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-N040-2018-0033-EA

Proposed Balzac Gulch - Phase 2 Oil and Gas Master Development Plan Project

Terra Energy Partners Rocky Mountain LLC

Federal Oil and Gas Lease COC62160
Federal Oil and Gas Lease COC73094

September 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.

TABLE OF CONTENTS

APPENDICES

FIGURES

TABLES

1. INTRODUCTION

NUMBER: DOI-BLM-CO-N040-2018-0033-EA

APPLICANTS: **Authorizations for Applications for Permit to Drill (APDs)**: Terra Energy Partners (TEP) Rocky Mountain LLC ("Terra") formerly known as WPX Energy Rocky Mountain LLC ("WPX"). Contact: Adam Tankersley, 1085 CR 215, Parachute, CO 81635.

Authorization for Natural Gas and Produced Water Pipeline Rights-of-Way (ROWs): Terra Energy Partners Rocky Mountain LLC ("Terra"). Contact: Bryan Hotard, 1085 CR 215, Parachute, CO 81635.

PROJECT NAME: **Balzac Gulch Phase 2 Master Development Plan**.

1.1. BACKGROUND

The Balzac Gulch Phase 2 Master Development Plan (BG2MDP) is an oil and gas exploration and development project proposed by TEP Rocky Mountain LLC (Terra) over an approximate 2- to 3-year period. The proposed BG2MDP project area is located about 9 miles west of Rifle, Colorado, and north of Rulison, Colorado, on the north side of Interstate 70 (I-70) in central Garfield County, Colorado. The project would occur within or near the Balzac Gulch area along the south-facing base of the Roan Plateau and includes all or portions of Sections 19, Township 6 South, Range 94 West, and Sections 13 and 23 to 26, Township 6 South, Range R95 West, Sixth Principal Meridian (see **Figure 1**).

The Proposed Action for the BG2MDP includes 63 additional Federal directional wells on four new well pads. An operator-developed Preferred Alternative was proposed after the initial project scoping revealed resource concerns in January 2018. The Preferred Alternative identifies 58 Federal directional wells on four new well pads, although one of the new pads (PA 44-13 pad) is different from the suite of four pads presented in the Proposed Action.

The new wells would be completed in Federal oil and gas lease COC73094, an undeveloped lease analyzed in the Record of Decision and Approved Resource Management Plan Amendment for BLM's Roan Plateau Planning Area (decision dated November 17, 2016). Regardless of alternative, the new Federal wells to be developed in the BG2MDP area could produce as much as 115 to 120 billion cubic feet (bcf) of natural gas over a 40-year production period.

The Proposed Action, if approved, would result in the construction of four proposed well pads: PA 31-26, PA 32-13, PA 34-24, and PA 41-24. **Figure 1** shows the proposed locations of these new pads, as well as the planned PA 32-13 Production Support Pad and PA 32-13 Operation Support Pad, two existing pads (the RWF 21-18 and RWF 334-18) to be expanded and used for cuttings storage, and the planned new RWF 12-20 Tank Pad to be constructed on private surface to store liquid condensate (oil) and produced water. The project would also include 2.06 miles of new access roads, 3.89 miles of temporary surface water lines, and 5.27 miles of buried pipelines to transport gas, oil, and water. A detailed description of the Proposed Action is provided in **Section 3.1**.

Aside from a decrease in five bottomholes to 58 proposed directional wells, the Preferred Alternative, if approved, would remain similar to the Proposed Action with the construction of four proposed well pads: PA 31-26, PA 32-13, PA 34-24, and PA 44-13 and the various ancillary sites. However, the PA 44-13 pad would replace the PA 41-24 pad and the PA 32-13 Production Support Pad, which would be deleted from consideration. As with the Proposed Action, the Preferred Alternative would include 2.06 miles of new access roads, 3.89 miles of temporary surface water lines, 5.27 miles of buried pipelines to transport gas, oil, and water. The Preferred Alternative is described more fully in **Section 3.7**.

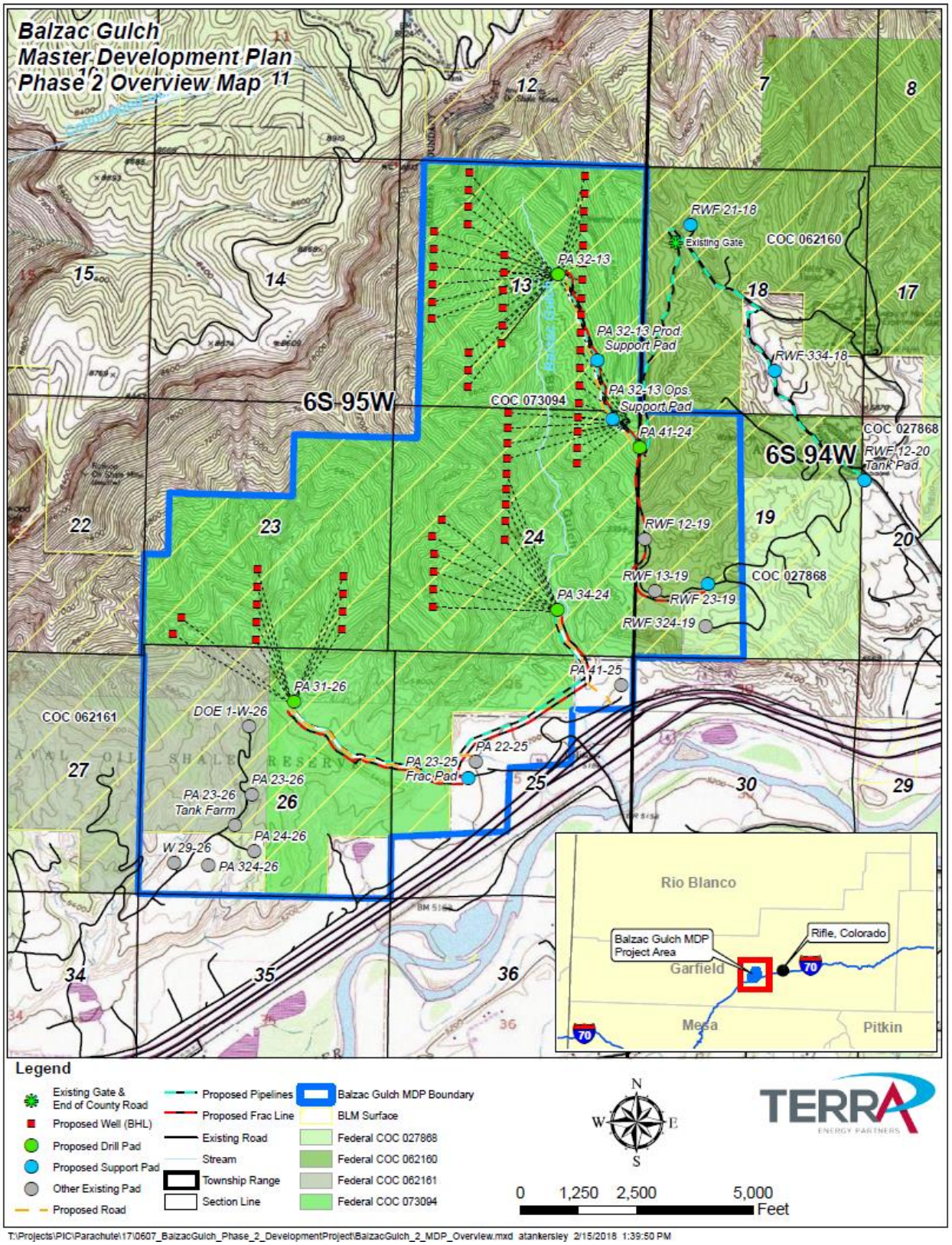


Figure 1. Balzac Gulch Phase 2 Master Development Plan Overview Map

The BG2MDP project area lies within the existing Balzac Gulch MDP boundary established in Environmental Assessment (EA) DOI-BLM-CO-N040-2017-0093, approved in September 2017. The initial (Phase 1) BGMDP analyzed 66 new Federal directional wells to be drilled from three existing well pads. The Phase 1 EA disclosed possible future development of additional wells and pads. Although Phase 2 had not yet been planned in sufficient detail for analysis, the Phase 1 EA analyzed a conservatively estimated total of 165 Federal wells, compared to the actual combined total of 129 wells. In addition to 129 wells included in Phases 1 and 2 of the Balzac Gulch MDPs, Terra currently operates 79 directional wells on 11 well pads in the area, mostly developed by Terra's predecessors.

1.2. LOCATION AND LEGAL DESCRIPTION

The BG2MDP project area encompasses roughly 2,917 acres of Federal and private lands. Surface ownership within the BG2MDP project area involves four Federal leases on BLM-administered lands (2,648 acres) and fee leases underlying private lands (269 acres) (**Figure 1**). All existing access routes to the proposed pads originate from I-70 frontage roads and cross private field development roads; public access is not available to the sites within the project area.

The legal description for the BG2MDP project area covers the following lands, both Federal and private:

Township 6 South, Range 94 West
Section 19, Lots 5-8, 13-16
Township 6 South, Range 95 West
Sections 13, E½, E½W½, Lots 1-4;
Section 23, NE¼SW¼, N½SE¼, SE¼NE¼, Lots 1-10;
Section 24, NE¼, E½NW¼, SW¼NW¼, N½S½, Lots 1-5;
Section 25, NW¼, N½SW¼, W½NE¼, NE¼NE¼; and
Section 26 in its entirety
Sixth Principal Meridian, Garfield County, Colorado

1.3. PURPOSE AND NEED FOR ACTION

The purpose of the action is to consider opportunities for Terra to develop Federal fluid mineral resource associated with Federal lease COC73094, consistent with Federal lease rights. The need for the action is to respond to applications by Terra to access its leased mineral rights, pursuant to the provisions of the Mineral Leasing Act (MLA), as amended. Under the Federal Land Policy and Management Act of 1976 (FLPMA), the BLM is charged with managing public lands for multiple use, 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.

1.4. SCOPING

NEPA regulations (40 CFR §1500-1508) require that the BLM use a scoping process to identify potential significant issues in preparation for impact analysis. The principal goals of scoping are to allow public participation to identify issues, concerns, and potential impacts that require detailed analysis. The BLM placed information regarding the BG2MDP project on its public ePlanning website in mid-December 2017 with a subsequent 30-day public scoping review and comment deadline established for February 8, 2018. A news release was issued to local media outlets on January 9, 2018; a public notice for the project scoping was filed in the Rifle Citizen Telegram and Glenwood Post Independent for three consecutive weeks beginning on January 18, 2018.

The BLM received written comments, submitted by letter or email, during public scoping. These included comments from two governmental bodies or associations, one industry group, two

environmental groups, and nine individuals. Comments included some in support of the development for employment and economic reasons, and a larger number opposed based on concern for impacts to the environment (including air, surface water, groundwater, soil erosion, wildlife, sensitive plants, livestock, and visual quality) and human health. Several comments focused on legal issues. **Appendix D** presents the comments and BLM responses. **Section 4** of this EA presents information on each resource section, including those that were the subject of substantive comments. Human health is addressed as components of Air Quality (**4.2**), Wastes – Hazardous or Solid (**4.16**), and Water Resources – Surface Water and Groundwater (**4.17**). Cumulative impacts for these resources are described in **Section 5**.

2. EXISTING DEVELOPMENT AND INFRASTRUCTURE

Terra currently manages 11 producing pad locations with 79 producing wells (34 Federal and 45 private) within the Balzac Gulch planning area. These are in addition to the 66 Federal wells being developed as part of Phase 1 of the BGMDP and the 63 Federal wells analyzed in this EA for Phase 2. **Table 1** lists the numbers of wells associated with the EA for Phase 1 and with previous EAs. The inclusion of all existing well sites in the project area indicates the amount of historical development that has occurred and provides a baseline for cumulative impacts to be analyzed in the environmental analysis.

Another existing development, Garfield County's Anvil Points Communication Site, is located directly adjacent to the proposed PA 41-24 pad site. The site, including a 195-foot-tall steel triangular lattice communication tower with concrete foundation, a building to house electronic equipment for the tower, a power generator, and 1,000-gallon propane tank, was analyzed in BLM EA DOI-BLM-CO-N040-2016-0067, approved in May 2017. The tower and supporting infrastructure were installed in summer 2017.

Table 1. Existing Development within the Balzac Gulch Phase 2 MDP Project Area

Well Pad	***Construction Date***	***Existing Pad Footprint (acres)***	***Surface Ownership***	***NEPA Documents***	***Wells Drilled and/or Approved (Federal/Fee)***
W 29-26	September 1987	2.82	Fee	--	0/2
DOE 1-W-26	August 1989	2.00	Federal	CO-140-2005-047-EA	4/0
PA 24-26	June 2002	2.21	Fee	--	0/1
PA 324-26	June 2002	3.30	Fee	--	4/7
PA 23-26	August 2002 October 2017	2.24	Federal	CO-N040-2013-0025-EA CO-N040-2017-0093-EA [1]	30/0
RWF 23-19	July 2004 May 2018	2.69	Federal	CO-140-2001-048-EA Serves as Remote Frac Pad	4/0
RWF 13-19	September 2004 May 2018	2.55	Federal	CO-140-2001-048-EA CO-N040-2017-0093-EA [1]	20/0
RWF 324-19	April 2005	2.19	Federal	--	3/0
RWF 12-19	September 2005	3.22	Federal	--	6/0
PA 41-25	July 2007	5.12	Fee	--	4/18
PA 22-25	January 2008 September 2017	5.52	Fee	CO-N040-2017-0093-EA [1]	25/17

[1] Balzac Gulch Phase 1 MDP/EA (DOI-BLM-CO-N040-2017-0093) approved 25 new Federal wells on PA 22-25 pad, 27 new Federal wells on PA 23-26 pad, and 14 new Federal wells on RWF 13-19 pad.

2.1. DECISION TO BE MADE

The primary decision by the BLM upon completion of this EA is whether to (1) authorize Terra's development, operation and production of 63 Federal wells in underlying Federal mineral lease COC73094 with the construction of new well pads and access roads and the installation of new production equipment; (2) authorize installation of buried gas gathering pipelines collocated with water and/or condensate lines alongside existing or proposed roads across BLM land; and (3) authorize use of temporary surface frac (hydraulic fracturing) lines on BLM land to conduct remote frac operations.

Based on the information presented and analyzed in this EA, the BLM may choose to (a) authorize the project as described in the Proposed Action; (b) authorize the project as described in the Preferred Alternative; (c) authorize the project with modifications, potentially including exceptions to the No Surface Occupancy (NSO) lease stipulation for Steep Slopes >50% and the I-70 Viewshed; or (d) not authorize the project at this time. Options (a), (b), and (c) would include the use of Conditions of Approval (COAs) as mitigation to avoid, minimize, or offset adverse project impacts.

The Decision Record associated with this EA may not constitute the final approval for all actions, such as the issuance of APDs or the approval of ROW grants or temporary use permits associated with the Proposed Action or Preferred Alternative. It does provide the BLM with an analysis from which to base the final approval, if warranted, for individual project components.

2.2. PLAN CONFORMANCE REVIEW

The Proposed Action and Preferred Alternative are subject to, have been reviewed for, and are in conformance with (43 CFR §1610.5 and §2800, BLM 1617.3) the following plan:

Land Use Plan (LUP) Name: The current LUP is the Colorado River Valley Field Office and White River Field Office Roan Plateau Planning Area including Naval Oil Shale Reserves Numbers 1 & 3 Record of Decision /Approved Resource Management Plan Amendment (Roan RMPA), approved November 17, 2016.

Decision Language: The following excerpts from the 2016 Roan Plateau Approved RMPA are germane to the Proposed Action:

Page 2-25, Lands and Realty (LRT)-GOAL-01: "Provide for compatible land use authorizations within the framework of laws and regulations."

Page 2-32, Fluid Minerals (FMI)-GOAL-01: "Make lands available, as appropriate for oil and gas leasing in an environmentally sound manner, under multiple use mandates. Conduct oil and gas leasing on leasable lands in accordance with the Transfer Act, Mineral Leasing Act, and the Federal Onshore Oil and Gas Reform Act of 1987 and applicable regulations under 43 CFR 3100 and in accordance with the decisions made through application of FLPMA and other laws applicable to public lands. Regulations governing onshore oil and gas operations can be found at 43 CFR 3160." Lease COC62160 was issued in April 1999.under the authority of Glenwood Springs Resource Area Oil & Gas Leasing & Development Record of Decision (ROD) and Resource Management Plan Amendment (RMPA) approved in March 1999. Lease COC73094 was initially issued in October 2008 under the initial 2007 Roan Plateau RMPA leasing decision.

Page 2-32, Fluid Minerals (FMI)-OBJECTIVE-01: "Open lands below the rim of the plateau to oil and gas leasing and development. All leases would be subject to lease notices, stipulations, and standard lease terms and conditions."

Page 2-33, FMI-Management Action (MA)-03: "For leases below the rim, prior to exploration and/or lease development, the operator shall submit a proposed MDP identifying its projected activities. Prior to

submitting the MDP, the operator shall consult with the CPW and BLM to develop terms that minimize impacts to wildlife and other resources." The Balzac Gulch Phase 1 MDP (#DOI-BLM-CON040-2017-0093 approved in September 2017) was the initial development plan for the project area with Phase 2 representing the description and analysis for the current project proposal.

Page 2-59, Transportation Routes (TRR)-GOAL-01: "Provide a network of roads and trails open to administrative, recreational, and permitted uses that accommodates environmental and resource concerns."

Determination: The Proposed Action and Preferred Alternative are in conformance with the LUP cited above because (1) the issuance of ROW grants, including temporary use permit, would provide for compatible land use authorizations within the framework of laws and regulations, and would meet ROW and utility needs in the public interest and within the constraints for other resources, and (2) the issuance of APDs to the operator on Federal well pads below the rim of the plateau would facilitate the development of the Federal fluid mineral lease in an environmentally sound manner under multiple use mandates.

2.3. SUMMARY OF LEASE STIPULATIONS FOR THE BG2MDP PROJECT

Table 2 lists the project components of the Proposed Action and Preferred Alternative (with its added feature of the PA 44-13 pad shown in bold text) and a summary of the oil and gas lease stipulations relative to Federal oil and gas leases COC62160 and COC73094 that pertain to the various project components.

Specific language describing the stipulations are available from the Colorado River Valley Field Office (CRVFO). Federal lease boundaries are illustrated on **Figure 1** for the Proposed Action and **Figure 11** for the Preferred Alternative with differing shades of green color that also collectively represent BLM land status. No split-estate Federal leases (private surface/Federal minerals) occur within the BG2MDP boundary.

The proposed development of Federal lease COC73094 was specifically analyzed in BLM's ROD and Approved RMPA (ROD/ARMP) for BLM's Roan Plateau Planning Area (decision dated November 17, 2016). The ROD for the Approved RMPA included the adoption of a Settlement Agreement (described in Appendix I of the ROD) and specific Base Lease language (Exhibit 3 of Appendix I of the ROD). Under the Settlement Agreement, the lands contained within the Base Leases would be open to oil and gas leasing and development, subject to lease notices stipulations, and standards lease terms and conditions consistent with those for the Base Leases, except as modified by a new stipulation that includes the following terms and conditions:

Prior to exploration and/or lease development on it Base Leases, an operator shall submit a proposed master development plan ("MDP") identifying its project activities. Prior to submitting the MDP, an operator shall consult with the Colorado Division of Parks and Wildlife and Bureau of Land Management to develop terms that minimize impacts to wildlife and other resources. Agreed-upon terms are required to be included in the operator's MDP.

Additionally, under its regulatory authority in 43 CFR 3160, the BLM applies COAs to mitigate environmental impacts. **Appendices A and B** present surface use and drilling COAs to be applied to any APDs approved under this EA.

Facets of the Proposed Action and Preferred Alternative would be implemented "off-lease" and would be authorized with BLM ROW grants subject to ROW stipulations based on land use plan decisions, not necessarily the same restrictions as the lease stipulations listed in **Table 2**. For example, the Proposed Action's PA 41-24 pad, its existing access road, the buried pipelines crossing BLM lands in Sections 18 and 19, and the series of temporary surface frac lines serving new wells in Section 13 would be

authorized with BLM ROW grants. Those developments would occur off-lease or outside of Federal lease COC73094 where the proposed Federal bottomholes would be developed.

Table 2. Project Components with Applicable Lease Stipulations

Project Component	*Mineral Lease*	*Legal Description*	*Summary of Federal Lease Stipulations*
PA 34-24 Pad/Road PA 31-26 Pad/Road PA 41-24 Pad/Road[1] PA 32-13 Pad/Road PA 32-13 Production Pad PA 32-13 Operations Pad **PA 44-13 Pad/Road**	Federal COC73094	T6S, R95W Sections 13, 24, 26	No Surface Occupancy (NSO) for Steep Slopes (>50%) NSO for I-70 Viewshed Controlled Surface Use (CSU) for Erosive Soils and Slopes Greater than 30% CSU for VRM Class II Areas Below the Rim CSU to Protect Special Status Plants/Habitat CSU to Protect Historic Properties/Resources Timing Limitation (TL) for Big Game Winter Range (12/1 to 4/30) Lease Notice (LN) for Required Conditions of Approval (COAs)
Buried Natural Gas, Water, and Condensate Pipelines and Surface Frac Lines Serving Pads: PA 34-24 PA 31-26 PA 32-13 **PA 44-13**	Federal COC73094	T6S, R95W Sections 13, 24, 25, and 26	NSO for Steep Slopes (>50%) NSO for I-70 Viewshed CSU for Erosive Soils and Slopes Greater than 30% CSU for VRM Class II Areas Below the Rim CSU to Protect Special Status Plants/Habitat CSU to Protect Historic Properties/Resources TL for Big Game Winter Range (12/1 to 4/30) LN for Required COAs
RWF 23-19 Frac Pad RWF 21-18 Cuttings Storage	Federal COC62160	T6S, R94W Section 18	NSO for Steep Slopes (>50%) CSU for Erosive Soils and Slopes Greater than 30% CSU to Protect Special Status Plants/Habitat TL for Big Game Winter Range (12/1 to 4/30) TL for Raptor Nest Protection
PA 23-25 Frac Pad RWF 12-20 Tank Pad RWF 334-18 Cuttings Storage	Private Fee Lease	T6S, R94W Sections 18 and 20; T6S, R94W Section 25	Fee mineral leases – no Federal lease involvement

[1] For the Proposed Action, the off-lease portion of the PA 41-24 pad including the surface holes (in T6S, R94W, Section 19) is subject to BLM site ROW stipulations described in Roan Plateau land use plan, including a Timing Limitation for big game winter habitat (12/1-4/30).

3. PROPOSED ACTION AND ALTERNATIVES

3.1. PROPOSED ACTION

The Proposed Action is to drill, complete, produce, and operate 63 new directional oil and gas wells into Federal lease COC73094 from four new BLM pads (PA 34-24 Pad in Section 24, PA 31-26 Pad in Section 26, PA 41-24 Pad in Section 19, and PA 32-13 Pad in Section 13) (**Figure 1** and **Table 3**). Success of the proposed development would depend largely on factors out of Terra's control, such as

geologic conditions, economic factors, and commodity markets. Only Federal directional wells (i.e., no vertical or horizontal wells) are proposed for development in the BG2MDP.

Some of the existing road network may undergo minor upgrades while new road construction totaling 2.3 miles would be required for all pads except for the PA 41-24 pad. New buried gas gathering pipelines (5.3 miles in total length) would be installed to all four of the new drill pads to gather the expected gas volumes. Buried water and condensate (oil) collection lines would be installed to deliver produced fluids to the tank farm on the existing PA 22-25 Pad (for the PA 34-24 and PA 31-26 pads) and to the tank farm on the proposed RWF 12-20 Tank Pad (for the PA 41-24 and PA 32-13 pads). These fluid collection lines would generally be collocated in the same trench and buried with gas gathering pipelines alongside new and existing roads or, in the instance of the PA 34-24 collection lines, would be buried within an existing pipeline corridor.

Table 3. Surface and Bottomhole Locations of Proposed Federal Wells – Proposed Action

Pad Name	*Lease*	*Well Name*	*Surface Location*	*Bottomhole Location*
PA 34-24 Pad 11 wells (Federal surface / new pad)	COC73094	PA 412-24	Lot 4, Section 24, T6S R95W	SWNW Sec. 24 T6S R95W
		PA 22-24		SENW Sec. 24 T6S R95W
		PA 322-24		SENW Sec. 24 T6S R95W
		PA 422-24		SENW Sec. 24 T6S R95W
		PA 522-24		SENW Sec. 24 T6S R95W
		PA 323-24		NESW Sec. 24 T6S R95W
		PA 13-24		NWSW Sec. 24T6S R95W
		PA 313-24		NWSW Sec. 24 T6S R95W
		PA 513-24		NWSW Sec. 24 T6S R95W
		PA 413-24		NWSW Sec. 24 T6S R95W
		PA 14-24		SWSW Sec. 24 T6S R95W
PA 31-26 Pad 11 wells (Federal surface / new pad)	COC73094	PA 423-23	Lot 2, Section 26, T6S R95W	NESW Sec. 23 T6S R95W
		PA 314-23		SWSW Sec. 23 T6S R95W
		PA 414-23		SWSW Sec. 23 T6S R95W
		PA 24-23		SESW Sec. 23 T6S R95W
		PA 324-23		SESW Sec. 23 T6S R95W
		PA 424-23		SESW Sec. 23 T6S R95W
		PA 524-23		SESW Sec. 23 T6S R95W
		PA 443-23		NESE Sec. 23 T6S R95W
		PA 44-23		SESE Sec. 23 T6S R95W
		PA 344-23		SESE Sec. 23T6S R95W
		PA 444-23		SESE Sec. 23 T6S R95W
PA 41-24 Pad 13 wells (Federal surface / new pad)	COC73094	PA 31-24	Lot 6, Section 19, T6S R94W	NWNE Sec. 24 T6S R95W
		PA 331-24		NWNE Sec. 24 T6S R95W
		PA 431-24		NWNE Sec. 24 T6S R95W
		PA 531-24		NWNE Sec. 24 T6S R95W
		PA 21-24		NENW Sec. 24 T6S R95W
		PA 321-24		NENW Sec. 24 T6S R95W

Pad Name	*Lease*	*Well Name*	*Surface Location*	*Bottomhole Location*
		PA 421-24		NENW Sec. 24 T6S R95W
		PA 521-24		NENW Sec. 24 T6S R95W
		PA 443-13		NESE Sec. 13 T6S R95W
		PA 334-13		SWSE Sec. 13 T6S R95W
		PA 434-13		SWSE Sec. 13 T6S R95W
		PA-44-13		SESE Sec. 13 T6S R95W
		PA 344-13		SESE Sec. 13 T6S R95W
PA 32-13 Pad 28 wells (Federal surface / new pad)	COC73094	PA 41-13	SW¼NE¼, Section 13, T6S R95W	NENE Sec. 13 T6S R95W
		PA 341-13		NENE Sec. 13 T6S R95W
		PA 441-13		NENE Sec. 13 T6S R95W
		PA 42-13		SENE Sec. 13 T6S R95W
		PA 342-13		SENE Sec. 13 T6S R95W
		PA 442-13		SENE Sec. 13 T6S R95W
		PA 542-13		SENE Sec. 13 T6S R95W
		PA 21-13		NENW Sec. 13 T6S R95W
		PA 321-13		NENW Sec. 13 T6S R95W
		PA 421-13		NENW Sec. 13 T6S R95W
		PA 312-13		SWNW Sec. 13 T6S R95W
		PA 12-13		SWNW Sec. 13 T6S R95W
		PA 412-13		SWNW Sec. 13 T6S R95W
		PA 22-13		SENW Sec. 13 T6S R95W
		PA 322-13		SENW Sec. 13 T6S R95W
		PA 422-13		SENW Sec. 13 T6S R95W
		PA 23-13		NESW Sec. 13T6S R95W
		PA 323-13		NESW Sec. 13 T6S R95W
		PA 423-13		NESW Sec. 13 T6S R95W
		PA 523-13		NESW Sec. 13 T6S R95W
		PA 13-13		NWSW Sec. 13 T6S R95W
		PA 313-13		NWSW Sec. 13 T6S R95W
		PA 413-13		NWSW Sec. 13 T6S R95W
		PA 24-13		SENW Sec. 13 T6S R95W
		PA 324-13		SENW Sec. 13 T6S R95W
		PA 424-13		SENW Sec. 13 T6S R95W
		PA 43-13		NESE Sec. 13 T6S R95W
		PA 343-13		NESE Sec. 13 T6S R95W

The existing PA 23-25 Frac Pad on private surface would serve for well completion support for the new wells on the PA 34-24 and PA 31-26 pads. Surface steel frac lines would be laid between the PA 23-25 Frac Pad and the drill pads (PA 34-24 and PA 31-26) to deliver and flow back fluids for well completions. The existing RWF 23-19 Pad (which was expanded for frac pad use in Phase 1) would serve as a remote frac pad providing well completion support for the new wells on the PA 41-24 and PA 32-13 pads. Surface steel frac lines would be laid between the RWF 23-19 Pad and the drill pads (PA 41-24 and PA 32-13) to deliver and flow back fluids for well completions. The pad, road, and pipeline improvement work related to the four new drill pads, the support pads, the existing pads for cuttings

storage, and the tank farm would occur in advance of the forecasted drilling start dates shown in **Table 4**, which presents the overall plan for well development, specifically identifying the number of wells to be drilled by year.

Table 4. Balzac Gulch Phase 2 Developments and Drilling Schedule – Proposed Action

Pad Name	*Surface*	*Legal Description*	*Drilling Start*	*Proposed Future Wells (All Federal)*		
				2018	*2019*	*Totals*
Proposed PA 34-24 Pad	Federal	T6S, R95W Section 24	Sep 2018	11	0	11
Proposed PA 31-26 Pad	Federal	T6S, R95W Section 26	Nov 2018	11	0	11
Proposed PA 41-24 Pad	Federal	T6S, R94W Section 19	May 2019	0	13	13
Proposed PA 32-13 Pad	Federal	T6S, R95W Section 13	July 2019	0	28	28
Totals				**22**	**41**	**63**

Drilling a single directional well would take an average of 4.5 days. Drilling of the BG2MDP wells would commence in September 2018 on the PA 34-24 pad (11 wells), then move directly to the PA 31-26 pad (11 wells), with drilling ending in late December 2018. After a pause during winter 2019, drilling would again commence on the PA 41-24 pad (13 wells) in May 2019 and then finish out the second phase of development with drilling starting in July 2019 on the PA 32-13 pad (28 wells) and ending in December 2019. Development may be accelerated or delayed based on market conditions and company constraints. To accomplish the development plan shown in **Table 4**, Terra would need to request an exception to the timing limitation that protects big game winter habitat.

Simultaneous operations ("simops") would be employed, in which drilling and hydraulic fracturing (fracing) would occur at the same time on the well pads. Drilling and well completion timeframes would overlap with "simops" completion work generally beginning 30 days after the first well is spud and ending approximately 60 days after the final well is drilled on the pad. With "simops" jobs lasting 60 days after drilling, frac operations would continue until early March 2019 during the first year and early February 2020 for the second year of development based on **Table 4**. This would effectively shorten the non-operational break during the winter timing limitation period to two months in 2019 and three months in 2020.

Fresh water would be trucked to the new wells to augment drilling to ensure the proper consistency of drilling muds for maintaining well control during the drilling process. Fresh water would be obtained from authorized sources, typically through contractors who have their own legal source of water. Water used for well completions would be sourced primarily from Terra's water recycling program, drastically negating the use of fresh water for frac operations, and the recycled treated water would be delivered in Terra's existing water line systems, drastically reducing truck traffic on roads.

During simops, well completion equipment would manage recycled water, sand, and chemicals, and engines would operate from a remote location (private PA 23-25 or Federal RWF 23-19) to provide the necessary pressure for the hydraulic fracturing.

Surface welded steel pipelines would be laid between the drill pad and the remote frac pad delivering pressurized water to the wells to be completed and returning flowback water generated from the completed wells. The surface lines would be laid alongside roads or within pipeline corridors where feasible; a cross-country alignment would be proposed down the ridgeline between the PA 41-24 pad and the existing RWF 12-19 pad (**Figure 1**).

Terra's existing water management facilities and its water line infrastructure in the Anvil Points and Grand Valley areas would deliver recycled water for frac operations and collect frac flowback and produced water without using truck transports. Oil truck transports would periodically haul condensate developed from the wells and stored in the various tanks within the MDP area to offsite processing facilities.

3.1.1 BLM Right-of-Way Considerations for the Proposed Action

A series of ROWs would be required for Terra's proposed use of "off lease" portions of the BG2MDP developments to directly support the proposed oil and gas wells drilled into Federal lease COC73094.

The section line between Sections 18 and 19, T6S R94W, serves as the eastern edge of Federal lease COC73094 and crosses directly through the proposed PA 41-24 well pad. Since the wells planned on the PA 41-24 pad have surface holes on the east or "off lease" side of that lease line, a site ROW would be issued for the drilling, completions, and production activities of those 13 new wells. Approximately 1.16 acres of the 2.73-acre pad footprint occurs on the Section 19 "off lease" side of the PA 41-24 pad representing the extent of the well site ROW (**Table 5**) (**Figure 1**).

Table 5. BLM Rights-of-Way for BG2MDP Project – Proposed Action

Description of ROW	***ROW Area (acres)***	***ROW length (miles)***
Relating to the PA 41-24 Well Developments (T6S, R94W, Sections 18 and/or 19, 6th P.M.)		
Off-Lease Portion of PA 41-24 Well Pad (site ROW)	1.16 acres	N/A
10-inch Buried Gas Pipeline from Section 18/19 lease line to RWF 12-20 Tank Pad (linear ROW)	(9,400 feet x 50 feet) 10.79 acres	1.78 miles
2-inch Buried Condensate Line from Section 18/19 lease line to RWF 12-20 Tank Pad (linear ROW)	(9,400 feet x 50 feet) 10.79 acres	1.78 miles
4-inch Buried Produced Water Line from Section 18/19 lease line to RWF 12-20 Tank Pad (linear ROW)	(9,400 feet x 50 feet) 10.79 acres	1.78 miles
4.5-inch Surface Frac Lines (3) crossing Section 19 (linear ROW)	(4,472 feet x 50 feet) 5.13 acres	0.85 mile
Access Road from end of County Road to Section 18/19 lease line (linear ROW)	(4,686 feet x 25 feet) 2.69 acres	0.89 mile
Note: The ROW lengths reflect the actual distances of the roads and pipelines that cross BLM lands.		

The existing road serving the proposed PA 41-24 and PA 31-26 pads crosses BLM lands in Sections 18 and 19, which is outside the COC73094 lease boundary thereby requiring a BLM access road ROW for Terra to use and maintain the road. Garfield County claims jurisdiction on the segment of the existing access road from the Anvil Points Landfill turnoff on CR 246 to a point 2 miles north at the switchback near an unnamed drainage crossing north of the RWF 21-18 pad. A locked traffic control gate is at the switchback to restrict public travel beyond the gate – essentially the end of the county road jurisdiction.

The linear ROW would be authorized for the segment of BLM road beginning at the switchback/gate and ending at the lease boundary or section line for a length of about 4,686 feet (0.89 mile) (**Figure 1**).

A series of pipeline ROWs would be authorized for Terra's installation, use, and maintenance of the collocated buried pipelines transporting natural gas, produced water, and condensate developed from the PA 41-24 and PA 32-13 pads across BLM lands to the RWF 12-20 Tank Pad (**Table 5**) (**Figure 1**).

A 30-year-term ROW would be issued under authority of the MLA for the 10-inch-diameter welded steel natural gas gathering pipeline and a 2-inch fused flexpipe condensate line for delivering product to the RWF 12-20 Tank Pad on the valley floor. The ROW length for this MLA-based ROW would be 9,400 feet and the ROW would authorize the portions of gas and oil lines that cross BLM lands "off lease" in Sections 18 and 19.

The 4-inch fused flexpipe produced water delivery line between the PA 41-24 and the RWF 12-20 Tank Pad would be authorized under FLPMA (**Table 5**). Although authorized under different ROWs, the natural gas, produced water, and oil lines would be collocated in the same excavated trench and buried alongside the PA 41-24 access road (**Figure 1**). Both types of ROWs (MLA and FLPMA) would have a 30-year span. The width of the ROWs would be 25 feet maximum with 25 feet attributed to temporary workspace for the PA 41-24 access road and varying widths for the collocated pipelines (**Table 5**).

A short-term (3-year) ROW would be authorized for Terra's fabrication, use, and maintenance of three side-by-side welded steel (4.5-inch-diameter) high pressure surface frac lines that would deliver high pressure fluids to the target wells being completed and bring frac flowback fluids to the remote frac pad and its connection with Terra's waterline recycling infrastructure (**Table 5**). The 3-year temporary use permit would be authorized for the surface lines supporting well completion operations on the PA 41-24 and PA 32-13 wells, specifically covering the cross-country segment between the PA 41-24 and RWF 12-19 pads and the segment following the RWF 12-19 access road to the RWF 23-19 remote frac pad. The frac lines would be purged, pulled, and disassembled in 30-foot segments on nearby existing well pads after the simops frac operations are finished.

The remote frac operations proposed for the RWF 23-19 pad location would be covered under the previously authorized site ROW (COC78666) issued in the BGMDP Phase 1 development.

All portions of the buried pipelines transporting natural gas, produced water lines, and condensate as well as segments of surface frac lines that are installed within the limits of Federal lease COC73094 are considered lease actions under the MLA and authorized with the appropriate APD approval.

The COAs listed in **Appendix A** are effectively Resource Protection stipulations that would be attached as appropriate along with Solicitor-approved standard stipulations to the applicable BLM ROW grant.

3.1.2 General Project Design Considerations for the Proposed Action

The Proposed Action would include drilling and completion of the wells, production of natural gas, and associated liquid condensate (oil), proper handling and disposal of produced water and condensate, and interim and final reclamation.

During pad construction, topsoil would be stripped during the initial earthwork and windrowed, where feasible, around the outer edge of the disturbance perimeter to serve as stormwater diversions and catchments. Topsoil would remain windrowed and temporarily seeded until interim reclamation is scheduled after all wells on each pad are placed into production. During road and pipeline construction, topsoil would be segregated along both sides of the road or along one edge of the pipeline corridor for later placement back onto the reclaimed ROW.

The access roads would have a 20-foot running surface with additional width for drainage ditches and occasional vehicle turnouts. Typical new road and pipeline construction would occur within an average 50-foot-wide disturbance corridor.

Construction of pads, roads, and pipelines would follow the guidelines established in the BLM Gold Book, *Surface Operating Standards for Oil and Gas Exploration and Development* (USDI and USDA 2007). The new access roads would be graveled to ensure all-weather accessibility to the pad sites; existing roads would undergo review for spot-graveling needs. A road maintenance program would be required during the production phase of the wells. This program would include, but not be limited to blading, ditching, culvert installation and cleanout, weed control, and gravel surfacing where excessive rutting or erosion occur. Roads would be maintained in a safe and usable condition.

Terra intends to conduct a geotechnical review by a qualified engineer of the PA 32-13 and PA 34-24 pads before construction commences to examine soil characteristics and site stability factors and to ensure the pad construction layout properly addresses the review findings. Although a geotechnical review is typically sought prior to NEPA preparation and any project disturbance, BLM determined that the ground and vegetation disturbance needed to allow a tracked core-drilling rig to the isolated site was beyond the scope of "casual use." A COA in **Appendix A** addresses the timing and scope of the required geotechnical examination and incorporation of the knowledge gained into the pad construction once the APDs are approved and the road is pioneered for core-drilling equipment access.

A closed-loop drilling system would be used during drilling, eliminating the need for a fluid-containing reserve pit. Recovered drilling fluid would be stored on location in steel tanks for reuse. Drill cuttings would be collected from the drill rig's shaker system, mixed with drying agents, and deposited in the cuttings trench or piled on location against the cut slope for later burial during interim reclamation. The cuttings would be tested and remediated per Colorado Oil and Gas Conservation Commission (COGCC) regulations (Table 910-1 standards) prior to reshaping for interim reclamation. The drilling plan includes the use of a self-contained flare unit to restrict venting.

The proposed directional wells with an estimated production life of 40 years would target Federal fluid minerals underlying lease COC73094 within the Mesaverde and Williams Fork formations.

The proposed pipeline work (approximately 5.27 miles of buried pipelines and 3.89 miles of temporary surface frac lines) would generally be conducted within existing or new roadways or pipeline corridors with the exception of a cross-country segment of surface frac line that traverses north-south along the western half of Section 19. Strength testing of the pipeline would be accomplished initially by passing reinforced poly pigs through the inside of the line to clean it in sections. Segments of the line would be tested for strength using water, compressed air or nitrogen, pressurized and held for a set duration. The length of the tested sections would depend on topography and the progress of the installation work.

To protect buried steel pipelines from external corrosion, Terra uses pipe segments with external fusion-bond epoxy powder (FBE) coating and operates an impressed current cathodic protection (CP) system for all buried pipeline installations and operations. The CP system utilizes rectifiers connected to the piping and attached to an in-ground anode system acting as the pipelines' sacrificial anode. Additionally, pipelines are isolated from the well heads which prevents the CP from flowing back down hole into any well bores thereby further increasing the CP system's integrity. Standard best management practices would be implemented to ensure disturbed areas on pads, roads, and pipelines are reclaimed in a timely manner.

The 63 proposed Federal wells and related road and pipeline lease developments would be authorized by APDs and the off-lease road and pipeline developments would be authorized by ROW grants after BLM's environmental analysis is completed. COAs for APDs and Special Stipulations for ROWs addressing

applicable mitigation measures and best management practices are listed in **Appendices A and B**. Under the Proposed Action, Terra could implement all or any combination of the following BGMDP Phase 2 developments with the authorization of APDs and related ROWs. The Proposed Action would be implemented consistent with the Federal oil and gas leases, Federal regulations (43 CFR 3100), and the operational measures included in the APDs. The operator would be responsible for continuous inspection and maintenance of the access roads, pads, and pipelines.

