS, although recent performance metrics for the 2011 Intermountain West Data Warehouse (IWDW) modeling platform show that the model tends to over-predict ozone formation in western Colorado. Unmonitored Area Analysis plots for both the CARMMS and the 2011 IWDW platform show high ozone in the same region of Colorado, just south of the Roan Plateau. CARMMS 1.0 is based on the 2008 platform and, as such, area monitors did not exist in Rifle, Rangely, and Meeker to provide for a relative response factor adjustment to account for these higher modeled impacts as the 2011 platform does. Given the similarity in the platforms and the emissions analyzed in the base case future year, the CARMMS is likely trending high for modeled ozone predictions.

Oil and gas development is expected to remain on the current track (i.e., tracking low relative to the CARMMS low scenario) for the foreseeable future in Colorado. There are currently no foreseeable significant shifts in petroleum market dynamics (supply, demand, etc.), changes or advancements in development / recovery technologies, newly discovered resources / plays, or political influences (tax or regulatory incentives) that would significantly affect the rates of development occurring in Colorado. Thus, CARMMS 1.0 remains an applicable and appropriate tool for describing impacts for future oil and gas projects within all of the Colorado planning areas.

Continued field development, operation of well site equipment, and associated vehicle traffic would result in minor cumulative contributions to atmospheric GHGs. Natural gas and condensate produced from the 33 Federal wells on the proposed SG 11-22 and SG 23-22 pads would be refined to produce a wide range of fuel products for consumer or commercial use. The combustion of these fuels would generate GHGs, which would be controlled through applicable GHG emission control regulations (emissions standards) or by applicable air permit requirements.

Other industrial operations in the area would also contribute to GHG emissions through use of carbon fuels (liquefied petroleum gas, oil, and diesel), and through use of electricity produced using carbon fuels. Other anthropogenic activities such as residential wood and open burning, as well as biogenic sources, also contribute GHGs to the atmosphere. These would be more dispersed, but also more sustained, than the emissions from this oil and gas development, which has a finite lifespan.

While significance levels exist to determine Prevention of Significant Deterioration (PSD) applicability and emissions control requirements for GHGs, policies regulating specific GHG concentration levels and their potential for significance with respect to regional or global impacts have not been established for GHGs. On the SG 11-22 and SG 23-22 pads, the maximum estimated GHG emissions resulting from well development and production activities are approximately 12,114 tpy (10,989 metric tpy) as CO₂ equivalent (CO₂e) and 7,809 tpy (7,084 metric tpy) as CO₂e, respectively (**Table 14**).

To put the modeled GHG emissions from these two pad in context, the calculated GHG emissions in year 2015 from oil and gas production in Garfield County, State of Colorado, and U.S. were approximately 5.98 million metric tons (MMT), 145 MMT, and 3,280 MMT of CO₂e, respectively (Colorado Oil and Gas Conservation Commission [COGCC] 2018b, Office of Natural Resources Revenue [ONRR] 2017, U.S. Environmental Protection Agency [EPA] 2014, Intergovernmental Panel on Climate Change [IPCC] 2013). The pads' maximum GHG emissions from development and production would be approximately 0.30 percent of Garfield County's 2015 oil and gas production emissions. The maximum annual downstream CO₂e emissions are estimated at approximately 6,081 metric tons per year. These maximum annual downstream emissions combined would be comparable to 0.10% of Garfield County's 2015 oil and gas production emissions.

Table 14. Maximum GHG Emissions from 33 Federal Wells on the SG 11-22 and SG 23-22 Pads				
<i>Project Phase</i>	<i>Pollutants (metric tons per year)</i>			
	<i>Carbon dioxide (CO₂)</i>	<i>Methane (CH₄)</i>	<i>Nitrous oxide (N₂O)</i>	<i>CO₂ equivalent</i>
Development	7,615.80	71.96	2.628	10,989
Production	2,756.96	117.98	0.269	7,084
<i>Subtotal – Upstream / Midstream</i>	<i>10,372.76</i>	<i>189.94</i>	<i>2.897</i>	<i>18,073</i>
<i>Subtotal – Downstream Combustion</i>	<i>3,810.02</i>	<i>28.22</i>	<i>4.210</i>	<i>6,081</i>
Total Federal GHG Emissions	14,182.78	218.16	7.107	24,154

According to ONRR data, the nation’s total Federal (onshore) oil and gas production in 2015 was approximately 191 million bbl of oil and 3,482,000 MMCF of natural gas, which accounted for 5.6 percent and 10.6 percent of the nation’s total production (combined Federal and non-Federal), respectively (ONRR 2017). Similarly, Colorado’s Federal oil and gas production represented 0.66 percent and 13.7 percent of the nation’s Federal oil and gas production, and 0.15 percent and 2.0 percent of the nation’s total (onshore and offshore) production (Federal and non-Federal). It is reasonable to assume that all of the oil and gas produced in the U.S. is combusted in some way, shape, or form and most likely within the broader parts of the economy (electricity generation, transportation, industry).

The U.S. produced 6,587 MMT of CO₂e emissions in 2015 according to EPA’s Inventory of U.S. Greenhouse Gas Emissions and Sinks (2017). The calculated CO₂e emissions from Federal oil and gas development in Colorado (38.4 MMT) and across the nation (273 MMT onshore and 592 MMT onshore and offshore combined) represent 0.58 percent, 4.1 percent (onshore), and 9.0 percent (onshore and offshore), respectively, of the nation’s total GHG emissions (ONRR 2017, EPA 2014, IPCC 2013).

At a global scale, the U.S. and the world produced 6,344 MMT and 53,530 MMT, respectively, of CO₂e emissions in 2012 (The World Bank Group 2017). In other words, the U.S. produced 12 percent of the global GHG emissions.

All climate model projections indicate future warming in Colorado (BLM 2015a). The Statewide average annual temperatures are projected to warm by +2.5 °F to +5 °F by 2050 relative to a 1971 to 2000 baseline under Representative Concentration Pathway (RCP) 4.5. Summer temperatures are projected to warm slightly more than winter temperatures, where the maximums would be similar to the hottest summers that have occurred in the past 100 years. Precipitation projections are less clear. Nearly all of the models predict an increase in winter precipitation by 2050, although most projections of snowpack (April 1 snow-water equivalent measurements) show declines by mid-century due to projected warming. Late-summer flows are projected to decrease as the peak shifts earlier in the season, although the changes in the timing of runoff are more certain than changes in the amount of runoff. In general, the majority of published research indicates a tendency towards future decreases in annual streamflow for all of Colorado’s river basins. Increased warming, drought, and insect outbreaks, all caused by or linked to climate change, will continue to increase wildfire risks and impacts to people and ecosystems.

5. AGENCIES AND PERSONS CONSULTED

Colorado Parks and Wildlife: Taylor Elm

Colorado Oil and Gas Conservation Commission: Dave Kubezkco

6. BLM INTERDISCIPLINARY REVIEW

BLM staff who participated in the preparation of this EA are listed alphabetically by last name in **Table 15**. Participation by these individuals various including reviewing survey results submitted by the operator’s consultants, evaluating impacts likely to occur from implementation of the Proposed Action, and identifying appropriate COAs to be attached and enforced by the BLM (see **Appendix**).

Table 15. BLM Interdisciplinary Team Authors and Reviewers		
<i>Name</i>	<i>Title</i>	<i>Areas of Participation</i>
John Brogan	Archaeologist	Cultural Resources, Native American Religious Concerns
Jim Byers	Natural Resource Specialist	Project Lead, Access & Transportation, Invasive Non-Native Plants, Socioeconomics and Environmental Justice, Wastes-Hazardous or Solid, Vegetation, Visual Resources, Cumulative Impacts
Vanessa Caranese	Geologist	Geology and Minerals, Groundwater, Paleontology
Allen Crockett, Ph.D., J.D.	Supervisory NRS	Technical Review, NEPA
Stephen Garcia	Petroleum Engineer	Downhole COAs
Sylvia Ringer	Wildlife Biologist	Migratory Birds, Special Status Species Animals, Aquatic and Terrestrial Wildlife
Carmia Woolley	Physical Scientist	Air Quality, Noise, Soils, Surface Water, Waters of the U.S.