3.1.3 Description of Specific Proposed Action Components

PA 34-24 Well Pad Construction and Operations

The PA 34-24 pad is a proposed 3.59-acre well pad on Federal surface (**Figure 2)**. Eleven bottomholes on Federal lease COC73094 are proposed. The new pad footprint would serve the new wells and production equipment. A cuttings trench would be excavated on the north side of the pad. A new access road (approximately 2,281 feet) would be constructed from the PA 41-25 Pad access road to the PA 34-24 Pad following Balzac Gulch. The road would require a 12-foot-diameter corrugated metal pipe (CMP) culvert at the Balzac Gulch drainage crossing. The existing 1.34-acre PA 23-25 Frac Pad on private surface would be used to remotely frac the proposed eleven Federal wells on the PA 34-24 pad. To support frac operations, two fused poly 10-inch temporary surface water supply lines (approximately 250 feet each) would be installed from the existing 10-inch water line to PA 23-25 Frac Pad to supply water to the location. Three 4.5-inch diameter welded steel temporary surface frac lines (approximately 5,403 feet) would be installed from the PA 23-25 Frac Pad to the PA 34-24 Pad following the existing pipeline easements and the new access road to the PA 34-24 Pad (**Figure 2**). The frac lines would operate under high pressure. The surface frac lines would be welded on pad, placed, pulled, and positioned on the ground; no specific surface disturbance would be allotted.

After drilling operations are finished, separator units (three quads/one vertical) would be staged near the center of the pad to help maximize interim reclamation of the pad perimeter. One 300-barrel blowdown tank would be installed at the southwest pad corner near the road entrance. Water and oil would be piped to the tanks on the PA 22-25 Pad (**Figure 2**).

A new 8-inch buried steel natural gas pipeline (approximately 5,120 feet) would be installed from the separators to the existing 12-inch gas pipeline near the PA 22-25 Pad (**Figure 2**). A new 4-inch flexpipe produced-water pipeline and 2-inch flexpipe oil pipeline (approximately 5,270 feet each) would be installed from the proposed separators to the tank battery on the PA 22-25 Pad. The pipeline easement would consist of a 25-foot permanent easement with an additional 15-foot-wide temporary workspace. Expanded workspace measuring 100 feet by 60 feet would be needed on both sides of the large drainage crossing adjacent to the 12-foot-diameter culvert to facilitate safe burial of the pipelines under the drainage. The gas, water, and oil pipelines would be collocated in the same trench with approximately 18-inch separation between pipes and a minimum 4 feet of cover. The new road and pipeline corridor, with an average disturbance width of 50 feet, would represent 5.88 acres of initial disturbance (2.46 acres on Federal surface and 3.42 acres on private surface).

Total initial disturbance for the PA 34-24 development would be 9.29 acres (6.05 acres on Federal surface and 3.78 acres on private surface). Total long-term disturbance for the PA 34-24 development would be 1.78 acres (1.12 acres on Federal surface and 0.66 acre on private surface). With storage tanks located offsite, the long-term disturbance footprint for the pad would be 0.71 acre after interim reclamation (**Table 6**).

A new 8-inch buried steel natural gas pipeline (approximately 5,120 feet) would be installed from the separators to the existing 12-inch gas pipeline near the PA 22-25 Pad (**Figure 2**). A new 4-inch flexpipe produced-water pipeline and 2-inch flexpipe oil pipeline (approximately 5,270 foot each) would be installed from the proposed separators to the tank battery on the PA 22-25 Pad.

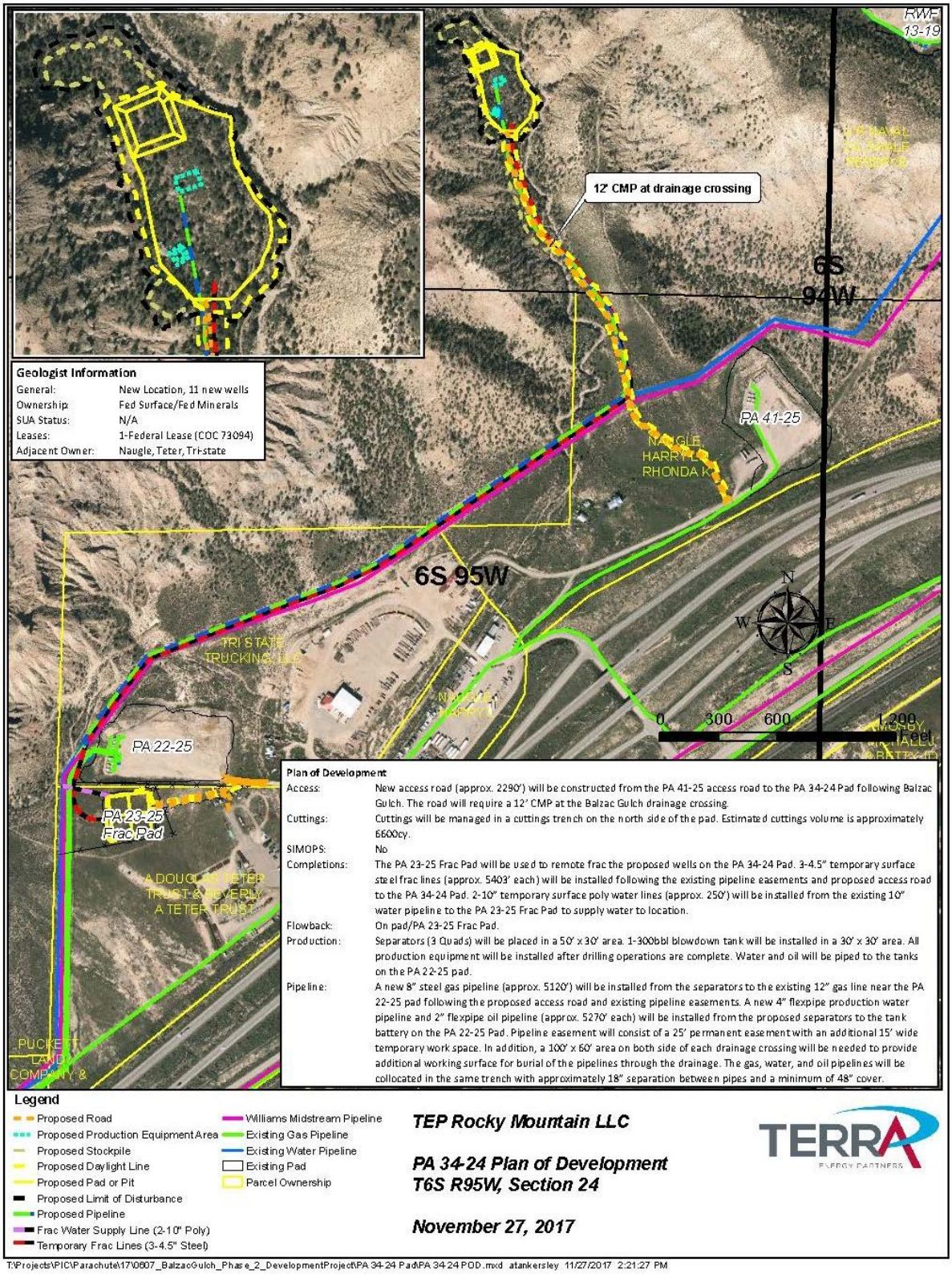


Figure 2. PA 34-24 Plan of Development

The pipeline easement would consist of a 25-foot permanent easement with an additional 15-foot-wide temporary workspace. An expanded workspace measuring 100 feet by 60 feet would be needed on both sides of the large drainage crossing adjacent to the 12-foot-diameter culvert to facilitate safe burial of the pipelines under the drainage. The gas, water, and oil pipelines would be collocated in the same trench with approximately 18-inch separation between pipes and a minimum 4 feet of cover. The new road and pipeline corridor, with an average disturbance width of 50 feet, would represent 5.88 acres of initial disturbance (2.46 acres on Federal surface and 3.42 acres on private surface).

Total initial disturbance for the PA 34-24 development would be 9.29 acres (6.05 acres on Federal surface and 3.78 acres on private surface). Total long-term disturbance for the PA 34-24 development would be 1.78 acres (1.12 acres on Federal surface and 0.66 acre on private surface). With storage tanks located offsite, the long-term disturbance footprint for the pad would be 0.71 acre after interim reclamation (**Table 6**).

PA 31-26 Well Pad Construction and Operations

The PA 31-26 Pad is a proposed 3.41-acre well pad on Federal surface (**Figure 3**). Eleven bottomholes on Federal lease COC73094 are proposed. The new pad footprint would serve the new wells and production equipment. A cuttings trench would be excavated on the north and west side of the pad. The cuttings trench would be constructed with 20-foot setback from the drainage. A new access road (approximately 4,795 feet) would be constructed from the PA 22-25 Pad to the PA 31-26 Pad following the existing two-track up the narrow valley. The proposed road would utilize the existing low water crossing which would be realigned and improved during construction. The proposed access road would be surfaced with 6 inches of gravel.

Separator units (three quads/one vertical) would be placed in the southwest corner of the pad after drilling operations are complete which maximizes interim reclamation opportunities. One 300-barrel blowdown tank would be installed at the south road entrance.

The existing 1.34-acre PA 23-25 Frac Pad on private surface would be used to remote frac the proposed 11 Federal wells on the PA 31-26 Pad. Three 4.5-inch welded steel surface frac lines (4,245 feet in length) would be laid alongside the PA 31-26 access road to deliver and collect fluids supporting the well completion operations. The lines would deviate from the proposed road near the drainage crossing to ensure pipelines are safely elevated and supported above the drainage (**Figure 3**). The surface frac lines would be welded on pad, placed and positioned on the ground; no specific surface disturbance would be allotted.

A new 8-inch buried steel natural gas pipeline (approximately 4,337 feet) would be installed from the units to the existing 12-inch gas pipeline near the PA 22-25 pad following the proposed access road. A new 4-inch flexpipe produced-water pipeline and 2-inch flexpipe oil pipeline (approximately 4,762 foot each) would be installed from the proposed separators to the tank battery on the PA 22-25 Pad. The pipeline easement would consist of a 25-foot permanent easement with an additional 15-foot-wide temporary workspace. Extra workspace (100-foot by 60-foot area) on both sides of the two drainage crossings would be needed to provide safe working room for burial of the pipelines through the drainages. The gas, water, and oil pipelines would be collocated in the same trench with approximately 18-inch separation between pipes and a minimum 4 feet of cover. The new road and pipeline corridor, with an average disturbance width of 50 feet, would represent 5.65 acres of initial disturbance (4.97 acres on Federal surface and 0.68 acre on private surface).

The total initial disturbance for the PA 31-26 development would be 9.06 acres (8.38 acres on Federal surface and 0.68 acre on private surface). Total long-term disturbance for the PA 31-26 development would be 2.94 acres (2.68 acres on Federal surface and 0.26-acre on private surface). With storage tanks located offsite, the long-term disturbance footprint for the pad would be 0.71 acre after interim reclamation (**Table 6**).

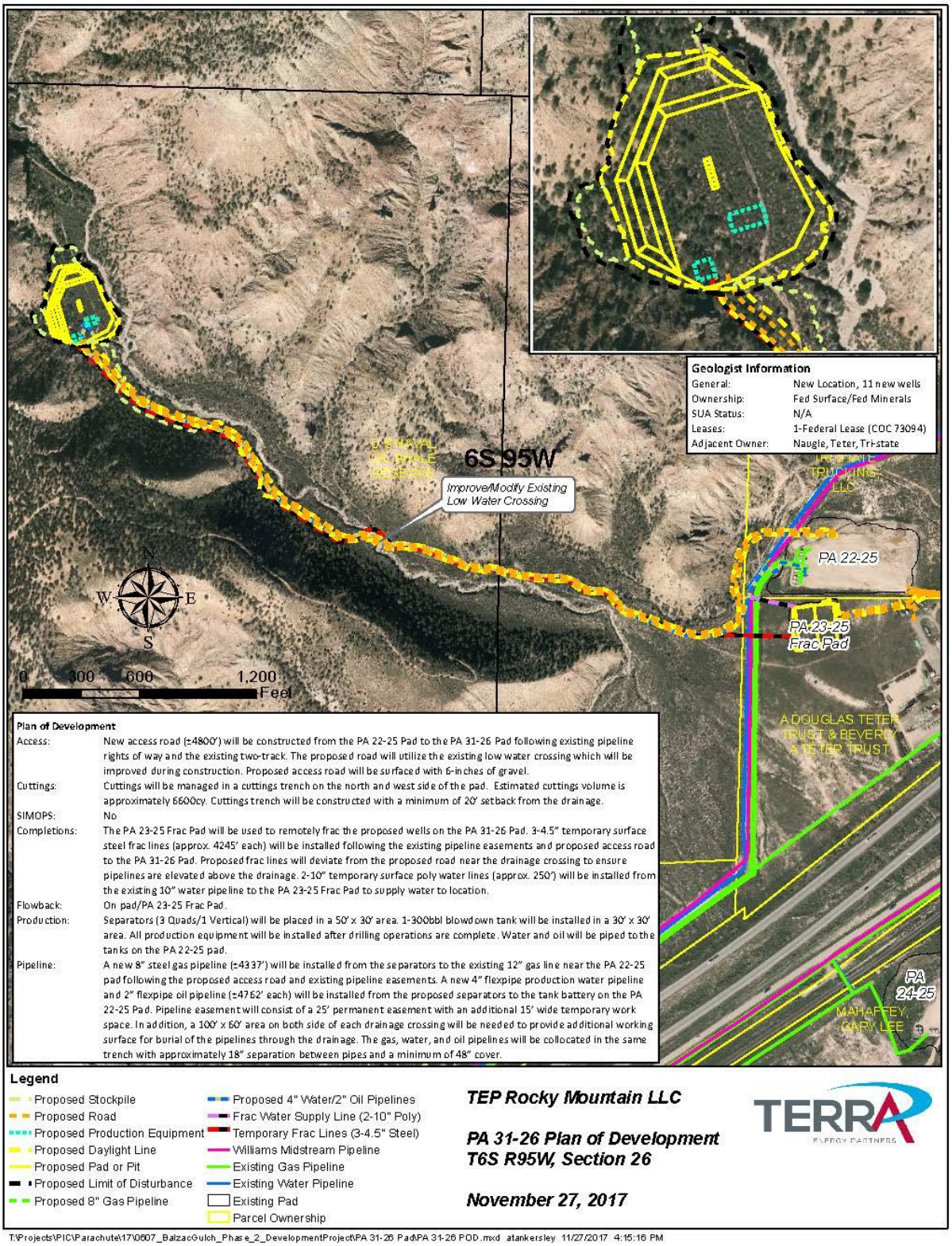


Figure 3. PA 31-26 Plan of Development

PA 23-25 Frac Pad Operations

The existing PA 23-25 Frac Pad would support remote frac operations for the eleven Federal wells on the PA 34-24 pad and the eleven Federal wells on the PA 31-26 pad (**Figure 1**). The primary power equipment and materials storage supporting the frac jobs would be located at the PA 23-25 Frac Pad and would deliver high-pressure fluids through the steel frac lines to the proposed wells at the PA 34-24 and the PA 31-26 Pads. The lines would also transport frac flowback fluids to the PA 23-25 Frac Pad for reuse or direct delivery into Terra's water gathering system. Two 10-inch temporary surface poly water lines (approximately 250 feet) would be installed from the existing 10-inch water pipeline to the PA 23-25 Frac Pad to supply water to the location. No new would be required to operate on the PA 23-25 Frac Pad.

PA 41-24 Well Pad Construction and Operations

The PA 41-24 Pad is a proposed 2.73-acre well pad on Federal surface (**Figure 4)**. Thirteen (13) bottomholes on Federal lease COC73094 are proposed; all of the proposed surface holes on this pad are physically located just east of the lease boundary in T6S, R94W Section 19. The new pad footprint would serve the new wells, production units and a blowdown tank. Cuttings would be hauled to the existing RWF 21-18 pad (Federal surface) and/or the existing RWF 334-18 Pad (private surface). The existing Anvil Points Road would provide access to the pad; no new road construction would be needed.

The existing RWF 23-19 pad on Federal surface was expanded to a 2.89-acre footprint during Phase 1 development and would be used to remotely frac the proposed thirteen Federal wells on the PA 41-24 Pad. To support fracing, two 10-inch temporary surface poly water lines (approximately 50 feet in length) would be installed from the proposed valve can adjacent to the RWF 23-19 Pad to the RWF 23-19 Pad. Three 4.5-inch steel temporary surface frac lines (approximately 4,762 feet each) would be installed between the RWF 23-19 Pad and the PA 41-24 Pad. Frac lines would be installed following the existing access road between the RWF 23-19 Pad and the RWF 12-19 Pad for approximately 1,750 feet and would then run cross-country for approximately 3,012 feet to the PA 41-24 Pad (**Figure 4**). The frac lines would operate under high pressure. The surface frac lines would be welded on pad, placed, pulled, and positioned on the ground; no specific surface disturbance would be allotted.

Separator units (three quads/one single/one vertical) would be staged in the southeast corner of the pad. One 300-barrel blowdown tank would be installed at the east edge of the pad. All production equipment would be installed after drilling operations are finished. Water and oil would be piped to the proposed RWF 12-20 Tank Pad (private surface) north of Anvil Points Compressor Station.

A new 10-inch buried steel natural gas pipeline, 4-inch flexpipe water pipeline, and 2-inch flexpipe oil pipeline (approximately 13,089 feet) would be installed from the separators to the proposed RWF 12-20 Tank Pad following existing roads. The gas, water, and oil pipelines would be collocated in the same trench with approximately 18-inch separation between pipes and a minimum 4 feet of cover. The new road and pipeline corridor, with an average disturbance width of 50 feet, would represent 9.82 acres of initial disturbance (6.76 acres on Federal surface and 3.06 acres on private surface).

The total initial disturbance for the PA 41-24 development would be 12.55 acres (9.49 acres on Federal surface and 3.06 acre on private surface). Total long-term disturbance for the PA 41-24 development would be 0.91 acre on Federal surface reflecting the long-term reclaimed PA 41-24 pad footprint (**Table 6**).

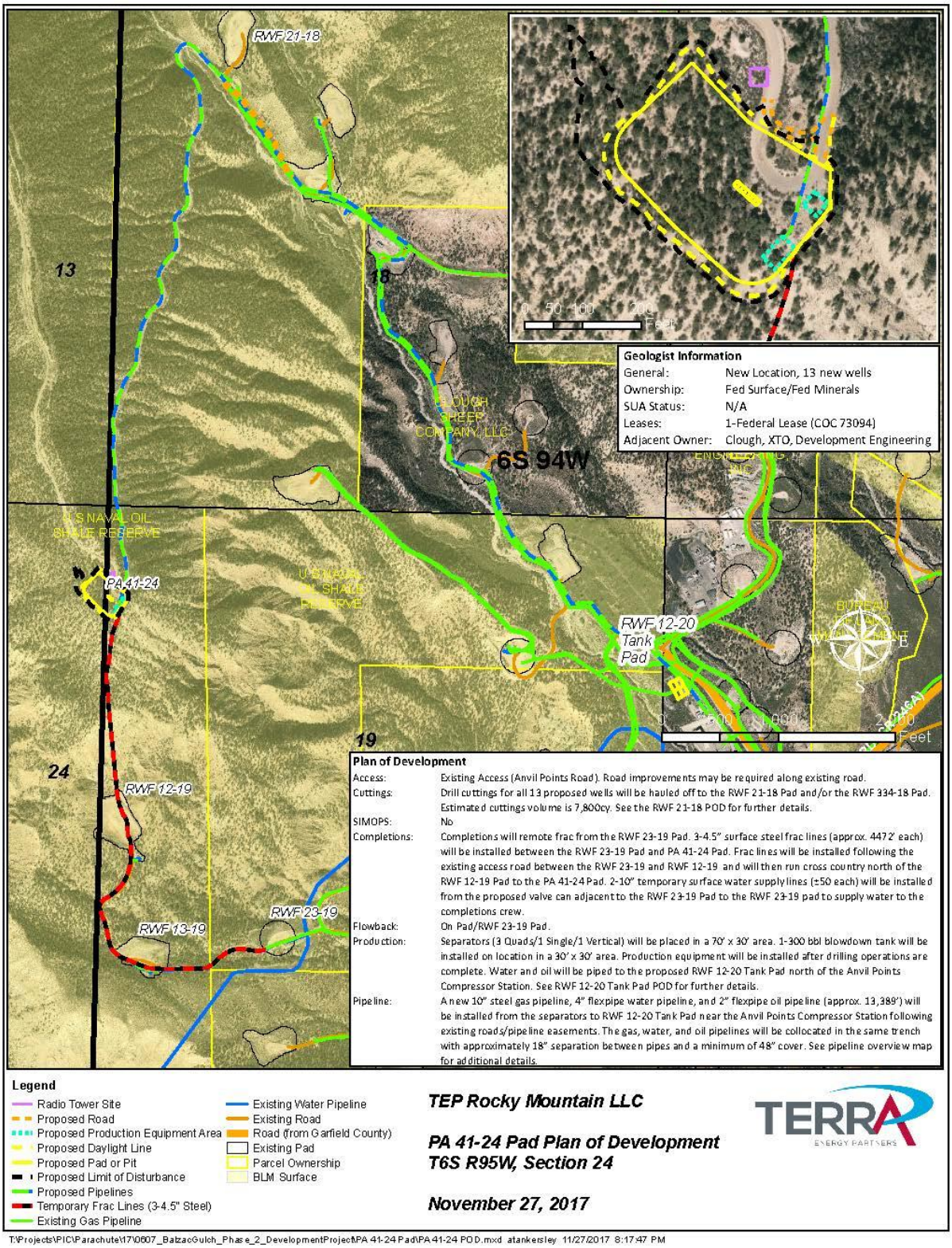


Figure 4. PA 41-24 Plan of Development

RWF 23-19 Frac Pad Operations

The RWF 23-19 Pad is an existing well pad constructed in 2004 on BLM land with four producing Federal wells (**Figure 4)**. It was expanded in spring 2018 to 2.89-acre footprint under the BGMDP development. The primary power equipment and materials storage supporting the frac jobs would be located at the RWF 23-19 Frac Pad and would deliver high-pressure fluids through the steel frac lines to the proposed wells at the PA41-24 and the PA 32-13 Pads. The remote well completion operations planned for this pad are authorized under BLM ROW grant COC78666, which was previously approved in the BGMDP development. With the recent pad expansion, no additional disturbance would be required to conduct remote well completions on the RWF 23-19 Frac Pad.

PA 32-13 Well Pad Construction and Operations

The PA 32-13 Pad is a proposed 2.75-acre well pad on Federal surface (**Figure 5**). Twenty-eight bottomholes are proposed on Federal lease COC73094. The new pad footprint would serve the new wells and production equipment. Cuttings would be hauled to the existing RWF 21-18 pad (Federal surface) and/or the RWF 334-18 pad (private surface). The existing Anvil Points Road would provide partial access and a new access road (approximately 3,751 feet) would be constructed from the PA 41-24 Pad to the PA 32-13 Pad.

The existing RWF 23-19 Frac Pad would be used to remote frac the proposed 28 Federal wells on the PA 32-13 Pad. Three 4.5-inch steel temporary surface frac lines (approximately 8,942 feet each) would be installed between the PA 32-13 Pad and the RWF 23-19 Pad. Frac lines would be installed from the PA 32-13 Pad to the PA 41-24 Pad following the proposed access road. The frac lines would be installed cross-country from the PA 41-24 Pad to the RWF 12-19 Pad and then follow the existing access road to the RWF 23-19 Pad. The PA 32-13 Production Support Pad would be constructed for offsite flowback equipment. Four 4.5-inch surface steel flowback lines (approximately 1,966 feet each) would be installed between the PA 32-13 Production Support Pad and the PA 32-13 Pad to support simops operations for the PA 32-13 wells. The surface frac lines would be welded on pad, placed, pulled, and positioned on the ground; no specific surface disturbance would be allotted.

Separator units (seven quads/one vertical) would be staged along the west side of the pad. Separators would be installed prior to drilling along with a temporary blowdown tank. The permanent blowdown tank (one 300-barrel) would be installed in northwest corner after drilling operations are complete to maximize interim reclamation. Water and oil would be piped to the proposed RWF 12-20 Tank Pad (private surface) north of Anvil Points Compressor Station.

A new 10-inch buried steel natural gas pipeline, 4-inch flexpipe water pipeline, and 2-inch flexpipe oil pipeline (approximately 4,694 feet each) would be installed from the separators to the PA 41-24 Pad following the proposed access road. Pipelines would tie-in to the proposed gas, water, and oil pipelines planned for the PA 41-24 Pad. The gas, water, and oil pipelines would be collocated in the same trench with approximately 18-inch separation between pipes and a minimum 4 feet of cover. The new road and pipeline corridor, with an average disturbance width of 50 feet, would represent 5.81 acres of initial disturbance on Federal surface.

Total initial disturbance for the PA 32-13 development would be 8.56 acres on Federal surface; total long-term disturbance would be 2.63 acres. With storage tanks located offsite, the long-term disturbance footprint for the pad would be 1.09 acres after interim reclamation (**Table 6**).

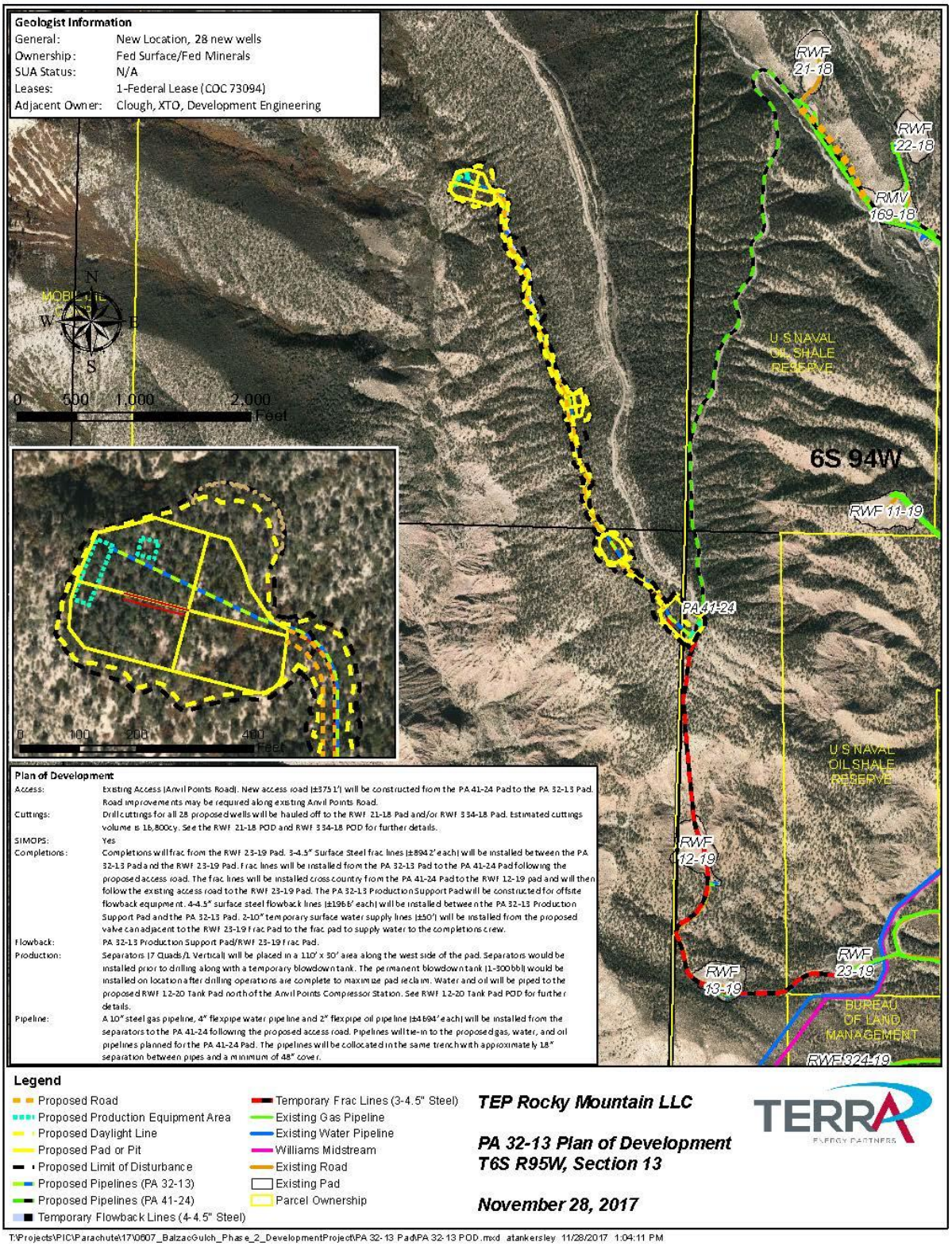


Figure 5. PA 32-13 Plan of Development

PA 32-13 Production Support Pad Construction and Use

The PA 32-13 Production Support pad is a proposed 1.83-acre pad on Federal surface (**Figure 6**). It would be constructed as a drive-through support facility along the access road to the PA 32-13 Pad to support flowback operations on the PA 32-13 Pad. Because of confining topography at the PA 32-13 well pad, pumps, temporary frac tanks, delivery storage, frac support equipment, and vehicles would use the Production Support Pad during the simops well completion operations for the PA 32-13 wells. Completions crew would remotely frac the 28 new Federal wells on the PA 32-13 Pad from the RWF 23-19 Pad with flowback support equipment placed on the PA 32-13 Production Support Pad. Four 4.5-inch surface steel flowback lines (approximately 1,966 feet each) would be installed along the access road between the PA 32-13 Production Support Pad and the PA 32-13 Pad.

The PA 32-13 Production Support Pad would be fully reclaimed following frac operations on the PA 32-13 pad with the exception of the access road and a truck turnout to allow vehicle passage along the east side of the access road. Long-term disturbance of this pad is estimated at 20 acres (**Table 6**).

PA 32-13 Operation Support Pad Construction and Use

The PA 32-13 Operation Support pad is a proposed 2.19-acre pad on Federal surface (**Figure 7).** It would be constructed as a drive-through support facility along the access road to the PA 32-13 Pad to support proposed drilling operations on the nearby PA 32-13 and the PA 41-24 Pads. This pad location would be used for equipment and material staging during drilling and completion and is necessary due to the reduced footprint of both the PA 32-13 Pad and the PA 41-24 Pad. The PA 32-13 Operation Support Pad would be fully reclaimed following drilling and completion on the PA 32-13 and PA 41-24 pads, with the exception of the access road and a truck turnout to allow vehicle passage along the east side of the access road. Long-term disturbance of this pad is estimated at 0.24 acre (**Table 6**).

RWF 21-18 Pad Expansion for Cuttings Storage

The RWF 21-18 Pad is an existing 1.16-acre well pad constructed in 2004 on BLM land (**Figure 8**). The pad, which is currently reclaimed, has 15 producing Federal wells. The pad would be redisturbed and expanded to a 3.01-acre footprint to accommodate cuttings storage developed from drilling the 41 wells on the PA 41-24 and PA 32-13 Pads. Cuttings would be buried in a cuttings trench to be excavated along the northern and western edges of the location. The existing cut slope along the southeast side of the pad would be laid back to reduce the slope of the existing cut, develop material to use to cap the cuttings trench, and improve the long-term interim reclamation of the pad. Total initial disturbance for the RWF 21-18 Pad would be 3.01 acres; total long-term disturbance on Federal surface would be 0.89-acre (**Table 6**).

RWF 334-18 Pad Expansion for Cuttings Storage

The RWF 334-18 Pad is an existing, interim reclaimed 0.45-acre well pad constructed in 2001 on private surface (**Figure 9**). It currently has two producing Fee wells. The pad would be expanded to a 2.65-acre footprint to accommodate cuttings storage developed from the drilling of 41 Federal wells from the PA 41-24 and PA 32-13 Pads. Cuttings would be buried in a cuttings trench to be excavated along the entire eastern extent of the location. Cuttings would be capped with clean material to a minimum depth of three feet. Total initial disturbance for the RWF 334-18 Pad would be 2.65 acres; total long-term disturbance would be 0.45-acre on Fee surface (**Table 6**).

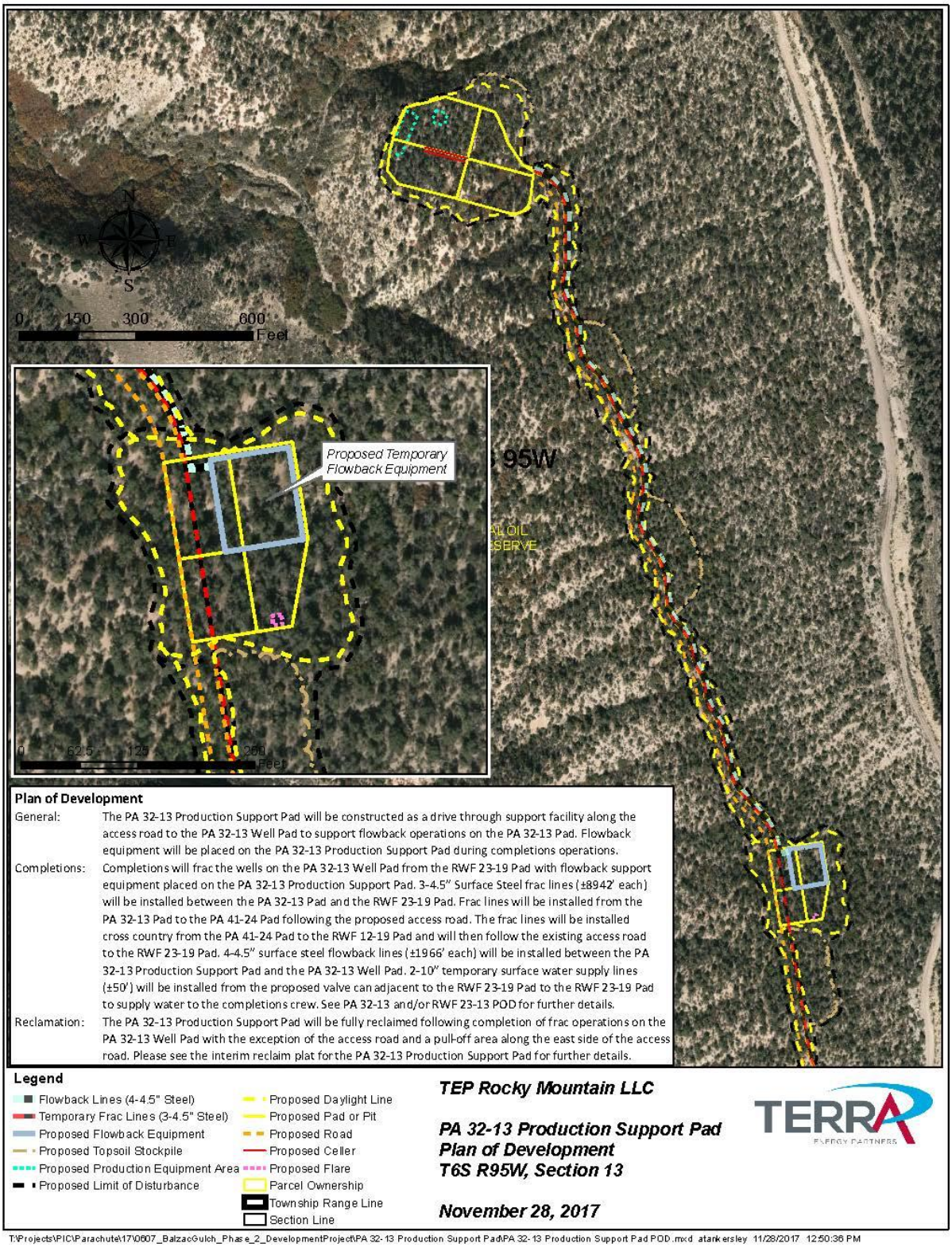


Figure 6. PA 32-13 Production Support Pad Plan of Development

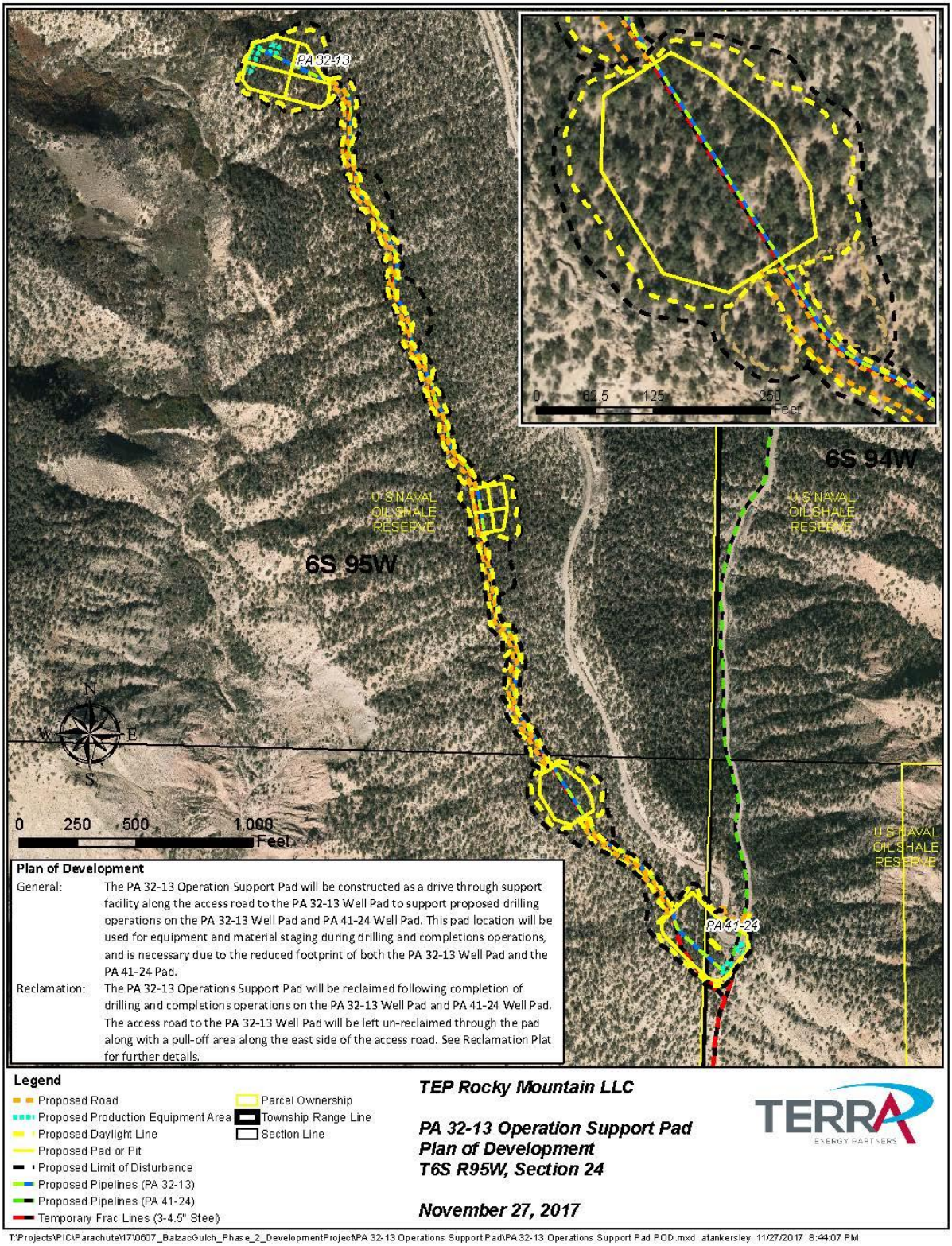


Figure 7. PA 32-13 Operation Support Pad Plan of Development

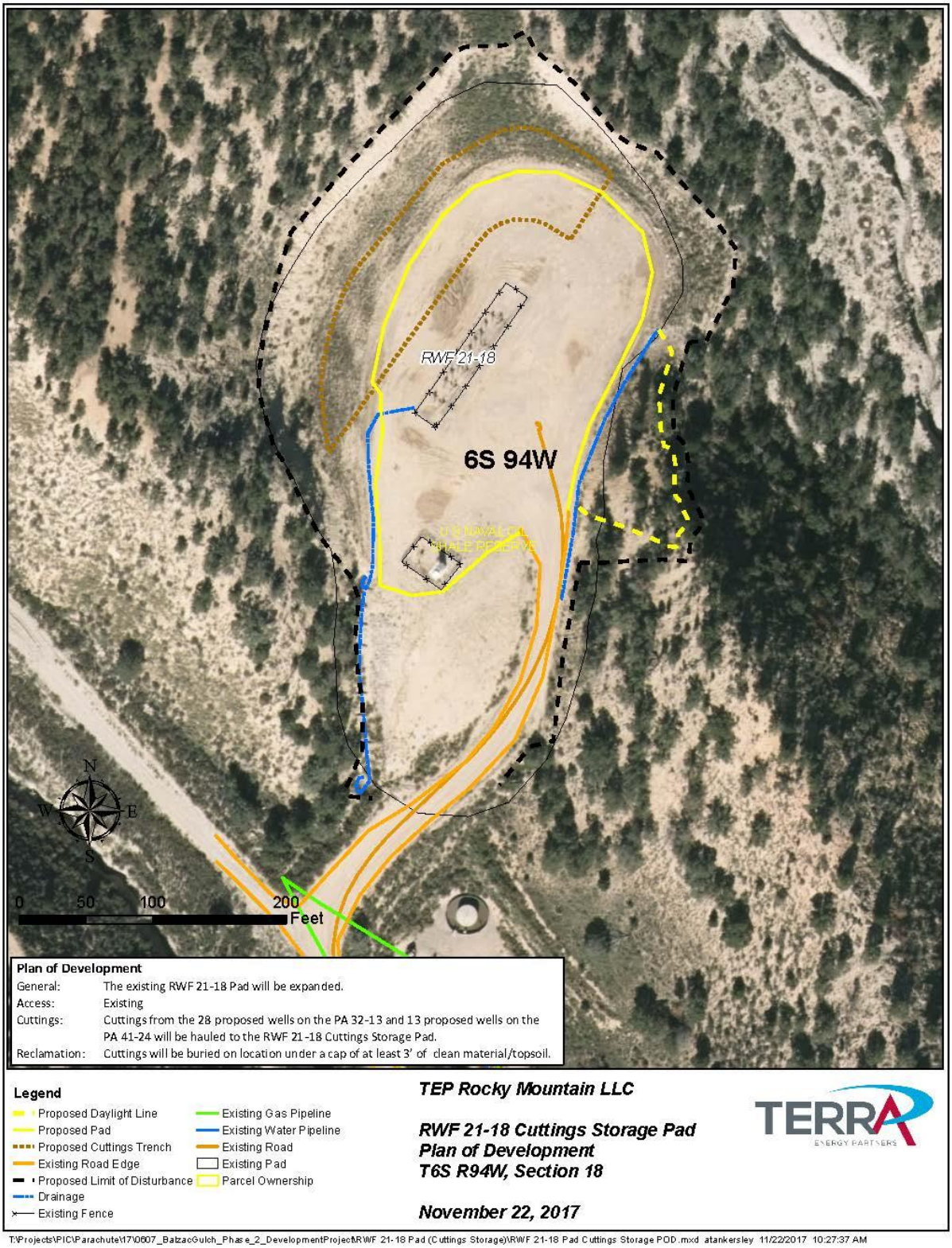


Figure 8. RWF 21-18 Cuttings Storage Pad Plan of Development

RWF 12-20 Tank Pad Construction and Operations

The proposed RWF 12-20 Tank Pad (0.99-acre) would be constructed on private surface on a previously disturbed storage yard and would be built adjacent to CR 246 just north of the Anvil Points Compressor Station (**Figure 10**). The tank pad would house eight 500-barrel upright steel tanks in a tank battery with lined metal containment walls to store condensate and water delivered through buried pipelines from the wells on the PA 32-13 and PA 41-24 pads. The existing paved CR 246 would directly access the storage tanks readily providing truck transport ingress and egress for oil sales from the condensate tanks. Produced water stored in the tanks would periodically be piped into Terra's buried water line system and the nearby water treatment facility. An Emissions Control Device (ECD) would be installed 75 feet south of the tank battery. Total initial disturbance for the RWF 12-20 Tank Pad would be 0.99 acre; total long-term disturbance would be 0.36 acre on Fee surface (**Table 6**). The tank farm would remain in operation for the life of the 41 Federal wells.

3.1.4 Summary List of the Proposed Action Components

Under the Proposed Action, Terra could implement all or any combination of the following BG2MDP developments with the authorization of APDs and related ROWs.

PA 34-24 Project Components (**Figure 2**):

- Construct the new PA 34-24 Pad with a 3.59-acre footprint to drill 11 new Federal wells.
- Construct a new access road (approximately 2,281 feet) from the junction with the PA 41-25 Pad access road and the proposed PA 34-24 Pad.
- Install two 10-inch temporary surface poly water supply lines (approximately 250 feet each) from the existing 10-inch water line connection to the PA 23-25 Frac Pad.
- Install three 4.5-inch steel temporary surface frac lines (approximately 5,403 feet) from PA 23-25 Frac Pad to the PA 34-24 Pad.
- Install 8-inch buried steel natural gas pipeline (approximately 5,120 feet) from the existing 12-inch natural gas line near the PA 22-25 Pad following the proposed access road and existing pipeline corridor the PA 34-24 Pad. Install 4-inch flexpipe produced-water line and 2-inch flexpipe oil line (approximately 5,270 feet) collocated with the 8-inch buried gas line from the tank battery on the PA 22-25 Pad to the PA 34-24 Pad.

PA 31-26 Project Components (**Figure 3**):

- Construct the new PA 31-26 Pad with a 3.41-acre footprint to drill 11 new Federal wells.
- Construct a new access road (approximately 4,795 feet) from the PA 22-25 Pad to the PA 31-26 Pad.
- Install three 4.5-inch steel temporary surface frac lines (approximately 4,245 feet) from the PA 23-25 Frac Pad to the PA 31-26 Pad.
- Install 8-inch buried steel natural gas pipeline (approximately 4,335 feet) from the existing 12-inch natural gas line near the PA 22-25 Pad following the proposed road to the PA 31-26 Pad.
- Install 4-inch flexpipe produced-water line and 2-inch flexpipe oil line (approximately 4,762 feet) collocated with the 8-inch buried gas line from the tank battery on the PA 22-25 Pad to the PA 31-26 Pad.

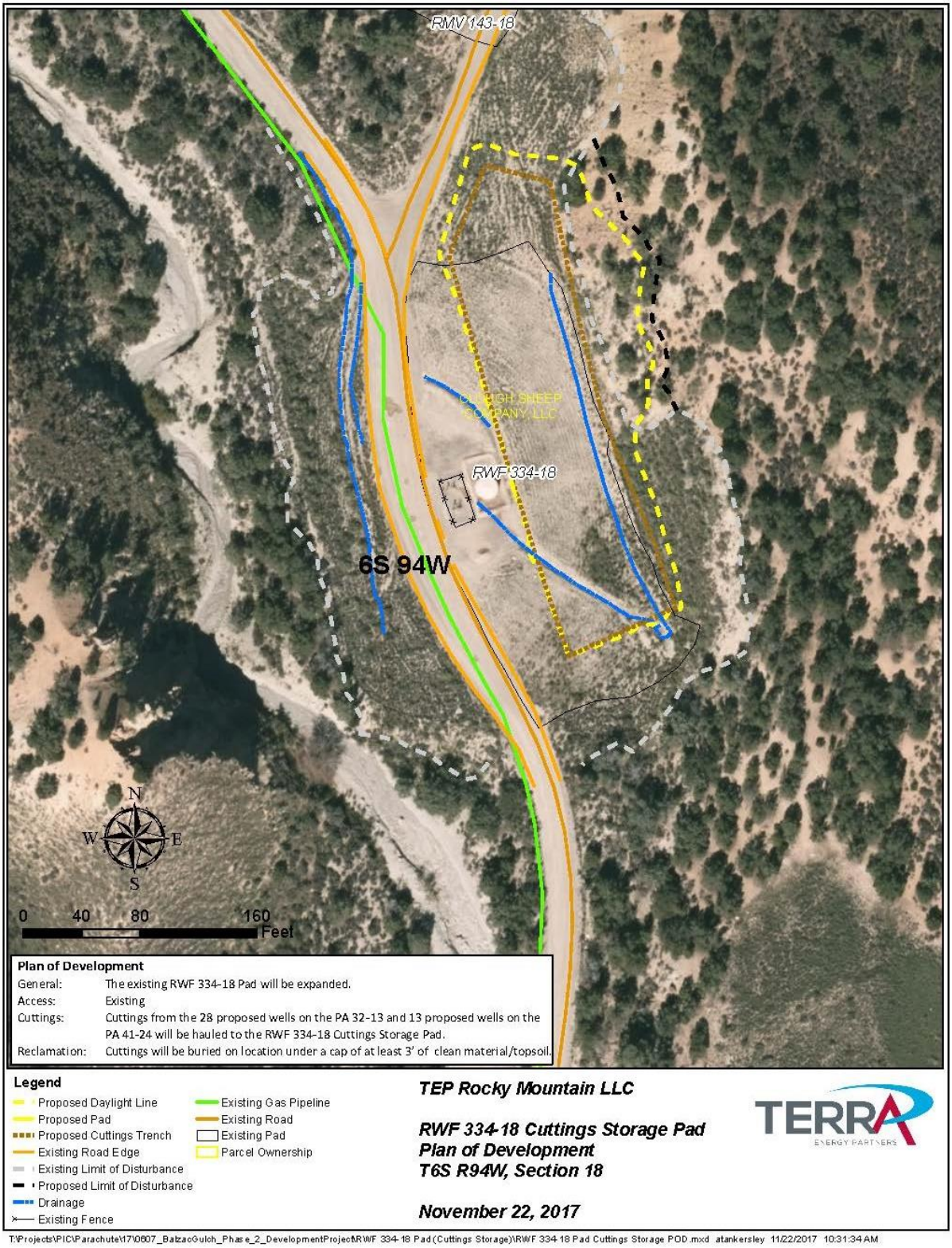


Figure 9. RWF 334-18 Cuttings Storage Pad Plan of Development

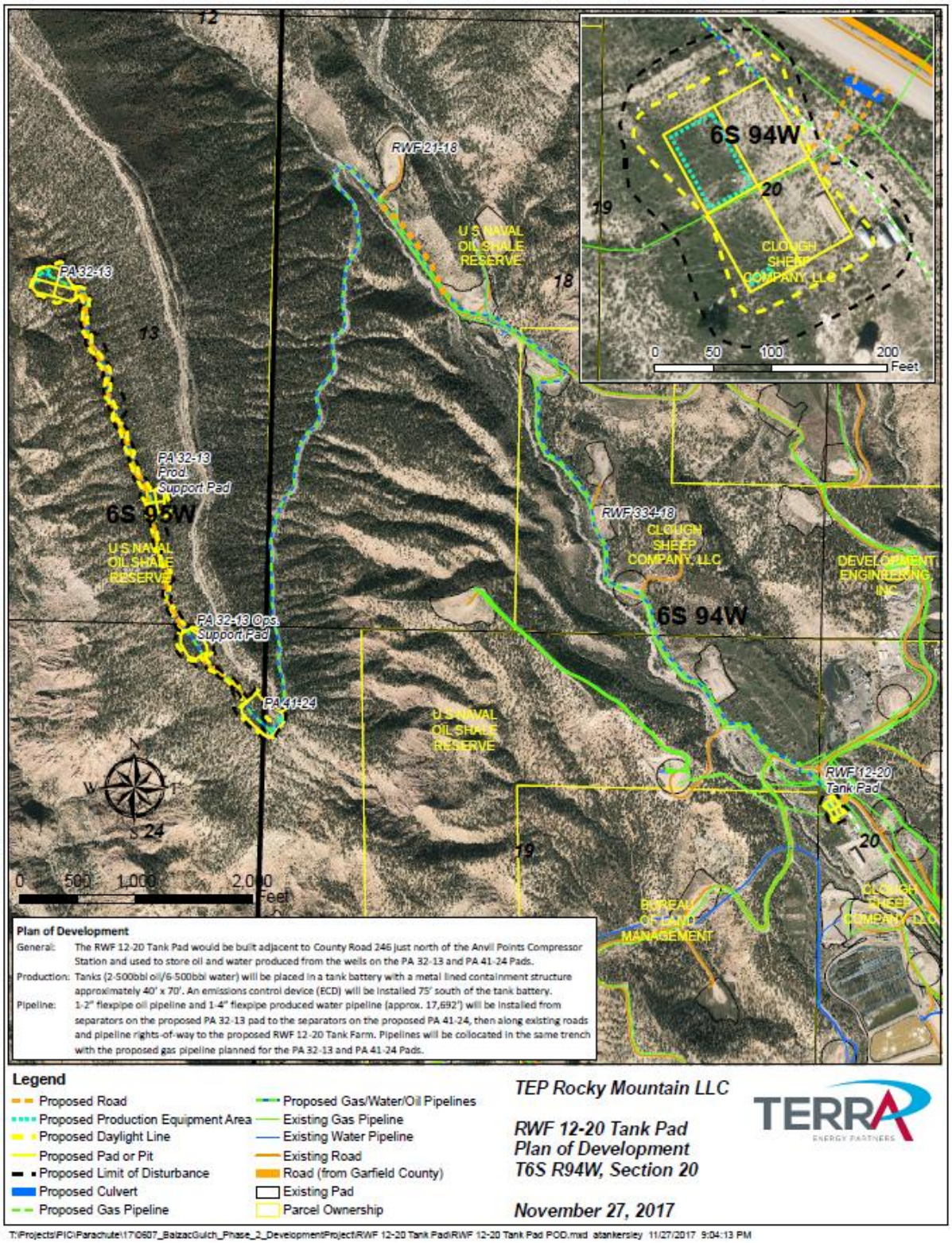


Figure 10. RWF 12-20 Tank Pad Plan of Development

PA 41-24 Project Components (**Figure 4**):

- Construct the new PA 41-24 Pad with a 2.73-acre footprint to drill 13 new Federal wells.
- Reinforce the low water crossing at the unnamed drainage near the locked traffic control gate at the end of the county road.
- Install two 10-inch temporary surface poly water supply lines (approximately 50 feet each) from the proposed valve can adjacent to the RWF 23-19 Pad to the RWF 23-19 Pad.
- Install three 4.5-inch steel temporary surface frac lines (approximately 4,762 feet) from RWF 23-19 Pad to the PA 41-24 Pad.
- Install 10-inch buried steel natural gas pipeline, 4-inch flexpipe produced-water line, and 2-inch flexpipe oil line (approximately 13,389 feet) collocated in the same trench from the RWF 12-20 Tank Pad following the existing roads and pipeline corridors to the PA 41-24 Pad.

PA 32-13 Project Components (**Figure 5**):

- Construct the new PA 32-13 Pad to a 2.75-acre footprint to drill 28 new Federal wells.
- Construct a new access road (approximately 3,751 feet) from PA 41-24 Pad to the PA 32-13 Pad.
- Install three 4.5-inch steel temporary surface frac lines (approximately 4,180) from the PA 41-24 Pad to the PA 32-13 Pad or 8,942 feet total length between the RWF 23-19 Pad and the PA 32-13 Pad.
- Install four 4.5-inch steel temporary surface flowback lines (approximately 1,966 feet) from the PA 32-13 Production Support Pad to the PA 32-13 Pad to support simops frac operations.
- Install 10-inch steel natural gas pipeline, 4-inch flexpipe produced-water line, and 2-inch flexpipe oil line (approximately 4,694 feet) from the PA 41-24 Pad following the proposed access road to the PA 32-13 Pad.

PA 32-13 Production Support Pad Component (**Figure 6**)

- Construct the new PA 32-13 Production Support Pad to a 1.83-acre footprint to support well completion work planned for the development of 28 new Federal wells on the PA 32-13 Pad

PA 32-13 Operation Support Pad Component (**Figure 7**)

- Construct the new PA 32-13 Operations Support Pad to a 2.19-acre footprint to support drilling operations for the 41 new Federal wells on the PA 41-24 and PA 32-13 Pads.

RWF 21-18 Pad (Cuttings Storage) Project Component (**Figure 8**):

- Expand the existing RWF 21-18 Pad on BLM to a 3.01-acre footprint to accommodate burial of cuttings from the 41 Federal wells on the PA 41-24 and PA 32-13 Pads.

RWF 334-18 Pad (Cuttings Storage) Project Component (**Figure 9**):

- Expand the existing RWF 334-18 Pad on private land to a 2.65-acre footprint to accommodate burial of cuttings from the 41 Federal wells on the PA 41-24 and PA 32-13 Pads.

RWF 12-20 Tank Pad Project Component (**Figure 10**):

- Construct the RWF 12-20 Tank Pad on private land (0.99-acre footprint with 90 feet of road) to provide storage for oil and water from the 41 Federal wells on the PA 41-24 and PA 32-13 Pads.

In summary, the four new well pads would develop a total of 63 wells along with associated access roads (10,917 feet or 2.06 miles), surface pipelines (20,556 feet or 3.89 miles) and pipelines (27,815 feet or 5.27 miles).

3.1.5 Summary of Surface Disturbance for the Proposed Action

Table 6 provides estimates of initial and long-term disturbance for the proposed developments. Initial disturbance includes the initial surface disturbance associated with the construction of four new well pads, expansion/construction of support pads, access roads, and pipelines. Once constructed, the well pads would be stabilized until the last well has been drilled and completed on the pad, at which time interim reclamation would occur.

Long-term disturbance is that portion of the initial disturbance that would remain during production of the wells (after interim reclamation), which includes the working area (unreclaimed portion) of the well pads that support production facilities and maintained roadways. A portion of the access road disturbance and all disturbance for pipelines would be reclaimed immediately after construction or within the next growing season.

The estimated initial and long-term disturbance for construction of four new well pads (PA 34-24, PA 31-26, PA 41-24, and PA 32-13), construction of the support pads (PA 32-13 Production Support pad and PA 32-13 Operation Support Pad), construction of the RWF 12-20 Tank Pad, and expansion of the RWF 21-18 Pad (cuttings storage), and RW 334-18 Pad (cuttings storage) is listed in **Table 6**. The estimated disturbance for ancillary roads and pipelines is also included in **Table 6**.

The estimates in **Table 6** include the proposed disturbances on Federal lands (BLM-administered lands) and private lands. The BG2MDP project would include 55.49 acres of short-term disturbance with 43.32 acres or 78% occurring on Federal land. Long-term disturbance would amount to 10.90 acres with 9.14 acres or 84% occurring on Federal lands. Approximately 39% of the disturbance in the Proposed Action would occur within existing disturbance or on land previously disturbed and reclaimed. Some of the proposed pipeline disturbance is not included in **Table 6** because it would occur within existing road disturbances. The construction of four new well pads supporting the 63 new Federal directional wells would result in construction of 2.06 miles of access roads, 5.27 miles of new natural gas, oil, and water pipelines, and 3.89 miles of temporary surface lines.

3.2. PREFERRED ALTERNATIVE

Based on comments received during the scoping of the Proposed Action, it was apparent that changes in the Proposed Action would be necessary to address the scoping concerns that were identified. The Preferred Alternative was developed by the operator to satisfy four primary concerns:

- Reduce impacts on steep slopes (>50%), particularly at the proposed PA 32-13 pad location by reducing the number of planned wells and thereby the overall pad footprint.
- Reduce potential visual impacts to the Garfield County communication tower by retaining the existing tree cover that surrounds the facility and removing a well pad from a prominent point in the landscape.
- Avoid potential impacts to big game winter range by planning drilling and completion work outside the winter months.
- Develop an escalated dual-rig drilling schedule to expedite the overall development period and reduce the duration of operational impacts on wildlife. A visual overview of the Preferred Alternative components is provided on **Figure 11**.

Table 6. Surface Disturbance for Components of the Proposed Action

Well Pad	*Surface Ownership*	*Length (feet) Federal/ Private [Total]*	*Existing Disturbance (acres) Federal/ Private [Total]*	*Re-disturbance (acres) Federal/ Private [Total]*	*New Disturbance (acres) Federal/ Private [Total]*	*Initial Disturbance (acres) Federal/ Private [Total]*	*Long-term Disturbance (acres) Federal/ Private [Total]*
WELL PADS/SUPPORT PADS							
PA 34-24	Federal		0/0	0/0	3.59/0	3.59/0	0.71/0
PA 31-26	Federal		0/0	0/0	3.41/0	3.41/0	0.71/0
PA 41-24	Federal		0.19/0	0/0	2.54/0	2.73/0	0.91/0
PA 32-13	Federal		0/0	0/0	2.75/0	2.75/0	1.09/0
PA 32-13 Production Support Pad	Federal		0/0	0/0	1.83/0	1.83/0	0.20/0
PA 32-13 Operations Support Pad	Federal		0/0	0/0	2.19/0	2.19/0	0.24/0
PA 23-25 Frac Pad [1]	Private		0/1.34	0/0	0/0	0/1.34	0/0
RWF 23-19 Frac Pad [1]	Federal		2.89/0	0/0	0/0	2.89/0	0/0
RWF 21-18 Cuttings Pad	Federal		1.16/0	1.68/0	0.17/0	3.01/0	0.89/0
RWF 334-18 Cuttings Pad	Private		0/0.45	0/2.03	0/0.17	0/2.65	0/0.45
RWF 12-20 Tank Pad	Private		0/0	0/0	0/0.99	0/0.99	0/0.36
Subtotal (Federal/Private)			**4.24/1.79 [6.03]**	**1.68/2.03 [3.71]**	**16.48/1.16 [17.64]**	**22.40/4.98 [27.38]**	**4.75/0.81 [5.56]**
ACCESS ROADS							
PA 34-24	Federal/ Private	950/1,331 [2,281]	0/0	0/0.05	1.13/0.97 [2.10]	1.13/1.02 [2.15]	0.41/0.62 [1.03]
PA 31-26	Federal/ Private	4,308/487 [4,795]	0/0	0/0.15	3.50/0.15 [3.65]	3.50/0.30 [3.80]	1.97/0.22 [2.19]
PA 41-24 [2]	Federal	0/0	0/0	0/0	0/0	0/0	0/0
PA 32-13	Federal	3,751/0	0/0	0/0	5.81/0	5.81/0	1.54/0
RWF 12-20 Tank Pad	Private	0/90	0/0	0/0	0/0.03	0/0.03	0/0.03

Well Pad	*Surface Ownership*	*Length (feet) Federal/ Private [Total]*	*Existing Disturbance (acres) Federal/ Private [Total]*	*Re-disturbance (acres) Federal/ Private [Total]*	*New Disturbance (acres) Federal/ Private [Total]*	*Initial Disturbance (acres) Federal/ Private [Total]*	*Long-term Disturbance (acres) Federal/ Private [Total]*
Subtotal (Federal/Private)		**9,009/1,908 [10,917]**	**0.15/0**	**0.07/0.20 [0.27]**	**11.14/1.15 [12.29]**	**11.36/1.35 [12.71]**	**4.39/0.87 [5.26]**
PIPELINES [3]							
PA 34-24 (8-inch gas line) (4-inch water line, and 2-inch oil line)	Federal/ Private	2,040/3,230 [5,270]	0/0.04	1.08/2.01 [3.09]	0.25/0.35 [0.60]	1.33/2.40 [3.73]	0/0.04
PA 31-26 (8-inch gas line) (4-inch water line, and 2-inch oil line)	Federal/ Private	4,085/677 [4,762]	0/0.04	0/0.34	1.47/0	1.47/0.38 [1.85]	0/0.04
PA 41-24 (10-inch gas line, 4-inch water line, and 2-inch oil line)	Federal/ Private	9,400/3,989 [13,389]	5.00/1.79 [6.79]	0.41/0.95 [1.36]	1.35/0.32 [1.67]	6.76/3.06 [9.82]	0/0
PA 32-13 (10-inch gas line, 4-inch water line, and 2-inch oil line) [4]	Federal	4,694/0	0/0	0/0	0/0	0/0	0/0
Subtotal (Federal/Private)		**20,219/7,896 [28,115]**	**5.00/1.87 [6.87]**	**1.49/3.30 [4.79]**	**3.07/0.67 [3.74]**	**9.56/5.84 [15.40]**	**0/0.08 [0.08]**
Grand Total (Federal/Private)			**9.39/3.66 [13.05]**	**3.24/5.53 [8.77]**	**30.69/2.98 [33.67]**	**43.32/12.17 [55.49]**	**9.14/1.76 [10.90]**

[1] Disturbances for the existing PA 23-25 Frac Pad and the existing RWF 23-19 Pad were previously analyzed in Balzac Gulch Phase 1 Project.
[2] Since the PA 41-24 pipelines would be buried within or alongside the existing PA 41-24 road, disturbance is allocated only under the Pipeline component.
[3] The longest length of collocated pipelines is shown in table.
[4] The new PA 32-13 road has disturbance acres allocated that include the collocated buried pipelines. Difference in lengths between road and pipelines is attributed to the road lengths being included in the pad footprints for the PA 41-24 and PA 32-13 support pads.

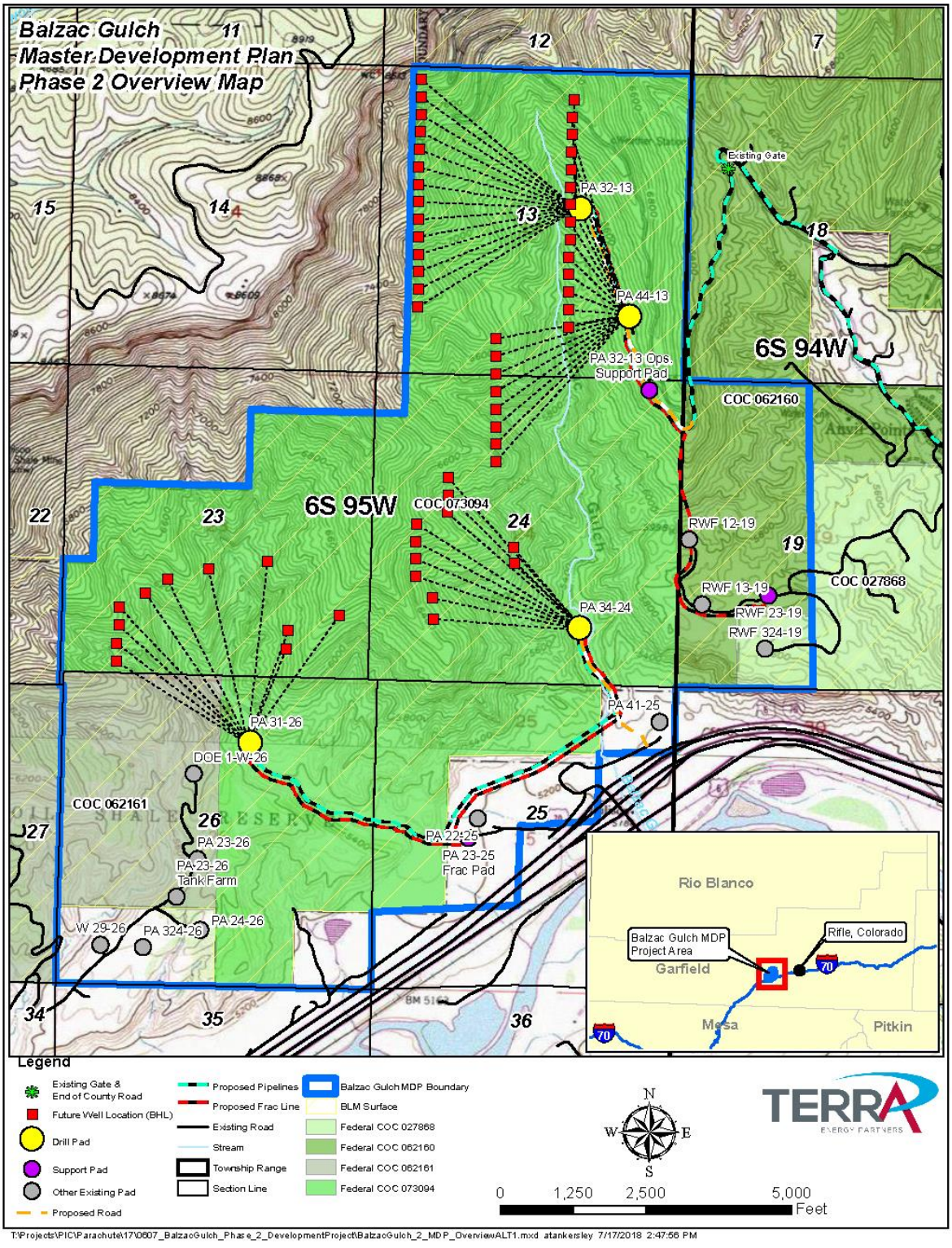


Figure 11. Balzac Gulch Phase 2 Master Development Plan Overview Map -- Preferred Alternative

The Preferred Alternative would involve five modifications of the Proposed Action that primarily pertain to the eastern portion of the project area. Other facets of the Preferred Alternative would be the same as those of the Proposed Action, including the western portion of the BG2MDP proposed development and the use of other pads to support general operations (PA 32-13 Operation Support Pad), frac operations (PA 23-25 and RWF 23-19), cuttings management (RWF 21-18 and RWF 334-18), and fluids storage (RWF 12-20).

The five primary project component changes in the Preferred Alternative are:

1. The PA 44-13 pad on BLM land (shown as the PA 32-13 Production Support Pad in the Proposed Action) would become the primary drill pad in the area and would reach 20 target bottomholes.
2. The PA 32-13 pad on BLM land would be reduced in size, allowing space for 16 wells (rather than 28 wells in the Proposed Action) to be drilled and developed in the northern reaches of the lease.
3. With the PA 44-13 site used as the primary drill pad, the Proposed Action's PA 41-24 pad with 13 wells on BLM land would be deleted from the Preferred Alternative.
4. The RWF 12-20 Tank Pad on private land would be slightly enlarged to provide more space for fluid storage at the tank battery, supporting the Balzac Gulch MDP Phase 1 and Phase 2 developments.
5. The development schedule would change, allowing two rigs to be drilling and completing wells during 2019 on an escalated timeframe so the BG2MDP wells could be drilled during the 2019 spring/summer/fall seasons and avoid the December 1-April 30 big game winter TL period.

In the Preferred Alternative, the total number of proposed wells would reduce to 58 (rather than 63 of the Proposed Action). **Table 7** provides the Preferred Alternative list of well pads with corresponding bottomholes to be developed from each pad location. The overall cuttings volume generated from 58 wells would be slightly less than that of 63 wells identified in the Proposed Action. The cuttings storage sites of the Preferred Alternative (RWF 21-18 and RWF 334-18 pads) would be the same as those serving the Proposed Action.

The narrative description in the Proposed Action covering drilling times, simops operations, freshwater use, and water recycling plans, the use of remote frac pads and surface frac lines remains applicable for the Preferred Alternative. However, simops would not be conducted on the PA 32-13 wells due to limited working space on the PA 32-13 drill pad.

Table 7. Surface and Bottomhole Locations of Proposed Federal Wells - Preferred Alternative

Pad Name	*Lease*	*Well Name*	*Surface Location*	*Bottomhole Location*
PA 34-24 Pad 11 wells (Federal surface / new pad)	COC73094	PA 412-24	Lot 4, Section 24, T6S R95W	SWNW Sec. 24 T6S R95W
		PA 423-24		NESW Sec. 24 T6S R95W
		PA 322-24		SWNW Sec. 24 T6S R95W
		PA 422-24		SWNW Sec. 24 T6S R95W
		PA 522-24		SWNW Sec. 24 T6S R95W
		PA 323-24		NESW Sec. 24 T6S R95W
		PA 13-24		NWSW Sec. 24T6S R95W
		PA 313-24		NWSW Sec. 24 T6S R95W
		PA 513-24		NWSW Sec. 24 T6S R95W
		PA 413-24		NWSW Sec. 24 T6S R95W
		PA 14-24		SWSW Sec. 24 T6S R95W

Pad Name	*Lease*	*Well Name*	*Surface Location*	*Bottomhole Location*
PA 31-26 Pad 11 wells (Federal surface / new pad)	COC73094	PA 423-23	Lot 2, Section 26, T6S R95W	NESW Sec. 23 T6S R95W
		PA 314-23		SWSW Sec. 23 T6S R95W
		PA 414-23		SWSW Sec. 23 T6S R95W
		PA 24-23		NESW Sec. 23 T6S R95W
		PA 324-23		SWSW Sec. 23 T6S R95W
		PA 424-23		SWSW Sec. 23 T6S R95W
		PA 524-23		NWSE Sec. 23 T6S R95W
		PA 443-23		NESW Sec. 23 T6S R95W
		PA 44-23		SESE Sec. 23 T6S R95W
		PA 344-23		SWSE Sec. 23T6S R95W
		PA 444-23		SWSE Sec. 23 T6S R95W
PA 32-13 Pad 16 wells (Federal surface / new pad)	COC73094	PA 11-13	SW¼NE¼, Section 13, T6S R95W	Lot 1, Sec. 13 T6S R95W
		PA 311-13		Lot 1, Sec. 13 T6S R95W
		PA 411-13		Lot 1, Sec. 13 T6S R95W
		PA 511-13		Lot 1, Sec. 13 T6S R95W
		PA 12-13		Lot 2, Sec. 13 T6S R95W
		PA 312-13		Lot 2, Sec. 13 T6S R95W
		PA 412-13		Lot 2, Sec. 13 T6S R95W
		PA 512-13		Lot 2, Sec. 13 T6S R95W
		PA 13-13		Lot 2, Sec. 13 T6S R95W
		PA 313-13		Lot 3, Sec. 13 T6S R95W
		PA 413-13		Lot 3, Sec. 13 T6S R95W
		PA 513-13		Lot 3, Sec. 13 T6S R95W
		PA 14-13		Lot 3, Sec. 13 T6S R95W
		PA 314-13		Lot 4, Sec. 13 T6S R95W
		PA 331-13		NWNE Sec. 13 T6S R95W
		PA 431-13		NWNE Sec. 13 T6S R95W
44-13 Pad 20 wells (Federal surface / new pad)	COC73094	PA 531-13	SW¼SE¼, Section 13, T6S R95W	NWNE, Sec. 13 T6S R95W
		PA 32-13		SWNE, Sec. 13 T6S R95W
		PA 332-13		SWNE, Sec. 13 T6S R95W
		PA 432-13		SWNE, Sec. 13 T6S R95W
		PA 532-13		SWNE, Sec. 13 T6S R95W
		PA 33-13		SWNE, Sec. 13 T6S R95W
		PA 333-13		NWSE, Sec. 13 T6S R95W
		PA 433-13		NWSE, Sec. 13 T6S R95W
		PA 533-13		NWSE, Sec. 13 T6S R95W
		PA 34-13		NWSE, Sec. 13 T6S R95W
		PA 334-13		SWSE, Sec. 13 T6S R95W
		PA 434-13		SWSE, Sec. 13 T6S R95W
		PA 324-13		SESW, Sec. 13 T6S R95W
		PA 424-13		SESW, Sec. 13 T6S R95W
		PA 524-13		SESW, Sec. 13 T6S R95W
		PA 21-24		NENW, Sec. 24 T6S R95W
		PA 321-24		NENW, Sec. 24 T6S R95W
		PA 421-24		NENW, Sec. 24 T6S R95W
		PA 521-24		NENW, Sec. 24 T6S R95W
		PA 22-24		SENW, Sec. 24 T6S R95W

Table 8 provides a drilling schedule that summarizes the Preferred Alternative project components with specific changes from the Proposed Action indicated in bold text. To avoid potential impacts to big game during the winter, the drilling schedule of the Preferred Alternative has been developed outside of the December 1 through April 30 big game timing limitation period. As previously noted, the Preferred Alternative schedule includes two drilling rigs with simops operations concurrently developing wells on an escalated timeframe in order for the BG2MDP wells to be drilled during 2019.

Table 8. Balzac Gulch Phase 2 Developments and Drilling Schedule - Preferred Alternative

Pad Name	*Surface*	*Legal Description*	*Drilling Start*	*Proposed Future Wells (All Federal)*		
				2018	*2019*	*Totals*
Proposed PA 34-24 Pad	Federal	T6S, R95W Section 24	July 2019	0	11	11
Proposed PA 31-26 Pad	Federal	T6S, R95W Section 26	Sep 2019	0	11	11
Proposed PA 44-13 Pad	Federal	T6S, R95W Section 13	May 2019	0	20	20
Proposed PA 32-13 Pad	Federal	T6S, R95W Section 13	Sep 2019	0	16	16
Totals				**0**	**58**	**58**

3.2.1 BLM Right-of-Way Considerations for Preferred Alternative

A series of ROWs would be authorized for Terra's proposed use of "off lease" portions of the BG2MDP developments to directly support the proposed oil and gas wells drilled into Federal lease COC73094.

The section line between Sections 18 and 19, T6S R94W, serves as the eastern edge of Federal lease COC73094. In the Preferred Alternative, the PA 41-24 pad has been replaced by the new PA 44-13 pad negating the need for a site ROW to be issued for the PA 41-24 well site (**Figure 11**). However, in the Preferred Alternative, there would be a series of linear ROWs issued to the operator authorizing the existing access road and buried/surface pipelines (**Table 9**). The length and description of the linear ROWs remains unchanged from that provided in the Proposed Action (see applicable ROW descriptions in **Section 3.2**).

Table 9. BLM Rights-of-Way for BG2MDP Project – Preferred Alternative

Description of ROW	*ROW Area (acres)*	*ROW length (miles)*
Relating to the PA 44-13 and PA 32-13 Developments in T6S, R94W, Sections 18 and/or 19, 6th P.M.		
10-inch Buried Gas Pipeline from Section 18/19 lease line to RWF 12-20 Tank Pad (linear ROW)	(9,400 feet x 50 feet) 10.79 acres	1.78 miles
2-inch Buried Condensate Line from Section 18/19 lease line to RWF 12-20 Tank Pad (linear ROW)	(9,400 feet x 50 feet) 10.79 acres	1.78 miles
4-inch Buried Produced Water Line from Section 18/19 lease line to RWF 12-20 Tank Pad (linear ROW)	(9,400 feet x 50 feet) 10.79 acres	1.78 miles

4.5-inch Surface Frac Lines (3) crossing Section 19 (linear ROW)	(4,472 feet x 50 feet) 5.13 acres	0.85 mile
Access Road from end of County Road to Section 18/19 lease line (linear ROW)	(4,686 feet x 25 feet) 2.69 acres	0.89 mile
Note: The ROW lengths reflect the actual distances of the roads and pipelines that cross BLM lands.		

The COAs listed in **Appendix A** are effectively Resource Protection stipulations that would be attached as appropriate along with Solicitor-approved standard stipulations to the applicable BLM ROW grant.

3.2.2 General Preferred Alternative Design Considerations

The entire description of project design considerations in the Proposed Action applies directly to the Preferred Alternative project components with the exception that geotechnical investigations would be conducted for PA 34-14, PA 44-13, and PA 32-13 well sites. A COA in **Appendix A** addresses the timing and scope of the required geotechnical examination and incorporation of the knowledge gained into the pad construction once the APDs are approved and the road is pioneered for core-drilling equipment access. Standard best management practices would be implemented to ensure disturbed areas on pads, roads, and pipelines are reclaimed in a timely manner.

The 58 proposed Federal wells and related road and pipeline lease developments would be authorized by APDs and the off-lease road and pipeline developments would be authorized by ROW grants after BLM's environmental analysis is completed. COAs for APDs and Special Stipulations for ROWs addressing applicable mitigation measures and best management practices are listed in **Appendices A and B**. Under Alternative1, Terra could implement all or any combination of the following BGMDP Phase 2 developments with the authorization of APDs and related ROWs. The Proposed Action would be implemented consistent with the Federal oil and gas leases, Federal regulations (43 CFR 3100), and the operational measures included in the APDs. The operator would be responsible for continuous inspection and maintenance of the access roads, pads, and pipelines.

3.2.3 Description of Specific Project Components for Preferred Alternative

The following descriptions cover the component changes in the Preferred Alternative.

PA 44-13 Well Pad Construction and Operations, Preferred Alternative

The proposed PA 44-13 well pad of the Preferred Alternative would be built at the same location of the Proposed Action's PA 32-13 Production Support Pad, although the new pad footprint would be expanded to accommodate 20 wells (**Figures 12 and 13**). The PA 44-13 pad would support the bottomholes shifted from the deleted PA 41-24 pad and the downsized PA 32-13 pad. The PA 44-13 pad would have a short-term disturbance footprint of 4.13 acres with a long-term disturbance of 1.12 acres.

A key factor in suitably siting the pad along the sandstone bench is to use a continuous ¼:1 fillslope along the entire west edge to avoid 50% slopes. The fillslope of the PA 41-24 pad would be designed and constructed using geogrid materials and compacted lifts with the specifications determined from the results of planned geotechnical soil testing and core drilling. The pad cutslope would remain at a 1½:1 grade to maintain slope stability. To provide adequate space to drill 20 directional wells and conduct well completion work on the pad, the separators and blowdown tank would be staged along an extended length of the pad adjacent to the access road. Topsoil from the PA 44-13 pad footprint would be hauled and stored along the access road, where flatter areas away from drainages allow.