7. REFERENCES CITED

- Bureau of Land Management (BLM). 1986. BLM Manual Handbook 8410-1-Visual Resource Inventory.
- _____. 2015a. 2015 Annual Report. BLM Colorado State Office. May. Available online at: <https://www.co.blm.gov/nepa/airreports/AR2015.html>. Accessed on July 17, 2018.
- _____. 2015b. Colorado Bureau of Land Management Comprehensive Air Resource Protection Protocol (CARPP). Available online at: https://www.blm.gov/sites/blm.gov/files/uploads/program_natural%20resources_soil%20air%20water_airco_quick%20link_CARPP.pdf. Accessed on July 17, 2018.
- _____. 2016. Colorado Air Resource Management Modeling Study (CARMMS) with Updated Mancos Shale Modeling: 2021 Modeling Results for the High, Low and Medium Oil and Gas Development Scenarios, CARMMS 1.5 Final Report. Bureau of Land Management, New Mexico State Office, Santa Fe, NM. March. Available online at: https://www.blm.gov/sites/blm.gov/files/uploads/program_natural%20resources_soil%20air%20water_airco_quick%20link_CARMMS1.5.pdf. Accessed on July 17, 2018.
- _____. 2017. Colorado Air Resource Management Modeling Study (CARMMS): 2025 CAMx Modeling Results for the High, Low and Medium Oil and Gas Development Scenarios, CARMMS 2.0 Final Report. Bureau of Land Management, Colorado State Office, Lakewood, CO. August. Available online at: <https://www.blm.gov/programs/natural-resources/soil-air-water/air/colorado>. Accessed on July 17, 2018.
- Cole, R.D., G.J. Daub, and L.K. Weston. 1995. Review of geology, mineral resources, and ground-water hydrology of Green River Formation, north-central Piceance Creek Basin, Colorado. *In* W.R. Averett

- (Ed.), *The Green River Formation in Piceance Creek and Eastern Uinta Basins*: Grand Junction, Colorado, Grand Junction Geological Society, p. 63-81.
- Colorado Department of Labor and Employment (CDLE). 2016. Summary Area Profile for Garfield County, Colorado. Colorado LMI Gateway. Available online at: <https://www.colmigateway.com/vosnet/Default.aspx>. Accessed on December 7, 2016.
- Colorado Department of Local Affairs (CDOLA). 2015. Preliminary Population Forecasts by County, 2010 to 2050. October 2015. Available online at: <https://demography.dola.colorado.gov/population/population-totals-counties/#population-totals-for-colorado-counties>. Accessed on December 7, 2016.
- _____. 2016. Demographic Profiles – County. Available online at: <https://demography.dola.colorado.gov/population/data/profile-county/>. Accessed on December 7, 2016.
- Colorado Department of Public Health and Environment (CDPHE). 2017. 2016 Colorado Air Quality Data Report. Air Pollution Control Division. October. Available online at: https://www.colorado.gov/airquality/tech_doc_repository.aspx?action=open&file=2016AnnualDataReport.pdf. Accessed on July 17, 2018.
- _____. 2018a. Regulation No. 37, Classifications and Numeric Standards for Lower Colorado River Basin, Appendix 37-1, Stream Classifications and Water Quality Standards Tables. Water Quality Control Commission, CDPHE. Available online at: https://colorado.gov/pacific/sites/default/files/37_2018%2806%29-Appendix37-1.pdf. Accessed on July 17, 2018.
- _____. 2018b. Regulation No. 93, Colorado’s Section 303(d) List of Impaired Waters and Monitoring and Evaluation List. Water Quality Control Commission, CDPHE. Available online at: https://www.colorado.gov/pacific/sites/default/files/93_2018%2803%29.pdf. Accessed on April 27, 2018.
- Colorado Geological Survey (CGS). 2003. Ground water atlas of Colorado, Special Publication 53, p. 97-106.
- Colorado Oil and Gas Commission (COGCC). 2014. Aesthetic and Noise Control Regulations. Available online at: <https://cogcc.state.co.us/documents/reg/Rules/LATEST/800Series.pdf>. Accessed on July 17, 2018.
- _____. 2018a. COGCC GIS Online database and interactive map. Online at: https://cogccmap.state.co.us/cogcc_gis_online.
- _____. 2018b. Production by County. Available online: <http://cogcc.state.co.us/data4.html#/production>. Accessed on February 6, 2018.
- Davies, R. J., S. Mathias, J. Moss, S. Hustoft, and L Newport. 2012. Hydraulic Fractures: How far can they go? *Marine and Petroleum Geology* 37(1):1-6. November.
- EnerMax, Inc. 2007. Hydraulic fracturing. <http://www.enermaxinc.com/hydraulic-fracturing>.
- Fenneman, N. M. 1946. Physical subdivisions of the United States (Map): U.S. Geological Survey, 1:700,000, one sheet.
- Fisher, K., and N. Warpinski. 2012. Hydraulic-fracture-height growth: Real data. *SPE Production & Operations Journal* 27(1):8-19. SPE-145949-PA. <http://dx.doi.org/10.2118/145949-PA>.
- Garfield County. 2016a. About Garfield County. Available online at: <http://www.garfield-county.com/about-garfield-county/index.aspx>. Accessed on December 7, 2016.

- _____. 2016b. Garfield County Profile, New Energy in the Wild West. Available online at: <http://www.garfield-county.com/economic-development/garfield-county-profile.aspx>. Accessed on December 14, 2016.
- _____. 2016c. Abstract of Assessment and Tax Levies, Garfield County, Colorado, 2015. Available online at: <http://www.garfield-county.com/assessor/documents/2015-Abstract-brochure.pdf>. Accessed on December 14, 2016.
- George, R.D. 1927. *Geology and Natural Resources of Colorado*. University of Colorado, Boulder.
- Gelbard, J.L., and J. Belnap. 2003. Roads as conduits for exotic plant invasions in a semiarid landscape. *Conservation Biology* 17(2):420-432.
- Green, C.A., R.D. Barree, and J.L. Miskimins. 2009. Hydraulic-fracture-model sensitivity analysis of a massively stacked, lenticular, tight gas reservoir. *SPE Production & Operations Journal* 24(1):66-73. SPE 106270-PA. February.
- Hemborg, T.H. 2000. Gas production characteristics of the Rulison, Grand Valley, Mamm Creek, and Parachute Fields, Garfield County, Colorado: Turning marginally economic basin-centered tight-gas sands into profitable reservoirs in the Southern Piceance Basin. Colorado Geological Survey, Resource Series 39. Denver.
- Hierro, J.L., D. Villarreal, O. Eren, J.M. Graham, and R.M. Callaway. 2006. Disturbance facilitates invasion: the effects are stronger abroad than at home. *The American Naturalist* 168(2):144-156.
- Intergovernmental Panel on Climate Change (IPCC). 2013. *Climate Change 2013: The Physical Science Basis, Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. [Stocker, T. F., D. Qin, G. K. Plattner, M. Tignor, S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, and P. M. Midgley (eds.)] Cambridge University Press, Cambridge, United Kingdom, and New York, NY, USA. 1,535 pp.
- Johnson, R.C. 1989. Geologic history and hydrocarbon potential of late Cretaceous-age, low-permeability reservoirs, Piceance Basin, western Colorado: U.S. Geological Survey Bulletin 1787, Evolution of sedimentary basins-Uinta and Piceance Basins, chapter E, 51 p.
- Kuuskræa, V.A. 1997. Producing massively stacked lenticular sands of Colorado's Piceance Basin: Gas Tips – A Publication of Gas Research Institute GRI-97/0206:4-11.
- La Plata County, Colorado. 2002. Final La Plata County Impact Report. October.
- Lorenz, J.C. 1989. Reservoir sedimentology of rocks of the Mesaverde Group, multiwall experiment site and east-central Piceance Basin, northwest Colorado. In B.E. Law and C.W. Spencer (Eds). *Geology of tight gas reservoirs in the Pinedale Anticline area, Wyoming, and at the multiwall experiment site, Colorado*: U.S. Geological Survey Bulletin 1886:K1-K24.
- Maxwell, S.C. 2011. Hydraulic fracture height growth. Canadian Society of Exploration Geophysicists (CSEG) Recorder. November.
- National Academy of Sciences (NAS). 2012. *Induced Seismicity Potential in Energy Technologies*. National Academy Press, Washington, DC.
- Office of Natural Resources Revenue (ONRR). 2017. U.S. Department of the Interior Natural Resources Revenue Data. Available online: <https://revenue.data.doi.gov/explore/>. Accessed on January 30, 2018.
- Palisch, T.T., M.A. Chapman, and J. Godwin. 2012. Hydraulic Fracture Design Optimization in Unconventional Reservoirs: A Case History. Paper SPE 160206 presented at the Annual Technical Conference and Exhibition, San Antonio, TX. October 8-10.