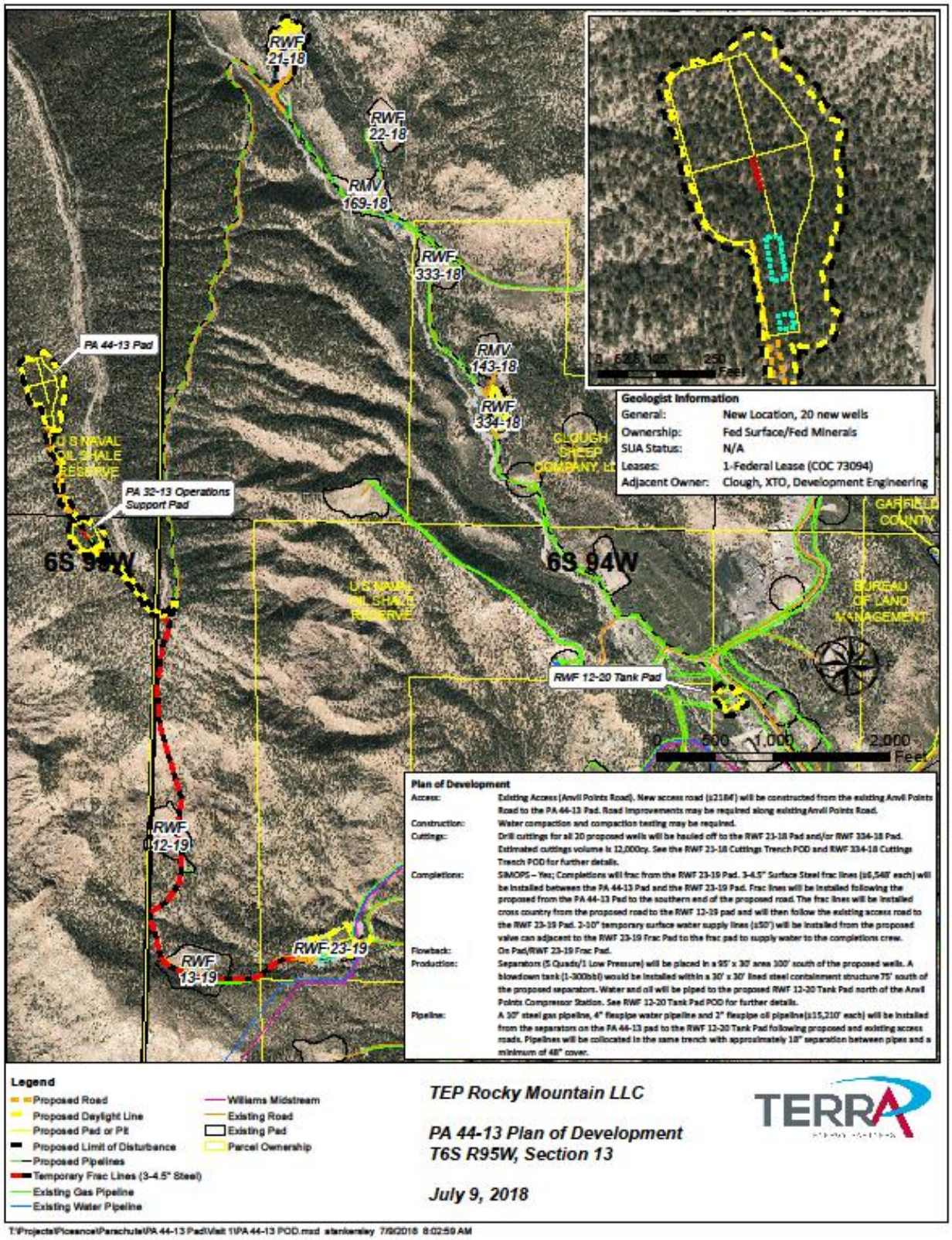


Figure 12. PA 44-13 Plan of Development – Preferred Alternative

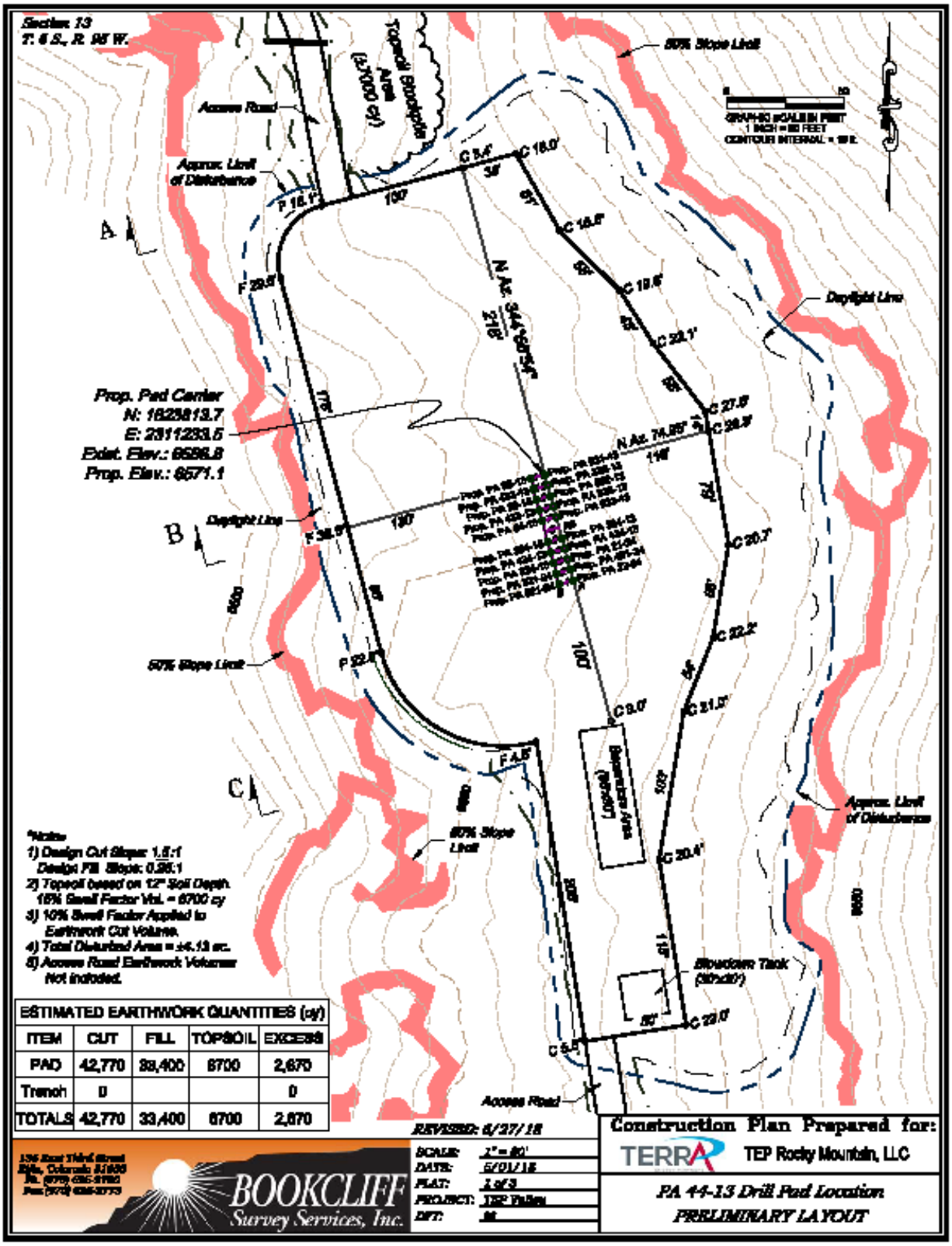


Figure 13. Construction Layout for the PA 44-13 Pad – Preferred Alternative

A new access road (approximately 2,184 feet) would be constructed from the county communication tower northwest along a narrow bench east of Balzac Gulch through the proposed PA 32-13 Operations Support Pad to the PA 44-13 Pad. The roadway would cross numerous side drainages where culverts would be installed with functioning stormwater controls. These culvert crossings, combined with gravel surfacing and road drainage structures such as ditches with rock check dams and armoring, would serve as erosion control structures mitigating potential soil erosion impacts to the drainages, including the few areas with sideslopes exceeding 50% slope (**Appendix C**).

A new 10-inch buried steel natural gas pipeline, 4-inch flexpipe water pipeline, and 2-inch flexpipe oil pipeline (approximately 15,211 feet) would be installed from the separators on the PA 44-13 Pad alongside and within the PA 44-13 access road and the existing Anvil Points Road to the RWF 12-20 Tank Pad. The gas, water, and oil pipelines would be collocated in the same trench with approximately 18-inch separation between pipes and a minimum 4 feet of cover. The new road and pipeline corridor would represent 13.66 acres of initial disturbance on Federal surface. Extra space has been allotted for topsoil storage along the access road corridor.

Three welded steel surface frac lines would be installed alongside the PA 44-13 road south cross-country to the RWF 12-19 pad and then alongside the existing road to the RWF 23-19 pad for a distance of 6,548 feet. The lines would provide delivery and collection of fluids supporting remote frac operations.

Total initial disturbance for the PA 44-13 development would be 17.79 acres on Federal surface; total long-term disturbance would be 1.95 acres. With storage tanks located offsite, the long-term disturbance footprint for the pad would be 1.12 acres after interim reclamation (**Table 10**).

PA 32-13 Well Pad Construction and Operations, Preferred Alternative

The revised PA 32-13 pad would support 16 directional wells, a reduction of 12 wells from the 28 wells slated in the Proposed Action. The reduced PA 32-13 pad footprint (2.25 acres of new interim disturbance) would eliminate the southeast corner of the pad, thereby avoiding the lengthy culvert placement in the drainage and pad construction that would impact sideslopes exceeding 50%. The reduced pad footprint would avoid nearly all slopes over 50%, except in one small area on the south central edge of the pad (**Figures 14 and 15**). The small area exceeding 50% would be inundated by the pad fillslope construction. The entire length of the pad fillslope would be designed with a 0.5:1 slope using geogrid materials and compacted lifts (details formulated from planned geotechnical soil testing and core drilling) to create a stable, yet steeper fillslope, reduce fillslope disturbance area, and essentially avoid the surrounding steep slope constraints. Mitigation measures and best management practices would be implemented to manage and control erosion from the pad construction work.

The culvert to be installed in the drainage at the road entrance to the pad would be drastically shortened to accommodate the 20-foot travelway width. To allow truck staging near the pad entrance, the road would be widened with a truck turnout area south of the planned culvert. The proposed cut slope of the pad would remain at 1.5:1 but would be extended in length with the reconfigured, shifted pad footprint of the Preferred Alternative. Topsoil stripped from the PA 32-13 pad would be hauled to defined storage areas along the new road alignment. The PA 32-13 pad would comprise 0.83 acre of long-term disturbance after interim reclamation.

The buried gas pipeline between the PA 32-13 and PA 44-13 pads (approximately 2,564 feet in length) would be changed to an 8-inch-diameter welded steel line (rather than a 10-inch-diameter welded steel pipeline of the Proposed Action). The gas pipeline from the PA 44-13 pad to the market line connection near the RWF 12-20 Tank Pad would remain as a 10-inch-diameter welded steel line. The produced water and condensate lines would generally be the same length as the collocated with the gas line.

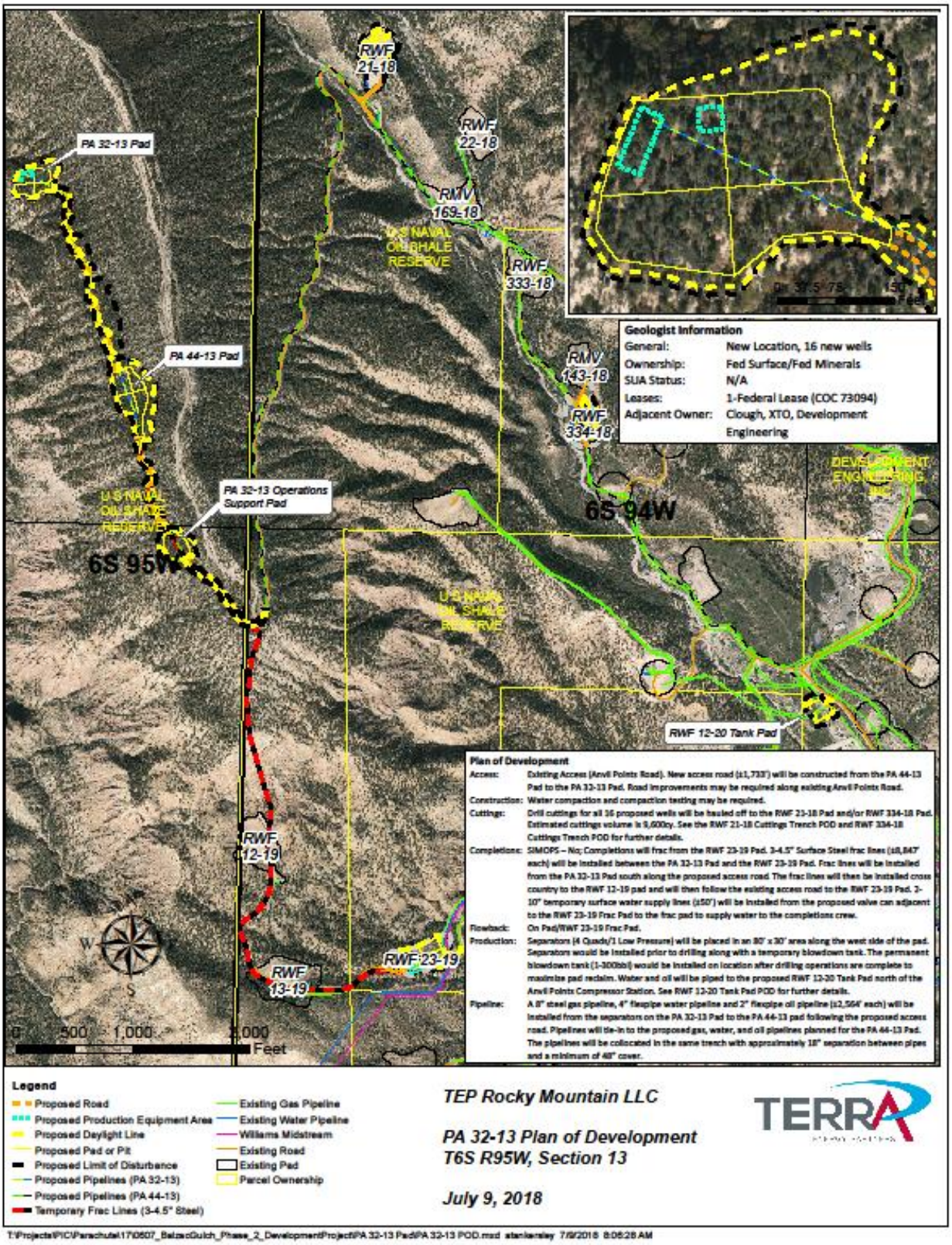


Figure 14. PA 32-13 Plan of Development for Preferred Alternative

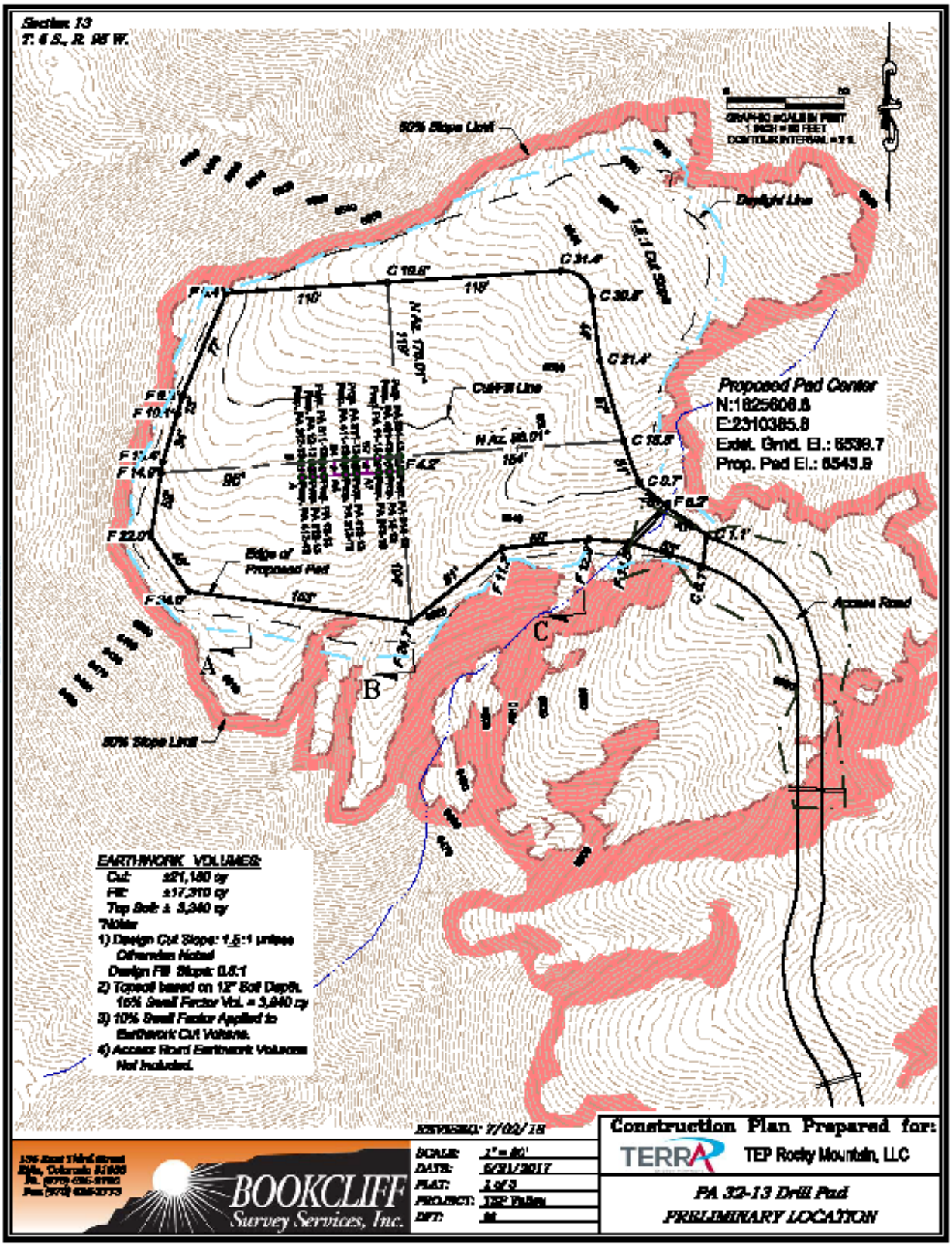


Figure 15. Construction Layout for PA 32-13 Pad – Preferred Alternative

The new road and pipeline corridor would represent 4.76 acres of initial disturbance on Federal surface. Extra space has been allotted for topsoil storage along the access road corridor.

Three welded steel surface frac lines would be installed alongside the PA 32-13 road south to the PA 44-13 pad for a distance of 2,299 feet. The lines would provide delivery and collection of fluids supporting remote frac operations. Since simops would not be used for the PA 32-13 wells, additional surface lines would not be installed from the PA 44-13 pad or the Operations Support Pad.

Total initial disturbance for the PA 32-13 development would be 7.01 acres on Federal surface; total long-term disturbance would be 1.56 acres. With storage tanks located offsite, the long-term disturbance footprint for the pad would be 0.83 acre after interim reclamation (**Table 10**).

Elimination of the Proposed Action's PA 41-24 pad in the Preferred Alternative allows the existing tree cover surrounding Garfield County's communication tower to remain undisturbed. This would reduce potential visual impacts to the landscape from the existing communication tower, as well as the Proposed Action's PA 41-24 pad.

RWF 12-20 Tank Pad Construction and Operations, Preferred Alternative

In the Preferred Alternative, the RWF 12-20 Tank Pad on private land would have 1.17 acres of initial disturbance and 0.48 acre of long-term disturbance to accommodate expanded fluid storage at the tank pad, primarily from other private and Federal development projects.

3.2.4 Summary List of the Preferred Alternative Components

Under the Preferred Alternative, Terra could implement all or any combination of the following BG2MDP developments with the authorization of APDs and related ROWs.

PA 34-24 Project Components (**Figure 2**):

- Construct the new PA 34-24 Pad with a 3.59-acre footprint to drill 11 new Federal wells.
- Construct a new access road (approximately 2,281 feet) from the junction with the PA 41-25 Pad access road and the proposed PA 34-24 Pad.
- Install two 10-inch temporary surface poly water supply lines (approximately 250 feet each) from the existing 10-inch water line connection to the PA 23-25 Frac Pad.
- Install three 4.5-inch steel temporary surface frac lines (approximately 5,403 feet) from PA 23-25 Frac Pad to the PA 34-24 Pad.
- Install 8-inch buried steel natural gas pipeline (approximately 5,120 feet) from the existing 12-inch natural gas line near the PA 22-25 Pad following the proposed access road and existing pipeline corridor to the PA 34-24 Pad.
- Install 4-inch flexpipe produced-water line and 2-inch flexpipe oil line (approximately 5,270 feet) collocated with the 8-inch buried gas line from the tank battery on the PA 22-25 Pad to the PA 34-24 Pad.

PA 31-26 Project Components (**Figure 3**):

- Construct the new PA 31-26 Pad with a 3.41-acre footprint to drill 11 new Federal wells.
- Construct a new access road (approximately 4,795 feet) from the PA 22-25 Pad to the PA 31-26 Pad.

- Install three 4.5-inch steel temporary surface frac lines (approximately 4,245 feet) from the PA 23-25 Frac Pad to the PA 31-26 Pad.
- Install 8-inch buried steel natural gas pipeline (approximately 4,335 feet) from the existing 12-inch natural gas line near the PA 22-25 Pad following the proposed road to the PA 31-26 Pad.
- Install 4-inch flexpipe produced-water line and 2-inch flexpipe oil line (approximately 4,762 feet) collocated with the 8-inch buried gas line from the tank battery on the PA 22-25 Pad to the PA 31-26 Pad.

PA 44-13 Project Components (**Figures 12 and 13**):

- Construct the new PA 44-13 Pad with a 4.13-acre footprint to drill 20 new Federal wells.
- Construct a new access road (approximately 2,184 feet) from the County Communication Tower Site to the PA 44-13 Pad.
- Reinforce the low water crossing at the unnamed drainage near the locked traffic control gate at the end of county road.
- Install two 10-inch temporary surface poly water supply lines (approximately 50 feet each) from the proposed valve can adjacent to the RWF 23-19 Pad to the RWF 23-19 Pad.
- Install three 4.5-inch steel temporary surface frac lines (approximately 6,548 feet) from RWF 23-19 Pad to the PA 44-13 Pad.
- Install 10-inch buried steel natural gas pipeline, 4-inch flexpipe produced-water line, and 2-inch flexpipe oil line (approximately 15,211 feet) collocated in the same trench from the RWF 12-20 Tank Pad following the existing roads and pipeline corridors to the PA 44-13 Pad.

PA 32-13 Project Components (**Figures 14 and 15**):

- Construct the new PA 32-13 Pad to a 2.25-acre footprint to drill 28 new Federal wells.
- Construct a new access road (approximately 1,733 feet) from PA 44-13 Pad to the PA 32-13 Pad.
- Install three 4.5-inch steel temporary surface frac lines (approximately 2,299 feet) from the PA 44-13 Pad to the PA 32-13 Pad or 8,847 feet total length between the RWF 23-19 Pad and the PA 32-13 Pad.
- Install 8-inch steel natural gas pipeline, 4-inch flexpipe produced-water line, and 2-inch flexpipe oil line (approximately 2,564 feet) from the PA 32-13 Pad following the proposed access road to the PA 44-13 Pad.

PA 32-13 Operation Support Pad Component (**Figure 7**)

- Construct the new PA 32-13 Operations Support Pad to a 2.19-acre footprint to support drilling operations for the 36 new Federal wells on the PA 41-24 and PA 32-13 Pads.

RWF 21-18 Pad (Cuttings Storage) Project Component (**Figure 8**):

- Expand the existing RWF 21-18 Pad on BLM to a 3.01-acre footprint to accommodate burial of cuttings from the 36 Federal wells on the PA 41-24 and PA 32-13 Pads.

RWF 334-18 Pad (Cuttings Storage) Project Component (**Figure 9**):

- Expand the existing RWF 334-18 Pad on private land to a 2.65-acre footprint to accommodate burial of cuttings from the 36 Federal wells on the PA 44-13 and PA 32-13 Pads.

Table 10. Surface Disturbance for Components of Preferred Alternative

Well Pad	*Surface Ownership*	*Length (feet) Federal/ Private [Total]*	*Existing Disturbance (acres) Federal/ Private [Total]*	*Re-disturbance (acres) Federal/ Private [Total]*	*New Disturbance (acres) Federal/ Private [Total]*	*Initial Disturbance (acres) Federal/ Private [Total]*	*Long-term Disturbance (acres) Federal/ Private [Total]*
WELL PADS/SUPPORT PADS							
PA 34-24	Federal		0/0	0/0	3.59/0	3.59/0	0.71/0
PA 31-26	Federal		0/0	0/0	3.41/0	3.41/0	0.71/0
PA 44-13	Federal		**0**/0	0/0	**4.13**/0	**4.13**/0	**1.12**/0
PA 32-13	Federal		0/0	0/0	**2.25**/0	**2.25**/0	**0.83**/0
PA 32-13 Operations Support Pad	Federal		0/0	0/0	2.19/0	2.19/0	0.24/0
PA 23-25 Frac Pad [1]	Private		0/1.34	0/0	0/0	0/1.34	0/0
RWF 23-19 Frac Pad [1]	Federal		2.89/0	0/0	0/0	2.89/0	0/0
RWF 21-18 Cuttings Pad	Federal		1.16/0	1.68/0	0.17/0	3.01/0	0.89/0
RWF 334-18 Cuttings Pad	Private		0/0.45	0/2.03	0/0.17	0/2.65	0/0.45
RWF 12-20 Tank Pad	Private		0/0	0/0	0/**1.17**	0/**1.17**	0/**0.48**
Subtotal (Federal/Private)			**4.05/1.79 [5.84]**	**1.68/2.03 [3.71]**	**15.74/1.34 [17.08]**	**21.47/5.16 [26.63]**	**4.50/0.93 [5.43]**
ACCESS ROADS							
PA 34-24	Federal/ Private	950/1,331 [2,281]	0/0	0/0.05	1.13/0.97 [2.10]	1.13/1.02 [2.15]	0.41/0.62 [1.03]
PA 31-26	Federal/ Private	4,308/487 [4,795]	0/0	0/0.15	3.50/0.15 [3.65]	3.50/0.30 [3.80]	1.97/0.22 [2.19]
PA 44-13[2]	Federal	**2,184**/0	**0.07**/0	**0**/0	**2.29**/0	**2.36**/0	**0.83**/0
PA 32-13 [2]	Federal	**1,773**/0	0/0	0/0	**4.76**/0	**4.76**/0	**0.73**/0
RWF 12-20 Tank Pad	Private	0/**50**	0/0	0/0	0/0.03	0/0.03	0/**0.01**
Subtotal (Federal/Private)		**9,215/1,868 [11,083]**	**0.07/0**	**0/0.20**	**11.68/1.15 [12.83]**	**11.75/1.35 [13.10]**	**3.94/0.85 [4.79]**

Well Pad	***Surface Ownership***	***Length (feet) Federal/ Private [Total]***	***Existing Disturbance (acres) Federal/ Private [Total]***	***Re-disturbance (acres) Federal/ Private [Total]***	***New Disturbance (acres) Federal/ Private [Total]***	***Initial Disturbance (acres) Federal/ Private [Total]***	***Long-term Disturbance (acres) Federal/ Private [Total]***
PIPELINES [3]							
PA 34-24 (8-inch gas line) (4-inch water line, and 2-inch oil line)	Federal/ Private	2,040/3,230 [5,270]	0/0.04	1.08/2.01 [3.09]	0.25/0.35 [0.60]	1.33/2.40 [3.73]	0/0.04
PA 31-26 (8-inch gas line) (4-inch water line, and 2-inch oil line)	Federal/ Private	4,085/677 [4,762]	0/0.04	0/0.34	1.47/0	1.47/0.38 [1.85]	0/0.04
PA 44-13 (10-inch gas line, 4-inch water line, and 2-inch oil line)	Federal/ Private	**11,500/3,711 [15,211]**	**6.53**/1.79 [**8.32**]	**0.46**/0.95 **[1.41]**	**1.47/0.10 [1.57]**	**8.46/2.84 [11.30]**	**0/0**
PA 32-13 (**8-inch gas line**, 4-inch water line, and 2-inch oil line)	Federal	**2,564**/0	0/0	0/0	0/0	0/0	0/0
Subtotal (Federal/Private)		**20,189/7,618 [27,807]**	**6.53/1.87 [8.40]**	**1.54/3.30 [4.84]**	**3.19/0.45 [3.64]**	**11.26/5.62 [16.88]**	**0/0.08 [0.08]**
Grand Total (Federal/Private)			**10.65/3.66 [14.31]**	**3.22/5.53 [8.75]**	**30.61/2.94 [33.55]**	**44.48/12.13 [56.61]**	**8.44/1.86 [10.30]**

[1] Disturbances for the existing PA 23-25 Frac Pad and the existing RWF 23-19 Pad were previously analyzed in Balzac Gulch Phase 1 Project.
[2] The portion of the PA 44-13 pipelines buried within or alongside the existing road serving the county communication tower has a disturbance allocation listed specifically under the Pipeline component.
[3] The longest length of collocated pipelines is shown in table.

RWF 12-20 Tank Pad Project Components (**Figure 10**):

- Construct the new RWF 12-20 Tank Pad on private land to a 1.17-acre footprint to provide storage for oil and water from the Federal wells on the PA 44-13 and PA 32-13 Pads.
- Construct a new road 50 feet in length from CR 246 into the tank farm facility on private land.

In summary, the four new well pads would develop a total of 58 wells along with associated access roads (11,083 feet or 2.10 miles), surface pipelines (18,495 feet or 3.50 miles) and buried pipelines (27,807 feet or 5.27 miles).

3.2.5 Summary of Surface Disturbance for Preferred Alternative

Table 10 summarizes the proposed surface disturbances related to the Preferred Alternative, with differences from the Proposed Action shown in bold text. **Table 10** provides a full estimate of the initial and long-term disturbance for the Preferred Alternative developments. Initial disturbance includes the initial surface disturbance associated with the construction of four new well pads (including the PA 44-13 pad) and the construction of support pads, access roads, and pipelines. Once constructed, the well pads would be stabilized until the last well has been drilled and completed on the pad, at which time interim reclamation would occur.

By combining the 2.73-acre disturbance estimate for the PA 41-24 site with the original estimate of 2.19 acres of the PA 32-13 Operations pad (totaling 4.92 acres), the consolidation of bottomholes on the PA 44-13 pad (with 4.13 acres of disturbance) yields a savings of 0.79 acre of overall surface disturbance.

By reducing the number of planned wells and the overall size of the PA 32-13 pad, the initial disturbance associated with the Preferred Alternative was reduced by 0.5 acre while the long-term disturbance was decreased by 0.26 acre.

The RWF 12-20 Tank Pad, with is expanded fluid storage demands from other surrounding private and Federal well developments, resulted in slight increases of 0.18 acre for short-term disturbance and 0.12 acre for long-term disturbance.

The estimated initial and long-term disturbance for construction of four new well pads (PA 34-24, PA 31-26, PA 44-13, and PA 32-13), construction of the PA 32-13 Operation Support Pad, construction of the RWF 12-20 Tank Pad, and expansion of the RWF 21-18 Pad (cuttings storage), and RWF 334-18 Pad (cuttings storage) is listed in **Table 10**. The estimated disturbance for ancillary roads and pipelines is also included in **Table 10**.

The estimates in **Table 10** include the proposed disturbances on Federal lands (BLM-administered lands) and private lands. The BG2MDP project would include 56.61 acres of short-term disturbance with 44.48 acres or 79% occurring on Federal land. Long-term disturbance would amount to 10.30 acres with 8.44 acres or 82% occurring on Federal lands. Approximately 41% of the disturbance in the Preferred Alternative would occur within existing disturbance or on land previously disturbed and reclaimed. Some of the proposed pipeline disturbance is not included in **Table 10** because it would occur within existing road disturbances. The construction of four new well pads supporting the 58 new Federal directional wells would result in construction of 2.09 miles of access roads, 5.27 miles of new natural gas, oil, and water pipelines, and 3.50 miles of temporary surface lines.

3.3. NO ACTION ALTERNATIVE

Council on Environmental Quality (CEQ) regulations require the BLM to analyze the No Action Alternative in comparison to the Proposed Action. Since all of the oil and gas wells proposed in this project would be developed in Federal minerals, the No Action Alternative would involve a scenario in

which none of the 63 new Federal wells would be drilled, completed, or produced. Because no new Federal well development would occur, the four new drill pads and two ancillary support pads on BLM and the RWF 12-20 tank pad on private land, the various buried and surface pipeline segments, and 5.3 miles of new road construction would not be needed. It is presumed that the PA 23-25 frac pad located on private land would be closed and reclaimed since it would have no further use without the Federal nexus.

Table 1 lists 11 existing pad locations within the BG2MDP boundary of which nine pads have operating Federal wells or wells that have been previously approved with APDs. On those nine pads, 100 Federal wells are either operating or poised to operate with active drilling ongoing or have APDs approved with future drilling specifically planned for summer 2018 on the RWF 13-19 pad. On the same 11 existing pads within the BG2MDP area, five of those pads also support 45 producing private wells tapping nearby fee mineral leases. Under the No Action Alternative, all of these 145 wells would continue to operate and develop the Federal and fee minerals within the BG2MDP area using the existing roads and pipeline infrastructure on BLM and private land. Travel, traffic congestion, noise, air quality, water quality, and wildlife impacts associated with the operation of 145 wells would continue over the next 20 to 40 years depending on the age of the wells and their future productivity.

3.4. ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

A possible location along the existing Anvil Points Mine Road that was constructed to serve the Anvil Points Mine in the early to mid-1900s was reviewed as part of the pad siting process for the Balzac Gulch lease. During field review, the ridge oriented north-south (that the mine road traverses and parallels) was found to have inadequate width and too much relief to safely accommodate a new pad location. The visual impact of positioning a new pad with a prominent notched change to the ridgeline would also not satisfy Class II VRM objectives. Since Garfield County's installation of the communications tower facility within the old Anvil Points Mine Road, the mine access, and any subsequent use of the old roadway has essentially been severed by the facility's location. Only all-terrain and utility vehicle access or hiking access are feasible around the County's facility.

4. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

During its internal scoping process for this EA, pursuant to NEPA, BLM resource specialists identified elements of the natural and human environment as present in the project vicinity and potentially affected by the project. Environmental elements not identified as being present or potentially affected by the project are not analyzed in this EA. Environmental elements identified as present, potentially present, or potentially affected by the project are listed below:

- Access and Transportation
- Air Quality
- Cultural Resources
- Fossil Resources
- Geology and Minerals
- Invasive Non-Native Plants
- Lands with Wilderness Characteristics
- Native American Religious Concerns
- Noise
- Socioeconomics
- Soils
- Special Status Species
- Vegetation
- Visual Resource Management
- Wastes – Hazardous and Solid
- Water Resources – Surface Water and Groundwater
- Wildlife – Aquatic and Terrestrial

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 Terra and by general and site-specific COAs included in **Appendices A and B**. Cumulative impacts are summarized in **Section 5**.

4.1. ACCESS AND TRANSPORTATION

Affected Environment

Two primary access routes would serve the BG2MDP project area (**Figure 1**). One route serving the west side of the proposed development (PA 31-26 and PA 34-24 pads) bears northwest off I-70, Rulison exit (#81) through private land. The east-side of BG2MDP area would be accessed by the south-side I-70 frontage road from Rulison exit #81 serving the existing RWF 23-19 frac pad and various new pads outlined in the Proposed Action (PA 41-24 and PA 32-13) and the Preferred Alternative (PA 44-13 and PA 32-13). Garfield County's preferred County Road haul routes system would be used (including CR 246 and the Anvil Points Mine Road to the locked gate that marks the end of county jurisdiction). Terra would be restricted from using other County Roads not designated as haul routes for heavy loads.

Traffic counts are not available for the existing roads accessing the project area. Aside from drilling and completion operations, oil and gas-related road use would be considered low and specifically focused on pickup traffic to monitor and maintain well production on the operating Terra well pads in the area. Produced water generated from Terra's producing wells is gathered and delivered to water treatment facilities in buried pipelines, vastly reducing heavy truck traffic in the field. The installation of buried water lines for the new developments would continue to collect and move fluids through Terra's expanded buried pipeline and water recycling infrastructure without the need for truck transports. Condensate would be moved from the well pads through 2-inch buried flexpipe lines to the PA 22-25 and RWF 12-20 tank farms where oil sales would occur and trucks would transport condensate to market.

Environmental Consequences

Proposed Action

The private road northwest of the I-70, Rulison exit has an east-bearing fork that passes through industrial wareyards and traverses by a private residence toward the existing PA 41-25 pad. On the western flanks of the PA 41-25 pad, a new road would be constructed about 0.43 mile northward over private and BLM land crossing the large unnamed ephemeral drainage using a 12-foot-diameter culvert and ending at the PA 34-24 pad site. The large culvert opening would be designed to allow shale debris flows common at the base of the Roan Plateau to pass through safely. The new road would disturb about 2.15 acres with 1.13 acres of short-term disturbance occurring on BLM land.

The west-bearing fork from the I-70, Rulison exit passes through and around the existing PA 22-25 pad and PA 23-25 frac pad and would continue with new road construction for approximately 0.91 mile in a northwest direction following an existing two-track road that crosses and parallels another large, unnamed ephemeral stream to the proposed PA 31-26 pad. An existing low water crossing at the ephemeral drainage would be improved to allow all-weather access to the PA 31-26 pad. With all but 0.1 mile of road construction occurring on BLM land, the short-term disturbance would amount to 3.80 acres with 2.19 acres of disturbance lasting long term.

From the south-side I-70 frontage road east of the Rulison exit, the turnoff at CR 246 (paved road) and a graveled, unnumbered Garfield County Road provide the initial roads directing access to the PA 41-24 and PA32-13 pads. The combination of the two county roads bears northwest for approximately 2 miles to a locked traffic control gate at the switchback crossing of the large unnamed ephemeral drainage in NW¼ of Section 18 (**Figure 1**). The new RWF 12-20 tank pad and the two existing pads proposed for

cuttings storage, RWF 21-18 and RWF 334-18 are located along the unnumbered county road, which technically indicates they are accessible to the motorized public.

Above the locked traffic control gate, the road was recently upgraded to support crane access and construction traffic for Garfield County's 2017 installation of Emergency Communication facility including a 100-foot tall tower. The existing road segment above the gate is a BLM-managed road; its condition and alignment is adequate for oil and gas development traffic. The drainage crossing just north and below the gate would require reinforcing concrete supports at the low water crossing to adequately support the heavy loads associated with drilling and completion operations. Extra workspace would be factored into the pipeline excavation footprint on either side of the low water crossing to allow for safe installation of the buried pipelines.

From the PA 41-24 pad northwest a new road would be constructed along a narrow bench in the pinyon-juniper woodlands passing through two new support pads and ending at the new PA 32-13 pad. This road would be 0.71 mile in length representing 5.81 acres of short-term disturbance and 1.54 acres of long-term disturbance after the cuts and fills are seeded and reclaimed.

The existing RWF 23-19 remote frac pad would be accessed by CR 246 and BLM field development roads west of CR 246. The road system serving the RWF 23-19 pad and other nearby sites are accessible to the motorized public. Public access would not be available to the four proposed pads since those routes are either controlled by the traffic control gate north of the PA 41-24 pad or served by private roads northwest of the I-70 Rulison exit. The Proposed Action would result in periods of substantial increases in traffic volume on the preferred haul routes, the existing private field development roads, and the newly constructed or realigned roads within the project area.

Truck traffic would be greatest during rig-up, drilling, and completion activities. As shown in **Table 11**, the overall traffic count for each well included in the Proposed Action would be approximately 1,190 trips by vehicle types typically associated with drilling and completion of directional wells.

Table 11. Traffic Associated with Directional Drilling and Completion Activities

Vehicle Class	***Trips per Well[1]***	***Portion of Total[1]***
16-wheel tractor trailers	88	7.3%
10-wheel trucks	216	18.2%
6-wheel trucks	452	38.0%
Pickup trucks	404	34.0%
Cuttings removal/storage	30	2.5%
Total	**1,190**	**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.

Once each well is producing, traffic would dramatically decrease to occasional visits in pickups for monitoring or maintenance activities. Produced water generated during the life of each well would be stored at the tank facilities and trucked offsite for recycling. The volume of condensate collected in a tank would require periodic truck visits to remove the oil from the tanks. The well may have to be recompleted once per year, requiring three to five 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 4.2**) and elevated noise levels (**Section 4.9**). Mitigation measures applied as COAs (see **Appendix A**) would ensure adequate dust abatement and road maintenance.

Proposed roads would be constructed with a disturbance corridor approximately 50 feet wide, reduced to 20 feet of finished road surface (excluding bar ditches) after interim reclamation. A conventional dozer and/or trackhoe would be used to clear vegetation and large boulders within the proposed limits of disturbance for the planned roads. Earth-moving equipment would be used to segregate and windrow the topsoil along the edge of the proposed road corridor. The roads would be constructed using standard equipment and techniques as described in the *Surface Operating Standards for Oil and Gas Exploration & Development* – The Gold Book (USDI and USDA 2007). Mitigation measures (**Appendix A**) would be required as COAs for road construction and maintenance operations including, but not limited to dust abatement, ditching, draining, crowning, surfacing, sloping, and dipping the roadbed as necessary. A minimum 6-inch layer of gravel would be applied to the new roads to provide an all-weather travel way.

Increased traffic on County roads may cause temporary conflicts with normal traffic, including travel delays and increased vehicle collision rates. Project traffic would also cause an increase in fugitive dust and noise and an increased risk of collision with wildlife. Degradation of County, private, and BLM roads may occur from heavy equipment, resulting in increased maintenance and safety management. Existing field development roads would be maintained and resurfaced as needed with minimum 6-inch layer of gravel.

Of the 2.06 miles of new road construction for the BG2MDP, approximately 1.70 miles of road would be constructed on BLM and 0.36 mile of road would be built on private lands. The initial disturbance estimates would amount to 12.71 acres with 11.36 acres occurring on BLM. After interim reclamation work is completed on the new roads, long term disturbance related to the running surface and associated ditches would total 5.26 acres with the bulk of that disturbance (4.39 acres) occurring on BLM.

Preferred Alternative

The impact analysis presented in the Proposed Action remains applicable for the Preferred Alternative. Replacing the PA 41-24 pad and PA 32-13 Production Pad with the new PA 44-13 pad represents only a subtle change in actual new road construction, the difference being the added lengths of road to be built across the "deleted" disturbance footprints of the two pads. The final length of road to be built under the Preferred Alternative would be 2.09 miles. Dropping five wells in the Preferred Alternative results in an 8% decrease in overall traffic when compared to the initial 63 wells planned in the Proposed Action.

No Action Alternative

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the new impacts to this resource or resource use as described in the Proposed Action would occur. Terra's existing field development roads would continue to be used and maintained for the 145 producing wells in the area.

4.2. AIR QUALITY

Affected Environment

The BG2MDP 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] 2017a). 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 semi-arid (dry and cold), mid-continental regime, typified by dry, 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), located approximately 12 miles east of the project area 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) (WRCC 2017b), located approximately 12 miles east of the project area. The annual mean wind speed at the Rifle site is 4.9 miles per hour (mph).

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). The APCD is the primary air quality regulatory agency responsible for determining potential impacts once detailed industrial development plans have been made, and those development plans are subject to applicable air quality laws, regulations, standards, control measures, and management practices. Unlike the conceptual "reasonable, but conservative" engineering designs used in NEPA analyses, any APCD air quality preconstruction permitting demonstrations required would be based on very site-specific, detailed engineering values, which would be assessed in the permit application review. Any proposed facility that meets the requirements set forth under division permit regulations is subject to the Colorado permitting and compliance processes.

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. Incremental increases in PSD Class I areas are strictly limited, while increases allowed in Class II areas are less strict. All areas of the country are assigned a classification that describes the degree of degradation to the existing air quality allowed to occur within the area under the PSD permitting rules. PSD Class I areas are areas of special national or regional natural, scenic, recreational, or historic value, and very little degradation in air quality is allowed by strictly limiting industrial growth. PSD Class II areas allow for reasonable industrial/economic expansion.

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. Areas throughout the region not designated as PSD Class I are classified as Class II. Federal Land Managers can designate specific Class II areas that they manage as "sensitive" Class II areas, based on their own criteria, and request that PSD Class I level air quality analyses be included for these areas.

Regulations and standards that limit permissible levels of air pollutant concentrations and air emissions and are relevant to the project air impact analysis include:

- National Ambient Air Quality Standards (NAAQS) (40 CFR Part 50) and Colorado Ambient Air Quality Standards (CAAQS) (5 Code of Colorado Regulations [CCR]-1001-14)
- Hazardous Air Pollutants (HAPs)
- PSD (40 CFR Part 51.166)
- New Source Performance Standards (NSPS) (40 CFR Part 60)

- National Emission Standards for Hazardous Air Pollutants (NESHAPs) (40 CFR Part 63)
- Non-Road Engine Tier Standards (40 CFR Part 89)
- Colorado Oil and Gas Permitting Guidance

Several air quality monitors are within the CRVFO boundaries, measuring particulate matter less than 10 microns in effective diameter (PM_{10}), particulate matter less than 2.5 microns in effective diameter ($PM_{2.5}$), ozone (O_3), and nitrogen dioxide (NO_2). The monitoring data have trends that comply with the current NAAQS. Although the trends for ground level ozone are very close to the 70 parts per billion standard.

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.

As described below, the BLM 2015 Annual Report provides further discussion on existing air quality.

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 2016b and 2017b).

The 2015 Annual Report is a web-based, dynamic, data-driven document that allows BLM Colorado to convey a vast amount of information in a relatively compact and reusable framework. Consistent with CEQ regulation 40 CFR §1502.21, Incorporation by Reference, and mandates to reduce paperwork, the data from the 2015 Annual Report for the CRVFO is incorporated by reference in this analysis to describe the affected environment and cumulative impacts analysis associated with the Proposed Action. All of the documents described above are available to the public on BLM Colorado's website at: https://www.blm.gov/programs/natural-resources/soil-air-water/air/colorado.

The sections of the Annual Report that describe the affected environment are as follows:

- Regulatory Analysis – This section of the report describes and defines the applicable general and oil-and-gas-specific air quality regulations as well as the authority for such laws; provides a basic overview of the science and issues associated with the various types of air pollutants (criteria,

hazardous, and greenhouse gases [GHGs]) and AQRVs, any applicable metrics for their analysis, and the contexts of such analysis relative to various geographic designations (attainment, non-attainment, Class I areas, etc.); and provides for all available criteria pollutant monitoring data and geographically-based national emissions inventory data. This section is referenced to set the context for current conditions and existing analysis.

- Analysis Methodology Summary – This section describes the basic science of air resources analysis; refers to the CARPP for project-specific analysis guidelines (followed in this EA); describes the analysis methods used with the annual report to scale current cumulative development within the context of the applicable CARMMS scenario; describes why scaling current report-year emissions is a scientifically valid method for describing cumulative impacts; and provides plots of the CARMMS high scenario emissions (for various development and pollutant groups) as well as plots of the modelled impacts (concentrations, AQRVs, etc.) for each CARMMS scenario. This section is referenced to provide support for the methodology of analysis used in this EA.
- Field Office Data / Analysis (CRVFO) – This section provides details about the current and trending pace of oil and gas development within a planning area and also describes a summary of the available air quality monitoring data for the field office presented in the Regulatory Analysis described above.

Note: Although the Annual Report is from 2015, the data reflects the best available analysis relative to current oil and gas development rates. Furthermore, the current emissions totals estimated for approved development are at or well below the levels analyzed by the low CARMMS scenario projections. Any updated impacts disclosed in the 2016 or subsequent Annual Reports are not expected to exceed the impacts shown for the low CARMMS scenario in the 2015 Annual Report. The 2016 Annual Report will include CARMMS 2.0 data (new model run on the 2011b Intermountain West Data Warehouse CAMx platform) when fully integrated into the report structure.

Environmental Consequences

Proposed Action

A detailed emissions inventory for the proposed action was prepared in accordance with section III.B of the CARPP. Terra provided data to develop the inventory using the BLM Colorado Emissions Tool and supplemented the data with a proposed drilling and development timeline shown on a per pad basis. All of the project's potential production would result from BLM's approval of development of the Federal mineral estate for the BG2MDP. The data used to produce the emissions inventories are the best available, and form the basis of the effects disclosures. **Tables 12 and 13** below present the criteria pollutants (particulate matter less than 10 microns in effective diameter [PM_{10}], particulate matter less than 2.5 microns in effective diameter [$PM_{2.5}$], volatile organic compounds [VOCs], nitrogen oxides [NO_X], carbon monoxide [CO], sulfur oxides [SO_X]) and hazardous air pollutant (HAP) emissions from all of the proposed BG2MDP facilities. See later discussion regarding GHG emissions.

Table 12. 2018 Federal Emissions from the BG2MDP

Project Phase	***Pollutants (tons per year)***						
	PM_{10}	***$PM_{2.5}$***	***VOCs***	***NO_X***	***CO***	***SO_X***	***HAPs***
Development (24%)	1.04	0.63	19.40	31.03	38.35	0.44	1.94
Production (24%)	0.07	0.07	4.14	0.96	0.82	0.01	0.41
Total	1.11	0.70	23.54	31.99	39.17	0.45	2.35
Note: Annual emissions are shown for each project phase and the total emissions assumes that 24% of project development and 24% of mineral production would occur in Year 2018.							

Table 13. 2019 Federal Emissions from the BG2MDP

Project Phase	*Pollutants (tons per year)*						
	PM_{10}	*$PM_{2.5}$*	*VOCs*	*NO_X*	*CO*	*SO_X*	*HAPs*
Development (76%)	3.29	1.99	61.44	98.27	121.43	1.39	6.14
Production (100%)	0.30	0.29	17.24	4.01	3.42	0.04	1.72
Total	3.59	2.28	78.67	102.27	124.85	1.43	7.86
Note: Annual emissions are shown for each project phase and the total emissions assumes that 76% of project development and 100% of mineral production would occur in Year 2019.							

In general, the Proposed Action would have a temporary impact on air quality, which would mostly occur during the development phase and the initial production years before well yields decline (production declines in excess of 50% during the first three years are typical). Use of the access roads, surface disturbances for well pad and pipeline construction, and development activities, such as drilling, hydraulic fracturing, well completion, and equipment installation would impact air quality through the generation of dust related to worker travel, materials transport, and general construction. This phase would also produce short-term emissions of criteria, hazardous, and GHG pollutants from vehicle and construction equipment exhausts. Once development is complete, the daily activities at the site would reduce to operational and maintenance checks and product load-out and hauling, which initially may occur as frequently as multiple daily visits (prior to declining production). These activities would produce vehicle emissions and fugitive emissions of production-related gases from infrastructure components (pressure relief valves, and working and breathing losses from tanks, flanges, seals, valves, etc.), pneumatic devices that utilize the gas's kinetic energy to operate, and liquid product load-out. Methane is the primary component for the majority of the various gas streams, although at some points in the process the fraction of VOCs and HAPs may be elevated relative to the sales gas fraction.

A quantitative analysis of the potential local impacts from the Proposed Action is provided below utilizing a near-field assessment tool based on the results of the CARMMS 2.0 modeling study. The tool determines how much new Federal and non-Federal oil and gas (emissions) was modeled in a CARMMS "near-field domain" (the 4-kilometer grid cell of the Proposed Action and adjacent grid cells, encompassing approximately a 10-kilometer radius from the proposed project) for all of the projected future year 2025 emissions scenarios (low, medium, and high). The tool also provides the range of corresponding cumulative modelled concentrations (for each scenario) of ambient nitrogen dioxide, ozone, and particulate matter (PM_{10} and $PM_{2.5}$), along with Federal oil-and-gas-specific source apportionment concentrations that would contribute to the modelled cumulative ambient concentrations. These data are useful for determining the relative contribution of new proposed Federal oil and gas emissions to the cumulative concentrations modelled within the domain. Concentration data are also available for carbon monoxide and sulfur dioxide; however, they are not modelled here due to their exceptionally small impacts relative to their impact thresholds (e.g., National Ambient Air Quality Standards [NAAQS]).

Figure 16 shows the BGMDP project boundary (pink / purple outline), Balzac Gulch Phase 2 pads (orange squares with black dot centers), Balzac Gulch Phase 1 facilities (red outlines) and CARMMS 2.0 grid cell points (yellow circles with black dot centers).

In addition to data specific to the project location /near-field domain, the tool also retrieves data for the modelled grid cell (any grid cell within Colorado and portions of nearby States) from each CARMMS scenario with the closest emissions greater than the project-specific emissions. Ultimately, the scenario with the lowest modelled Federal contribution impacts and closest emissions greater than the project-specific emissions is used to represent the "project only" modelled emissions and is used to determine the

project's potential contributions to site-specific concentrations. In other words, the selected grid cell would be least influenced by neighboring grid cells with other "non-project" emissions sources and by neighboring Federal emissions sources influencing the adjacent grid cell concentrations. Such influences would adversely affect isolating project-only source impacts since the CARMMS 2.0 source apportionment impacts for the tool represent Colorado-wide new Federal oil and gas development. A variety of factors can affect the overall accuracy of this approach for describing project-related impacts. However, as a first-tier assessment, the cumulative projected domain-specific data used to assess potential project impacts are conservative. This method is a fast and reliable way to allocate CARMMS gridded emissions and impacts for project tracking assessments at the near-field scale. Note that for this project-level assessment, CARMMS modeled source apportionment / contributions for grid cell points within the domain shown in **Figure 16** were used to describe potential project-specific contributions to cumulative modelled concentrations discussed in **Section 5.1**.

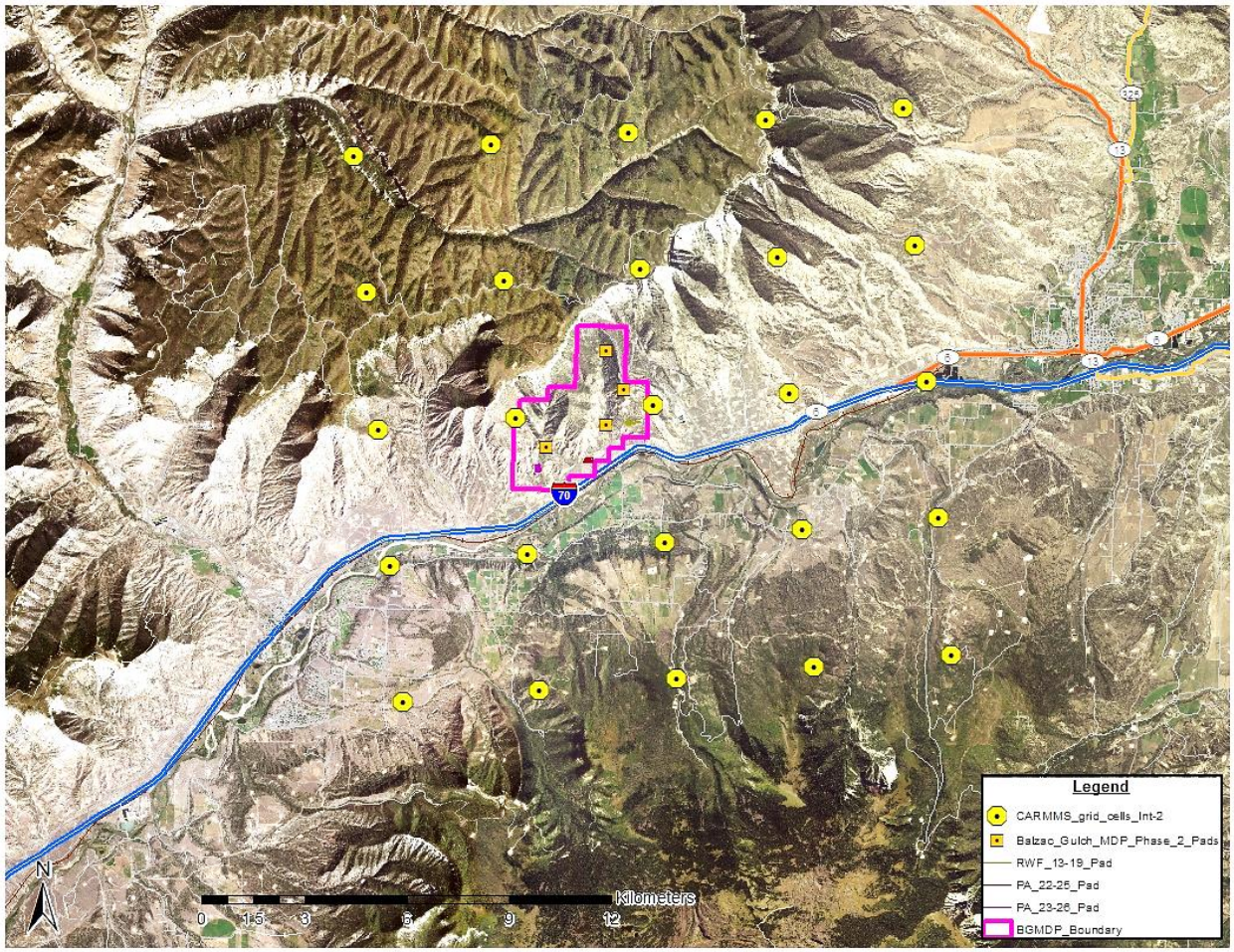


Figure 16. Gridded Near-Field Modeling Domain

The gridded emissions near-field assessment tool was run twice, once with Year 2018 annual emissions (24% development and production emissions) and once with Year 2019 annual emissions (76% development and 100% production emissions) for the proposed BG2MDP development and operations. The total modeled emissions of PM_{10}, $PM_{2.5}$, VOCs, and NO_X from **Tables 12 and 13** above are the annual emissions rates used to model potential project-specific impacts to the cumulative ambient air quality for both modelled Years 2018 and 2019.

The CARMMS low scenario produced spatially allocated emissions for new oil and gas development (Year 2016 through Year 2025) in the project area near-field domain that adequately (in terms of magnitude and location) account for the development and production phases of the Proposed Action for both years 2018 and 2019 as well as new emissions for full (100%) development and operation of the facilities associated with the Balzac Gulch Phase 1 project and operations associated with 65 Federal wells and 141 non-Federal wells that were developed in years 2016 and 2017 and are located within the CARMMS near-field modeling domain as shown above in **Figure 16**. To date, no other new Federal oil and gas development within the near-field domain has been proposed for Years 2016 to 2025 that would need to be added to the Balzac Gulch MDP emissions totals (Phase 1 and Phase 2) and inventory for existing wells developed in years 2016 and 2017 for comparing to the CARMMS 2.0 modeled emissions rates for the near-field domain.

In the modelled CARMMS 2.0 low scenario, the increased Federal oil and gas development / operations through Year 2025 in the project's near-field domain produce approximately 690 tons per year of new NO_X emissions and over 900 tons per year of new VOC emissions, and over 400 tons per year of new NO_X emissions and approximately 740 tons per year of new VOC emissions in the domain for new non-Federal oil and gas development / operations (**Figure 16**). These modelled emissions rates are several times higher than the emissions totals for the Proposed Action plus emissions rates for the other foreseeable Phase 1 project, as well as for other new Federal and non-Federal oil and gas wells developed in years 2016 and 2017 within the domain. New oil-and-gas-related particulate matter emissions modeled for the project near-field domain using CARMMS 2.0 are also well above the totals for the foreseeable projects combined. CARMMS 2.0 cumulative emissions totals modeled at rates much higher than projected emissions rates for actual foreseeable projects indicate that the CARMMS 2.0 predicted cumulative ambient concentrations for the project area should adequately account for the potential increase in cumulative emissions for the actual foreseeable projects in the area.

Tables 14 and 15 below show the maximum modelled concentrations in the project near-field domain for each pollutant analyzed, as well as the project's expected contributions to those cumulative concentrations. All concentrations are provided in the units of the NAAQS standards for comparison. As previously described, the CARMMS 2.0 low scenario modeled cumulative new Federal and non-Federal oil and gas related emissions that greatly exceed emissions levels estimated for the reasonably foreseeable new oil and gas development / operations for the area. The CARMMS 2.0 low scenario predicted cumulative concentrations for all pollutants below the applicable ambient air quality standards for the near-field domain (**Figure 16**).

Table 14. 2018 Gridded Near-field Model Impacts

Pollutant (unit)	*CARMMS 2.0 Cumulative Concentrations* [1]	*% of NAAQS* [2]	*Project Contributions* [3]	*Significant Impact Level (SIL)* [4]
NO_2 (ppb)	31	31	3.9	4
O_3 (ppb)	67	96	0.7	1
PM_{10} ($\mu g/m^3$)	11	7	0.4	5
24-hour $PM_{2.5}$ ($\mu g/m^3$)	4	12	0.04	1.2
Annual $PM_{2.5}$ ($\mu g/m^3$)	3	23	0.06	0.2

[1] Ambient concentrations based on the full cumulative model for the CARMMS 2.0 low scenario
[2] The percent of the NAAQS the full cumulative model results represent
[3] The project's emissions contributions to the CARMMS 2.0 modeled cumulative ambient concentrations
[4] Significant Impact Levels are defined by the CDPHE and EPA

As shown for Year 2018 (**Table 14**), all of the project's contributions are well below the established and recommended SILs for modelled value contributions, and thus the project's emissions are not a significant contributing factor to the CARMMS modelled concentrations (or ambient air quality impacts). For Year 2019 (**Table 15**), the project's modeled contributions for NO_2 and annual $PM_{2.5}$ are approximately equal to the SILs, but since the cumulative modeled concentrations are well below the standards, no further analysis is needed.

Table 15. 2019 Gridded Near-field Model Impacts

Pollutant (unit)	*CARMMS 2.0 Cumulative Concentrations [1]*	*% of NAAQS [2]*	*Project Contributions [3]*	*SIL [4]*
NO_2 (ppb)	31	31	~ 4	4
O_3 (ppb)	67	96	0.1	1
PM_{10} ($\mu g/m^3$)	11	7	0.2	5
24-hour $PM_{2.5}$ ($\mu g/m^3$)	4	12	0.1	1.2
Annual $PM_{2.5}$ ($\mu g/m^3$)	3	23	~ 0.2	0.2

[1] Ambient concentrations based on the full cumulative model for the CARMMS 2.0 low scenario
[2] The percent of the NAAQS the full cumulative model results represent
[3] The project's emissions contributions to the CARMMS 2.0 modeled cumulative ambient concentrations
[4] Significant Impact Levels are defined by the CDPHE and EPA

No analysis tools exist to describe the project's incremental contributions to the global phenomenon of climate change in terms of potential warming, drought, sea level rise or other common environmental metrics associated with increasing concentrations of atmospheric GHGs. The problem is by nature a cumulative issue, and any downscaling of the projected global climate changes effects to project scales (based on emissions scaling) does not provide meaningful analysis because no significance levels have been defined. As identified in the emissions inventory, the project would emit GHGs (**Table 16**), and thus contribute to the accumulation of atmospheric GHGs, and potential climate change effects if future year global emissions and the associated impacts are consistent with any of the scenarios analyzed by the contributing scientists of the Intergovernmental Panel on Climate Change.

Table 16. Maximum Federal GHG Emissions from the BG2MDP

Project Phase	*Pollutants (tons per year)*			
	Carbon dioxide (CO_2)	*Methane*	*Nitrous oxide*	*CO_2 equivalent*
Development	33,838	357	20	52,330
Production	8,236	431	0	22,931
Subtotal – Upstream / Midstream	42,074	788	21	75,261
Subtotal – Downstream Combustion	13,774	3,673	4,536	1,544,766
Total Federal GHG Emissions	55,848	4,461	4,556	1,620,027

Note: Annual emissions are shown for each project phase and the total emissions account for 100% of project development and 100% of new Federal wells in operation.

The operator shall use best management practices to control fugitive dust, including but not limited to sufficient water application to prevent offsite transport. This should ensure that nuisance dust is eliminated during most onsite activities. No other mitigation is required beyond the design features to which the operator is already committed.

In addition, the operator should follow State and Federal Regulations / requirements, and implement the practices and technologies as described for the Proposed Action design features including dual fuel primary drill rig engines, green completions with closed loop systems and no open pits, capture and control efficiency for tank emissions, and no-bleed pneumatic devices.

Preferred Alternative

Table 17 provides the maximum estimated emissions from the BG2MDP Preferred Alternative for year 2019.

Table 17. 2019 Federal Emissions from the BG2MDP, Preferred Alternative

Project Phase	*Pollutants (tons per year)*						
	PM_{10}	*$PM_{2.5}$*	*VOCs*	*NO_X*	*CO*	*SO_X*	*HAPs*
Development	3.99	2.42	74.42	119.03	147.10	1.68	7.44
Production	0.27	0.26	15.87	3.69	3.14	0.04	1.58
Total	4.26	2.68	90.29	122.72	150.24	1.72	9.02
Note: Annual emissions are shown for each phase and the total emissions assumes that all 58 Preferred Alternative wells would be developed and producing in Year 2019.							

The gridded emissions near-field assessment was completed for Year 2019, the year associated with maximum projected annual emissions rates of the Preferred Alternative and other nearby development (84 new wells developed and 110 new wells in operation). **Table 18** shows the maximum modelled concentrations in the project near-field domain for each pollutant analyzed, as well as the project's expected contributions to those cumulative concentrations. As shown in **Table 18**, the project's contributions are below or approximately equal to the established and recommended SILs for modelled values ozone and particulate matter contributions, and thus the project's emissions are not a significant contributing factor to the CARMMS modelled cumulative concentrations (or ambient air quality impacts) for those pollutants and averaging times. For maximum emissions year 2019, the project's modeled contribution for NO_2 1-hour is larger than the SIL, but since the cumulative modeled NO_2 1-hour concentration is well below the NAAQS, no further analysis is needed.

Table 18. 2019 Gridded Near-field Model Impacts

Pollutant (unit)	*CARMMS 2.0 Cumulative Concentrations [1]*	*% of NAAQS [2]*	*Project Contributions [3]*	*SIL [4]*
NO_2 (ppb)	31	31	~ 7	4
O_3 (ppb)	67	96	~ 1	1
PM_{10} (µg/m^3)	11	7	0.4	5
24-hour $PM_{2.5}$ (µg/m^3)	4	12	0.1	1.2
Annual $PM_{2.5}$ (µg/m^3)	3	23	~ 0.2	0.2

[1] Ambient concentrations based on the full cumulative model for the CARMMS 2.0 low scenario
[2] The percent of the NAAQS the full cumulative model results represent
[3] The project's emissions contributions to the CARMMS 2.0 modeled cumulative ambient concentrations
[4] Significant Impact Levels are defined by the CDPHE and EPA

The emissions of GHGs from the Preferred Alternative would be slightly reduced from those of the Proposed Action (**Table 16**), since the overall development would reduce from 63 to 58 wells.

No Action Alternative

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the impacts to this resource or resource use as described for the Proposed Action would occur.

4.3. CULTURAL RESOURCES

Affected Environment

Several intensive (Class III) cultural resource linear and block inventories have been conducted within the project area including CRVFO# 1117-01 and CRVFO# 1118-01, which were completed specifically for the Balzac Gulch Master Development Plan - Phase 2 Project.

Environmental Consequences

Proposed Action

Literature reviews of known cultural resource surveys and known sites in the project area were undertaken of the CRVFO cultural resource files and the Colorado Historical Society's Office of Archaeology and Historic Preservation COMPASS website. The literature review for this project determined that six previously recorded sites occur within the project area: 5GF886, 5GF2204, 5GF2205, 5GF2006, 5GF2007, and 5GF2008. Due to the small number of eligible resources in the project area, the Area of Potential Effect (APE) for this project is viewed as the actual area of disturbance for the pads and linear routes.

Of the previously recorded cultural sites, 5GF2004 – 2008 and were located and reevaluated during the current inventory. None of these cultural resources (of which only 5GF2008 is considered a historic property) will be affected by the Balzac Gulch Development Phase 2 Project. Additionally, two isolates (5GF.5467 and 5GF.5468) were newly recorded. The two isolated finds do not meet any of the criteria for eligibility and are field evaluated as not eligible for listing on the National Register of Historic Places.

As currently designed, the implementation of the Proposed Action would have no direct impacts to known "historic properties." Consequently, the BLM made a determination of "**No Historic Properties Affected**." This determination was made in accordance with the 2001 revised regulations [36 CFR 800.4(d)(1)] for Section 106 of the National Historic Preservation Act (NHPA 16U.S.C 470f), the BLM/State Historic Preservation Officer (SHPO) Programmatic Agreement (2012) and Colorado Protocol (2014)]. Additional consultation with the Colorado SHPO's office in ongoing.

Cultural resource types typically found in the surrounding areas include prehistoric open camps, lithic scatters, historic ditches, historic structures, historic trash scatters/dumps, and isolated prehistoric and historic finds. "Historic properties" are cultural resources that are eligible or potentially eligible for inclusion on the NRHP. Isolated finds are by definition not eligible to the NRHP.

Although no known eligible sites within the Areas of Potential Effect will be affected, indirect, short-term cumulative impacts from the temporary increased access and the presence of project personnel could result in a range of impacts to known and undiscovered cultural resources in the vicinity of the project location. These impacts could range from accidental damage or vandalism to illegal collection and excavation.

In addition to site specific COA's, a Standard Education/Discovery COA for cultural resource protection would be attached to the APDs as a COA (see **Appendix A**). The importance of all cultural COAs would

be stressed to the operator and their contractors, including informing them of their responsibilities to protect and report any cultural resources encountered during construction operations.

Preferred Alternative

The impacts to cultural resources are similar if not nearly identical to the impact analysis presented in the Proposed Action since the replacement of the PA 41-24 pad and PA 32-13 Production Support Pad with the PA 44-13 pad fell within the previously conducted cultural resource inventories.

No Action Alternative

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the impacts to this resource or resource use as described in the Proposed Action would occur.

4.4. FOSSIL RESOURCES

Affected Environment

The predominant bedrock formations present at or near the surface within the project area are the Shire member of the Wasatch Formation (including the Fort Union Formation or equivalent at its base) and the Anvil Points, Garden Gulch, and Parachute Creek members of the Green River Formation. Both formations are overlain by areas of Quaternary gravels and earthflow deposits. Occurring in varying thicknesses, these Quaternary sediments are considered Potential Fossil Yield Classification Class 2, defined as having a low probability of fossil occurrence. Class 2 geologic units are not likely to contain vertebrate or scientifically significant invertebrate fossils.

Both the Wasatch and Green River Formations are considered BLM Condition 5 formations, defined as an area that is known to contain vertebrate fossils or noteworthy occurrences of invertebrate fossils. These types of fossils are known to occur or have been documented, but may vary in occurrence and predictability. The Wasatch Formation is divided into the early Eocene Shire, and the Paleocene Molina and Atwell Gulch members, while the Eocene Green River Formation is divided into the Parachute Creek, Garden Gulch, Douglas Arch, Cow Ridge, and Anvil Points members.

All members of the Wasatch Formation contain vertebrate fossils in varying abundances (Murphy and Daitch 2007). Rocks of the Wasatch Formation are lithologically similar throughout the Piceance Creek Basin as heterogeneous continental fluvial deposits with interfingering channel sandstone beds and overbank deposits consisting of variegated claystone, mudstone, and siltstone beds (Franczyk et al. 1990). Eocene mammals have been found in the lower part of the Shire member.

Fossils historically identified in the Wasatch are archaic mammals—including marsupials, representatives of two extinct orders of early mammals (pantodonts and creodonts), artiodactyls (deer-like even-toed ungulates), ancestral horses and other perissodactyls (odd-toed ungulates), carnivores, and primates—as well as birds, lizards, turtles, crocodilians, gars and other fishes, freshwater clams, gastropods (snails), and other invertebrates (BLM 1999).

The Green River Formation consists of fine-grained lacustrine and fluvial-lacustrine rocks that were deposited in the Eocene Lake Uinta. The lake expanded early in its history, during the Long Point transgression (Johnson 1985), to cover much of the Piceance and Uinta Basins. The Green River Formation has yielded hundreds of invertebrate and plant fossils and more than 60 vertebrate taxa have been described from the formation, including crocodiles, boa constrictors, and birds.

Environmental Consequences

Proposed Action

The locations of roads, pads, and pipelines are primarily located in the Wasatch Formation. The Green River Formation is located north of any surface disturbance, and is not likely to be impacted by the proposed action. Although mapped as the predominant bedrock formation of the project area, field inspection revealed the Wasatch Formation exposed only in a few outcrops found on cliff faces and landslide exposures. Most of the project impacts occur on thick Quaternary deposits. The thickness of the Quaternary sediments cannot be accurately determined, but construction activities have the potential to affect adversely any important fossils present in the underlying Wasatch and Green Formations. The greatest potential for impacts is associated with excavation of shallow bedrock that may be unearthed during well pad and facilities (especially pipeline) construction. In general, alluvium, colluvium, and other unconsolidated sediments are much less likely than bedrock to contain well-preserved fossils.

An examination of the BLM paleontology database indicates that there are 11 known fossil discovery sites within a 1-mile radius of the project area. Areas covered with vegetation and soil cover do not usually yield fossil resources, but inspections should be conducted for proposed facilities that are located on or within 200 feet of Wasatch or Green River Formation bedrock surface exposures. As such, a paleontological survey was conducted by Western Colorado Paleontological Services May 24 and 25, 2017 (GRI Report 1117-03). Bedrock exposures within 200 feet of proposed disturbance were inspected for fossils. Searches resulted in two discoveries. The first (5GF5430) is an isolated vertebrate bone fragment from the Shire Member of the Wasatch Formation. While generally considered scientifically significant, this find is isolated and does not grade into a body fossil, and therefore this locality is determined not scientifically significant. The other find (5GF431) consists of small fragments of marine invertebrate fossils, which are not scientifically significant.

Because of the discoveries during the recent surveys, as well as other paleontological localities in the project vicinity, it is recommended that Terra use a qualified paleontological monitor during construction that would adversely affect bedrock or outcrops.

Preferred Alternative

The impacts to fossil resources are similar if not nearly identical to the impact analysis presented in the Proposed Action since the replacement of the PA 41-24 pad and PA 32-13 Production Support Pad with the PA 44-13 pad falls within similar disturbance footprints.

No Action Alternative

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the impacts to this resource or resource use as described in the Proposed Action would occur.

4.5. 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 19** lists the geologic formations within the project area.

Table 19. Geologic Formations within the Project Area

Map Symbol	***Formation Name***	***Age***	***Characteristics***	***Location***
Qg	Unconsolidated gravel deposits.	Pleistocene	Subangular to subrounded pebble, cobble, and boulder gravels.	Streams, outwash, and terraces.
Tgl	Green River	Tertiary	Fine-to coarse-grained sandstone and few layers of siltstone and oil shale.	Outcrops and ledges.
Two	Wasatch	Tertiary	Variegated claystone, some sandstone, and conglomerate.	Steep slopes and outcrops.
Source: Donnell et al. 1989				

The predominant bedrock exposures within the proposed development area are the Tertiary Green River and Wasatch Formations. The Green River Formation is composed of alternating layers of fine-grained sandstones and laminated to massive marlstone. The Green River Formation overlies the Wasatch Formation, which 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.

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 of natural gas and associated liquid condensate is derived from three reservoir intervals in 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 (lake), and palustrine (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 hydrocarbon 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 (related to lithology) and diagenetic (related to post-depositional process).

No commercial deposits of coal, oil shale, 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.

Environmental Consequences

Proposed Action

If the proposed wells are proven feasible, 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 1950s to be trapped within 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 that would be 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 are addressed in the Groundwater Subsection of **Section 4.17**.

Preferred Alternative

The impacts to geology and minerals are slightly less with 8% less wells to be developed in the Preferred Alternative when compared to the Proposed Action.

No Action Alternative

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the impacts to this resource or resource use as described in the Proposed Action would occur.

4.6. 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 were initially conducted from August 23 to September 12, 2017 and identified state-listed noxious weeds occurring within the BG2MDP project area, as well as other non-native plant species that can also have detrimental impacts on native plant communities (WWE 2017). A survey addendum report was submitted to BLM in July 2018 that reviewed new areas of the project related to the Preferred Alternative (WWE 2018). Thirteen Colorado State listed noxious weed species were observed within the project area. Noxious weeds were commonly observed near and along existing disturbances such as access roads and pipeline ROWs. Cheatgrass (*Bromus tectorum*), field bindweed (*Convolvulus arvensis*), halogeton (*Halogeton glomeratus*), and redstem filaree (*Erodium cicutarium*) were observed throughout the project area; however, mapping of these species was not feasible due to their widespread abundance. Noxious weeds observed in the project area are described in **Table 20**. Weed infestations for specific portions of the project area are described below.

Table 20. Noxious Weed Observations within the Project Area

Common and Scientific Name	***State Listing Status***	***Recorded Locations***
Bull thistle *Cirsium vulgare*	B List	Observed south of the proposed RWF 12-20 tank pad and along the existing road between the RWF 12-19 and RWF 13-19 well pads.
Canada thistle *Cirsium arvense*	B List	One location near the proposed PA 31-26 well pad and one location on the Anvil Points Mine access road.
Cheatgrass *Bromus tectorum*	C List	Thinly scattered throughout the project area along ridgetops and hillsides. More dense in the valley bottoms.
Common Mullein *Verbascum thapsus*	C List	Scattered occurrences near the two proposed cuttings storage pads.
Field bindweed *Convolvulus arvensis*	C List	Scattered along existing disturbances.
Halogeton *Halogeton glomeratus*	C List	Scattered along existing disturbances.
Hounds-tongue *Cynoglossum officinale*	B List	Scattered occurrences around proposed cutting storage pads and along the drainage leading to the proposed PA 31-26 pad.
Musk thistle *Carduus nutans*	B List	Densely scattered along the existing Anvil Points Mine access road to the proposed cuttings storage pads.
Plumeless thistle *Cirsium vulgare*	B List	Two observations along the existing Anvil Points Mine access road.
Redstem filaree *Erodium cicutarium*	C List	Common in areas of previous disturbance.
Russian knapweed *Acroptilon repens*	B List	Observed in an isolated patch on the existing road to the proposed RWF 12-20 tank pad.
Scotch thistle *Onopordum acanthium*	B List	Isolated occurrence near the existing PA 23-25 frac pad.
Tamarisk *Tamarix ramosissima*	B List	Found in scattered patches in drainages throughout the project area.
Source: WWE 2017.		

The most common problematic plant species not listed by the State of Colorado or by Garfield County and encountered during the survey included annual wheatgrass (*Eremopyrum triticeum*), Russian-thistle (*Salsola iberica*), and kochia (*Kochia scoparia*). All of these species have the potential to become invasive, particularly in disturbed areas.

Environmental Consequences

Proposed Action

Under the Proposed Action, a total of 55.49 acres would be disturbed, including 43.42 acres on BLM land and 12.17 acres on private land. Following construction, drilling, and well completions, interim reclamation would occur on all areas not needed for ongoing operations. A total of 10.90 acres would remain as long-term disturbance, including 9.14 acres on BLM land and 1.76 acres on private land. Temporary reclamation on BLM land would consist of seeding with native plant species in accordance

with the reclamation COAs presented in **Appendix A**. The composition of seed mixes used for reclamation on private lands would be at the discretion of the landowner.

Surface-disturbing activities, such as those proposed for this project, provide an opportunity for the invasion and establishment of non-native plant species, particularly when these species are already present in the surrounding area. The mechanisms for this invasion and establishment are three-fold. 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). Well pad construction and subsequent well drilling and operations activities, as well as new road construction and installation of gathering lines and pipelines, require construction equipment and motorized vehicles which often transport invasive plant seeds either alone or in mud clods on the vehicle undercarriage or tires and deposit them in disturbed habitats along access roads and at well pad sites (Zwaenepoel et. al. 2006; Schmidt 1989).

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, Vogelsgang 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 are difficult to eliminate.

Most of the project area has a history of disturbance associated with oil and gas development, and all of the project area has a history of livestock grazing. As a result, noxious weed occurrences are concentrated primarily near existing disturbance areas, although species that readily attach to the hair of livestock, such as hounds-tongue and cheatgrass, are more widely scattered. However, much of the previously undisturbed areas are essentially free of noxious weeds and other non-native species. With new project disturbances, the potential for increased establishment of noxious weeds and other undesirable plants following construction activities is high. Movement of soil by construction equipment could be expected to spread weed seeds throughout the project area, and the total area of disturbed habitat would increase. Vehicles and equipment could also transport new noxious weed species to the site, where they would have disturbed habitats in which to establish.

Installation of temporary surface pipelines would cause minimal disturbance, however workers and vehicles installing the pipeline could act as vectors to spread weed seeds. Cheatgrass and hounds-tongue in particular have seeds that attach easily to clothing if personnel walk through existing occurrences. If the ground is wet and muddy, weed seeds could also be transported in mud sticking to boots. To mitigate the invasive species risk, treatment of existing noxious weed infestations would be required prior to starting construction, and the standard weed control COA would be attached to APDs to require periodic monitoring and weed control practices to ensure that these weedy plants are controlled (**Appendix A**). Establishment of native plant species is also crucial in preventing the establishment and spread of invasive non-native plant species. Therefore, the standard reclamation COAs would also be attached to APDs to require seeding with an appropriate native seed mix and monitoring of reclamation seeding results (**Appendix A**).

Preferred Alternative

The total disturbance under the Preferred Alternative has slightly increased (1.12 acres) for short-term disturbance when compared to the Proposed Action while the long-term disturbance has a decrease of

0.60 acre. Essentially the impact analysis presented in the Proposed Action for invasive non-native plants remains unchanged and relevant for the Preferred Alternative.

No Action Alternative

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the impacts to this resource or resource use as described for the Proposed Action would occur.

4.7. LANDS WITH WILDERNESS CHARACTERISTICS

The Southeast Cliff Unit was found to contain wilderness characteristics in the updated inventory report of February 2016. The unit of 13,705 acres is located in Garfield County, approximately 4 miles northwest of Rifle. The unit's northern boundary is located on the southeastern and southern cliff edge of the Roan Plateau and includes lands south of the JQS road, east of Cottonwood Gulch, and north of private lands located north of I-70. The Southeast Cliff Unit was found to have wilderness characteristics in 2014 was updated to include lands farther south and west based on new information.

Naturalness. Due to the unit's steep and rugged topography and lack of public access routes, most of the area is inaccessible and appears to have been affected primarily by the forces of nature. The unit's boundaries were created to exclude all wilderness inventory roads (including oil and gas pad access roads) and oil and gas pads and associated developments (including surface pipelines or obviously disturbed linear area with underground pipelines). In addition, unnatural areas were excluded around the West Garfield landfill where trash had dispersed onto public land, and the waste oil shale depository. The total unit will continue to decrease in size from 13,705 acres to about 13,500 acres while Phase 2 construction continues into next fall to keep the unit natural (BLM 2017a).

Outstanding Opportunities for Solitude. The Southeast Cliff Unit provides visitors a variety of outstanding opportunities for solitude in some remote portions of the unit. The rugged topography and diverse vegetation provide natural screening and opportunities for seclusion in some areas. Outside sights and sounds are apparent in other areas of the unit. However, outstanding opportunities do not have to be everywhere in the unit for these criteria to be present.

Outstanding Opportunities for Primitive and Unconfined Recreation. The Southeast Cliff Unit offers visitors outstanding opportunities for primitive and unconfined recreation. Access is limited due to surrounding private land and the steepness of the cliffs. This, along with difficult terrain, restricts most visitors to undeveloped recreation activities in most of the unit excluding the top 113 acres on top of the plateau. However, visitors have excellent opportunities to enjoy undeveloped types of recreation such as hiking, backpacking, sightseeing, camping, wildlife viewing, and hunting in the portions where they can access.

Supplemental Values. Portions of this unit were identified as "Significant" conservation sites for biodiversity by the Colorado Natural Heritage Program (CNHP) in 1996. One element, the Parachute penstemon, has been found in only one other location. The unit includes the "Yellow Slide," which historically has been claimed, probably erroneously, to be a meteor impact site. The unit supports multiple elements identified by the CNHP report, including 1) cliff-nesting raptors such as the American peregrine falcon and golden eagle; 2) two watch-listed butterfly species; 3) several oil shale endemic plants including the Parachute penstemon; 4) montane grasslands; 5) excellent scenic opportunities; 6) big game refuge (security, seclusion) areas important during hunting seasons; and 7) geologic values.

Environmental Consequences

Proposed Action

The Proposed Action would develop 63 additional Federal directional wells on four new well pads. The total unit would decrease in size from 13,500 acres at the end of the first phase to about 13,470 acres to keep the unit natural to keep all infrastructure and disturbances outside of the unit boundary. This decrease of 30 acres is minimal compared to the rest of the unit's area. This would not affect outstanding opportunities for solitude or primitive and unconfined recreation, nor the supplemental values of the unit.

The Roan Plateau Planning Area Record of Decision and Approved Resource Management Plan Amendment (BLM 2016a) made the decision that the BLM would not manage to protect wilderness characteristics for this unit.

Preferred Alternative

The impacts to lands with wilderness character (LWC) would remain unchanged from the estimated 30-acre decrease analyzed in the Proposed Action. The replacement of the PA 41-24 and PA 32-13 Production Pads with the new PA 44-13 Pad essentially equalizes the overall change in LWC acreage.

No Action Alternative

Under this alternative, the proposed wells and associated infrastructure would not be approved, but the other existing well pads would continue to operate using the existing roads and pipeline infrastructure on BLM and private lands. Therefore, impacts to wilderness characteristics associated with implementation of the Proposed Action would not occur, and existing operations represent no impacts to lands with wilderness characteristics.

4.8. NATIVE AMERICAN RELIGIOUS CONCERNS

Affected Environment

The proposed Balzac Gulch Master Development Plan – Phase 2 project is located within a larger area identified by the Ute Tribes as part of their ancestral homeland. Two cultural resource inventories specific to this project were conducted to determine if there are any areas that might be culturally sensitive to Native Americans. Although some cultural resources were identified in this and prior inventories; no Native American historic properties are currently known to be located in the project's Area of Potential Effect.

Environmental Consequences

Proposed Action

At present, no Native American concerns are known within the project area, and none were identified during the inventories. The proposed Balzac Gulch Master Development Plan – Phase 2 project is located within a larger area identified by the Ute Tribes as part of their ancestral homeland. Several cultural resource inventories (see the section on Cultural Resources) were conducted specifically for this project to determine if there are any areas that might be culturally sensitive to Native Americans. No areas were identified during the inventories and none are currently known by the CRVFO within the proposed Balzac Gulch Master Development Plan – Phase 2 project area. If new data are identified or disclosed, new terms and conditions may have to be negotiated to accommodate their concerns. Although the Proposed Action would have no direct impacts, increased access and personnel at the site could indirectly impact previously unidentified Native American resources ranging from illegal collection to vandalism.

The NHPA requires that if newly discovered cultural resources are identified during project implementation, work in that area must stop and the agency Authorized Officer notified immediately (36 CFR 800.13). The Native American Graves Protection and Repatriation Act (NAGPRA), requires that if inadvertent discovery of Native American Remains or Objects occurs, activity must cease in the area of discovery, a reasonable effort made to protect the item(s) discovered, and immediate notice made to the agency Authorized Officer, as well as the appropriate Native American group(s) (IV.C.2). Notice may be followed by a 30-day delay (NAGPRA Section 3(d)).