- Parendes, L.A., and J.A. Jones. 2000. Role of light availability and dispersal in exotic plant invasion along roads and streams in the H.J. Andrews Experimental Forest, Oregon. *Conservation Biology* 14(1):64-75.
- Perdue, Zach. 2018. Email from Zach Perdue, ELEV8 Inc. to Jim Byers, BLM CRVFO Natural Resource Specialist, regarding summary of viewshed analysis for SG 11-22 project, June 18, 2018.
- Reinhart, K.O., and R.M. Callaway. 2006. Soil biota and invasive plants. *New Phytologist* 170:445-447.
- Robson, S.G., and G.J. Saulnier, Jr. 1981. Hydrogeochemistry and simulated solute transport, Piceance Basin, northwestern Colorado. U.S. Geological Survey Professional Paper 1196, 65 p.
- Schmidt, W. 1989. Plant dispersal by motor cars. *Vegetation* 80:147-152.
- Soil Survey Staff. 2017. Web Soil Survey. Available online at: <https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>. Accessed on July 17, 2018.
- Spencer, C.W., and Wilson, R.J. 1988. Petroleum geology and principal exploration plays in the Uinta-Piceance-Eagle Basins Province, Utah and Colorado: U.S. Geological Survey Open-File Report 88-450-G, 35 p.
- The World Bank Group. 2017. Total Greenhouse Gas Emissions (kt of CO2 equivalent). Available online: <https://data.worldbank.org/indicator/EN.ATM.GHGT.KT.CE>. Accessed on February 6, 2018.
- U.S. Bureau of Economic Analysis. 2016. Personal Income Summary, Garfield County, 2000 to 2015. Available online at: <http://www.bea.gov/iTable/iTable.cfm?ReqID=70&step=1.#reqid=70&step=30&isuri=1&7022=20&7023=7&7024=non-industry&7033=-1&7025=4&7026=08045&7027=-1&7001=720&7028=-1&7031=08000&7040=-1&7083=levels&7029=20&7090=70>. Accessed on December 8, 2016.
- U.S. Census Bureau. 2012. 2010 Census of Population and Housing, Population and Housing Unit Counts. CPH-2-7. Colorado. U.S. Government Printing Office, Washington, DC. Available online at: <http://www.census.gov/prod/cen2010/cph-2-7.pdf>. Accessed on December 7, 2016.
- U.S. Department of Energy (DOE). 2009. Modern shale gas development in the United States: A Primer. National Energy Technology Laboratory, Morgantown, WV, and Office of Fossil Energy, Washington, DC.
- U.S. Department of the Interior. 2016. Fiscal Year 2016 Payments In Lieu of Taxes National Summary. Available online at: <https://www.doi.gov/pilt/resources/annual-reports>. Accessed on December 14, 2016.
- U.S. Department of the Interior and U.S. Department of Agriculture (USDI and USDA). 2007. Surface operating standards and guidelines for oil and gas exploration and development. The Gold Book. Fourth edition.
- U.S. Environmental Protection Agency (EPA). 2004. Evaluation of impacts to underground sources of drinking water by hydraulic fracturing of coalbed methane reservoirs. EPA 816-R-04-003, Attachment 3, The Piceance Basin. June.
- _____. 2014. Emission Factors for Greenhouse Gas Inventories, Table 1: Stationary Combustion Emission Factors. April 4. Available online: https://www.epa.gov/sites/production/files/2015-07/documents/emission-factors_2014.pdf. Accessed on March 9, 2018.
- _____. 2017. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2015. April. Available online: <https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2015>. Accessed on March 9, 2018.

- U.S. Fish and Wildlife Service (USFWS). 2014. Birds of Conservation Concern 2014. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. 85 pp. Online at: <http://www.fws.gov/migratorybirds/>.
- Vinton, M.A., and E.M. Goergen. 2006. Plant-soil feedbacks contribute to the persistence of *Bromus inermis* in tallgrass prairie. *Ecosystems* 9:967-976.
- Vogelsgang, K.M., and J.D. Bever. 2009. Mycorrhizal densities decline in association with nonnative plants and contribute to plant invasion. *Ecology* 90(2):399-407.
- Warpinski, N.R. 2011. Fracture growth in layered and discontinuous media. Proceedings of the Technical Workshops for the Hydraulic Fracturing Study: Fate and Transport. U.S. Environmental Protection Agency, Washington, DC. May.
- Warpinski, N.R., J. Du, and U. Zimmer. 2012. Measurements of hydraulic-fracture induced seismicity in gas shales. Paper SPE 151597 presented at the SPE Hydraulic Fracture Technology Conference, The Woodlands, TX. February 6-8.
- Weiner, R.J., and J.D. Haun. 1960. Guide to the Geology of Colorado. Geological Society of America.
- Western Regional Climate Center (WRCC). 2017a. Historical Climate Data for Rifle, Colorado (057031). Available online at: <https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?co7031>. Accessed on July 17, 2018.
- _____. 2017b. Remote Automated Weather Station (RAWS) USA Climate Archive. Meteorological observations collected at Rifle Colorado Site. Available online at: <https://wrcc.dri.edu/cgi-bin/rawMAIN.pl?coCRIF>. Accessed on July 17, 2018.
- WestWater Engineering (WWE). 2010. Williams Production RMT Parachute District Biological Survey Report, Kelly Gulch Project Area. June 2010. Grand Junction, CO.
- _____. WestWater Engineering (WWE). 2018. Terra Energy Partners SG 11-22 and SG 23-22 Biological Survey Report. June 2018. Grand Junction, CO.
- Zhai, Z., and M.M. Sharma. 2005. A new approach to modeling hydraulic fractures in unconsolidated sands. Paper SPE 96246 presented at the SPE Annual Technical Conference and Exhibition, Dallas, TX. October 9-12.
- Zwaenepoel, A., P. Roovers, and M. Hermy. 2006. Motor vehicles as vectors of plant species from road verges in a suburban environment. *Basic and Applied Ecology* 7:83-93.

APPENDIX

Surface Use and Drilling Conditions of Approval

Left blank for two-sided copying.

SURFACE-USE CONDITIONS OF APPROVAL

TEP's SG 11-22 Project with 20 Federal Directional Wells

DOI-BLM-CO-N040-2018-0078-EA

Note: The following Conditions of Approval (COAs) will also be used as Resource Protection Stipulations, where applicable, for the SG 11-22 Right-of-way issued for this project.

GENERAL COAS APPLICABLE TO ALL PROJECT-RELATED SURFACE DISTURBANCE

1. **Administrative Notification.** The operator shall notify the BLM representative at least 48 hours prior to initiation of construction. If requested by the BLM representative, the operator shall schedule a pre-construction meeting, including key operator and contractor personnel, to ensure that any unresolved issues are fully addressed prior to initiation of surface-disturbing activities or placement of production facilities. No construction activities shall commence without staking of pad construction limits, pad corners, and road/pipeline centerlines and disturbance corridors.
2. **Road Construction and Maintenance.** Roads shall be crowned, ditched, surfaced, drained with culverts and/or water dips, constructed, and maintained to road standards submitted with APDs and described in BLM's Gold Book and as shown in Uintah's SG 11-22 Road Design package submitted with the APDs. Initial gravel application shall be a minimum of 6 inches. The operator shall provide timely year-round road maintenance and cleanup on the access roads. A regular schedule for maintenance shall include, but not be limited to, blading, ditch and culvert cleaning, road surface replacement, and dust abatement. When rutting within the traveled way becomes greater than 6 inches, blading and/or gravelling shall be conducted as approved by the BLM. (*Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development, The Gold Book, Fourth Edition—Revised 2007, BLM/WO/ST-06/021+3071/REV 07.*)
3. **Drill Cuttings Management.** Cuttings generated from the numerous planned well bores shall be worked through a shaker system on the drill rig, mixed with a drying agent, if necessary, and deposited in the planned cuttings trench or piled on location against the cut slope for later burial during the interim reclamation earthwork. The cuttings shall be remediated per COGCC regulations (Table 910-1 standards) prior to earthwork reshaping related to well pad interim reclamation.
4. **Dust Abatement.** The operator shall implement dust abatement measures as needed to prevent fugitive dust from vehicular traffic, equipment operations, or wind events. The BLM may direct the operator to change the level and type of treatment (watering or application of various dust agents, surfactants, and road surfacing material) if dust abatement measures are observed to be insufficient to prevent fugitive dust.
5. **Drainage Crossings and Culverts.** Construction activities at perennial, intermittent, and ephemeral drainage crossings (e.g., burying pipelines, installing culverts) shall be timed to avoid high flow conditions. Construction that disturbs any flowing stream shall utilize either a piped stream diversion or a cofferdam and pump to divert flow around the disturbed area.

Culverts at drainage crossings shall be designed and installed to pass a 25-year or greater storm event. On perennial and intermittent streams, culverts shall be designed to allow for passage of aquatic biota. The minimum culvert diameter in any installation for a drainage crossing or road drainage shall be 24 inches. Crossings of drainages delineated as jurisdictional Waters of the U.S. pursuant to Section 404 of the Clean Water Act may require additional culvert design capacity. Due to the flashy nature of area drainages and anticipated culvert maintenance, the U.S. Army Corps of Engineers (USACE) recommends designing drainage crossings for the 100-year event. Contact the USACE Colorado West Regulatory Branch at 970-243-1199.

Pipelines installed beneath stream crossings shall be buried at a minimum depth of 4 feet below the channel substrate to avoid exposure by channel scour and degradation. Following burial, the channel grade and substrate composition shall be returned to pre-construction conditions.

6. Jurisdictional Waters of the U.S. The operator shall obtain appropriate permits from the U.S. Army Corps of Engineers (USACE) prior to discharging fill material into Waters of the U.S. in accordance with Section 404 of the Clean Water Act. Waters of the U.S. are defined in 33 CFR Section 328.3 and may include wetlands as well as perennial, intermittent, and ephemeral streams. Permanent impacts to Waters of the U.S. may require mitigation. Contact the USACE Colorado West Regulatory Branch at 970-243-1199.
7. Reclamation. The goals, objectives, timelines, measures, and monitoring methods for final reclamation of oil and gas disturbances are described in Appendix I (Surface Reclamation) of the 1998 Draft Supplemental EIS (DSEIS). Specific measures to follow during interim reclamation are described below.
 - a. Reclamation Plans. In areas that have low reclamation potential or are especially challenging to restore, reclamation plans will be required prior to APD approval. The plan shall contain the following components: detailed reclamation plans, which include contours and indicate irregular rather than smooth contours as appropriate for visual and ecological benefit; timeline for drilling completion, interim reclamation earthwork, and seeding; soil test results and/or a soil profile description; amendments to be used; soil treatment techniques such as roughening, pocking, and terracing; erosion control techniques such as hydromulch, blankets/matting, and wattles; and visual mitigations if in a sensitive VRM area.
 - b. Deadline for Interim Reclamation Earthwork and Seeding. Interim reclamation to reduce a well pad to the maximum size needed for production, including earthwork and seeding of the interim reclaimed areas, shall be completed within 6 months following completion of the last well planned to be drilled on that pad as part of a continuous operation. If a period of greater than one year is expected to occur between drilling episodes, BLM may require implementation of all or part of the interim reclamation program.

Reclamation, including seeding, of temporarily disturbed areas along roads and pipelines, and of topsoil piles and berms, shall be completed within 30 days following completion of construction. Any such area on which construction is completed prior to December 1 shall be seeded during the remainder of the early winter season instead of during the following spring, unless BLM approves otherwise based on weather. If road or pipeline construction occurs discontinuously (e.g., new segments installed as new pads are built) or continuously but with a total duration greater than 30 days, reclamation, including seeding, shall be phased such that no portion of the temporarily disturbed area remains in an unreclaimed condition for longer than 30 days. BLM may authorize deviation from this requirement based on the season and the amount of work remaining on the entirety of the road or pipeline when the 30-day period has expired.

If requested by the project lead NRS for a specific pad or group of pads, the operator shall contact the NRS by telephone or email approximately 72 hours before reclamation and reseeding begin. This will allow the NRS to schedule a pre-reclamation field visit if needed to ensure that all parties are in agreement and provide time for adjustments to the plan before work is initiated.

The deadlines for seeding described above are subject to extension upon approval of the BLM based on season, timing limitations, or other constraints on a case-by-case basis. If the BLM approves an extension for seeding, the operator may be required to stabilize the reclaimed surfaces using hydromulch, erosion matting, or other method until seeding is implemented.

- c. Topsoil Stripping, Storage, and Replacement. All topsoil shall be stripped following removal of vegetation during construction of well pads, pipelines, roads, or other surface facilities. In areas of thin soil, a minimum of the upper 6 inches of surficial material shall be stripped. The BLM may specify a stripping depth during the onsite visit or based on subsequent information regarding soil thickness and suitability. The stripped topsoil shall be stored separately from subsoil or other excavated material and replaced prior to final seedbed preparation. The BLM best management practice (BMP) for the Windrowing of Topsoil shall be implemented for well pad construction whenever topography allows.
- d. Seedbed Preparation. For cut-and-fill slopes, initial seedbed preparation shall consist of backfilling and recontouring to achieve the configuration specified in the reclamation plan. For compacted areas, initial seedbed preparation shall include ripping to a minimum depth of 18 inches, with a maximum furrow spacing of 2 feet. Where practicable, ripping shall be conducted in two passes at perpendicular directions. Following final contouring, the backfilled or ripped surfaces shall be covered evenly with topsoil.

Final seedbed preparation shall consist of scarifying (raking or harrowing) the spread topsoil prior to seeding. If more than one season has elapsed between final seedbed preparation and seeding, and if the area is to be broadcast-seeded or hydroseeded, this step shall be repeated no more than 1 day prior to seeding to break up any crust that has formed.

If directed by the BLM, the operator shall implement measures following seedbed preparation (when broadcast-seeding or hydroseeding is to be used) to create small depressions to enhance capture of moisture and establishment of seeded species. Depressions shall be no deeper than 1 to 2 inches and shall not result in piles or mounds of displaced soil. Excavated depressions shall not be used unless approved by the BLM for the purpose of erosion control on slopes. Where excavated depressions are approved by the BLM, the excavated soil shall be placed only on the downslope side of the depression.

If directed by the BLM, the operator shall conduct soil testing prior to reseeding to identify if and what type of soil amendments may be required to enhance revegetation success. At a minimum, the soil tests shall include texture, pH, organic matter, sodium adsorption ratio (SAR), cation exchange capacity (CEC), alkalinity/salinity, and basic nutrients (nitrogen, phosphorus, potassium [NPK]). Depending on the outcome of the soil testing, the BLM may require the operator to submit a plan for soil amendment. Any requests to use soil amendments not directed by the BLM shall be submitted to the CRVFO for approval.

- e. Seed Mixes. A seed mix consistent with BLM standards in terms of species and seeding rate for the specific habitat type shall be used on all BLM lands affected by the project (see Attachment 1 of the letter provided to operators dated September 9, 2014).

For private surfaces, the menu-based seed mixes are recommended, but the surface landowner has ultimate authority over the seed mix to be used in reclamation. The seed shall contain no prohibited or restricted noxious weed seeds and shall contain no more than 0.5% by weight of other weed seeds. Seed may contain up to 2.0% of "other crop" seed by weight, including the seed of other agronomic crops and native plants; however, a lower percentage of other crop seed is recommended. Seed tags or other official documentation shall be submitted to BLM at least 14 days before the date of proposed seeding for acceptance. Seed that does not meet the above criteria shall not be applied to public lands.

- f. Seeding Procedures. Seeding shall be conducted no more than 24 hours following completion of final seedbed preparation.

Where practicable, seed shall be installed by drill-seeding to a depth of 0.25 to 0.5 inch. Where drill-seeding is impracticable, seed may be installed by broadcast-seeding at twice the drill-seeding rate, followed by raking or harrowing to provide 0.25 to 0.5 inch of soil cover or by hydroseeding and hydromulching. Hydroseeding and hydromulching shall be conducted in two separate applications to ensure adequate contact of seeds with the soil.

An exception to these seeding requirements shall be made for seeding of sagebrush. Sagebrush seeding shall occur prior to winter snowfall, or on top of snow. Sagebrush may be sown either by broadcast seeding, or, if not on snowpack, by placing the seed in the fluffy seed box of a seed drill, with the drop tube left open to allow seed to fall out on the ground surface.

If interim revegetation is unsuccessful, the operator shall implement subsequent reseeding until interim reclamation standards are met.

- g. Mulch. Mulch shall be applied within 24 hours following completion of seeding in project areas within pinyon-juniper, sagebrush shrubland, and/or salt desert shrub habitat types. Mulch may consist of either hydromulch or of certified weed-free straw or certified weed-free native grass hay crimped into the soil. Mulch shall not be used within mountain shrub or spruce-fir forest habitat types, unless requested or approved by the BLM.

NOTE: Mulch is not required in areas where erosion potential mandates use of a biodegradable erosion-control blanket (straw matting).

- h. Erosion Control. Cut-and-fill slopes shall be protected against erosion with the use of water bars, lateral furrows, or other BMPs approved by the BLM. Additional BMPs such as biodegradable wattles, weed-free straw bales, or silt fences shall have be employed as necessary to reduce transport of sediments into the drainages. The BLM may, in areas with high erosion potential, require use of hydromulch or biodegradable blankets/matting to ensure adequate protection from slope erosion and offsite transport of sediments and to improve reclamation success.
- i. Site Protection. The pad shall be fenced to BLM standards to exclude livestock grazing for the first two growing seasons or until seeded species are firmly established, whichever comes later. The seeded species will be considered firmly established when at least 50% of the new plants are producing seed. The BLM will approve the type of fencing.
- j. Monitoring. The operator shall conduct annual monitoring surveys of all sites categorized as “operator reclamation in progress” and shall submit an annual monitoring report of these sites, including a description of the monitoring methods used, to the BLM by **December 31** of each year. The monitoring program shall use the four Reclamation Categories defined in Appendix I of the 1998 DSEIS to assess progress toward reclamation objectives. The annual report shall document whether attainment of reclamation objectives appears likely. If one or more objectives appear unlikely to be achieved, the report shall identify appropriate corrective actions. Upon review and approval of the report by the BLM, the operator shall be responsible for implementing the corrective actions or other measures specified by the BLM.
8. Weed Control. The operator shall regularly monitor and promptly control noxious weeds or other undesirable plant species as set forth in the Glenwood Springs Field Office *Noxious and Invasive Weed Management Plan for Oil and Gas Operators*, dated March 2007. A Pesticide Use Proposal (PUP) must be approved by the BLM prior to the use of herbicides. Annual weed monitoring reports and Pesticide Application Records (PARs), including GPS data in accordance with the February 27, 2014, letter to operators, shall be submitted to BLM by **December 1**.
9. Bald and Golden Eagles. It shall be the responsibility of the operator to comply with the Bald and Golden Eagle Protection Act (Eagle Act) with respect to “take” of either eagle species. Under the

Eagle Act, “take” includes to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest and disturb. “Disturb” means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle; (2) a decrease in its productivity by substantially interfering with normal breeding, feeding, or sheltering behavior; or (3) nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior. Avoidance of eagle nest sites, particularly during the nesting season, is the primary and preferred method to avoid a take. Any oil or gas construction, drilling, or completion activities planned within 0.5 mile of a bald or golden eagle nest, or other associated activities greater than 0.5 miles from a nest that may disturb eagles, shall be coordinated with the BLM project lead, BLM wildlife biologist, and USFWS representative to the BLM Field Office at 970-243-2778 x28.