Terra Energy Partners, LLC will notify its staff and contractors of the requirement under the NHPA, that work must cease if cultural resources are found during project operations. A standard Education/Discovery COA for the protection of Native American values would be attached to the ROW Agreement (see **Appendix A**). The importance of these COAs should be stressed to the operator and its contractors, including informing them of their responsibilities to protect and report any cultural resources encountered. The operator and its contractors would be made aware of the requirements under the NAGPRA.

Preferred Alternative

The impacts to cultural resources are similar if not nearly identical to the impact analysis presented in the Proposed Action since the replacement of the PA 41-24 pad and PA 32-13 Production Support Pad with the PA 44-13 pad fell within the previously conducted cultural resource inventories.

No Action Alternative

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the impacts to this resource or resource use as described in the Proposed Action would occur.

4.9. NOISE

Affected Environment

The project area is located about 6 miles northeast of the Town of Parachute and about 9 miles west of the City of Rifle in a rural setting characterized by I-70 traffic, oil and gas development, wildlife habitat, ranching, and sparse residences. Noise levels in the area are generally created by traffic on roads and by activities associated with oil and gas development, the latter primarily during construction, drilling, and completion activities. The nearest residence is approximately 1,850 feet to the south of the PA 34-24 pad. Commercial buildings and other oil and gas development are also in the vicinity.

Noise is generally described as unwanted sound and may be measured with an A-weighted decibel (dBA) scale. The decibel scale is logarithmic, not linear, because the range of sound detected by the human ear is so great that it is convenient to compress the scale. A dBA scale accounts for the lesser sensitivity of the human ear to low and high frequencies, which are in turn weighted less on the dBA scale than on the standard dB scale. Each 10-unit increase in dBA increases the sound intensity by a factor of 10.

Sound levels have been calculated for areas that exhibit typical land uses and population densities. In rural recreational areas, ambient sound levels are typically 30 to 40 dBA (EPA 1974, Harris 1991). As a basis for comparison, the sound level of a normal conversation between two people standing five feet apart is 60 dBA.

Environmental Consequences

Proposed Action

The Proposed Action would increase the frequency of noise. Noise levels would increase during construction activities, 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 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 21**) 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, and workover rig are subject to the maximum permissible noise levels for industrial zones.

Given the location of the project activities and current activities in the area, the light industrial standard is applicable. The allowable noise level for periodic impulsive or shrill noises is reduced by 5 dBA from the levels shown (COGCC 2014).

Table 21. 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
Source: COGCC 2014		

Short-term increases in noise levels would characterize the pipeline, road, and well pad construction. Based on the Inverse Square Law of Noise Propagation (Harris 1991), the typical noise level for construction sites is about 68 dBA at 350 feet (**Table 22**). Project-related noise levels would be approximately 59 dBA at a distance of 1,000 feet, approximating active commercial areas (EPA 1974). Using this information, anticipated noise levels for the project would be equivalent to the noise standards for daytime operations (defined as 7:00 a.m. to 7:00 p.m.) in the light industrial zone at a distance of 350 feet (**Tables 21 and 22**). At a distance of 1,850 feet (the distance to the nearest residence), the anticipated level (54 dBA) would approximate the daytime standard for the residential/agricultural/rural zone.

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 use existing water line systems to transport water. Based on La Plata County data presented in **Table 22**, 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.

Table 22. Noise Levels at Typical Construction Sites and along Access Roads

Equipment	*Noise Level (dBA)*		
	50 feet	*350 feet*	*1,000 feet*
Air Compressor, Concrete Pump	82	65	56
Backhoe	85	68	59
Bulldozer	89	72	63
Crane	88	71	62
Front End Loader	83	66	57
Heavy Truck	88	71	62
Motor Grader	85	68	59
Road Scraper	87	70	61
Tractor, Vibrator/Roller	80	63	54
Sources: BLM 1999; La Plata County 2002			

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.

Preferred Alternative

Noise impacts from the Preferred Alternative would be more intense than those of the Proposed Action due to simops development at two locations (rather than one) and over one year (rather than two years). Noise impacts would occur over a larger area but over a shorter duration.

No Action Alternative

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the impacts to this resource or resource use as described for the Proposed Action would occur.

4.10. REALTY AUTHORIZATIONS

Affected Environment

Within the project area, there are numerous existing realty authorizations. **Table 23** lists the BLM mineral leases, associated lessees, communitization agreements, and various types of ROWs and ROW holders located within Section 19, Township 6 South, Range 94 West, 6th P.M.

Two oil and gas leases held by Terra cover the project area within Section 19, T6S, R94W:

- Lease (COC27868) covers Lots 9-12 and Lots 16-18
- Lease (COC62160) covers Lots 3-8 and Lots 13-15

Three Communitization Agreements (CAs) are authorized to Terra in Section 19:

- CA (COC42343) covering gas production from the Wasatch Formation in Lots 3, 4, 9, and 10
- CA (COC42344) covering gas production from the Mesaverde Formation in Lots 3-10
- CA (COC60132) covering gas production from the Mesaverde Formation in Lots 11-18

Table 23. Existing Realty Authorizations within T6S, R94W, Section 19, 6th P.M.

Oil and Gas Leases and Communitization Agreements	***Serialized Realty Actions by Type***			
	Powerlines	***Access Roads***	***Pipelines***	***Other***
Leases COC27868 -Terra COC62160 -Terra Communitization Agreement(s) COC42343 -Terra COC4234 4 - Terra COC60132-Terra	CC30381 - Quest Corporation	COC40249 - DOE, WAPA	COC70860 -Terra COC74870 - Terra COC748780A - Terra	COC69836 - BLM COC76427 - Terra COC73900 - Terra

Quest Corporation held a BLM ROW (COC30381) for a buried telephone line in Lot 3, which was recently relinquished and closed in 2017. The Department of Energy (DOE) Western Area Power Administration (WAPA) holds a BLM ROW (COC40249) in lots 9 and 10, which allows the use of the DOE 1-M-19 well pad and access to the pad across the existing BLM road. Since the transfer of Naval Oil Shale Reserves 1 and 3 from the DOE to the BLM in the late 1990s, this ROW is no longer necessary and would be subject to relinquishment by the BLM as time allows.

Pipeline ROW (COC70860) issued to Terra authorizes the operation of a 24-inch buried natural gas gathering line from the Webster Hill compressor to the Rabbit Bush compressor in Section 19, Lots 9, 10, 12, 13, and 15. In that same corridor, Terra also holds ROW (COC74870) for a 10-inch produced water pipeline that runs from the PA 22-35 well pad in the NW¼ of Section 30, and ROW (COC74780A) for a 6-inch produced water pipeline that runs from the Rulison Evaporation Facility in Section 20.

Other existing ROW authorizations in Section 19 include:

- COC69836 issued to Anvil Points authorizing an 8-acre spent oil shale repository
- COC76427 issued to Terra which authorizes produced water disposal within Federal pore space in Lot 12, Section 19 emanating from a fee well (RMV 205-20) located in SW¼NW¼ of Section 20
- COC73900 issued to Terra which authorizes produced water disposal within Federal pore space from two fee wells (RWF 32-30 and RWF 332-40 pads) situated in Lot 17 and as allowed under the terms of a Communitization Agreement

Table 24 lists the BLM mineral leases, associated lessees and various types of ROWs and ROW holders located within Sections 13, 23, 24, 25, and 26, Township 6 South, Range 95 West, Sixth P.M.

Table 24. Existing Realty Authorizations within T6S, R95W, Sections 13, 23-26, 6th P.M.

Oil and Gas Leases and Communitization Agreements	***Serialized Realty Actions by Type***			
	Powerlines	***Access Roads***	***Pipelines***	***Other***
Leases COC62161-Terra COC73094 -Terra Communitization Agreement(s) COC62730 -Terra COC66630 -Terra	COC35161 - PSCo	COC63154 - Mobil Oil Corp COC66659 - Tosco Corp & Puckett Land Co.	COC70860 - Terra COC74870 - Terra COC748780A - Terra	COC66664 - Terra COC76267 - Terra COC93824 - Union Pacific Railroad

Two oil and gas leases held by Terra cover the project area within Sections 13, and 23-26, T6S, R95W:

- Lease (COC62161) covering Lots 3-6 and N½SW¼ of Section 26
- Lease (COC73094) covering; Lots 1-4 and E½, E½W½, in Section 13, Lots 1-10 and SE¼NE¼, NE¼SW¼, N½SE¼ in Section 23, Lots 1-5, NE, NE¼NW¼, S½NW¼, N½S½ in Section 24, W¼NE¼, N½NW¼, SW¼NW¼, NW¼SW¼ in Section 25, and Lots 1,2,7,8, and N½SE¼, SW¼SE¼ in Section 26

Two Communitization Agreements (CAs) are authorized to Terra within the Sections listed:

- CA (COC62730) covering gas production from the Wasatch Formation in the SW¼ of Section 26
- CA (COC66630) covering gas production from the Mesaverde Formation in Lots 3-6 and the SW½ of Section 26

Public Service Company of Colorado (PSCo) holds a BLM ROW (COC35161) for a 13.1 mile, 69kv, Shoshone-Palisade overhead electric transmission line in the NW¼ of Section 25.

Mobil Oil Corp holds one authorization: (COC63154) for 3.15 miles of access road easement in the S½SW¼ of Section 26.

Tosco Corp and Puckett Land Co. held ROW (COC66659) for a 1.63 mile-long easement on an access road in the SE¼SE¼ of Section 26; the road was closed in 2013.

Pipeline ROW (COC70860) was issued to Terra authorizing the operation of a 24-inch buried natural gas gathering line from the Webster Hill compressor to the Rabbit Bush compressor in the NW1/4NE1/4 of Section 25. In that same corridor, Terra is also authorized ROW (COC74870) for a 10-inch produced water pipeline that runs from the RWF 22-35 well pad in the NW¼ of Section 30, and ROW (COC74780A) for a 6-inch produced water pipeline that runs from the Rulison Evaporation Facility in Section 20.

Other existing ROW authorizations include:

- Department of Energy (DOE) Naval Oil Shale Reserve (NOSR) ROW (COC66664) in the SW¼SW¼ of Sections 26
- Terra ROW (COC76267) for a salt water disposal (SWD) well number DOE 1- W-26 and a 4-inch buried Flexsteel produced water pipeline located in Lot 6 and the NE¼SW¼ of Section 26
- Union Pacific Railroad ROW (COC93824) runs through Lots 1-3 and the S½SW¼ of Section 25

Environmental Consequences

Proposed Action

Table 5 lists the various ROWs to be issued allowing the development of 63 new Federal wells that would be drilled into the adjacent Federal lease (COC73094) from four new proposed well pads PA 31-26, PA 32-13, PA 34-24, and PA 41-24, shown in **Figure 1**. Potential impacts to any of the existing BLM ROWs listed in **Tables 23 and 24** by the lease operations or ROWs proposed by Terra would be mitigated based on written maintenance and use agreements between Terra and the various existing ROW holders.

Preferred Alternative

Table 9 lists the various ROWs to be issued allowing the development of 58 new Federal wells that would be drilled into the adjacent Federal lease (COC73094) from four new proposed well pads PA 31-26, PA 32-13, PA 34-24, and PA 44-13 shown in **Figure 11**.

The impacts to realty authorizations are similar to the impact analysis presented in the Proposed Action with the exception that the deletion of the PA 41-24 pad in the Preferred Alternative negates the need for a site ROW to be issued for the 13 "off lease" Federal wells.

No Action Alternative

Under this alternative, none of the proposed new wells, new well pads or associated infrastructure or facilities would be developed on BLM-administered public land. Therefore, none of the impacts to this resource or resource use as described for the Proposed Action would occur.

4.11. SOCIOECONOMICS

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 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 ¾ of the population residing in urban areas and ¼ of the population 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 25** lists the top 10 industries in Garfield County for the second quarter of 2016.

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, while the communities of Glenwood Springs and Carbondale have the least affordable housing, which is largely influenced by more limited space for residential development and greater proximity to resort facilities. The County has a very low vacancy rate of 3.65%.

Table 25. 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		

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 Council on

Environmental Quality (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.

Preferred Alternative

Knowing that there would be five fewer wells developed and produced, the Preferred Alternative would have similar impacts as outlined in the Proposed Action. With 8% less wells to be developed in the Preferred Alternative, less benefits to the Garfield County economy and tax revenues could be the result. The Preferred Alternative would result in similar 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

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the impacts to this resource or resource use as described for the Proposed Action would occur.

4.12. SOILS

Affected Environment

The project area is situated amongst the steep southern slopes and ridgelines of the Roan Plateau, as well as the foothills and alluvial fans of tributaries to the Colorado River. The proposed western pads are east-facing at elevations ranging from 5,320 to 5,560 feet amsl. The proposed eastern pads are generally south-to-southwest-facing at elevations between 6,450 and 6,600 feet amsl. The gradient ranges from level to very steep. Five soil types would be disturbed and are described in **Table 26** (Soil Survey Staff 2017), arranged by decreasing proportion of the proposed disturbance area.

Environmental Consequences

Proposed Action

The Proposed Action would impact soil characteristics and productivity. Additional potential impacts would include:

- Erosion due to water, wind, loss of vegetation, and mass wasting
- Compaction and damage to soil structure from heavy construction equipment
- Mixing or displacement from grading, excavation, stockpiling, and reclamation

- Rutting from equipment or vehicle traffic
- Structural damage to wet or frozen soils and soils with poor drainage
- Introduction of large stones or rocks into the topsoil

Table 26. Soil Description of the BG2MDP Area

Soil Map Unit	***Description***	***Disturbance (%)***	***Project Components***
35 – Ildefonso-Lazear complex, 6 to 65% slopes	Well-drained soil on breaks and hillsides. Originates from very calcareous, mixed, stony alluvium derived from basalt. The topsoil varies from a 4-inch-thick gravelly loam to an 8-inch-thick stony loam. Non-saline to slightly saline. Moderate to very rapid runoff. Low to high permeability. Moderate erosion hazard. Reclamation may be challenging due to steep slopes, large rock fragments, and water erosion.	39	PA 32-13 pad, support pads, road, and pipelines; RWF 334-18 cuttings pad; majority of PA 41-24 pad; minor portions of access road and pipelines to PA 41-24
47 – Nihill channery loam, 6 to 25% slopes	Well-drained soil on alluvial fans and valley sides. Originates from alluvium derived from sandstone and shale. The topsoil is an 11-inch-thick channery loam. Slow runoff. Non-saline to slightly saline. High or moderately high permeability. Moderate erosion hazard. Reclamation may be challenging due to steeper slopes, large rock fragments, and water erosion.	27	Minor portion of PA 31-26 and PA 34-24 pads; major portion of roads and pipelines to PA 31-26 and PA 34-24; RWF 12-20 tank pad; road and pipelines up to RWF 334-18 (leading to PA 41-24)
66 – Torriorthents-Camborthids-Rock outcrop complex, steep	Well-drained soils on mountainsides. Originates from stony, basaltic alluvium derived from sandstone and shale. The topsoil depth is 4 inches with variable soil and rock. Non-saline to very slightly saline. Rapid runoff. Moderately low to moderately high permeability. Very severe erosion hazard. Reclamation may be challenging due to steep slopes, water erosion, and rock outcrops.	20	RWF 21-18 cuttings pad; majority of access road and pipelines to PA 41-24 (from the RWF 334-18); minor portion of road and pipelines to PA 31-26
9 – Badland	Nearly barren soft shale and sandstone and/or soft shale and siltstone on intermittent drainageways. Very rapid runoff. Very low to moderately high permeability. Very severe erosion hazard. Challenging to reclaim.	11	Majority of PA 31-26 and PA 34-24 pads; minor portion of PA 31-26 access road
3 – Arvada loam, 1 to 6% slopes	Well-drained soil on terraces and fans. Originates from highly saline alluvium derived from sandstone and shale. The topsoil is a 3-inch loam. Slightly saline to strongly saline. Rapid runoff. Moderately low to moderately high permeability. High shrink-swell. Slight erosion hazard. Reclamation may be challenging due to excessive sodium and salt.	3	Minor portion of PA 31-26 access road; minor portion of pipelines to PA 31-26 and PA 34-24
Soil Survey Staff 2017			

The Proposed Action would increase soil loss, decrease soil productivity, and increase sediment available for transport to surface waters. Potential for such soil loss and transport would increase as a function of slope, feature (pad, road, or pipeline route) to be constructed, and proximity to streams and drainages. Infestations of noxious weeds resulting from soil disturbance could also affect soil productivity. The

potential for soil transport to surface waters would increase as a function of slope, proximity to streams, and type of disturbance. Impacts would be minimized by implementing stormwater management BMPs, stockpiling and windrowing topsoil, controlling erosion, and rehabilitating disturbed surfaces as quickly as feasible.

Surface-use stipulation GS-NSO-Roan-22 for steep slopes (greater than 50 percent) applies to the project. The Proposed Action would disturb steep slopes greater than 50% at the following locations:

- Two areas on BLM land along the proposed PA 31-26 access road, one at the western embankment of the low-water crossing and the other that shifts the access road upgradient of the existing two-track road and away from the ephemeral drainage but crosses a side ridge with steep sideslopes.
- Two areas along the proposed PA 34-24 access road, one that avoids a drainage and encroaches on steep slopes but avoids very steep slopes and the other that intersects steep slopes on either side of the drainage crossing. The first point, it should be noted, occurs on private land, which is not subject to Federal lease stipulations.
- Four areas on BLM land along the proposed PA 32-13 access road at drainage crossings, where stormwater would be managed to ensure continued drainage function.
- Two locations of the proposed PA 32-13 drill pad, one at the central southern pad perimeter that temporarily fills a small drainage and the other at the drainage crossing onto the pad that would be temporarily filled. In both cases, the fill material would be removed and the drainage function restored at the time of interim reclamation.

These points would require NSO exceptions. Since the project area has erosive soils and slopes greater than 30 percent, GS-CSU-Roan-04 applies. As such, project-specific surface-use COAs and mitigation measures were developed (**Appendix A**) and would apply to protect soil resources and ensure reclamation success. An example is provided below.

Terra would conduct a geotechnical review by a qualified engineer of the PA 32-13 pad before pad construction commences to examine soil characteristics and site stability factors and to ensure the pad construction layout properly addresses the review findings. Although a geotechnical review is typically sought prior to NEPA preparation and any project disturbance, BLM determined that the ground and vegetation disturbance needed to allow a tracked core-drilling rig to the isolated site was beyond the scope of "casual use." A COA in **Appendix A** addresses the timing and scope of the required geotechnical examination and incorporation of the knowledge gained into the pad construction once the PA 32-13 APDs are approved and the road is pioneered for core-drilling equipment access.

The surface pipelines between the PA 41-24 and RWF 23-19 pads would be laid on soils with moderate to very severe erosion hazards. Portions of the surface pipelines would also descend slopes greater than 50 percent; however, these pipelines would be temporary and, in contrast to the other pipelines, would not disturb the surface. Particular care would be taken to ensure that proper BMPs, including the COAs listed in **Appendix A**, are used to prevent erosion and slope instability due to the development.

The proposed PA 31-26 pad is on fairly level ground in a narrow valley between ridgelines at the base of the Roan Plateau. The proposed pad layout is largely based on avoidance of steep slopes and drainages. Disturbance to the western portion of the pad would avoid steep slopes, as well as the head of a natural drainage, where surface runoff from the surrounding steep slopes concentrates. A diversion ditch would tie into this drainage further downgradient, where sedimentation tends to occur, direct flows around the pad, and tie back into an existing drainage, which would have a culvert installed near the pad entrance. Since topsoil would not be windrowed around much of the pad perimeter due to topographical constraints, a relatively flat area south of the pad would be used for topsoil storage. The proposed access road

alignment is based on minimizing the overall road length (i.e., disturbance), using as much of the existing two-track road as possible, and maximizing distances from drainages. Most of the two-track road leading to the pad would be used and upgraded (including a low-water crossing) with a minimal road width; the portions of the existing two-track road not used would be reclaimed. The proposed cuttings trench was revised to ensure an adequate buffer from a drainage. The proposed pipelines would be collocated in the access road and buried deep at the low-water drainage crossing. The proposed wells would be remotely fractured from the PA 23-25 pad, and produced water and condensate tanks would be stored on the PA 22-25 pad.

The proposed PA 34-24 pad is situated on fairly level ground in Balzac Gulch, with a layout largely dictated by drainages and the surrounding steep slopes of the gulch. Cuttings from well drilling would be managed in a trench on the northern portion of the pad and distanced from drainages. The proposed pad would require the construction of a new access road with a large culvert installed at the Balzac Gulch drainage crossing. To minimize surface disturbance, wells would be remotely fractured from the PA 23-25 pad, and produced water and condensate tanks would be stored on the PA 22-25 pad. The proposed pipelines would be collocated in the proposed access road and within existing pipeline easements. Pipelines would be buried deep at the drainage crossing.

The location of the proposed PA 41-24 pad is on a fairly level grade along a ridgeline, adjacent to a switchback in the existing Anvil Points Road. To minimize surface disturbance and avoid steep slopes, cuttings from well drilling would be stored at the RWF 21-18 pad, wells would be remotely fractured from the RWF 23-19 pad, and produced water and condensate tanks would be stored on the RWF 12-20 pad. The proposed pipelines would be collocated in the existing road. Pipelines would be buried deep at an existing low-water crossing. The low water crossing would be upgraded and maintained in collaboration with Garfield County and the BLM; in addition, the existing low-water drainage crossing and its reinforcement will be examined by a qualified geotechnical engineer to ensure adequacy for the proposed use (**Appendix A**).

The general area of the proposed PA 32-13 pad has steep slopes, rock outcrops, and erosive soils. The areas of proposed disturbance were carefully selected and ground-truthed in the challenging terrain to minimize environmental impacts. The location, shape, and area of the proposed PA 32-13 pad were dictated by steep slopes. Since the proposed well pad cannot accommodate well development due to its limited size, two support pads are proposed along the access road. With the exception of areas necessary for road turnouts, the support pads would be fully reclaimed after well development. Pipelines would be collocated in the road. The proposed road alignment follows level grades as much as possible, with culverts installed at drainage crossings that would be reinforced with boulders. To minimize surface disturbance and avoid steep slopes, cuttings from well drilling would be stored at the RWF 21-18 pad, wells would be remotely fractured from the RWF 23-19 pad, and produced water and condensate tanks would be stored on the RWF 12-20 pad. A long culvert would be installed on the southeast pad corner to provide the working area necessary for well development; however, the culvert would be substantially reduced in length following well development and the associated natural drainage would be reclaimed.

Two existing pads, RWF 334-18 and RWF 21-18, would be used for storage of cuttings from wells developed on the proposed PA 32-13 and PA 41-24 pads. The interim-reclaimed RWF 334-18 pad would be re-disturbed and slightly expanded at the northeast corner to accommodate the cuttings storage. The existing RWF 21-18 working pad has very steep, barren cut slopes from previous disturbance. This existing pad was selected for cuttings storage due to its proximity to the proposed PA 32-13 and 41-24 pads (minimizing the haul distance), adequate space to accommodate cuttings storage, and potential for improved reclamation. The RWF 21-18 pad would be re-disturbed to store cuttings produced from the wells on the PA 32-13 and PA 41-24 pads. The cuttings would be laid against the cut slopes to better reshape and blend the site into the natural landscape, as well as to facilitate successful revegetation.

Existing equipment on the fillslope would be removed, thereby making the fillslope material available. The fillslope material would be used for capping the cuttings and maximizing the reclaimed area of the site.

The proposed RWF 12-20 tank pad would be located on level ground in existing disturbance.

Long-term soil protection could be achieved by continued road and pad maintenance to reduce erosion (e.g., graveled roads, crowned road surfaces, and storm-water management), minimization of the long-term pad footprints through interim reclamation measures, and remediation of contaminated soils.

During interim and final reclamation, Terra would be responsible for revegetating the disturbance area until self-sustaining communities of desirable plants have 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 stipulations presented in **Appendix A** 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.

The Proposed Action includes the following BMPs, which reduce potential soil impacts:

- Approximately 40 percent of the proposed disturbance area is either existing or previously disturbed (**Table 6**).
- Construction of pads, roads, and pipelines would follow the guidelines established in the BLM Gold Book, *Surface Operating Standards for Oil and Gas Exploration and Development* (USDI and USDA 2007).
- The new access roads would be surfaced with gravel or a suitable substitute to minimize fugitive dust and erosion and to ensure all-weather accessibility to the pad sites; existing roads would undergo review for spot-graveling needs.
- During road and pipeline construction, topsoil would be segregated along both sides of the road or along one edge of the pipeline corridor for later placement back onto the reclaimed ROW.
- Topsoil at the pad sites would be stored in windrows where feasible or in piles along the access roads or near the pad perimeters, and would be temporarily seeded until interim reclamation is scheduled after all wells on a pad are placed into production. Flatter terrain would be used to store topsoil in proximity to the pad sites. Topsoil along the road/pipeline corridor would generally be stored in a discontinuous windrow as topography dictates (i.e., avoiding drainages and steep side hills.
- A closed-loop drilling system would be used during drilling, eliminating the need for a fluid-containing reserve pit. Recovered drilling fluid would be stored on location in steel tanks for reuse.
- Drill cuttings would be tested and remediated per COGCC regulations (Table 910-1 standards) prior to reshaping for interim reclamation.
- Standard best management practices would be implemented to ensure disturbed areas on pads, roads, and pipelines are reclaimed in a timely manner.
- Portions of the hydraulic fracturing pipelines would be laid cross-country; however, these pipelines would be temporarily laid on the surface, minimizing disturbance.

Preferred Alternative

The overall amount of disturbed soils of the Preferred Alternative (**Table 10**) would be slightly less than that of the Proposed Action (**Table 6**). In addition, impacts on steep slopes (50%) would be greatly

reduced at the proposed PA 32-13 pad. The reduced pad footprint would nearly avoid 50% slopes, except in the small area at the central southern pad perimeter (see **Appendix C** for greater detail).

Overall, the various small areas on BLM land needing exception to the steep slope NSO would total 0.51 acre of steep sideslopes. As shown in the various exhibits in **Appendix C**, eight of the nine locations exceeding a 50% slope would occur on BLM land, with one location (shown as "C" and representing 0.24 acre) along the PA 34-24 access road occurring on private land. These isolated small areas are typically drainage-related (areas of steep channel sideslopes) and would be readily mitigated with stormwater controls and best management reclamation practices associated with culvert installations representing 0.36 acre on BLM road segments. In other instances, small steep areas would be compacted, controlled, and stabilized during placement of fill material around and over the steep areas to become part of the new roadway on the PA 31-26 access road (shown as "B" and representing 0.14 acre) or the southern fillslope of the PA 32-13 pad (shown as "I" and representing 0.01 acre). In summary, the affected steep areas would be stabilized with appropriate stormwater controls and promptly reclaimed within 7 days after excavation work is completed.

No Action Alternative

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the impacts to this resource or resource use as described for the Proposed Action would occur.

4.13. SPECIAL STATUS SPECIES

FEDERALLY LISTED, PROPOSED, OR CANDIDATE PLANT SPECIES

Affected Environment

The U.S. Fish and Wildlife Service (2017a) identified three plants species listed as threatened under the Endangered Species Act (ESA) that should be considered in effects analysis for the Proposed Action. **Table 27** lists these species and summarizes information on their habitat associations, potential for occurrence in the project vicinity based on known geographic range and habitats present, and potential for adverse impacts from the Proposed Action.

Table 27. Potential for Occurrence of Threatened or Endangered Plant Species

Species and Status	***Occurrence***	***Habitat Association***	***Range or Habitat in Vicinity?***	***Potentially Affected?***
Colorado hookless cactus *(Sclerocactus glaucus)* – Threatened	Rocky hills, mesa slopes, and alluvial benches in salt desert shrub communities; often with well-formed microbiotic crusts; can occur in dense cheatgrass 4,500 to 6000 feet	Desert shrubland with shadscale, galleta grass, black sagebrush, Indian ricegrass grading upward into big sagebrush and sagebrush/pinyon-juniper	No	No
DeBeque phacelia *(Phacelia submutica)* – Threatened	Sparsely vegetated, steep slopes in chocolate-brown, gray, or red clay on Atwell Gulch and Shire Members, Wasatch Formation; 4,700 to 6,200 feet	Desert shrubland with four wing saltbush, shadscale, greasewood, broom snakeweed, bottlebrush squirreltail and Indian ricegrass, grading upward into scattered junipers	No	No

Species and Status	***Occurrence***	***Habitat Association***	***Range or Habitat in Vicinity?***	***Potentially Affected?***
Parachute Beardtongue *Penstemon debilis* – Threatened with Critical Habitat	Sparsely vegetated, steep, white shale talus slopes of the Parachute Creek Member of the Green River Formation at elevations of 8,000 to 9,000 feet.	Associated species include bluebunch wheatgrass, alderleaf mountain mahogany, yellow rabbitbrush, Henderson's wavewing, lanceleaf buckwheat, Colorado bedstraw, rock-spirea, rayless tansy-aster, dragon milkvetch, oil shale fescue, and Cathedral Bluffs meadow-rue	Yes	No

Surveys were conducted according to BLM CRVFO plant inventory standards (BLM 2013) from August 23 to September 12, 2017, which is outside of the active flowering season for the ESA-listed plants. No Colorado hookless cactus plants were observed during surveys; the project area is greater than 1 mile to the east from known locations of this species (WWE 2017). No Debeque phacelia plants or suitable habitat were detected during surveys. Based on field observations and inspection by qualified biologists, no areas within the survey buffers demonstrated habitat characteristics preferred by this plant species (WWE 2017). Parachute beardtongue was not observed during surveys (WWE 2017).

Environmental Consequences

Proposed Action

Colorado hookless cactus were not observed during surveys conducted from August 23 to September 12, 2017. Additionally, no DeBeque phacelia or its suitable habitat or Parachute beardtongue were observed during surveys. Because no occurrences of any Federally listed plant species are known or expected within or near the project area, the determination for all three Federally listed plants is "**No Effect**."

Preferred Alternative

No occurrences of any Federally listed, proposed, or candidate threatened or endangered plant species are known or expected within or near the project area as it relates to the Preferred Alternative, so the determination for all three Federally listed plants is "**No Effect**."

No Action Alternative

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the impacts to this resource or resource use as described for the Proposed Action would occur.

BLM SENSITIVE PLANT SPECIES

Affected Environment

During surveys in 2017 and 2018, BLM sensitive plant species were searched for within 30 meters of project boundaries (WWE 2017). The 2018 survey identified no additional findings or information for BLM sensitive plants. Four BLM sensitive plant species have the potential to occur in the project area including Cathedral Bluff meadow-rue (*Thalictrum heliophilum*), DeBeque milkvetch (*Astragalus debequaeus*), Piceance bladderpod (*Lesquerella parviflora*), and Roan Cliffs blazing star (*Mentzelia rhizomata*).

The focus for surveys for Cathedral Bluff meadow-rue (typical elevational range is 6,300 to 8,800 feet) and Piceance bladderpod (typical elevational range is 6,200 to 8,600 feet) was in streambeds and washes that contained appropriate shale soils eroded from higher elevation outcrops on the Roan Plateau. Neither of these species were observed during surveys (WWE 2017).

DeBeque milkvetch occurs on varicolored, fine textured, seleniferous, saline soils of the Atwell Gulch Member of the Wasatch Formation at elevations ranging from 5,100 to 6,400 feet. DeBeque milkvetch was observed near previously mapped locations outside of the plant survey buffer; however, no DeBeque milkvetch was found to occur within the plant survey buffer (WWE 2017).

Roan Cliffs blazing star typically occurs on steep eroding talus slopes of shale from the Green River Formation at elevations of 5,800 to 9,000 feet. The focus of surveys for this species was in streambeds and washes that contained appropriate shale soils eroded from higher elevation talus slopes on the Roan Plateau. Roan Cliffs blazing star was observed at two locations within the 30-meter plant survey buffer along the Anvil Points Road between the proposed RWF 12-20 Tank Pad and the proposed cuttings storage pads. Both locations were in a drainage below the species' typical elevational range. There were five plants at one of the locations and three plants at the other (WWE 2017).

Environmental Consequences

Proposed Action

Because no occurrences of Cathedral Bluff meadow-rue, Piceance bladderpod, or DeBeque milkvetch are known within the 30-meter survey area, the Proposed Action would have no effects on these species. Both occurrences of Roan Cliffs blazing star are likely from seed sources that were washed down from occupied habitat incidentally and likely do not constitute a stable population, because storm events or heavy spring runoff would eventually uproot the plants. No direct impacts to the Roan Cliffs blazing star would be expected. No special protections for these plants are recommended.

Preferred Alternative

The Roan Cliffs blazing star would not be negatively affected by the actions described in the Preferred Alternative. No special protections for these plants are recommended.

No Action Alternative

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the impacts to this resource or resource use as described for the Proposed Action would occur.

FEDERALLY LISTED, PROPOSED, OR CANDIDATE FISH AND WILDLIFE SPECIES

Affected Environment

Federally listed, proposed, or candidate species potentially occurring within or affected by actions in Garfield County include eight species of vertebrate wildlife. **Table 28** lists these species and summarizes information on their distribution, habitat associations, and potential to occur or be adversely affected.

Environmental Consequences

Proposed Action

The Canada lynx, greater sage-grouse, Mexican spotted owl, distinct western population segment of the yellow-billed cuckoo, and Green Lineage Colorado River cutthroat trout 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, based on the summaries below.

Table 28. Potential for Occurrence of Threatened or Endangered Animal Species

Species and Status	***Distribution in Region***	***Preferred Habitats***	***Potentially Present in Vicinity?***	***Potentially Adversely Affected?***
Canada lynx *(Lynx canadensis)* – 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
Yellow-billed cuckoo (*Coccyzus americanus*), Distinct Western Population Segment- – Threatened	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 (*Strix occidentalis lucida*) – 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 (*Xyrauchen texanus*) – Endangered	Colorado River and major tributary rivers, including mainstem Colorado River upstream to town of Rifle in CRVFO.	General: Deep, slow runs, pools, and eddies. Spawning: silt to gravel substrates in shallow water and seasonally flooded overbank areas.	**Yes**	**Yes**
Colorado pikeminnow *(Ptychocheilus lucius*) – Endangered			**Yes**	**Yes**
Humpback chub (*Gila cypha*) -- Endangered	Mainstem Colorado River and major tributaries – upstream to Black Rocks near Utah state line.	Rocky runs, riffles, and rapids in swift, deep rivers.	**Yes**	**Yes**
Bonytail chub (*Gila elegans*) – Endangered			**Yes**	**Yes**
*Green Lineage Colorado River cutthroat trout (*Oncorhynchus clarkii* 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 (*O. c. stomias*) pending completion of genetic and morphometric studies and taxonomic reassessment of native cutthroat trout in Colorado.

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. This portion of the Colorado River lies a few miles northeast of the project area. The nearest known habitat for the humpback chub and bonytail is within the Colorado River approximately 70 miles downstream from the project area. Occasionally, the bonytail is in Colorado west of Grand Junction, but its range does not

extend east from that point. Only one population of humpback chub, at Black Rocks west of Grand Junction, is known to exist in Colorado.

The four endangered Colorado River fishes are assumed likely to 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.

Given that the proposed action would result in the estimated depletion of 0.58 acre-feet of fresh water from within 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 (BLM 2017).

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, which concurred with BLM's determination that water depletions are "Likely to Adversely Affect" the razorback sucker, Colorado pikeminnow, humpback chub, and bonytail chub. Water depletions are also likely to adversely affect designated critical habitats for these endangered fish along the Green, Yampa, White, Colorado, and Gunnison rivers. 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 razorback sucker, Colorado pikeminnow, humpback chub, or bonytail chub. Similarly, these water depletions are not likely to destroy or adversely modify designated critical habitat for the four species of endangered Colorado River fishes.

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.

While the Proposed Action and the Preferred Alternative (see below) provide an estimate of anticipated fresh water to be used, the BLM will obtain, analyze, and compile after the fact reported fresh water use data. For well completion activities, reported water use data for all Federal wells will be obtained from the 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 is requiring operators to report after the fact fresh water use amounts for the drilling of all Federal wells, as well as any fresh water used for hydrostatic pipeline testing. 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 in the year following data collection.

Given that the fresh water use for this project fits under the umbrella of the 2017 PBO, including the conservation measures contained therein, and the actual fresh water use will be reported pursuant to that PBO, no further consultation on water depletions for this project is required at this time and no analysis of effects is provided here. The water depletion discussion provided here is for reference purposes only.

Other potential impacts to these species include inflow of sediments from areas of surface disturbance and inflow of chemical pollutants related to oil and gas activities. Construction activities would increase the potential for soil erosion and sedimentation. Although a minor temporary increase in sediment transport to the Colorado River may occur, it is unlikely that the increase would be detectable above current background levels. In any case, the Federally listed, proposed, or candidate fish species associated the Colorado River are adapted to naturally high sediment loads and would not be affected.

In contrast to inflow of sediments, the inflow of chemical pollutants could impact the endangered big-river fishes if concentrations are sufficient to cause acute effects. The potential for adverse impacts would be limited to the Colorado pikeminnow and razorback sucker, the two species known to occur within the CRVFO area. Spills or other releases of chemical pollutants as a result of 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 an ephemeral 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 into the Colorado River 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.

Preferred Alternative

The total disturbance under the Preferred Alternative has slightly increased (1.12 acres) for short-term disturbance when compared to the Proposed Action while the long-term disturbance has a decrease of 0.60 acre. The impact analysis presented in the Proposed Action for Federally listed, proposed, or candidate threatened or endangered animals is unchanged and relevant for the Preferred Alternative.

No Action Alternative

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the impacts to this resource or resource use as described for the Proposed Action would occur.

BLM SENSITIVE FISH AND WILDLIFE SPECIES

Affected Environment

Table 29 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. Potential impacts to the species listed are discussed following the table.

Table 29. BLM Sensitive Vertebrate Species Present or Potentially Present in the Project Area

Common Name	***Habitat***	***Potential for Occurrence***
Fringed myotis (*Myotis thysanodes*)	Roosting: Caves, trees, mines, and buildings. Foraging: Pinyon-juniper, montane conifers, and semi-desert shrubs.	Possible
Spotted bat *(Euderma maculatum)*		
Townsend's big-eared bat (*Corynorhinus townsendii*)		
Rocky Mountain Bighorn sheep *(Ovis canadensis)*	Typically inhabits steep, precipitous mountain and canyon terrain with good visibility and escape terrain. The CRVFO includes the Glenwood Canyon, Derby Creek, Deep Creek, and Battlement Mesa herds. Herds also inhabit nearby USFS lands.	Absent
Northern goshawk (*Accipiter gentilis*)	Nests in montane and subalpine coniferous forests and aspen forests; may move to lower elevation pinyon/juniper woodland in search of prey during winter.	Unlikely
Ferruginous hawk (*Buteo regalis*)	Inhabits open, rolling, and/or rugged terrain in grasslands and shrub-steppe communities; also grasslands and cultivated fields; nests on cliffs and rocky outcrops. Fall/ winter resident, non-breeding.	Absent
Golden eagle *(Aquila chrysaetos)*	Nests and roots on cliffs and in 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. Primary forages include small rodents, lagomorphs, and carrion during winter.	Possible
Bald eagle (*Haliaeetus leucocephalus*)	Nesting/Roosting: Mature cottonwood forests along rivers. Foraging: Fish and waterfowl along rivers and lakes; may feed on carrion, rabbits, and other foods in winter.	Nests and roosts along Colorado River
Peregrine falcon (*Falco peregrinus*)	Nesting: Cliffs, usually near a river, large lake, or ocean. Foraging: Waterfowl on rivers and lakes; upland fowl in open grassland or steppe.	Possible
Greater sage-grouse (*Centrocercus urophasianus)*	Found only in areas where sagebrush is abundant, providing both food and cover, and prefers relatively open sagebrush flats or rolling sagebrush hills. In winter, sagebrush accounts for 100% of the diet for these birds. In late winter, males begin to concentrate on traditional strutting grounds or leks. Females arrive at the leks 1-2 weeks later. Leks can occur on a variety of land types (windswept ridges, knolls, flat areas of sagebrush, and flat bare openings in the sagebrush. Breeding occurs on the leks and in the adjacent sagebrush, typically from March through May. Females and their chicks remain largely dependent on forbs and insects for food well into early fall. Within the CRVFO, greater sage-grouse are present in the northeastern part of the Field Office in the Northern Eagle/Southern Routt population, and in the northwestern part of the Field Office in the Parachute/Piceance/Roan population.	Absent
Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbiana*)	Uses a variety of habitats within sagebrush, mountain shrub, and riparian areas. From spring to fall a component of denser riparian or mountain shrub vegetation is important for escape cover. Winter habitat contains a dominant component of deciduous trees and shrubs. In Colorado, leks typically occur in sagebrush.	Absent

Common Name	***Habitat***	***Potential for Occurrence***
Black swift *(Cypseloides niger)*	Nests in colonies on vertical rock faces, near waterfalls or in dripping caves. Birds arrive in Colorado in June and take all summer to raise a single nestling. Adults forage widely on aerial insects.	Absent
Brewer's sparrow (*Spizella breweri*)	Nests in extensive stands of sagebrush, primarily Wyoming sagebrush on level or undulating Terrain.	Possible
Midget faded rattlesnake (*Crotalus oreganus concolor*)	Occurs in cold desert of NW Colorado, SW Wyoming, and NE Utah, primarily in sagebrush with rock outcrops and exposed canyon walls.	Possible
Boreal toad (*Anaxyrus boreas*)	Habitat is found in montane wetlands and associated uplands between 8,000 and 11,000 feet in elevation	Absent
Northern leopard frog (*Lithobates pipiens*)	Occupies clean, perennial waters in slow-flowing streams, wet meadows, marshes, and shallows of clean ponds and lakes.	Absent
Bluehead sucker (*Catostomus latipinnis*)	Found primarily in smaller streams with a rock substrate and mid to fast- moving waters; also shallows of larger rivers.	Present in Colorado River
Flannelmouth sucker (*Catostomus discobolus*)	Inhabits runs, riffles, eddies, and backwaters in large rivers.	Present in Colorado River
Roundtail chub (*Gila robusta*)	Inhabits slow-moving waters adjacent to fast waters in large rivers.	
*Blue Lineage Colorado River cutthroat trout (*Oncorhynchus clarkii* ssp.)	Limited to headwaters streams and ponds with cool, clear waters isolated from populations of non-native cutthroats and rainbow trout.	Absent
*Blue Lineage = Relict populations of cutthroat trout indigenous to the Yampa/Green River drainages but widely transplanted throughout the state. Managed as a BLM sensitive species pursuant to prior designation of the Colorado River cutthroat trout (*O. c. pleuriticus*) pending completion of genetic and morphometric studies and taxonomic reassessment of native cutthroat trout in Colorado.		

Environmental Consequences

Proposed Action

Fringed Myotis, Spotted Bat, and Townsend's Big-eared Bat. No caves or other suitable roosting sites occur in the project area. Loss of large trees, potentially also used for roosting, would be negligible. Loss of habitat above which the bats could search for aerial prey would also be minimal, and disturbance due to construction activities would not occur at night when the bats are feeding.

Northern Goshawk. This species is mostly limited to spruce/fir or aspen forests, such as atop the Roan Plateau, Battlement Mesa, and other areas that reach subalpine elevations. However, goshawks may migrate to lower elevation pinyon/juniper or Douglas-fir habitats during winter and therefore could make occasional, transitory use of the project area for winter foraging. Goshawks feed primarily on small birds but also on diurnal small mammals (rabbits, chipmunks, etc.).

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 and are found in mountains to 12,000 feet, canyon and rimrock terrain, and along 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, although nesting has occurred along the nearby cliffs north of the project.

Bald Eagle. Although bald eagles nest and roost along the Colorado River in the project vicinity, the potential for use of the actual project area is low. Any such use would most likely be by an individual 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.

Peregrine Falcon. Peregrine falcons nest along cliff bands south and north of the project and hunt for waterfowl along the Colorado River or other birds across open terrain. Use of the project area is unlikely, except for infrequent, transitory overflights while traveling between the Colorado River and the cliff bands to the north.

Brewer's Sparrow. Although the habitat is marginal in the project area, nesting by this species is possible. The 60-day TL to prohibit removal of vegetation during the period May 1 to July 1 (**Appendix A**) would avoid or minimize the potential for impacts to nesting Brewer's sparrows. Construction activities outside this period could cause individuals to avoid the disturbance while feeding. However, this impact would be limited in duration at any point along the corridor, and individuals are expected to feed across very large home ranges outside the nesting season, thus minimizing the severity of this potential indirect impact.

Midget Faded Rattlesnake. This viper is a small, pale-colored subspecies of the common and widespread Great Basin rattlesnake, although some authorities consider it a genetically distinct species. Although movement patterns of midget faded rattlesnakes are not well known, 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. Several rocky outcrops that could potentially provide suitable denning habitat for rattlesnakes were located; however, no snakes are known to occur in the project area.

Flannelmouth Sucker, Bluehead Sucker, and Roundtail Chub. As with the ecologically similar Colorado River endangered fishes described above, the flannelmouth sucker and roundtail chub are adapted to naturally high sediment loads and therefore would not be affected by increased sediment transport to the Colorado River. Furthermore, protective COAs for water quality (**Appendix A**) would minimize this potential. However, these species are vulnerable to alterations in flow regimes in the Colorado River (including evaporative loses 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.

Preferred Alternative

The total disturbance under the Preferred Alternative has slightly increased (1.12 acres) for short-term disturbance when compared to the Proposed Action while the long-term disturbance has a decrease of 0.60 acre. Essentially the impact analysis presented in the Proposed Action for BLM sensitive vertebrate species remains unchanged and relevant for the Preferred Alternative.

No Action Alternative

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the impacts to this resource or resource use as described for the Proposed Action would occur.

4.14. VEGETATION

Affected Environment

The project would be located north of I-70 along the foothills of the Roan Plateau. The foothills are divided by intermittent and ephemeral drainages that generally flow south into the Colorado River. Slopes in the area are steep, rising rapidly from the valley floor to the Roan Plateau. The proposed project would be located in vegetation communities composed of pinyon/juniper woodlands, mixed pinyon/juniper and mountain shrub, mostly barren steep-sided hillsides, and mixed Wyoming sagebrush shrublands and grasslands along the ridgetops and sideslopes. The valley bottoms are composed of Basin big sagebrush shrublands, cheatgrass-dominated rangelands, and reclaimed pipeline ROW corridors.

Although there has been extensive oil and gas development in the area, the remaining undisturbed vegetation contains diverse native species. Woody plants reflect the range in elevation and substrate within the project area. At lower (drier, finer textured soil) sites, woody plants include basin big sagebrush (*Artemisia tridentata* spp. *tridentata*), black sagebrush (*Artemisia nova*), broom snakeweed (*Gutierrezia sarothrae*), crispleaf buckwheat (*Eriogonum corymbosum*), fourwing saltbush (*Atriplex canescens*), greasewood (*Sarcobatus vermiculatus*), longflower rabbitbrush (*Chrysothamnus depressus*), Mormon tea (*Ephedra viridis*), rubber rabbitbrush (*Ericameria nauseosa*), shadscale saltbush (*Atriplex confertifolia*), siltbush (*Zuckia brandegeei*), Wyoming sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), and yellow rabbitbrush (*Chrysothamnus viscidiflorus*).

At higher elevations and on coarser textured or rocky soils, woody plants include alderleaf mountain mahogany (*Cercocarpus montanus*), and antelope bitterbrush (*Purshia tridentata*), and mesa pepperweed (*Lepidium alyssoides*) interspersed among or occurring beneath pinyon pine (*Pinus edulis*), brittle prickly pear (*Opuntia fragilis*) and yucca (*Yucca harrimaniae*) occur throughout.

Common grasses present include the native perennial grasses bluebunch wheatgrass (*Pseudoroegneria spicata*), galleta (*Pleuraphis jamesii*), Indian ricegrass (*Achnatherum hymenoides*), Salina wildrye (*Leymus salinus*), and slender wheatgrass (*Elymus trachycaulus*), and the western wheatgrass (*Pascopyrum smithii*). The dominance of bunchgrasses (all except the last species) underscores the dry and rocky conditions. In addition to these were the widely planted non-native perennial grass crested wheatgrass (*Agropyron cristatum*) and smooth brome (*Bromus inermis*), and the invasive non-native annual grasses annual wheatgrass (*Eremopyrum triticeum*) and cheatgrass (*Bromus tectorum*).

Forbs were dominated by native perennial species typically associated with the soils and woody plant communities in the project area. See **Section 4.6** regarding invasive non-native plants.

Environmental Consequences

Proposed Action

Under the Proposed Action, a total of 55.49 acres would be disturbed, including 43.42 acres on BLM land and 12.17 acres on private land. Following construction, drilling, and well completions, interim reclamation would occur on all areas not needed for ongoing operations. A total of 10.90 acres would remain as long-term disturbance, including 9.14 acres on BLM land and 1.76 acres on private land.

Interim reclamation would consist of seeding in accordance with the reclamation COAs presented in **Appendix A**. A seed mix consisting of native grasses, forbs, and shrubs would be used on BLM land, but for portions of the project located on private land, the composition of seed mixes 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 leaves. Dust levels could be expected to increase above ambient levels in the short term from pad expansion, well drilling, new road construction, and new pipeline installation. Increased dust levels can negatively impact plants by clogging stomatal openings in the leaves, impeding gas exchange and reducing the ability of plants to take in carbon dioxide. Dust on the leaf surface can also effectively reduce light availability at the leaf surface. Light and carbon dioxide are both critical for plants to conduct photosynthesis, and reductions in either can reduce the quantity of carbohydrates plants can produce through photosynthesis, and thereby reduce plant growth and seed production. Dust on leaf surfaces can also facilitate plant tissue uptake of toxic pollutants (Thompson et. al. 1984, Farmer 1993, Sharifi et. al. 1997).

Additional indirect impacts to adjacent vegetation could occur from noxious weeds and other non-native plants associated with project area disturbances. The proposed removal of native vegetation would increase the site's vulnerability to invasion and establishment of noxious weeds and other non-native invasive plant species, particularly with the existing widespread establishment of noxious weeds and other non-native species. Neighboring vegetation would also become more vulnerable to invasion by noxious weeds and other non-native species. Ground disturbance combined with vehicle traffic and construction equipment provides both excellent habitat and vectors for invasive species, particularly when these species are already present within the soil seed bank (Schmidt 1989, Parendes and Jones 2000, Gelbard and Belnap 2003, Larson 2003, Zaenepoel et. al. 2006). Invasive non-native species can negatively affect native plant communities, both directly through competition for resources, and indirectly through alteration of soil microbial communities (Klironomos 2002, Hierro et. al. 2006, Reinhart and Callaway 2006, Vogelsang and Bever 2009). Herbicide treatments of weeds can also result in negative effects or mortality to desirable plants if they are co-occurring or located nearby and vulnerable to the specific chemical being applied (BLM 2007).

Implementation of COAs for noxious weeds and temporary reclamation (**Appendix A**) would reduce the risk of establishment and spread of noxious weeds and other invasive non-native plants through the judicious use of herbicides in combination with prompt reestablishment of desirable vegetation through interim reclamation.

Preferred Alternative

Under the Preferred Alternative, a total of 56.61 acres would be disturbed, including 44.48 acres on BLM land and 12.13 acres on private land. Following construction, drilling, and well completions, interim reclamation would occur on all areas not needed for ongoing operations. A total of 10.30 acres would remain as long-term disturbance, including 8.44 acres on BLM land and 1.86 acres on private land. The total disturbance under the Preferred Alternative has slightly increased (1.12 acres) for short-term disturbance when compared to the Proposed Action while the long-term disturbance has a decrease of 0.60 acre. Essentially the analysis presented in the Proposed Action for the vegetation resource remains unchanged and relevant for the Preferred Alternative.

No Action Alternative

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the impacts to this resource or resource use as described for the Proposed Action would occur.

4.15. VISUAL RESOURCES

Affected Environment

The Proposed Action is located primarily on BLM land approximately 9 miles west of the City of Rifle on the north side of I-70 near the Rulison exit in Garfield County, Colorado. Three of the BLM pads (PA 34-24, PA 41-24 and PA 32-13) and the two PA 32-13 pad support pads on BLM would be located within the Balzac Gulch drainage. The proposed PA 31-26 pad, road, and pipelines would be situated on BLM land within the unnamed drainage west of the Rulison - I-70 interchange. BLM's existing RWF 23-19 frac pad is nestled amongst the rolling ridges on a mesa east of Balzac Gulch while the RWF 21-18 cuttings storage pad is situated near an unnamed ephemeral drainage along the existing County road serving the PA 41-24 proposed pad. All of the new and existing project components proposed on BLM land fall within BLM's Visual Resource Management (VRM) Class II designation as defined by the 2016 Roan Plateau RMPA/ROD (BLM 2016a).

New road and pipelines buried alongside the roads would serve the four proposed well pads and ancillary support pad(s) while connecting to the existing road and pipeline infrastructure established within the existing oil and gas field. Additional support pads, such as the RWF 12-20 tank pad, the PA 23-25 frac pad, and the RWF 334-18 cuttings storage pad, would be located on adjacent private land. Developments within private ownership are not subject to BLM's VRM objectives; visual values for private land are only protected by landowner discretion.

MountainWest's landscape architect prepared a Visual Assessment Report for the BG2MDP, which represents the visual impact analysis for the Proposed Action (Perdue 2018a).

An Addendum Report to the Visual Resource Assessment Report for the BG2MDP was completed in summer 2018 that provides visual impact analysis for the Preferred Alternative (Perdue 2018b). Details of the Affected Environment describing visual character and scenic quality, descriptions of BLM's VRM classes and BLM's I-70 Viewshed NSO stipulation, and conclusions with recommended visual mitigation measures are described in both reports. The reports also include completed Visual Contrast Rating Worksheets and a suite of visual simulations for select project components that support the conclusions and recommendations. KOPs for the proposed BG2MDP project components were described and illustrated in the reports showing the relationship of VRM Class II and the I-70 Viewshed NSO Stipulation (**Figure 17**).

VRM Class II Visual Objective and Lease Stipulations

The objective for VRM Class II, as defined in BLM 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. Management activities 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.

The Federal lease COC73094 and 2016 Roan Plateau RMPA/ROD (BLM 2016a) includes two stipulations to protect visual resources values:

- NSO stipulation for the I-70 viewshed, which includes slopes over 30%. Exceptions would be granted if protective measures could be designed to accomplish VRM Class II objectives.
- CSU stipulation for VRM Class II areas.

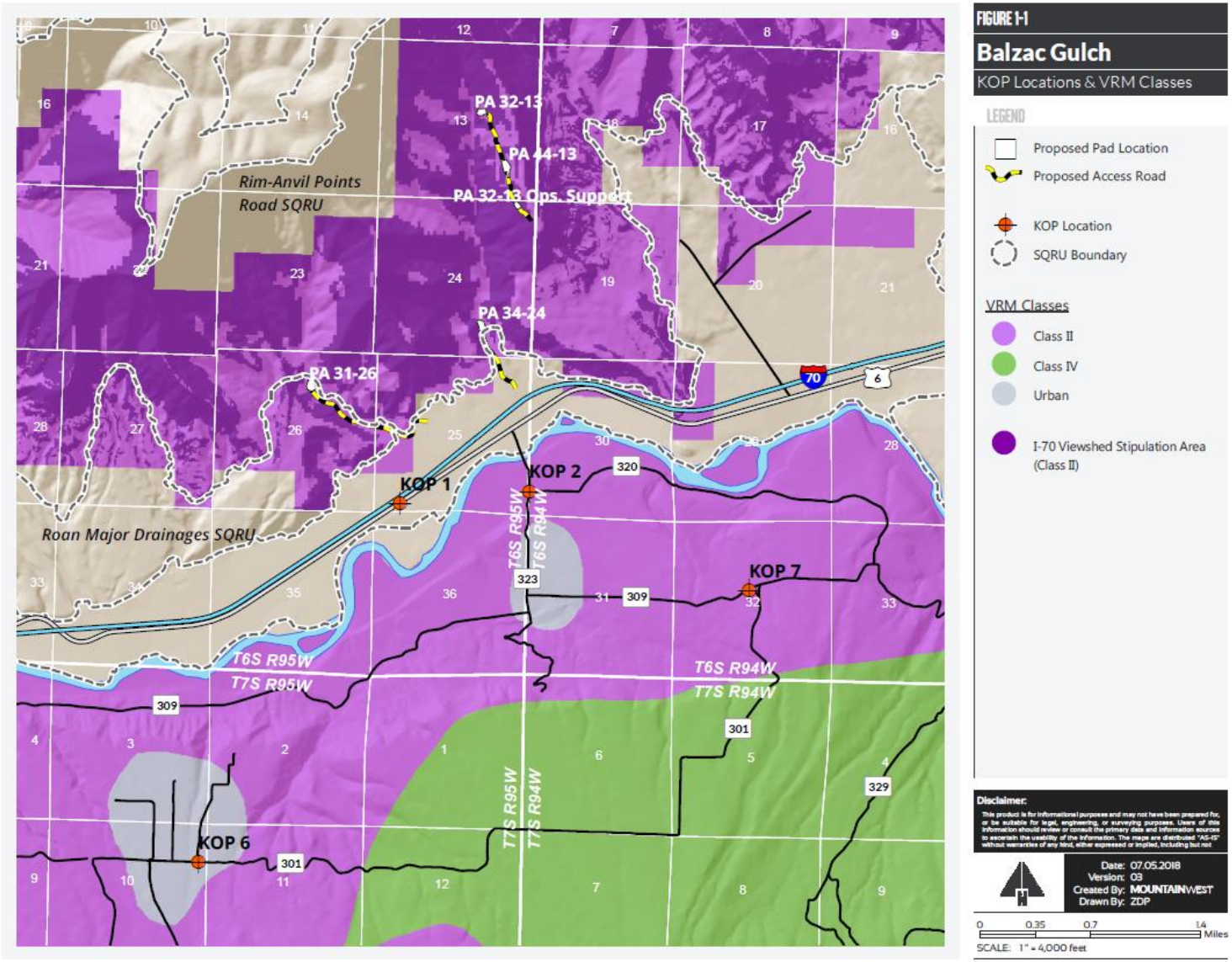


Figure 17. KOP Locations and VRM Classes for the Proposed Action

Interstate 70 Viewshed Stipulation (NSO - No Surface Use)

The CRVFO has a NSO stipulation in place to protect approximately 9,780 acres of VRM Class II lands that precludes ground-disturbing activities on slopes greater than 30%. The affected lands are within five miles north of the I-70 corridor with moderate to high visual exposure, where details of vegetation and landform are readily discernible, and changes in contrast can be easily noticed by the casual observer on I-70. The stipulation states that a ground-disturbing activity may be permitted if the BLM determines that the Proposed Action would not impair values associated with VRM Class II objectives or degrade the visual characteristics of the viewshed below Class II standards. Should the ground-disturbing activity be permitted, the proponent must collect monitoring data prior to, during, and subsequent to the proposed activity using widely accepted scientific methods as approved by and reported to the BLM not less than annually. If the unanticipated types or levels of adverse effects are noted during monitoring, the BLM must be promptly notified, and corrective measures, as approved by the BLM, will be identified and implemented by the proponent.

VRM Class II (CSU - Controlled Surface Use)

The objective of BLM's CSU stipulation is to preserve the existing character of the landscape to meet VRM Class II objectives in all areas designated with this class. The BLM may require special design, construction, operation, mitigation, or reclamation measures, or relocation by more than 200 meters to retain the existing landscape character and allow only limited changes. The BLM may determine that the level of protection available under a CSU stipulation is not required to meet VRM Class II objectives based on site-specific conditions, visibility of the site, the type, amount, and duration of the associated impacts, and the effectiveness of standard stipulations in a given situation.

Environmental Consequences

Proposed Action

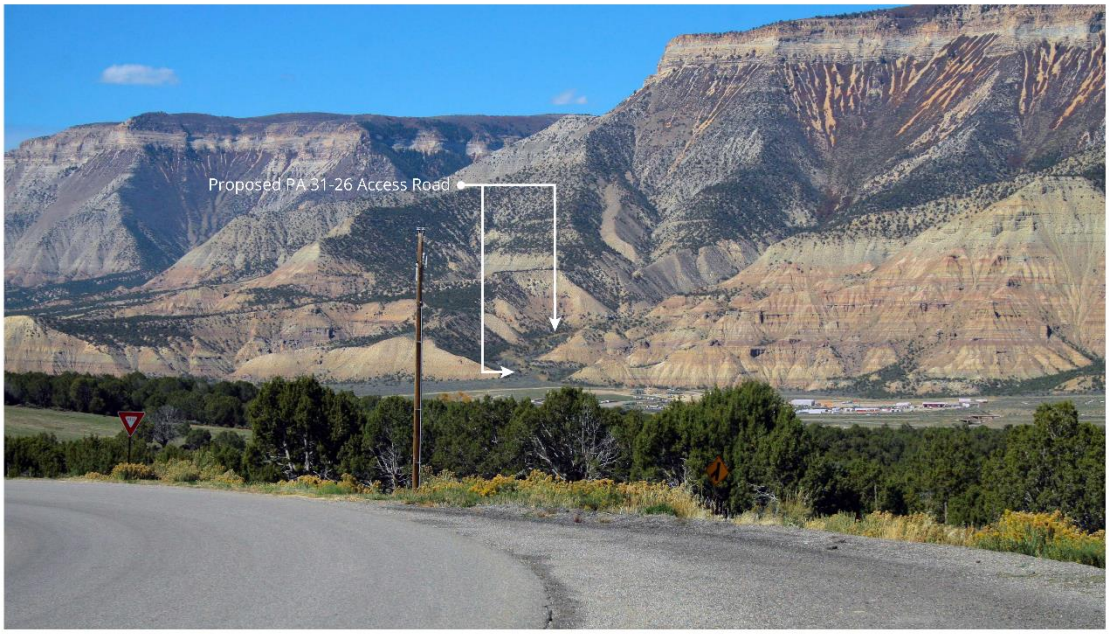
Visual resource impacts are analyzed and assessed by comparing the Proposed Action to the VRM Class II designation, which covers the BG2MDP project area, and the I-70 viewshed, which occurs in portions of the project (**Figure 17**). MountainWest's report addresses the potential changes to scenic quality that may result using visual simulations and visual contrast ratings, methods recognized by BLM to assess visual impacts of the proposed project.

Conclusions and Required Mitigation Measures

Based on the findings outlined in the MountainWest Report including the Visual Contrast Rating Worksheets and visual simulations, none of the proposed project sites would have significant impacts to visual resources or degrade the viewshed below VRM Class II standards, thereby meeting the objectives of the VRM Class II designation (CSU stipulation) and the I-70 Viewshed designation (NSO stipulation). The Visual Contract Rating Worksheets in the BG2MDP Visual Resources Report indicate no changes would occur to the three of the four key elements (form, color, and texture) concerning land, water, and structural features for any portion of the Proposed Action from any of the defined KOP locations. For KOP locations #1, #2, and #6, the Visual Contrast Rating Worksheets indicate a weak level of contrast occurring to linear elements of vegetation features, while KOP #7 indicates a moderate degree of contrast to linear elements of vegetation as a result of the proposed PA 31-26 access road (**Figure 18**).

The following visual resource mitigation measures outlined in MountainWest's report would be implemented as COAs to reduce the degree of contrast associated with implementation of the Proposed Action (**Appendix A**):

Existing Conditions



Proposed Conditions

Visual Simulation: KOP #7
*Looking Northwest onto **PA 31-26 Pad and Access Road***
Middleground Distance Zone
Balzac Gulch Master Development Plan

Figure 18. PA 31-26 Access Road/Pad as seen from KOP#7 – Proposed Action

- All proposed operating equipment located on pad surfaces would be painted a non-reflective dark green color to blend with adjacent and background pinyon-juniper woodlands.
- All proposed operating equipment should be located away from the outer proposed pad surface perimeters above fill faces to avoid the potential for creating a ridgeline effect whereby the operating equipment are silhouetted against the sky at certain viewing angles, increasing the chance of visibility. When feasible, all operating equipment should be located within the interior portion of the pad or along the toe of cut slopes at the pad surface perimeter.
- Retain cut pinyon-juniper slash onsite and distribute on proposed pad cut and fill faces to break-up any unnatural or geometric forms resulting from grading activities and to help blend each site more seamlessly with surrounding and background vegetation.
- Perform annual monitoring of the proposed project sites to ensure compliance with the objectives of the I-70 Viewshed NSO stipulation. The operator would ensure cut-and-fill slopes are stabilized and that adequate slash is distributed across cut and fill faces to facilitate blending with the surrounding and background vegetation. In addition, project sites should be viewed from each KOP location to ensure the level of contrast regarding form, line, color, or texture are rated no greater than *weak* to prevent the viewshed from being degraded below VRM Class II standards.

Preferred Alternative

The Preferred Alternative would involve replacing the PA 41-24 pad with the new PA 44-13 pad to be sited in the same location as the PA 32-13 Production Support Pad, although the new pad would create a larger disturbance footprint to accommodate the original bottomholes planned on the PA 41-24 and PA 32-13 pads. Dropping the PA 41-24 pad in this alternative relieves some visual impacts associated with opening the southern edge of the long ridge where Garfield County's Communication Tower exists. The size of the PA 32-13 pad would also be reduced, although visual assessment reveals this location would not be readily visible from KOPs.

While the Preferred Alternative was primarily developed to mitigate steep slope impacts and avoidance of the big game winter timing limitation period, concerns were raised during project scoping regarding potential visual impacts related to the well sites and roads in the Proposed Action, particularly the PA 41-24 well pad near Garfield County's Communication Tower. In the Preferred Alternative, Terra addressed this visual concern by replacing the PA 41-24 well site with the new PA 44-13 well site in place of the initially proposed PA 32-13 Production Support Pad.

Conclusions and Required Mitigation Measures

MountainWest's Addendum to the BG2MDP Visual Assessment Report, completed in summer 2018, arrived at similar conclusions as the recommendations in the Proposed Action report. The same KOPs (**Figure 17**) were used in the visual assessment for the Preferred Alternative. The proposed PA 31-26 and PA 34-24 pad sites and associated elements are identical between the Proposed Action and the Preferred Alternative. **Figure 19** simulates implementation of the upper proposed pad sites and the associated access road of the Preferred Alternative. The degree of contrast regarding linear elements concerning vegetation features are rated as weak from KOP #1, as project implementation will result in the introduction of a faint horizontal line in the existing pinyon-juniper woodland that may be noticed, but will not draw attention to the viewer. Other visual resource mitigation measures discussed for the Proposed Action would be applied to the Preferred Alternative (**Appendix A**).

The visual resource mitigation measures listed above for the Proposed Action would also apply to the Preferred Alternative.

Existing Conditions

Proposed Conditions

Visual Simulation: KOP #1
Looking Northeast onto PA 32-13 Operations Support and PA 44-13 Pads
Middleground Distance Zone
Balzac Gulch Master Development Plan

Figure 19. PA 44-13 Pad and PA 32-13 Support Pad as seen from KOP#1 – Preferred Alternative

No Action Alternative

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the impacts to this resource or resource use as described for the Proposed Action would occur.

4.16. WASTES – HAZARDOUS OR SOLID

Affected Environment

Federal laws regulating hazardous wastes or other hazardous materials include:

- The 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.

- The 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 CRVFO *Hazardous Materials Contingency Plan*.

- The Resource Conservation and Recovery Act (RCRA) (Public Las 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 of as a result of 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.

Transport of Natural Gas and Liquid Condensate through Unregulated Gas Gathering Pipelines

Although produced gas and liquid condensate are exempt from RCRA hazardous waste regulations, such wastes could present a hazard to human health and the environment. In recent years, public concern has been raised regarding the risk of rural gathering pipelines to public safety. Consequently, the regulatory framework of gathering pipelines has undergone and continues to undergo revisions. While the BLM may evaluate the siting and potential environmental impacts of pipeline activities, as well as perform environmental surface inspections on public lands, the Federal pipeline safety program resides within the U.S. Department of Transportation (USDOT) Pipeline and Hazardous Materials Safety Administration (PHMSA). PHMSA has the primary responsibility for the promulgation and enforcement of Federal pipeline safety standards. However, various Federal and State agencies oversee pipeline safety.

Determining the specific agencies overseeing pipeline safety in a given scenario is not simple. An overview of hydrocarbon pipeline regulation is provided in "A Regulatory Review of Liquid and Natural Gas Pipelines in Colorado" published by COGCC (2014b).

In general, the PHMSA, Colorado Public Utilities Commission (COPUC), and COGCC oversee the pipeline safety of rural areas in Colorado. The PHMSA Western Region Office of Pipeline Safety inspects interstate natural gas and all hazardous liquids pipeline systems located in Colorado (Colorado Department of Regulatory Agencies 2018). The Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011 was designed to examine and improve the state of pipeline safety regulation. In 2016, the PHMSA published a notice of proposed rulemaking for gas transmission and gathering pipelines. The notice of proposed rulemaking shall have three separate final rulemakings anticipated in 2019 largely focused on gas transmission, integrity management, and safety of gas gathering lines (USDOT 2018).

The COPUC's Gas Pipeline Safety Section (GPS) enforces the State's gas pipeline safety regulations in order to provide for the public safety of the citizens of Colorado (Colorado Department of Regulatory Agencies 2018). Through its 60105 Agreement with the PHMSA, COPUC's GPS conducts and carries out the inspection and monitoring of intrastate gas pipeline systems. The COPUC works with trade and technical organizations representing the pipeline industry, utility damage prevention, and other State and Federal Agencies. As excavation damage is currently the largest single threat to our state's pipelines, the Utility Notification Center of Colorado (UNCC) is an important resource for understanding the laws, methods, and means of reducing utility damage in Colorado.

To address public safety concern, COGCC began Rulemaking proceedings on flowlines on October 15, 2017 (COGCC 2018a). On February 13, 2018, the COGCC adopted Flowline Rules to address oversight of flowlines and related infrastructure associated with oil and gas development (2018b). COGCC defines a flowline as a segment of pipe transferring oil, gas, or condensate between a wellhead and processing equipment to the load point or point of delivery to a PHMSA- or COPUC-regulated gathering line or a segment of pipe transferring produced water between a wellhead and the point of disposal, discharge, or loading. The Flowline Rules include requirements for registration, installation, and design standards, transfer lines, transfer line valves, enhanced integrity management, abandonment, and financial assurance for produced water transfer systems, among other requirements.

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 pad, road, 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 pad, from haul trucks used to transport materials to and from the pad, 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 CRVFO 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.

Preferred Alternative

The impacts from wastes, either hazardous or solid, would be slightly less than described in the Proposed Action with 8% less wells to be developed in the Preferred Alternative. The impacts described in the Proposed Action are otherwise similar with the implementation of the Preferred Alternative.

No Action Alternative

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the impacts to this resource or resource use as described for the Proposed Action would occur.

4.17. WATER RESOURCES – SURFACE WATER AND GROUNDWATER

SURFACE WATER

Affected Environment

The project area is located north of the Colorado River, between Parachute and Rifle, Colorado, within the Cache Creek-Colorado River sub-watershed (Hydrologic Unit Code 140100050702). The project area is situated amongst the steep southern slopes and ridgelines of the Roan Plateau, as well as the foothills and alluvial fans of tributaries to the Colorado River. The proposed western disturbance area lies approximately 0.4 to 1.0 air-mile north of the Colorado River, while the proposed eastern disturbance area lies approximately 1.2 to 2.1 air-miles north of the Colorado River. Both areas contribute to intermittent drainages that cross beneath I-70, U.S. Highway 6, and the Union Pacific Railroad tracks. These drainages are within Stream Segment COLCLC04a, otherwise known as “all tributaries, including wetlands, to the Colorado River from the confluence with the Roaring Fork River to a point immediately below the confluence with Parachute Creek,” which has the following classifications:

- Agriculture: These surface waters are suitable or intended to become suitable for irrigation of crops usually grown in Colorado and which are not hazardous as drinking water for livestock.
- Aquatic Life Cold 2: These are waters that are not capable of sustaining a wide variety of cold or warm 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 N (Not Primary Contact Use): These surface waters are not suitable or intended to become suitable for primary contact recreation uses.

- Water Supply: These surface waters are suitable or intended to become suitable for potable water supplies. After receiving standard treatment, these waters will meet Colorado drinking water regulations and any revisions, amendments, or supplements thereto (CDPHE 2017b).

Stream Segment COLCLC04a is on Colorado's Monitoring and Evaluation list for temperature, total phosphorus, and sulfate, and on the Clean Water Act's Section 303(d) list of impaired waters for dissolved selenium (CDPHE 2018).

The project area drainages contribute to Stream Segment COLCLC02a, "Mainstem of the Colorado River from immediately below the confluence with Rifle Creek to immediately above the confluence of Rapid Creek." This stretch is classified as:

- Agriculture.
- Aquatic Life Warm 1: These are waters that 1) currently are capable of sustaining a wide variety of warm water biota, including sensitive species, or 2) could sustain such biota but for correctable water quality conditions. Waters shall be considered capable of sustaining such biota where physical habitat, water flows or levels, and water quality conditions result in no substantial impairment of the abundance and diversity of species.
- Recreation E: (Existing Primary Contact Use): These surface waters are used for primary contact recreation or have been used for such activities since November 28, 1975.
- Water Supply (CDPHE 2017b).

This reach of the Colorado River is on Colorado's Monitoring and Evaluation list for sediment (CDPHE 2018).

Instantaneous discharge was measured and water-quality samples were collected at Stream Site No. 09092570 (Colorado River at Rulison) by the U.S. Geological Survey (USGS) in 1977 and 1978 approximately 0.25-mile south of the project area boundary (USGS 2017). The USGS conducted monthly sampling events from April 1977 through January 1978. During that time, the streamflow of the Colorado River measured from 1,300 cubic feet per second (cfs) in November to 4,160 cfs in June. The temperature of the river measured between 1.5 degrees Celsius (°C) in December and 21 °C in July. The specific conductance ranged from 540 to 1,380 microSiemens per centimeter (µS/cm) at 25°C in June and November, respectively. **Table 30** presents the water-quality results of the ten monthly sampling events. Note that the laboratory analysis results of the samples collected in September 1977 are generally inconsistent with the other monthly results.

Environmental Consequences

Proposed Action

Potential impacts to surface water from the Proposed Action are associated with surface-disturbing activities, water use, road use, waste management, and the use, storage and transportation of fluids (i.e., chemicals, condensate, and produced water). Surface-disturbing activities associated with the well pads, roads, and pipelines result in loss of vegetation cover, soil compaction and displacement, increased volume and velocity of runoff, and increased sedimentation and impacts to overall surface water quality.

Stormwater management of the roads and pads would reduce erosion. As proposed, these measures would include limiting cut slope steepness, crowning road surfaces, installing culverts and drainage systems, and applying gravel to all upgraded roads in the project area to a compacted thickness of 6 inches (**Appendix A**).

Fresh water would be obtained from approved commercial water sources and would be trucked to the new wells to augment drilling. Water used for well completions would be sourced primarily from Terra's water recycling and water line delivery systems. Approximately 0.58 acre-feet of fresh water would be used for dust abatement and well development and 9.67 acre-feet of recycled water would be used for well development.

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. The use, storage, and transportation of fluids, such as produced water, hydraulic fracturing fluids, and oil condensate, have an associated risk of spills that could affect water resources. Elements of the Proposed Action are designed to minimize and mitigate risks to surface waters associated with the release and migration of drilling fluids, produced water, and condensate. A closed-loop drilling system would be implemented. Drill cuttings would be collected from the drill rig a shaker system, mixed with drying agents, tested and remediated per COGCC standards, and either deposited in the cuttings trench or stacked against the cut slope for later burial during interim reclamation. Completions would be conducted remotely from the existing PA 23-25 and RWF 23-19 pads.

In addition to individual containment measures, each pad would have berms to contain an accidental release. In the event of an accidental release, produced water and condensate would be confined for cleanup in a containment area to prevent migration to surrounding soils or surface waters. Pipelines associated with the transport of these liquids would be pressure-tested to detect leakage prior to use. Implementation of COAs for mitigating impacts to surface waters (**Appendix A**) would minimize risks of adverse impacts associated with construction and ongoing production activities.

Balzac Gulch dissects the project area, which contributes to the intermittent Balzac Gulch drainage and the intermittent unnamed drainages to the west and east. The PA 31-26 pad would drain to the unnamed drainage to the west of Balzac Gulch. The PA 34-24, PA 32-13, and most of the PA 41-24 pads would drain to Balzac Gulch. A portion of the PA 41-24 pad would drain to the unnamed drainage to the east of Balzac Gulch.

To minimize impacts to natural resources, including surface water, the proposed locations of well pads, roads, and pipelines utilize existing or previously disturbed areas as feasible, and are designed to avoid or minimize impacts to drainages, as bulleted below:

Table 30. Water Quality of the Colorado River at Rulison, 1977 to 1978

Parameter	***4/8/1977***	***5/18/1977***	***6/3/1977***	***7/8/1977***	***8/10/1977***	***9/21/1977***	***10/14/1977***	***11/17/1977***	***12/6/1977***	***1/18/1978***
Temperature (degrees Celsius)	11	13	18	21	19	14.5	10	5	1.5	2.5
Instantaneous Discharge (cfs)	1,560	2,600	4,160	2,000	2,000	1,800	1,600	1,300	1,500	1,500
Specific Conductance (µS/cm at 25°C)	1,200	860	540	970	980	1,120	1,090	1,380	1,270	1,320
Hydrogen Ion (mg/L)	0.00001	0.00001	0.00003	0.00001	0.00006	0.00005	0.00001	0.00001	0.00006	0.00001
Dissolved Oxygen (mg/L)	10.4	10.2	8.9	9.2	7.9	18	10.6	10.4	10.8	11.2
Chemical Oxygen Demand (mg/L)	17	13	22	37	12	7.3	15	88	37	41
pH (standard units)	8.1	8.2	7.6	8.3	7.2	13	8.2	8	7.2	7.9
Carbon Dioxide (mg/L)	2	1.4	4.4	1.3	16	130	1.7	3.2	18	3.6
Acid Neutralizing Capacity (mg/L as $CaCO_3$)	130	110	90	130	130	160	140	160	150	150
Bicarbonate (mg/L)	160	140	110	160	160	0	170	200	180	180
Carbonate (mg/L)	0	0	0	0	0	0.26	0	0	0	0
Total Nitrogen (mg/L)	0.4	1	1.7	0.25	0.38	0.24	0.77	0.25	0.31	0.93
Organic Nitrogen (mg/L as N)	0.28	0.92	1.4	0.2	0.33	< 0.010	0.66	0.13	0.16	0.51
Ammonia (mg/L as N)	0.06	< 0.010	0.07	< 0.010	0.01	0.24	0.01	0.07	0.04	0.11
Ammonia + Organic Nitrogen (mg/L as N)	0.34	0.92	1.5	0.2	0.34	0.02	0.67	0.2	0.2	0.62
Nitrate + Nitrite (mg/L as N)	0.06	0.09	0.2	0.05	0.04	0.03	0.1	0.05	0.11	0.31
Phosphorus (mg/L as P)	0.02	0.05	0.02	< 0.010	0.04	250	< 0.010	0.01	< 0.010	0.09
Organic Carbon (mg/L)	3.6	210	160	4.1	230	120	2.7	330	290	1.9
Hardness (mg/L as $CaCO_3$)	250	96	65	230	98	76	250	160	140	280
Noncarbonate Hardness (mg/L as $CaCO_3$)	120	63	48	100	67	15	110	95	84	140
Calcium (mg/L)	74	13	8.6	70	15	130	73	22	19	82
Magnesium (mg/L)	17	99	53	14	120	3.6	17	180	150	19
Sodium (mg/L)	160	3	1.9	120	3.5	52	150	4.3	3.8	160
Sodium Adsorption Ratio	4.4	50	42	3.4	53	4.2	4.1	54	53	4.1

Parameter	***4/8/1977***	***5/18/1977***	***6/3/1977***	***7/8/1977***	***8/10/1977***	***9/21/1977***	***10/14/1977***	***11/17/1977***	***12/6/1977***	***1/18/1978***
Sodium Fraction of Cations (%)	57	3.4	2.7	52	4	180	56	5.2	4.6	55
Potassium (mg/L)	4.8	130	76	3.9	180	140	4.4	260	210	4.4
Chloride (mg/L)	230	130	76	180	110	0.3	200	180	150	230
Sulfate (mg/L)	160	0.2	0.6	110	0.3	8	160	0.3	0.1	160
Fluoride (mg/L)	0.3	7.8	17	0.3	7.7	51	0.4	7.5	8.5	0.3
Silica (mg/L as SiO_2)	7.1	74	118	7.3	57	632	7.2	37	42	9.6
Arsenic (µg/L)	< 1.0	516	337	< 1.0	583	3,070	1	849	715	< 1.0
Iron (µg/L)	80	3,620	3,790	40	3,150	0.86	70	2,980	2,900	20
Lead (µg/L)	M	0.7	0.46	U	0.79	0	M	1.15	0.97	M
Manganese (µg/L)	50	0	0.09	M	0.01	--	20	0.09	0.05	30
Selenium (µg/L)	1	--	--	< 1	--	--	< 1	--	--	2
Instantaneous Discharge (cubic meters per second)	44	--	--	57	--	--	45	--	--	42
Dissolved Solids (mg/L)	733	--	--	585	--	--	696	--	--	756
Dissolved Solids (short tons per day)	3,090	--	--	3,160	--	--	3,010	--	--	3,060
Dissolved Solids (short tons per acre-foot)	1	--	--	0.8	--	--	0.95	--	--	1.03
Ammonia (mg/L as NH_4)	0.08	--	--	0	--	--	0.01	--	--	0.14
Mercury (µg/L)	< 0.50	--	--	< 0.50	--	--	< 0.10	--	--	< 0.10

Source: USGS 2017
M = presence verified but not quantified
U = analyzed for but not detected

- The proposed PA 31-26 pad layout was driven by steep slopes and drainages – by avoidance of them, careful selection of topsoil storage areas, revising the proposed cuttings trench to ensure an adequate buffer from a drainage, and designing run-on stormwater diversions to support the continued function of the natural drainage. The existing low-water crossing would be used to minimize disturbance to the stable channel alignment. Pipelines would be buried deep at the drainage crossing.
- The proposed PA 34-24 pad layout was largely dictated by drainages and the surrounding steep slopes of the gulch. Cuttings from well drilling would be managed in a trench on the northern portion of the pad and distanced from drainages. The proposed pad would require the construction of a new access road with a large culvert installed at the Balzac Gulch drainage crossing. Pipelines would be buried deep at the drainage crossing.
- The proposed PA 41-24 pad is on a fairly level grade along a ridgeline, adjacent to a switchback in the existing Anvil Points Road. To minimize surface disturbance and avoid steep slopes, cuttings from well drilling would be stored at the RWF 21-18 pad. Pipelines would be buried deep at the existing low-water crossing. A portion (about 1,000 feet) of the existing access road would be realigned to improve drainage and avoid debris flow impacts. The access road would be upgraded and maintained in collaboration with Garfield County and the BLM; in addition, the existing low-water drainage crossing and its reinforcement would be examined by a qualified geotechnical engineer to ensure adequacy for the proposed use (**Appendix A**).
- The general area of the proposed PA 32-13 pad has steep slopes, rock outcrops, and erosive soils. The areas of proposed disturbance were carefully selected and ground-truthed in the challenging terrain to minimize environmental impacts. The location, shape, and area of the proposed PA 32-13 pad were dictated by steep slopes. Since the proposed well pad cannot accommodate well development due to its limited size, two support pads are proposed along the access road. With the exception of areas necessary for road turnouts, the support pads would be fully reclaimed after well development. Pipelines would be collocated in the road. At drainage crossings, culverts would be installed and reinforced with boulders. To minimize surface disturbance and avoid steep slopes, cuttings from well drilling would be stored at the RWF 21-18 pad. A long culvert would be installed on the southeast pad corner to provide the working area necessary for well development; however, the culvert would be substantially reduced in length following well development and the associated natural drainage would be reclaimed.

To minimize disturbance, all of the pads would be remotely fractured, and tanks for produced water and condensate would be offsite. The remote location of the fracturing facility and tanks reduces truck traffic, minimizing the risk of spills in areas with steep slopes and rapid, intense flows from localized rainfall events.