10. Raptor Nesting. To protect nesting raptors, a survey shall be conducted prior to construction, drilling, or completion activities that are to begin during the raptor nesting season (**February 1 to August 15**). The survey shall include all potential nesting habitat within 0.25 mile of a well pad or 0.125 mile of an access road, pipeline, or other surface facility. Results of the survey shall be submitted to the BLM. If an active raptor nest is located within the buffer widths specified above, a TL will be applied by the BLM to preclude initiation of construction, drilling, and completion activities during a 60-day period appropriate for the specific raptor species. The operator is responsible for complying with the MBTA, which prohibits the “take” of birds or of active nests (those containing eggs or young), including nest failure caused by human activity (see COA for Migratory Birds).
11. Migratory Birds – Birds of Conservation Concern. Pursuant to BLM Instruction Memorandum 2008-050, all vegetation removal or surface disturbance in previously undisturbed lands that provide potential nesting habitat for Birds of Conservation Concern (BCC) is prohibited from **May 15 to July 15**. An exception to this TL may be granted if nesting surveys conducted no more than one week prior to surface-disturbing activities indicate that no BCC species are nesting within 30 meters (100 feet) of the area to be disturbed. Nesting shall be deemed to be occurring if a territorial (singing) male is present within the distance specified above. Nesting surveys shall include an aural survey for diagnostic vocalizations in conjunction with a visual survey for adults and nests. Surveys shall be conducted by a qualified breeding bird surveyor between sunrise and 10:00 AM under favorable conditions for detecting and identifying a BCC species. This provision does not apply to ongoing construction, drilling, or completion activities initiated before May 1 and continue into the 60-day period at the same location.
12. Migratory Birds – General. It shall be the responsibility of the operator to comply with the Migratory Bird Treaty Act (MBTA) with respect to “take” of migratory bird species, which includes injury and direct mortality resulting from human actions not intended to have such result. To minimize the potential for the take of a migratory bird, the operator shall take reasonable steps to prevent use by birds of fluid-containing pits associated with oil or gas operations, including but not limited to reserve pits, produced-water pits, hydraulic fracturing flowback pits, evaporation pits, and cuttings trenches. Liquids in these pits—whether placed or accumulating from precipitation—may pose a risk to birds as a result of ingestion, absorption through the skin, or interference with buoyancy and temperature regulation.

Based on low effectiveness of brightly colored flagging or spheres suspended over a pit, the operator shall install netting with a mesh size of 1 to 1.5 inches, and suspended at least 4 feet above the fluid surface, on all pits into which fluids are placed, except for storage of fresh water in a pit that contains no other material. The netting shall be installed within 24 hours of placement of fluids into a pit. The requirement for netting does not apply to pits during periods of continuous, intensive human activity at the pad, such as drilling and hydraulic fracturing phases or, as pertains to cuttings trenches, during periods of active manipulation for cuttings management, remediation of contaminated materials, or other purposes.

13. Fossil Resources. All persons associated with operations under this authorization shall be informed that any objects or sites of paleontological or scientific value, such as vertebrate or scientifically important invertebrate fossils, shall not be damaged, destroyed, removed, moved, or disturbed. If in connection with operations under this authorization any of the above resources are encountered the operator shall immediately suspend all activities in the immediate vicinity of the discovery that might further disturb such materials and notify the BLM of the findings. The discovery must be protected until notified to proceed by the BLM.

Where feasible, the operator shall suspend ground-disturbing activities at the discovery site and immediately notify the BLM of any finds. The BLM would, as soon as feasible, have a BLM-permitted paleontologist check out the find and record and collect it if warranted. If ground-disturbing activities cannot be immediately suspended, the operator shall work around or set the discovery aside in a safe place to be accessed by the BLM-permitted paleontologist.

14. Cultural Education/Discovery. All persons in the area who are associated with this project shall be informed that if anyone is found disturbing historic, archaeological, or scientific resources, including collecting artifacts, the person or persons would be subject to prosecution.

If subsurface cultural values are uncovered during operations, all work proximity to the resource will cease and the Authorized Officer with the BLM notified immediately. The operator shall take any additional measures requested by the BLM to protect discoveries until they can be adequately evaluated by the permitted archaeologist. Within 48 hours of the discovery, the SHPO and consulting parties will be notified of the discovery and consultation will begin to determine an appropriate mitigation measure. BLM in cooperation with the operator will ensure that the discovery is protected from further disturbance until mitigation is completed. Operations may resume at the discovery site upon receipt of written instructions and authorization by the authorized officer.

Pursuant to 43 CFR 10.4(g), the holder must notify the authorized officer, by telephone, with written confirmation, immediately upon the discovery of human remains, funerary items, sacred objects, or objects of cultural patrimony on Federal land. Further, pursuant to 43 CFR 10.4 (c) and (d), the holder must stop activities in proximity to the discovery that could adversely affect the discovery. The holder shall make a reasonable effort to protect the human remains, funerary items, sacred objects, or objects of cultural patrimony for a period of thirty days after written notice is provided to the authorized officer, or until the authorized officer has issued a written notice to proceed, whichever occurs first.

Antiquities, historic ruins, prehistoric ruins, and other cultural or paleontological objects of scientific interest that are outside the authorization boundaries but potentially affected, either directly or indirectly, by the Proposed Action shall also be included in this evaluation or mitigation. Impacts that occur to such resources as a result of the authorized activities shall be mitigated at the operator's cost, including the cost of consultation with Native American groups.

Any person who, without a permit, injures, destroys, excavates, appropriates or removes any historic or prehistoric ruin, artifact, object of antiquity, Native American remains, Native American cultural item, or archaeological resources on public lands is subject to arrest and penalty of law (16 USC 433, 16 USC 470, 18 USC 641, 18 USC 1170, and 18 USC 1361).

15. Visual Resources. Production facilities and pipeline risers shall be placed to avoid or minimize visibility from travel corridors, residential areas, and other sensitive observation points—unless directed otherwise by the BLM due to other resource concerns—and shall be placed to maximize reshaping of cut-and-fill- slopes and interim reclamation of the pad.

The BLM may direct that cleared trees and rocks be salvaged and redistributed over reshaped cut-and-fill slopes or along linear features. The disturbance width of the road/pipeline corridors shall vary to help reduce a visual “straight line” edge and create opportunities to blend the developments into the landscape.

16. Range Management. Range improvements (fences, gates, reservoirs, pipelines, etc.) shall be avoided during development of natural gas resources to the maximum extent possible. If range improvements are damaged during exploration and development, the operator will be responsible for repairing or replacing the damaged range improvements. If a new or improved access road bisects an existing livestock fence, steel frame gate(s) or a cattleguard with associated bypass gate shall be installed across the roadway to control grazing livestock.
17. Windrowing of Topsoil. Where feasible given the challenging topography in proximity to the well pad and access road, topsoil shall be windrowed around the pad and along the limits of disturbance on the road alignment (BLM 2009 PowerPoint presentation available upon request from Glenwood Springs Field Office). Topsoil shall also be windrowed, segregated, and stored along pipelines and roads, where terrain allows, for later spreading across the disturbed corridor during final reclamation. Topsoil berms shall be promptly seeded to maintain soil microbial activity, reduce erosion, and minimize weed establishment. When topsoil windrowing is not feasible, topsoil storage areas shall be determined during the pre-work construction meeting.
18. Interim Reclamation Related to Drilling Phases. Within 1 year of completion of all exploratory wells proposed on a pad or within one year of completion of all development wells on a pad (whichever the situation may be), the operator would stabilize the disturbed area by recontouring, mulching, providing runoff and erosion control, replacing topsoil as directed, and seeding with BLM-prescribed native seed mixes (or landowner requested seed mix on fee surface), and conducting weed control, as necessary. In cases where the exploratory drilling and development drilling on a single pad occur more than 1 year apart, slopes shall be recontoured to the extent necessary to accommodate seeding, and seed mixes required by BLM or requested by the private landowner shall be applied to stabilize the soil between visits per direction of the BLM.
19. Special Status Plant Protections
 - DeBeque Phacelia
 - a. Surface-disturbing activities located within 100 meters of mapped delineated DeBeque phacelia habitats shall have dust control measures implemented.
 - b. To prevent impacts from herbicide drift and from noxious weeds, no herbicide shall be applied within 20 meters of any mapped DeBeque phacelia habitat. Within these herbicide prohibition buffers, noxious weeds in these areas shall be controlled by manual treatments. In areas between 20 meters and 100 meters of mapped DeBeque phacelia habitat, spot treatments of noxious weeds may be made using herbicide, only when no DeBeque phacelia plants are present within mapped habitat areas. A BLM approved Pesticide Use Proposal (PUP) noting this sensitive area restriction must be obtained prior to any herbicide use. All mapped habitat areas within 100 meters of planned herbicide use shall be surveyed for DeBeque phacelia plants by a BLM approved botanist prior to any herbicide application. If DeBeque phacelia plants are found, the BLM botanist shall be notified immediately, and consultation with USFWS shall be reopened.
 - c. If botany surveys are conducted at the appropriate time of year, in a year when DeBeque phacelia plants are present at known sites of similar elevation and moisture conditions, and no DeBeque phacelia plants are found within the mapped habitat areas, the protections listed above shall no longer be necessary.

20. **Big Game Winter Range Timing Limitation.** To minimize impacts to wintering big game, no construction, drilling or completion activities shall occur during a Timing Limitation (TL) period from **December 1 through April 30** annually.

PROJECT-SPECIFIC MITIGATION MEASURES APPLICABLE TO SPECIFIC COMPONENTS

1. **SG 11-22 Pad, Road and Pipeline Construction Details**

- a. **Pad Containment Berm Spill Prevention Measures.** With the pad being in direct proximity to drainages on all but the north side, attention shall be given to installing a solid containment berm system around the perimeter of the pad working area. Sediment traps shall be located and designed to readily accept pad drainage with a focus of locating these traps near the cut/fill balance line of the pad surface. Sediment trap outlets with drop-down black piping are discouraged and, if used, such piping shall not feed directly into the nearby drainages. As a minimum, a hand-drawn schematic on Plat #2 shall provide the details for the storm water control plan for this pad. This plan shall be presented to the BLM and approved prior to pad construction earthwork.
- b. **Juniper Trees.** Trees cleared during pad construction shall be broken down and placed at the toe of the fill slope to reduce erosion.
- c. **Road Construction Details.** The new access road serving the SG 11-22 pad shall be constructed with a length of 3,149 feet (2,451 feet on BLM land) and a finished roadway width of 25 feet (which includes two 4-foot ditches on either side). The road's running surface shall be graveled for its entire length with a minimum 6-inch depth of surfacing.

The road design package (prepared and stamped by Uintah Engineering and Land Surveying and referenced in the project APDs) shall outline the construction limits, design standards, road alignment and grades, earthwork quantities, culvert locations and construction practices to be used in the roadwork. The proposed road shall be staked (centerline and limits of disturbance) prior to start of roadwork in a manner that allows adequate review during the pre-construction meeting.

A required deviation for the road design would include the following measures to help mitigate the visual appearance of the existing road to be improved between STA 21+00 and 29+00: No sidecasting of material off the existing western edge of the road and existing fillslope shall occur between STA 21+00 and 29+00. Efforts to reduce the height of the road cutslope between STA 21+00 and 29+00 shall include narrowing the road width as much as safely feasible for this 800-foot segment so as to keep the re-disturbed "cut" side of the road within the original cutslope disturbance as much as feasible.

A sufficient dirt berm shall be installed on the outside edge of the new access road that exits the SG 23-22 pad at Corner 9 (NE) to ensure truck traffic stays on the roadway and out of the deep canyon directly adjacent.

Prior to any rig move or heavy equipment hauling on the SG 11-22 road, TEP shall ensure that safe, adequate clearance exists underneath the existing overhead powerline in two separate locations at STA 14+50 and STA 20+00.

- d. **Buried Pipeline Installation Details.** The proposed 8-inch-diameter welded steel gas gathering pipeline and 4-inch-diameter flexpipe water line serving the SG 11-22 pad shall be collocated in the same trench and buried within the new access road corridor. The 8-inch gas line would total 3,088 feet with 2,578 feet being buried on BLM land. The 4-inch produced water line to be

collocated with the gas line would have a total length of 3,573 feet between the two pads and 2,578 feet being buried on BLM land.

The limits of the pipeline disturbance corridor shall generally adhere to the existing disturbance limits of the new or improved access roadway (generally not to exceed 35 feet in width) except as noted on Plan of Development and Road Design package submitted with the APD package. The pipeline installation work shall adhere to the following standard procedures:

- Administrative Notification. The operator shall notify the BLM representative at least 48 hours prior to initiation of construction. If requested by the BLM representative, the operator shall schedule a pre-construction meeting, including key operator and contractor personnel, to ensure that any unresolved issues are fully addressed prior to initiation of surface-disturbing activities.

- Pipeline Construction and Maintenance. The pipelines (natural gas, condensate, and water for production) shall be installed to industry and BLM “Gold Book” standards.

All pipeline(s) shall be buried with a minimum depth of 48 inches from the top of the pipe to the surface. Where the alignments are shared, the gas gathering line and the water collection line shall be installed concurrently in the same trench. The centerline and disturbance limits of the proposed pipeline(s) shall be clearly staked and/or flagged prior to any commencement of operations. No equipment or vehicle use shall be allowed outside the staked disturbance corridor of the pipeline ROW unless authorized by BLM personnel.

- Welding of Pipeline. Visual inspections shall be performed on 100% of all pipeline welds. All welders shall be appropriately certified. (43 CFR 192.227, *Qualification of welders and welding operators*, 49 CFR 192.241, *Inspection and test of welds*).

Welding must be performed by a qualified welder in accordance with welding procedures qualified under section 5 of API 1104 (incorporated by reference, see §192.7) or section IX of the ASME Boiler and Pressure Vessel Code “Welding and Brazing Qualifications” (incorporated by reference, see §192.7) to produce welds meeting the requirements of this subpart. The quality of the test welds used to qualify welding procedures shall be determined by destructive testing in accordance with the applicable welding standard(s).

- Pipeline Testing. The entire pipeline shall be tested in compliance with United States Department of Transportation (DOT) Code of Federal Regulations (CFR) (49 CFR Part 192). (Ref. 49 CFR 192.500.Subpart J entitled “Test Requirements”). (49 CFR 192.225, *Welding Procedures*.)

- Fire Suppression. Welding with acetylene or other open-flame torch shall be operated in an area barren or cleared of all flammable materials at least ten feet on all sides of equipment. Internal combustion engines must be equipped with approved spark arrestors which meet either (a) Department of Agriculture, Forest Service Standard 5100-1a, or (b) Society of Automotive Engineers (SAE) recommended practices J335(b) and J350(a).

- Saturated Soil Conditions. When saturated soil conditions exist on or along the proposed right-of-way, construction shall be halted until soil material dries out or is frozen sufficiently for construction to proceed without undue damage and erosion to soils.

- Warning Signs. Pipeline warning signs shall be installed within 5 days of completion of construction and prior to use of the pipeline for transportation of product. Pipeline warning signs shall be installed at all road crossings and shall be visible from sign to sign along the ROW. For safety purposes, each sign shall be permanently marked with the operator’s name and shall clearly identify the owner (emergency contact) and purpose (product) of the pipeline.

- e. Surface Pipeline Installation Details. Three 4½-inch diameter welded steel surface lines shall be temporarily laid in a cross-country alignment from the GV 33-22 pad north up the ridgeline to the SG 11-22 pad. The total length of the steel high-pressure lines shall be 6,002 feet with about 2,456 feet per pipe on BLM land. Two 10-inch poly surface water supply lines (with length of 760 feet) shall be installed on private land to provide recycled water for the frac operations on the GV 33-22 pad and return frac flowback fluids via the existing water line collection system to the Smith Gulch water storage facility
 - f. Surface Pipeline Decommissioning. When the temporary surface steel frac lines and water supply pipeline for the planned developments related to SG 11-22 and other nearby projects on BLM are no longer necessary, the surface lines shall be pigged and blown dry to ensure all fluid has been purged from the lines. Once all fluid has been removed from the lines, the lines shall be cut and pulled to the existing pad(s) or the existing road. Removal of temporary surface lines shall occur in a manner that minimizes disturbance to native ground cover. Should surface disturbance occur during surface line removal that warrants reclamation work, appropriate reclamation practices shall be implemented per BLM direction.
2. SG 23-22 Cuttings Storage. Any excess cuttings volume exceeding the capacity of the cuttings management storage area shown on the SG 23-22 construction plat in the related APD shall be hauled to the cuttings trench on BLM's SG 11-22 pad for permanent storage. Prior to final storage and capping at the SG 11-22 pad, the cuttings shall be tested and remediated if necessary on location to satisfy COGCC Table 910-1 standards. Cuttings shall be covered with a minimum 3-foot-deep cap.
 3. Operations on the GV 33-22 Well Pad. The GV 33-22 pad shall be expanded and re-constructed per Construction plats shown in APDs. The completion work for the SG 11-22 wells shall be remotely conducted from the GV 33-22 fee pad. An expanded tank battery shall also be staged on the GV 33-22 tank pad to collect and store produced water delivered by the new SG 11-22 4-inch water line.
 4. Agreements with Other Holders. Potential impacts to the existing BLM ROWs (COC112731 issued to Qwest Corporation for the Grand Valley Microwave Repeater Station and Access Road and COC123951 issued to Public Service of Colorado for Mount Callahan Microwave Distribution Line) from the lease operations proposed by TEP or by the rights-of-way to be authorized to TEP would be mitigated based on written maintenance and use agreements between TEP and the existing ROW holders. Such agreements shall be obtained and verified with the BLM prior to any disturbance or construction across or adjacent to an existing right-of-way.

BUREAU OF LAND MANAGEMENT

Colorado River Valley Field Office
2300 River Frontage Road
Silt, CO 81652

**Additional Downhole Drilling Conditions of Approval
Applications for Permit to Drill**

Operator: TEP Rocky Mountain LLC
Lease Numbers: COC27874, COC58673
Pad: SG 11-22
Surface Location: Garfield County, NW¼NW¼, Section 22, T7S, R96W,
6th PM

List of Wells	
<i>Proposed Pad</i>	<i>Proposed Wells</i>
SG 11-22	Federal SG 11-22
	Federal SG 14-15
	Federal SG 21-22
	Federal SG 31-21
	Federal SG 42-21
	Federal SG 311-22
	Federal SG 314-15
	Federal SG 321-22
	Federal SG 324-15
	Federal SG 341-21
	Federal SG 342-21
	Federal SG 411-22
	Federal SG 414-15
	Federal SG 421-22
	Federal SG 441-21
	Federal SG 442-21
Federal SG 511-22	
Federal SG 514-15	
Federal SG 541-21	
Federal SG 542-21	

1. Twenty-four hours *prior* to (a) spudding, (b) conducting BOPE tests, (c) cementing/running casing strings, and (d) within 24 hours *after* spudding please leave message on the following contact number: 970-876-9064.

The BLM CRVFO inspectors are Marlan Deaton, Ed Fancher, Greg Rios, Alex Provstgaard, Brandon Jamison, and Jennifer Robinson.

Please contact one of the following petroleum engineers with emergency, drilling or completion issues: Bob Hartman at (970) 589-6735, bhartman@blm.gov, or Stephen Garcia at (970) 456-2138, sbgarcia@blm.gov

2. A CRVFO petroleum engineer shall be contacted for a verbal approval prior to commencing remedial work, sidetracking operations, plugging operations on newly drilled boreholes, changes within the drilling plan, changes to the well design, changes or variances to the BOPE, deviating from conditions of approval, and conducting other operations not specified within the APD. Contact the petroleum engineer for verbal approvals (contact information above).
3. If a well control issue or failed test (e.g. kick, blowout, water flow, casing failure, or a bradenhead pressure increase) arises during drilling or completions operations, the petroleum engineer shall be notified within 24 hours from the time of the event. IADC/Driller's Logs and Pason Logs (mud logs) shall be forwarded to CRVFO – Petroleum Engineer, 2300 River Frontage Road, Silt, CO 81652 within 24 hours of a well control event.
4. The BOPE shall be tested and conform to Onshore Order No. 2 for a 3M system and recorded in the IADC/Driller's log.
5. Air and/or mist drilling requires BLM petroleum engineers notification and approval.
6. Flexible choke lines shall meet or exceed the API SPEC 16C requirements. Flexible choke lines shall have flanged connections and configured to the manufacturer's specifications. The flexible choke lines shall be anchored in a safe and workmanlike manner. At minimum, all connections shall be effectively anchored in place for safety of the personal on location. Manufacturer specifications shall be kept with the drilling rig at all times and immediately supplied to the Authorized Officer (AO) or inspector upon request. Specifications at a minimum shall include acceptable bend radius, heat range, anchoring, and the working pressure. All flexible choke lines shall be free of gouges, deformations, and as straight/short as possible.
7. Chronologic drilling progress reports must be emailed directly to the BLM Colorado River Valley Field Office petroleum engineers on a daily basis. Reports shall include daily mud reports, details of casing that has been run and its cementing, water flows, lost circulation zones, hydrocarbon shows and other information that describes drilling conditions.
8. An electrical/mechanical mud monitoring equipment shall be function tested prior to drilling out the surface casing shoe. As a minimum, this equipment shall include a pit volume totalizer, stroke counter, and flow sensor.
9. A gas buster shall be functional and all flare lines effectively anchored in place, prior to drilling out the surface casing shoe. The discharge of the flare lines shall be a minimum of 100 feet from the wellhead and targeted at bends. The panic line shall be a separate line (not open inside the buffer tank) and effectively anchored. All lines shall be downwind of the prevailing wind direction and directed into a flare pit, which cannot be the reserve pit. The flare system shall use an automatic ignition. Where noncombustible gas is likely or expected to be vented, the system shall be provided supplemental fuel for ignition and maintain a continuous flare.
10. On the first well drilled on this pad, a triple combo open-hole log shall be run from the base of the surface borehole to surface and from TD to bottom of surface casing shoe. This log shall be submitted within 48 hours in .las and .pdf format to: CRVFO – Petroleum Engineer, 2300 River Frontage Road, Silt, CO 81652. Contact 970-876-9000 for clarification.
11. Submit the (a) mud/drilling log (e.g. Pason disc), (b) driller's event log/operations summary report, (c) production test volumes, (d) directional survey, and (e) Pressure Integrity Test results within 30 days of completed operations (i.e. landing tubing) per 43 CFR 3160-9 (a).

12. Notify the BLM Petroleum Engineer two weeks prior to commencing completion operations.
13. Whether the well is completed as a dry hole or as a producer, "Well Completion and Recompletion Report and Log" (Form 3160-4) will be submitted not later than 30 days after completion of the well or after completion of operations being performed, in accordance with 43 CFR 3164. In accordance with 43-CFR 3162.4(b) submit a complete set of electrical/mechanical logs in .las format with standard Form 3160-4, Well Completion or Recompletion Report and Log.
14. Not later than the 5th business day after any well begins production on which royalty is due anywhere on a lease site or allocated to a lease site, or resumes production in the case of a well which has been off production for more than 90 days, the operator shall notify the authorized officer by letter or sundry notice, Form 3160-5, or orally to be followed by a letter or sundry notice, of the date on which such production has begun or resumed. If the well is completed for production, the AO will be notified when the well is placed in a producing status. Such notification may be sent by telegram or other written communication, not later than five (5) days following the date on which the well is placed on production.
15. A schematic facilities diagram as required by 43 CFR 3162.7-5 (b.9. d.), and shall be submitted to the appropriate District Office within sixty (60) days of installation or first production, whichever occurs first. All site security regulations as specified in Onshore Oil & Gas Order No. 3 shall be followed. All product lines entering and leaving hydrocarbon storage tanks will be effectively sealed in accordance with 43 CFR 3162.7-5 (b. 4).
16. All off-lease storage, off-lease measurement, or commingling on-lease or off-lease will have prior written approval from the AO.
17. "Sundry Notice and Report on Wells" (Form 3160-5) will be filed for approval for all changes of plans and other operations in accordance with 43 CFR 3162.3-2.
18. **Water Use.** The purpose of this COA is to assist the BLM in ensuring that water depletions associated with Federal oil and gas development activities are adequately covered by the USFWS Programmatic Biological Opinion for the four endangered Colorado River fishes.

Well Name/No.:				API No.:	
County:				Well Pad:	
Operator:					
Activity	Water Use (barrels)				
	Construction	Drilling		Completion	
	Fresh	Fresh	Reused/ Recycled	Fresh	Reused/ Recycled
Road/Pipeline/Pad Dust Abatement					
Pipeline Hydrostatic Testing					
Cementing					
Mud					
Acid Wash/ Hydraulic Fracturing					

The Operator shall provide the volumes of fresh water and reused/recycled water used during project development using the following table. The volumes per well shall be identified by each development phase (construction, drilling, and completion) and by activity (e.g., dust abatement, pipeline hydrostatic

testing, drilling, and completion operations). The water volumes shall be identified in an attachment to the BLM Form 3160-4, "Well Completion or Recompletion Report and Log" (completion report) submitted to the BLM Field Office. All volumes are to be reported in barrels per well.

The Operator shall submit the total volume of water used during construction of a pad with the first well completion report of the pad. Volumes of water used for subsequent activities (drilling and completing an additional well on the pad, dust abatement) shall be included in subsequent completion reports.

**United States Department of the Interior
Bureau of Land Management
Colorado River Valley Field Office, Colorado**

FINDING OF NO SIGNIFICANT IMPACT

SG 11-22 Project

***TEP Rocky Mountain LLC*
Federal Leases COC27874 and COC58673**

DOI-BLM-CO-N040-2018-0078-EA

Based on the analysis of potential environmental impacts contained in the attached Environmental Assessment (EA), and considering the significance criteria in 40 CFR 1508.27, I have determined that the Proposed Action will not have a significant effect on the human environment. An Environmental Impact Statement (EIS) is therefore not required.

BACKGROUND

The Bureau of Land Management, Colorado River Valley Field Office (CRVFO), has prepared an EA that analyzes the effects of drilling, completing, and operating 20 Federal wells from the proposed SG 11-22 well pad located on BLM-administered public land north of I-70 and approximately 4 miles southwest of Parachute, Garfield County, Colorado. The project would consist of drilling directionally into Federal fluid mineral leases COC27874 and COC58673. The project would also include building, using, and maintaining 0.6 mile of new access road on BLM land adjacent private land; installing 0.6 mile of collocated buried pipelines to transport gas, oil, and water; and using 1.1 miles of temporary surface water lines to deliver and collect water for well hydraulic fracturing activities (completions).

The EA also analyzes use of the existing GV33-22 pad on fee land (private surface/private minerals) and located along the north side the I-70 frontage road to support well completion activities for the 20 Federal wells and to be used as a tank farm. The private road to the nearby SG 23-22 pad would provide the primary access to the SG 11-22 project site. No private wells would be developed with this project.

The buried natural gas pipelines, to be installed along the new pad access road, would transport gas to Terra's existing gas gathering infrastructure along the I-70 corridor. Delivering produced water through buried water lines collocated with the gas pipelines to a new tank farm established on the GV 33-22 pad will greatly reduce truck traffic within the field. Using the remote frac pad, TEP's existing water line distribution system, and the surface frac lines will considerably decrease truck traffic on state, county, BLM, and private roads. Storage tanks staged on the SG 11-22 pad would store condensate requiring periodic truck visits to sell and haul the oil product to local markets.

Implementation of the SG 11-22 project could produce nearly 35 billion cubic feet (bcf) of natural gas over the life of the project, estimated to be 40 years.

Use of the SG 11-22 pad to drill and develop 13 Federal wells (of the 20 total) that would bottomhole in the nearby Federal lease COC27874, instead of in Federal lease COC58673 underlying the well pad, would require a BLM site right-of-way for the pad and the ancillary new access road, collocated buried natural gas and water pipelines, and surface frac lines. The project was posted on the CRVFO NEPA website in June 2018 to invite public involvement. No public comments were received.

INTENSITY/SEVERITY

I have considered the potential intensity/severity of the impacts anticipated to accompany implementation of the Proposed Action in relation to each of the ten areas suggested for consideration by the Council on Environmental Quality (CEQ):

- 1. *Impacts that may be both beneficial and adverse.*** This project would have short-term impacts to soils, vegetation, wildlife, and air quality during construction, drilling, and completion activities. These impacts are not significant and would decrease during long-term production activities. This project would have a long-term benefit from the production of natural gas for public use, from employment, and from generation of revenue in the form of Federal oil and gas royalties and a variety of State and local taxes.
- 2. *The degree to which the Proposed Action affects public health and safety.*** The Proposed Action is not expected to have significant adverse impacts on public health and safety.
- 3. *Unique characteristics of the geographic area such as proximity of historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.*** The Proposed Action would not result in significant impacts to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas. The project has been designed to avoid impacts or minimize impacts to other resources and uses, including recreation and visual resources. The project area does not include municipal water supplies and is not expected to impact groundwater aquifers used for domestic or agricultural purposes.
- 4. *The degree to which effects on the quality of the human environment are likely to be highly controversial.*** Because the proposed development would occur primarily with one new well site and 0.6 mile of new access road and pipelines extending north to the base of Mount Callahan and using existing roads, the existing GV 33-22 pad as a remote frac pad, and delivering and collecting water for the frac operations without use of water trucks, the construction, drilling, and completion activities and its environmental effects are not expected to be controversial.
- 5. *The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.*** The construction of the well pad, road, and buried pipelines and the drilling, completion, and production of oil and gas wells are common activities in the project vicinity. The degree of possible effects of the project on the human environment are neither unique nor unknown.
- 6. *The degree to which the Proposed Action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.*** This decision is similar to many that have previously been made and will continue to be made by the BLM regarding the development of valid Federal oil and gas leases in the CRVFO area. The decision is within the scope of the applicable Resource Management Plan. The decision does not represent a decision in principle about a future consideration.
- 7. *Whether the Proposed Action is related to other actions with individually insignificant but cumulatively significant impacts.*** The Proposed Action would have no significant cumulative effects on the environment, either when combined with the effects created by past and concurrent projects, or when combined with the effects from natural changes taking place in the environment or from reasonably foreseeable future projects.
- 8. *The degree to which the Proposed Action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historic resources.*** The Proposed Action would have no adverse impacts to the above resources.

9. *The degree to which the Proposed Action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.* The Proposed Action incorporates the results of surveys for Federally listed, proposed, or candidate threatened or endangered plant and animal species and would have no effect on such species.

10. *Whether the Proposed Action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.* This decision complies with other Federal, State, or local laws and requirements imposed for the protection of the environment.

FINDING OF NO SIGNIFICANT IMPACT

On the basis of the information contained in the EA, and all other information available to me, it is my determination that: 1) the implementation of the Proposed Action or alternatives will not have significant environmental impacts beyond those already addressed in the "Record of Decision and Resource Management Plan," (2015); (2) the Proposed Action is in conformance with the Resource Management Plan; and (3) the Proposed Action does not constitute a major Federal action having a significant effect on the human environment. Therefore, an Environmental Impact Statement (EIS) or a supplement to the existing environmental impact statement is not necessary and will not be prepared.

This finding is based on my consideration of Council on Environmental Quality (CEQ) criteria for significance (40 CFR 1508.27) with regard to both the context and the intensity of the impacts described in the EA.



Gloria Tibbetts, Acting Field Manager
Colorado River Valley Field Office

8/2/2018

Date

**United States Department of the Interior
Bureau of Land Management
Colorado River Valley Field Office, Colorado**

DECISION RECORD

SG 11-22 Project

***TEP Rocky Mountain LLC*
Federal Leases COC27874 and COC58673**

DOI-BLM-CO-N040-2018-0078-EA

DECISION

It is my decision to authorize the Proposed Action as described in Section 2 of the attached EA. The Proposed Action includes constructing one well pad on BLM land and expanding an ancillary support pad on private land for remote frac (hydraulic fracturing) operations; drilling, completing, and producing 20 Federal oil and gas wells from the SG 11-22 well pad; constructing 0.6 mile of new access road; installing 0.6 mile of buried natural gas and produced water pipelines collocated in the same trench; using 1.1 miles of surface frac lines; and operating ancillary surface facilities as a tank farm for storage of fluids. The site is located in the 6th Principal Meridian, Township 7 South, Range 96 West, Section 22, in Garfield County, Colorado.

This decision is contingent on meeting all mitigation measures and monitoring requirements presented in the Surface-Use and Downhole Conditions of Approval (COAs) in the **Appendix** of the attached EA. The project was noticed to the public by posting on the Colorado River Valley Field Office NEPA website in June 2018. No public comments were received regarding this proposal.

The EA resulted in a Finding of No Significant Impact (FONSI) for the Proposed Action. Consequently, an Environmental Impact Statement (EIS) is not required.

RATIONALE

The bases for this decision are as follows:

1. Approval of the Proposed Action is validating the rights granted with Federal oil and gas leases (COC27874 and COC58673) to develop the leases to provide commercial commodities of oil and gas.
2. The project would allow natural gas and associated liquid hydrocarbons (“oil”) to be delivered to markets for the use and benefit of the public.
3. Environmental impacts would be avoided, minimized, or offset with the mitigation measures incorporated into the Proposed Action or attached and enforced by BLM as COAs.
3. This decision does not authorize the initiation of drilling activities associated with any Federal oil and gas well. Initiation of activities related to the proposed new Federal oil and gas wells may commence only upon approval by BLM of an Application of Permit to Drill (APD) and site right-of-way (ROW) related to that particular well. Similarly, this Decision does not authorize the initiation of construction activities or use associated with any access road, natural gas, condensate, or water gathering pipelines. Initiation of construction activities or use related to the existing access roads or the proposed gas/oil/water pipelines may commence only upon approval by BLM of a ROW for the

SG 11-22 site, which considers the access road and pipelines as ancillary components of the ROW. However, this decision provides the BLM's Authorized Officer with an analysis upon which to base approval of the APD and site ROW.

MITIGATION MEASURES AND MONITORING

If an APD for any of the wells sought by the proponents is approved as an outcome of this decision, the Surface-Use and Drilling COAs provided in the **Appendix** of the attached EA would be attached to the APD and enforced by the BLM. These protections would be in addition to any design features and best management practices to which the proponent committed in the Surface Use Plan of Operations (SUPO) included with the APD. Furthermore, if a site ROW is approved as an outcome of this decision, the Surface-Use COAs provided in the **Appendix** of the attached EA would be attached to the ROW enforced by the BLM.

PROTESTS AND APPEALS

In accordance with 43 CFR 3165.3, any adversely affected party contesting this decision may request an administrative review of this decision, before the State Director, either with or without oral presentation. This request, including all supporting documentation, shall be submitted in writing within 20 business days of the date this decision was received, or considered to have been received, by the party and shall be sent to Colorado State Director, 2850 Youngfield Street, Lakewood, Colorado 80215-7076. The decision of the State Director may then be appealed to the Interior Board of Land Appeals in accordance with 43 CFR 3165.4. BLM Colorado will not accept a request for State Director Review or a notice of appeal transmitted electronically (e.g., by email, facsimile, or social media means)

NAME OF PREPARER

Jim Byers, Natural Resource Specialist, Colorado River Valley Field Office

NAME OF TECHNICAL REVIEWER/ ENVIRONMENTAL COORDINATOR

Allen Crockett, Supervisory NRS/Physical Scientist, Colorado River Valley Field Office

DATE REVIEWED

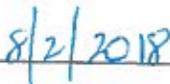
August 1, 2018

SIGNATURE OF AUTHORIZED OFFICIAL



Gloria Tibbetts, Acting Field Manager
Colorado River Valley Field Office

DATE SIGNED



8/2/2018