The Proposed Action includes, but is not limited to, the following BMPs that reduce potential surface water impacts:

- Construction of pads, roads, and pipelines would follow the guidelines established in the BLM Gold Book, *Surface Operating Standards for Oil and Gas Exploration and Development* (USDI and USDA 2007).
- The new access roads would be graveled to ensure all-weather accessibility to the pad sites; existing roads would undergo review for spot-graveling needs.
- During pad construction, topsoil would be windrowed, where feasible, around the outer edge of the disturbance perimeter to serve as a stormwater diversion and catchment, and temporarily

seeded until interim reclamation is scheduled after all of the wells on the pad are placed into production.

- A closed-loop drilling system would be used. Recovered drilling fluid would be stored on location in steel tanks for reuse.
- The development would be largely supported by existing pipeline infrastructure to a centralized water storage facility and remote fracturing.
- Water used for well completions would be sourced primarily from Terra's water recycling program, drastically negating the use of fresh water for frac operations, and the recycled treated water would be delivered in Terra's existing water line systems, drastically reducing truck traffic on roads.
- Disturbed areas on pads, roads, and pipelines would be reclaimed in a timely manner.

Appendix A includes additional measures to minimize impacts to surface water resources. For instance, a road maintenance program would be required during the production phase of the wells. This program would include, but not be limited to blading, ditching, culvert installation and cleanout, weed control, and gravel surfacing where excessive rutting or erosion occur. The operator would be responsible for continuous inspection and maintenance of the access roads, pads, and pipelines.

Preferred Alternative

Impacts to surface water resources from the Preferred Alternative would be less than those of the Proposed Action due to the reduction in well development and overall disturbance footprint. Less water would be used and potential risks of impacts to water quality would decrease.

No Action Alternative

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the impacts to this resource or resource use as described for the Proposed Action would occur.

WATERS OF THE U.S.

Affected Environment

The Proposed Action may affect five potential jurisdictional waters of the U.S. – five ephemeral streams. Section 404 of the Clean Water Act requires a Department of the Army permit from the U.S. Army Corps of Engineers (USACE) prior to discharging dredged or fill material into waters of the U.S. as defined by 33 CFR Part 328.

Environmental Consequences

Proposed Action

Potential jurisdictional waters of the U.S. were avoided when possible while considering locations of the various project components (well pads, roads, and pipelines). The six potential jurisdictional waters of the U.S. that may be affected by the Proposed Action are described below along with associated design features, BMPs, and mitigation measures that avoid or minimize potential impacts to waters of the U.S.

- The proposed 31-26 access road would cross a large intermittent drainage, where the existing stable low-water crossing would be used and pipelines would be buried deep.

- The proposed PA 34-24 access road would cross the large intermittent Balzac Gulch drainage, where a large culvert would be installed and pipelines would be buried deep.
- The proposed pipelines between the PA 31-26 and PA 34-24 pads would cross another two intermittent drainages and would be adequately buried.
- The existing Anvil Points Road, where proposed pipelines would be collocated, crosses a large, ephemeral drainage (by culvert) and a perennial drainage that is managed by Garfield County as a low-water crossing. The culvert and low-water crossing would be managed in collaboration with Garfield County and the BLM; in addition, the existing low-water drainage crossing and its reinforcement will be examined by a qualified geotechnical engineer to ensure adequacy for the proposed use (**Appendix A**).

Impacts to waters of the U.S. from the planned features of the Proposed Action would be addressed by the USACE through the agency's permitting system. A COA listed in **Appendix A** requires that the operator obtain a formal jurisdictional determination by the USACE prior to any construction that could affect waters of the U.S. and verification that the impacts do not require a permit.

Preferred Alternative

Impacts to waters of the U.S. from the Preferred Alternative would be the same as those of the Proposed Action.

No Action Alternative

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the impacts to this resource or resource use as described for the Proposed Action would occur.

GROUNDWATER

Affected Environment

The Lower Piceance Basin contains both alluvial and bedrock aquifers (CGS 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 wells are limited to 15 gallons per minute (gpm) administratively, while municipal wells are designed and constructed for maximum 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). Both upper and lower aquifer systems are present beneath higher portions of the project area, but no water wells are completed within either the upper or lower bedrock aquifers units as described above. Beneath these two aquifer

systems is a confining unit consisting of the Wasatch Formation and the lower two members of the overlying Green River Formation. Some fresh-water wells are completed in localized water-bearing intervals within this unit.

Below the Wasatch Formation is the Cretaceous-aged Mesaverde aquifer. This aquifer consists of sandstone with interbedded shale and coal of the Williams Fork Formation and the marine sands and shales of the Iles Formation. 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. Studies of the potentiometric surface performed by Glover et al. (1998) indicate that water from the Mesaverde aquifer does discharge into the Colorado River and its alluvium downstream from the town of Parachute.

Water quality of the upper Piceance Basin aquifer 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. Although no primary (health-based) water quality standard has been established for TDS, the secondary (aesthetic or non-health-based) standard for TDS in drinking water is 500 mg/L or less (EPA 2006). Water quality of 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 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 (EPA 2004).

According to the Colorado Division of Water Resources (CDWR), 44 registered wells are located within a 1-mile buffer of the proposed pads and roads. Of these, 17 were listed as domestic/household or commercial/industrial. These water wells have depths between 20 and 270 feet, with water yields ranging between 1.5 and 15 gallons per minute (gpm). Other wells identified within the buffer are listed as monitoring wells, or were canceled or denied.

Environmental Consequences

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. These typically 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 is 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 5,000 feet or more bgs. Drilling scenarios are developed to prevent fluids and produced hydrocarbons from migrating upward into fresh water zones. Also see the discussion of hydraulic fracturing on groundwater resources in the section of this EA on Geology and Minerals. 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 Downhole COAs in **Appendix B**).

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 2009). 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 1.0 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 1.0 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 (NAS 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 well depth 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 vertical distances (thousands of feet) needed to reach fresh-water aquifers much closer to the surface. This conclusion applies to the CRVFO area, and is also applicable 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 shallow fresh-water wells are 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 space between the casing and borehole wall is 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 31**). Since fracture jobs are tailored to the downhole environment and companies are aware of the concerns involving hydraulic fracturing, the chemicals listed in **Table 31** may or may not be used, and the information is provided solely as general information.

Although a variety of chemicals additives are used in hydraulic fracturing—the examples in **Table 31** 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 in **Table 31**. The sand listed in the table is used as a proppant to help keep the newly formed fractures from closing.

Following completion of fracturing activities, 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 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.*

No incidents of groundwater in contamination in Colorado due to use of this method have been confirmed since the COGCC report.

Based on the information summarized above, the CRVFO has concluded that properly implemented hydraulic fracturing of oil and gas wells drilled within its boundaries for accessing 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.

Table 31. Constituents of Typical Hydraulic Fracturing Operations in Tight Gas Formations

Additive Type*	***Typical Example****	***Percent by Volume*** **	***Function****	***Common Use of Example Compound***
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 flocculant 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 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
**USDOE 2009

Preferred Alternative

Impacts to groundwater from the Preferred Alternative would be less than those of the Proposed Action due to the reduction in well development and overall disturbance footprint. With 8% less wells to be developed in the Preferred Alternative, impacts to groundwater would be reduced slightly when compared to the Proposed Action.

No Action Alternative

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the impacts to this resource or resource use as described for the Proposed Action would occur.

4.18. WILDLIFE – AQUATIC AND TERRESTRIAL

AQUATIC ORGANISMS

Affected Environment

The Proposed Action would occur in an area of highly dissected terrain containing a number of ephemeral drainages. Due to the short stream lengths and small watersheds of ephemeral streams potentially affected by the Proposed Action, fish species do not occur. Aquatic macroinvertebrates most likely to occur include water striders, water boatmen, predaceous diving beetles, and the aquatic larvae of caddisflies and true flies such as biting midges, nonbiting midges, and mosquitoes. Amphibians, if present, would probably be limited to spadefoots and true toads, which are adapted to seasonal flow regimes in arid environments.

The Colorado River is located approximately 0.5 mile from the proposed pad developments. In addition to the fish species identified in the special status fish section, fish surveys in the upper reaches of the Colorado River conducted by CPW and BLM have documented the native mountain whitefish (*Prosopium williamsoni*) and speckled dace (*Rhinichthys osculus*), as well as the non-native rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*). The two trout have been widely introduced as sportfish throughout the region, and the brown trout in particular has been stocked in marginal coldwater streams because of its tolerance for slightly warmer waters than the native cutthroat trout and its ability to reproduce successfully in streams with small flows.

Environmental Consequences

Proposed Action

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 of sediments into nearby ephemeral washes and eventually the Colorado River. The potential increase of sedimentation into the Colorado River would probably be nominal 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 (**Appendix A**).

Preferred Alternative

The total disturbance under the Preferred Alternative has slightly increased (1.12 acres) for short-term disturbance when compared to the Proposed Action while the long-term disturbance has a decrease of

0.60 acre. Because construction, drilling, and completion operations under the Preferred Alternative are generally limited between May through November, it is likely that roads and pads would not be muddy for extended periods. Roads are generally drier and in better condition during the non-winter months and consequently are less prone to erosion. Essentially the impact analysis for aquatic organisms presented in the Proposed Action remains unchanged and relevant for the Preferred Alternative.

No Action Alternative

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the impacts to this resource or resource use as described for the Proposed Action would occur.

MIGRATORY BIRDS

Affected Environment

The project area includes pinyon-juniper woodlands, sagebrush grasslands, and some Gambel's oak thickets. Given this vegetation, the project area provides cover, forage, breeding, and nesting habitat for a variety of migratory birds.

Species on the U.S. Fish and Wildlife Service (2008) list of Birds of Conservation Concern (BCC) for the project region include two species associated with pinyon-juniper woodlands, the pinyon jay (*Gymnorhinus cyanocephalus*) and juniper titmouse (*Baeolophus griseus*). Another BCC species, Cassin's finch (*Haemorhous cassinii*), nests in higher elevation montane and subalpine conifer forests but commonly moves into pinyon-juniper woodlands following nesting and throughout winter. None of these species was observed during the most recent survey (WWE 2017). Non-BCC species associated with this habitat type include the broad-tailed hummingbird (*Selasphorus platycercus*), black-chinned hummingbird (*Archilochus alexandri*), western kingbird (*Tyrannus verticalis*), Say's phoebe (*Sayornis saya*), plumbeous vireo (*Vireo plumbeus*), Townsend's solitaire (*Myadestes townsendii*), American robin (*Turdus migratorius*), mountain bluebird (*Sialia sialis*), blue-gray gnatcatcher (*Polioptila caerulea*), black-throated gray warbler (*Setophaga nigrescens*), chipping sparrow (*Spizella passerina*), lark sparrow (*Chondestes grammacus*), and lesser goldfinch (*Spinus psaltria*).

Areas of mountain shrubs such as mountain-mahogany and serviceberry, although limited, have the potential to attract additional non-BCC species such as the black-headed grosbeak (*Pheucticus melanocephalus*) and spotted towhee (*Pipilo maculata*).

Sagebrush habitats may support one BCC species associated almost entirely with sagebrush steppe, the Brewer's sparrow (*Spizella breweri*), as well as other migrants such as the western meadowlark (*Sturnella neglecta*), vesper sparrow (*Pooecetes gramineus*), and lark sparrow. Based on the extent and quality of the sagebrush, the habitat is marginal for Brewer's sparrow and outside the normal range of the sagebrush sparrow (*Artemisiopiza bellii*), another obligate on sagebrush occurring in the Wyoming Basin of northwestern Colorado.

Oakbrush and mixed mountain shrub habitats in the area are suitable for migrants such as common poorwill (*Phalaenoptilus nuttallii*), dusky flycatcher (*Empidonax oberholseri*), Woodhouse's scrub-jay (*Aphelocoma woodhouseii*), mountain chickadee (*Poecile gambeli*), Virginia's warbler (*Oreothlypis virginiae*), MacGillivray's warbler (*Geothlypis tolmiei*), spotted towhee, green-tailed towhee (*P. chlorurus*), black-headed grosbeak, and lazuli bunting (*Passerina amoena*).

Additional passerine (perching) birds commonly found in the area include year-round residents such as the common raven (*Corvus corax*), American crow, black-billed magpie, and house finch (*Haemorhous mexicanus*).

Raptors potentially nesting in the area 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*), the latter uncommonly. A small owl potentially nesting in the area, the flammulated owl (*Psiloscops flammeolus*), is a BCC species. Other additional BCC raptors nesting in the vicinity and potentially visiting the project area during foraging are the golden eagle and prairie falcon (*Falco mexicanus*), both potential transients from suitable nesting sites on cliffs and rocky bluffs throughout the area. The carrion-feeding turkey vulture (*Cathartes aura*) is also likely to search the area for food. Two BCC species that nest in the general project region but are not expected to forage within or near the site, the bald eagle and peregrine falcon, are BLM sensitive species (see the section on Special Status Species).

A raptor survey of eastern portions of the MDP area conducted in July 2018 did not identify any occupied nests within 0.25 mile of the proposed development. Due to the transitory nature of many raptor species, the area would need to be resurveyed if the development is to be initiated in subsequent raptor nesting seasons (**Appendix A**).

Environmental Consequences

Proposed Action

The Proposed Action would result in a loss of nesting, roosting, perching, and foraging habitat for migratory birds on disturbed areas and reduce habitat effectiveness adjacent to areas where disturbance-related effects could be expected. The various new pads in the BG2MDP area would result in 56.61 acres of surface disturbance with 44.48 acres occurring on BLM. These changes to the habitat could negatively affect bird species that require large expanses of intact habitat. Habitat fragmentation could result in increased competition, increased exposure to predators, and a higher likelihood of nest parasitism. It is also possible that individual nests could be destroyed if the well pad, pipeline, and production facilities are constructed during the nesting season.

In addition to the physical loss of habitat and habitat fragmentation, it is possible that during construction 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. Furthermore, impacts to birds at the species or local population level could include a change in abundance and composition as a result of cumulative habitat fragmentation from energy development in the larger area. Impacts to migratory bird species that nest in pinyon-juniper and sagebrush habitats can be minimized by avoiding surface-disturbing activities during the nesting season. take place outside the nesting season.

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 (**Appendix A**) 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.

Also for the protection of migratory birds is a COA (**Appendix A**) specifying that any pits containing fluids must be fitted with one or more devices to avoid or minimize exposure to the fluids by migratory birds. Such exposures could result in acute toxicity or compromised insulation or buoyancy due to dissolution of protective oil on the feathers.

Preferred Alternative

The total disturbance under the Preferred Alternative has slightly increased (1.12 acres) for short-term disturbance when compared to the Proposed Action while the long-term disturbance has a decrease of 0.60 acre. Essentially the impact analysis presented in the Proposed Action for migratory birds remains unchanged and relevant for the Preferred Alternative.

No Action Alternative

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the impacts to this resource or resource use as described for the Proposed Action would occur.

OTHER TERRESTRIAL SPECIES

Affected Environment

The project area would be located in medium density pinyon-juniper woodlands with openings of sagebrush; dense mountain brush becomes more predominant at the higher elevations of the project area. Understory vegetation consists of mostly native grasses and forbs with some cheatgrass. Given these vegetation types, the area provides cover, forage, breeding, and nesting habitat for a variety of big game and small game species as well as nongame species.

Mammals

The project area is within overall ranges of mule deer (*Odocoileus hemionus*) and Rocky Mountain elk (*Cervus elaphus nelsonii*). Because of its low elevation, the project area consists of both winter range and severe winter range for mule deer, meaning that it receives most use by animals that have migrated downslope to where temperatures are milder, snowcover thinner and less persistent, and forage more readily available. In addition to these migrant animals, a small number of mule deer reside in the general vicinity year-round. Winter densities of big game animals in a given area are dependent on the type of habitat present and the severity of the winter. Severe winter range is the portion of overall winter range used primarily during the most severe winters in terms of temperatures and, especially, snow cover. Consequently, severe winter range is typically at the lower margins of overall winter range and often comprised of plant species that are not necessarily ideal as forage but remain available when higher quality winter range is covered with deep snow.

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. Other small carnivores potentially present are the raccoon (*Procyon lotor*) and striped skunk (*Mephitis mephitis*), and their analogous relatives the ringtail (*Bassariscus astutus*) and spotted skunk (*Spilogale gracilis*) in drier and more rugged, higher terrain and along smaller drainages.

Small mammals present within the planning area include rodents such as the rock squirrel (*Otospermophilus variegatus*), golden-mantled ground squirrel *(Callospermophilus lateralis)*, least

chipmunk (*Tamias minimus*), and packrat (bushy-tailed woodrat) (*Neotoma cinerea*), and lagomorphs such as the desert cottontail (*Sylvilagus audubonii*). Rodents and, to a lesser extent, lagomorphs are the primary prey base for a variety of avian and mammalian predators.

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 the 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.

Environmental Consequence

Proposed Action

Direct impacts to 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 from the 56.61 acres of habitat loss or modification, 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).

Deer and elk are often restricted to smaller areas during the winter months and may expend high amounts of energy to move through snow, locate food, and maintain body temperature. Disturbance during the winter can displace wildlife, depleting much-needed energy reserves and may lead to decreased over winter survival. To minimize impacts to wintering big game, a Timing Limitation (TL) stipulation would be applied from December 1 through April 30 annually (**Appendix A**). A big game TL requires that no construction, drilling or completion activities shall occur during the period of restriction. Terra has expressed a desire for year-round drilling to complete the drilling schedule outlined in **Table 4**, which would require an annual exception to the TL. Terra has been working in consultation with the BLM and CPW to develop a plan that would mitigate impacts that would potentially impair habitat value should a TL exception request be pursued.

Additional, indirect habitat loss may occur if increased human activity (e.g., traffic, noise) associated with infrastructure causes intolerant species to be displaced or alter their habitat use patterns. The extent of indirect habitat loss varies by species, the type and duration of the disturbance, and the amount of screening provided by vegetation and topography. In general, disturbance-related impacts are temporary, with patterns of distribution and habitat use returning to predisturbance conditions rather quickly when disturbance stops.

Preferred Alternative

The total disturbance under the Preferred Alternative has slightly increased (1.12 acres) for short-term disturbance when compared to the Proposed Action while the long-term disturbance has a decrease of 0.60 acre. Major differences with the Preferred Alternative is Terra's proposal to (1) avoid the big game winter timing limitation period stipulated on the Federal lease and (2) implement drilling with two rigs during 2019 to compress the actual drilling operations to one year, reducing impacts to big game wildlife, birds, and other terrestrial wildlife species.

No Action Alternative

Under this alternative, none of the proposed new Federal wells, new well pads on BLM-administered public land, or associated facilities would be developed. Therefore, none of the impacts to this resource or resource use as described for the Proposed Action would occur.

5. CUMULATIVE IMPACTS

Table 1 identifies existing development and infrastructure in the project area, which indicates the amount of historical development that has occurred and provides a baseline for cumulative impacts to be analyzed in the environmental analysis. This includes the 79 wells that Terra currently operates in the area, the 66 wells being developed as part of Balzac Gulch Phase 1, the proposed development of Phase 2 (either with the Proposed Action or Preferred Alternative), and another existing development, Garfield County's Anvil Points Communication Site. Other reasonably foreseeable development near the project includes the following:

1. NR 23-3 pad with 27 wells in 2018
2. RWF 31-9 pad with 11 wells in 2019
3. DOE 1-M-18 pad with 15 wells in 2019
4. RWF 41-16 pad with 7 wells in 2020

5.1. AIR RESOURCES

The CARMMS assesses statewide impacts of projected oil and gas development (both Federal and fee [i.e., private]) to year 2025. Each field office was modeled with the source apportionment option, meaning that incremental impacts to regional ozone and AQRVs from Federal oil and gas development in these areas are essentially tracked to better understand the significance of such development on impacted resources and populations. The CARMMS leverages the work completed by the WestJumpAQMS, and the base model platform and model performance metrics are based on those products.

Based on the CARMMS projections, the BLM continually tracks emissions changes and air quality conditions to determine which projection path (low, medium, high) would be most appropriate to estimate air quality impact correlations based on the cumulative development (i.e., net emissions changes) that has occurred since the base emissions inventory year. Although the predicted impacts are based on future modeling results (2025), the relative changes in the impacts between the scenarios provides insight into understanding how mass emissions impact the atmosphere on a relative basis.

The CARMMS incremental modeling changes / results for each source group (i.e., CRVFO planning area) are applicable to the amount of new Federal oil and gas air pollutant emissions that were modeled in the CARMMS. Annual oil and gas completions / development inventories are routinely compiled by the BLM to track current oil and gas development with regard to CARMMS-modeled "budgets" (oil and gas

development / emissions rates). The following summarizes oil and gas development that has occurred for the CRVFO with CARMMS projection information.

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.

The CARMMS analysis shows that 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 BG2MDP wells 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 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. The maximum estimated GHG emissions resulting from new well development and production activities from the BG2MDP are approximately 75,261 tons per year (68,295 metric tons per year) as carbon dioxide equivalent (CO_2e). To place the project GHG emissions 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 CO_2e, respectively (COGCC 2018, Office of Natural Resources Revenue [ONRR] 2017, EPA 2014, Intergovernmental Panel on Climate Change [IPCC] 2013). The project's maximum GHG emissions from full development and production would be approximately 1.1 percent of Garfield County's 2015 oil and gas production emissions.

As provided in **Table 15**, the maximum annual CO_2e emissions (assuming 100% development and operations plus 1 year of down-stream combustion) are estimated at approximately 1,620,027 tons per year (1,470,079 metric tons per year). These maximum annual downstream emissions would be comparable to the following GHG emissions from 2015 oil and gas production: 25% of Garfield County, 1% of the State, and 0.04% of the US.

According to ONRR's U.S. Department of the Interior data, the country'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 CO_2e emissions in 2015 according to EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks (2017). The calculated CO_2e 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, 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 CO_2e 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 ºF to +5 ºF 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.

For greater detail, the sections of the Annual Report that describe the cumulative analysis are as follows:

- Field Office Data / Analysis (CRVFO) – This section presents data for cumulative emissions from new Federal oil and gas development within the CRVFO as compared to the emissions scenarios analyzed by CARMMS, and qualitatively scales the CARMMS projected impacts to the cumulative report year emissions to provide a context for the current cumulative impacts (concentrations, AQRVs, etc.) for the Field Office. This section is referenced to set the context for the projects current cumulative impacts at field office scales.
- Field Office Data / Analysis (BLM Colorado) – This section provides data and analysis similar to those described above, except on a statewide basis (BLM Colorado Cumulative). This section is referenced to set the context for the projects current cumulative impacts at BLM Colorado (i.e. state level) scales.
- Climate Statistics and Change Analysis – This section describes Colorado's climate (as summarized from the WRCC's website), and the science, metrics and trends accounting for recent and projected climate change (relative to future global emissions scenarios) as summarized from IPCC's Fifth Assessment Report (2013). This section also provides context for the estimates of various downstream combustion related emissions from various Federal and non-Federal contributors relative to total U.S. and global emissions.

5.2. EXISTING OIL AND GAS DEVELOPMENTS

The Balzac Gulch MDP – Phase 2 project occurs along the south-facing ridges and drainages of the Roan Plateau directly north of the I-70, Rulison exit. The Federal wells to be developed in the second phase have bottomholes exclusively within the northern extent of Federal lease COC73094, which was one of the Federal leases "below the rim" that was analyzed in the Roan Plateau EIS/RMPA (BLM 2016a). A Phase 1 project for Balzac Gulch MDP with 66 Federal wells was analyzed in BLM EA DOI-BLM-CO-N040-2017-0093, approved in September 2017. The Phase 1 development focused on reaching bottomholes in the southern extent of lease COC73094 using existing, expanded BLM and private well pads near the Colorado River valley floor. The Phase 1 project is currently being developed with expected completion of the 66 Federal wells in fall 2018.

Except for the Balzac Gulch lease COC73094, the vast area below the Roan Plateau rim between Parachute and West Rifle (addressed in the Wheeler to Webster Mesa MDPs [CO-140-2001-048-EA and CO-140-2005-047-EA]) has previously been developed under a series of NEPA documents prepared since the early 2000's to address and analyze the majority of in-fill oil and gas development "below the rim" of the Roan Plateau (**Table 32**). With the Balzac lease development, the Federal mineral leases held by Terra along the flanks of the Roan Plateau will be placed into production.

Prior to the start of the Phase 1 drilling operations within the Balzac Gulch MDP boundary, Terra, the sole operator of oil and gas wells in the project area, managed 11 pad locations supporting 79 producing wells (34 Federal wells and 45 Fee wells). With the initial Balzac Gulch MDP and its 66 Federal wells expected to be completed by fall/winter 2018, the total well count on these 11 existing pads would increase to 145 wells (100 Federal wells and 45 fee wells) (**Table 32**).

For the Preferred Alternative, the full development of the planned 58 Federal wells in the Balzac Gulch MDP – Phase 2, would raise the number of Federal producing oil and gas wells within the MDP boundary to 158 wells. For the Proposed Action, 63 wells were analyzed bringing the potential total in the MDP area to 163 Federal wells. No new fee wells are included in the BGMDP or BG2MDP projects.

Alternative IV of the Roan Plateau Final SEIS evaluated 2,475 wells, including 149 atop the Roan Plateau and 2,326 below the Cliffs (BLM 2016c). The combined well development from both phases (66 Federal

wells being developed as part of Balzac Gulch Phase 1 and the proposed development of 58 Federal wells for Phase 2 – Preferred Alternative) would represent 5.5 percent of the potential well development below the Roan Cliffs that was evaluated in the Final SEIS.

Because only Federal wells are being considered in the BG2MDP development, under the No Action Alternative, regardless of the alternative selected, no Federal wells would be drilled or developed resulting in no change to cumulative impacts.

Table 32. Summary of Cumulative Well Count for the Balzac Gulch MDP – Phase 2 Project Area

Existing Development within the Balzac Gulch MDP – Phase 2 Project Area					
Well Pad	***Construction Date***	***Existing Footprint (acres)***	***Surface Ownership***	***NEPA Documents***	***Wells Drilled or Approved (Federal/Fee)***
W 29-26	September 1987	2.82	Fee	--	0/2
DOE 1-W-26	August 1989	2.00	Federal	CO-140-2005-047-EA	4/0
PA 24-26	June 2002	2.21	Fee	--	0/1
PA 324-26	June 2002	3.30	Fee	--	4/7
PA 23-26 [1]	August 2002 October 2017	2.24	Federal	CO-N040-2013-0025-EA CO-N040-2017-0093-EA	3+**27**/0
RWF 23-19	July 2004 May 2018	2.69	Federal	CO-140-2001-048-EA Serves as Remote Frac Pad	4/0
RWF 13-19 [1]	September 2004 May 2018	2.55	Federal	CO-140-2001-048-EA CO-N040-2017-0093-EA	6+**14**/0
RWF 324-19	April 2005	2.19	Federal	--	3/0
RWF 12-19	September 2005	3.22	Federal	--	6/0
PA 41-25	July 2007	5.12	Fee	--	4/18
PA 22-25 [1]	January 2008 September 2017	5.52	Fee	CO-N040-2017-0093-EA	**25**/17
				Total Existing Wells in BG2 MDP Area	**100/45**
Preferred Alternative Development within the Balzac Gulch MDP - Phase 2 Project Area					
Well Pad	***Estimated Drilling Start***	***Existing Footprint (acres)***	***Surface Ownership***		***Wells Proposed (Federal/Fee)***
PA 34-24	July 2019	3.59	Federal		11/0
PA 31-26	Sep 2019	3.41	Federal		11/0
PA 44-13	May 2019	4.13	Federal		20/0
PA 32-13	Sep 2019	2.25	Federal		16/0
				Total Proposed Wells in BG2MDP Project (Preferred Alternative) [2]	**58/0**
				Cumulative Total of Wells in BG2MDP Area (Federal/Fee)	***158/45***

[1] Pads and wells shown in **Bold** were analyzed in 2017 Balzac Gulch MDP - Phase 1; EA # CO-N040-2017-0093
[2] For the Proposed Action, total well count would be 63 Federal wells with total of 163 for the BG2MDP area.

5.3. SUMMARY OF CUMULATIVE IMPACTS

Adverse cumulative impacts in the CRVFO gas-producing 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 the well pad, access road, 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 state, county, and 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 adverse (negative) 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 and nearby portions of the CRVFO.

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 Colorado Air Resources Protection Protocol (CARPP), which incorporates the CARMMS process. 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.

NEPA requires Federal agencies to consider the cumulative effects of proposals under their review. Cumulative effects are defined in the CEQ regulations 40 CFR §1508.7 as "...the impact on the environment that results from the incremental impact of the action when added to the other past, present, and reasonably foreseeable future actions..." The following narrative describes past, present, and reasonably foreseeable actions known to BLM that may occur within the broader project vicinity.

Historically, habitat loss or modification in the CRVFO areas was characteristic of agricultural, ranching lands, rural residential, with localized industrial impacts associated with the railroad and I-70 corridors

and the small communities. More recently, the growth of residential and commercial uses, utility corridors, oil and gas developments, and other rural industrial uses (e.g., gravel mining along the Colorado River) has accelerated the accumulation of impacts in the area. Cumulative impacts have included (1) direct habitat loss, habitat fragmentation, and decreased habitat effectiveness; (2) increased potential for runoff, erosion, and sedimentation; (3) expansion of noxious weeds and other invasive species; (4) increased fugitive dust from construction of oil and gas pads, roads, and pipelines and associated truck travel; (5) increased noise, especially along access and haul roads; (6) increased potential for spills and other releases of chemical pollutants; (7) decreased scenic quality, and (8) increased air emissions from construction, drilling, completions and well production operations.

Although none of the cumulative impacts was described in the 2016 Roan Plateau RMPA/ROD (BLM 2016a) as significant, and while new technologies and regulatory requirements have reduced the impacts of some activities, many existing and future actions will continue or begin to have adverse effects on various elements of the human and natural environment. Anticipated impacts for existing and future actions range from negligible to locally major, and primarily negative, for specific resources.

The primary bases for this assessment are twofold: First, although the rate of development, including oil and gas development, has slowed in recent years due to the general economic downturn and depressed natural gas prices, some development continues to occur, adding to the previous residential, commercial, and industrial growth and to the previous habitat loss, modification, and fragmentation. Second, residential and commercial expansion, as well as most of the oil and gas development, has occurred on private lands where mitigation measures designed to protect and conserve resources may not be in effect to the same extent as on BLM lands. However, COGCC regulations enacted in recent years have closed considerably the former gap between the potential environmental impacts associated with development of private versus Federal fluid mineral resources.

Based on the above, the Proposed Action would contribute to the collective adverse impact for some resources. Although the contribution would be minor, the Proposed Action would contribute incrementally to the collective impact to air quality, native vegetation, migratory birds, terrestrial wildlife, and other resources.

6. PERSONS AND AGENCIES CONSULTED

Terra Energy Partners – Adam Tankersley, Eric Dekam, Kevin Moore, Bryan Hotard, Kyle Kohl, Brandon Sagrillo
Colorado Oil and Gas Conservation Commission - Dave Kubeczko
Colorado Parks and Wildlife - Taylor Elm
Mountain West – Zach Perdue
WestWater Engineering – Leah Weckworth, Amie Wilsey

7. INTERDISCIPLINARY REVIEW

BLM staff from the CRVFO who participated in the preparation of this EA, including review of survey results submitted by the operator's consultants, evaluation of impacts likely to occur from implementation of the Proposed Action, and identification of appropriate COAs to be attached and enforced by BLM, are listed in **Table 33**.

Table 33. BLM Interdisciplinary Team Authors and Reviewers

Name	*Title*	*Areas of Participation*
John Brogan	Archaeologist	Cultural Resources, Native American Religious Concerns
Jim Byers	Natural Resource Specialist	EA Project Lead, Access and Transportation, Socioeconomic, Visual Resources, Wastes-Hazardous or Solid
Vanessa Caranese	Geologist	Geology and Minerals, Groundwater, Paleontology
Allen Crockett, Ph.D.	Supervisory Natural Resource Specialist	Technical Review, NEPA Review
Bob Hartman	Petroleum Engineer	Downhole COAs
Kimberly Leitzinger	Outdoor Recreation Planner	Lands with Wilderness Character
Laura Millard	Realty Specialist	Realty Authorizations
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.

Participation by the BLM Interdisciplinary team included site visits to assess existing conditions, comparing proposed activities and locations with resource information in the BLM's corporate GIS database, interacting with the project proponent and its contractors to improve the project design, and identifying appropriate management actions and mitigation measures for avoiding, reducing, or offsetting adverse impacts, and ensuring compliance with the 2016 Roan Plateau ROD/Approved RMPA.

8. REFERENCES CITED

Bureau of Land Management (BLM). 1986. Manual H-840-1 – Visual Resource Inventory. January 17.

_____. 1999. Oil & Gas Leasing & Development – Final Supplemental Environmental Impact Statement. Glenwood Spring Field Office, Colorado.

_____. 2006. Final Roan Plateau Resource Management Plan Amendment & Environmental Impact Statement. Glenwood Springs Field Office, Colorado.

_____. 2007. Final biological assessment, vegetation treatments on BLM lands in 17 western states. Reno, NV.

_____. 2013. BLM Colorado River Valley Field Office (CRVFO) Standards for Contractor Inventories for Special Status Plants, Significant Plant Communities, and Noxious Weeds. U.S. Bureau of Land Management, Colorado River Valley Field Office. Silt, CO.

_____. 2015a. 2015 Annual Report. BLM Colorado State Office. May. Available online at: https://www.co.blm.gov/nepa/airreports/AR2015.html. Accessed on March 5, 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 March 5, 2018.

_____. 2016a. Colorado River Valley Field Office and White River Field Office Roan Plateau Planning Area including Naval Oil Shale Reserves Numbers 1 & 3 Record of Decision and Approved Resource Management Plan Amendment. Available online at: https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=94518. Accessed on July 31, 2018.

_____. 2016b. 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_air co_quick%20link_CARMMS1.5.pdf. Accessed on March 5, 2018.

_____. 2016c. Colorado River Valley Field Office Roan Plateau Planning Area including Naval Oil Shale Reserves Numbers 1 & 3, Proposed Resource Management Plan Amendment and Final Supplemental Environmental Impact Statement. BLM/CO/PL-16/010. Bureau of Land Management, Colorado State Office.

_____. 2017a. Proposed Balzac Gulch – Phase 1 Oil and Gas Master Development Plan Project, Environmental Assessment DOI-BLM-CO-N040-2017-0093, Bureau of Land Management, Colorado River Valley Field Office. September 2017.

_____. 2017b. 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/documents/colorado/public-room/report. Accessed on March 5, 2018.

_____. 2017c. Programmatic Biological Assessment: Management of the Federal Fluid Minerals Program in Western Colorado, Water Depletion Effects on the Four Endangered Big River Fishes: Bonytail (*Gila elegans*), Colorado Pikeminnow (*Ptychocheilus lucius*), Humpback Chub (*Gila cypha*), and Razorback Sucker (*Xyrauchen texanus*) in the Upper Colorado River Basin. Bureau of Land Management, Northwest District Office. 54 pp. May 26.

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). 2017a. 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 March 28, 2018.

_____. 2017b. Water Quality Control Commission, Regulation No. 37. Classifications and Numeric Standards for Lower Colorado River Basin. Effective June 30, 2017. Available online at: https://www.colorado.gov/pacific/sites/default/files/37_2017%2806%29.pdf. Accessed on August 23, 2017.

_____. 2018. Water Quality Control Commission, Regulation No. 93. Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List. Effective March 2, 2018. Available online at: https://www.colorado.gov/pacific/sites/default/files/93_2018%2803%29.pdf. Accessed on February 28, 2018.

Colorado Geological Survey (CGS). 2003. Ground Water Atlas of Colorado, Special Publication 53:97-106.

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 September 5, 2017.

_____. 2015. Annual Form 2 Permits issued. Available online at: http://cogcc.state.co.us/data.html#/cogis

_____. 2016. Monthly Coalbed and Natural Gas Produced by County. Available online at: http://cogcc.state.co.us/COGCCReports/production.aspx?id=MonthlyGasProdByCounty

_____. 2018. 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.

Donnell, J.R., W.E. Yeend, and M.C. Smith. Geologic Map of the Grand Valley Quadrangle, Garfield County, CO. 1:24,000 Scale. Map MF-1883.

EnerMax, Inc. 2007. Hydraulic fracturing. http://www.enermaxinc.com/hydraulic-fracturing.

Farmer, A.M. 1993. The effects of dust on vegetation – a review. Environmental Pollution 79:63-75.

Fenneman, N. M. 1946. Physical subdivisions of the United States (Map): U.S. Geological Survey, 1:700,000, 1 sheet.

Fisher, K., and N. Warpinski. 2011. 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.

Franczyk, K.J., J.K. Pitman, and D.J. Nichols. 1990. Sedimentology, mineralogy, and depositional history of some Uppermost Cretaceous Lowermost Tertiary rocks along the Utah Book and Roan Cliffs east of the Green River: U.S. Geological Survey Bulletin 1787:27 pp.

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. 2015 Abstract of Assessment and Tax Levies, Garfield County, Colorado. 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.

Glover, K.C., D.L. Naftz, and L.J. Martin, 1998. Geohydrology of tertiary rocks in the Upper Colorado River basin in Colorado, Utah, and Wyoming, excluding the San Juan Basin, regional aquifer-system analysis. U.S. Geological Survey Water-Resources Investigations Report 96-4105.

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.

Harris, C.M. 1991. Handbook of acoustical measurements and noise control, McGraw-Hill, Inc., New York.

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., 1985, Early Cenozoic history of the Uinta and Piceance Creek Basins, Utah and Colorado, with special reference to the development of Eocene Lake Uinta United States: Rocky Mountain Section, Society of Economic Paleontology and Mineralogy: Denver, Colo., p. 247–276.

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.

Klironomos, J.N. 2002. Feedback with soil biota contributes to plant rarity and invasiveness in communities. Nature, 417:67-70.

Kuuskraa, 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.

Larson, D.L. 2003. Native weeds and exotic plants: relationships to disturbance in mixed-grass prairie. Plant Ecology 169:317-333.

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, C.W. (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.

Murphy, P.C., and D. Daitch. 2007. Paleontological overview of oil shale and tar sands areas in Colorado, Utah, and Wyoming, p. 58.

National Academy of Sciences (NAS). 2012. Induced Seismicity Potential in Energy Technologies. National Academy Press, Washington, DC.

Office of Natural Resources Revenue. 2017. U.S. Department of the Interior Natural Resources Revenue Data. Available online: https://revenuedata.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.

Parker, J. M., and S. H. Anderson. 2007. Ecology and behavior of the midget faded rattlesnake (Crotalus oreganus concolor) in Wyoming. Journal of Herpetology 41:45–51

Perdue, Zach. 2018a. Visual Assessment Report for Balzac Gulch Phase 2 Master Development Plan. April 2018

_____. 2018b. Addendum to Visual Assessment Report for Balzac Gulch Phase 2 Master Development Plan. July 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. Vegetatio, 80:147-152.

Sharifi, M.R., A.C. Gibson, and P.W. Rundel. 1997. Surface dust impacts on gas exchange in Mojave Desert shrubs. Journal of Applied Ecology 34(4):837-846.

Soil Survey Staff. 2017. Web Soil Survey. Available online at: https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm. Accessed on February 21, 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.

Thompson, J.R., P.W. Mueller, W. Fluckiger, and A.J. Rutter. 1984. The effect of dust on photosynthesis and its significance for roadside plants. Environmental Pollution (Series A), 34:171-190.

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. April.

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). 1974. Information on noise levels identified as requisite to protect public health and welfare with an adequate margin of safety. EPA-550/9-74-004, Arlington, VA.

_____. 2004. Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs. Document #EPA 816-R-04-003. Office of Ground Water and Drinking Water Drinking Water Protection, Washington, DC.

_____. 2006. Drinking water standards and health advisories, EPA 822-R-06-013, August 2006. Available online.

_____. 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 February 6, 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 February 6, 2018.

U.S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. 85 pp. [Online version available at <http://www.fws.gov/migratorybirds/>]

_____. 2017a. Official Species List Balzac Gulch Phase 2 MDP. Consultation Code: 06E24100-2018-SLI-0142. January 17.

_____. 2017b. Programmatic Biological Opinion for Water Depletions Associated with Bureau of Land Management's Fluid Mineral Program within the Upper Colorado River Basin in Colorado. Western Slope Supervisor, Fish and Wildlife Service, Ecological Services, Grand Junction, Colorado. ES/GJ-6-CO-08-F-0006. 90 pp. December 26.

U.S. Geological Survey (USGS). 2017. National Water Information System: Web Interface. USGS 09092570 Colorado River at Rulison, CO. Available online at: https://nwis.waterdata.usgs.gov/nwis/inventory/?site_no=09092570&agency_cd=USGS. Accessed on August 24, 2017.

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 non-native plants and contribute to plant invasion. Ecology 90 (2):399-407.

Warpinski, N. 2009. Microseismic Monitoring: Inside and Out. J Pet Tech 61:80-85, cited in U.S. EPA. Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources (External Review Draft). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-16/236fb, 2016.

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. 2017a. Historical Climate Data for Rifle, Colorado (057031). Available online at: https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?co7031. Accessed on March 28, 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 in August 2017.

WestWater Engineering (WWE). 2017. Terra Energy Partners Balzac Gulch Development Project Phase 2 Biological Survey Report. Grand Junction, CO.

_____. 2018. Terra Energy Partners Balzac Gulch Development Project Phase 2 Biological Survey Report Addendum. 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.

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.

APPENDICES

Balzac Gulch Phase 2 Master Development Plan Project

Appendix A. Surface-Use Conditions of Approval

Appendix B. Downhole Conditions of Approval

Appendix C. I-70 Viewshed and Steep Slopes NSO Exception Rationale

Appendix D. Public Scoping Comments and BLM Responses

APPENDIX A

SURFACE-USE CONDITIONS OF APPROVAL
Balzac Gulch Master Development Plan Project
DOI-BLM-CO-N040-2018-0033-EA

Note: The following Conditions of Approval (COAs) will also be used as Resource Protection Stipulations, where applicable, for the Access Road, Buried Pipeline, and Surface Frac Line Rights-of-Way Issued for the Balzac Gulch Phase 2 Master Development Plan.

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, and constructed to road design plats submitted with APDs and BLM's Gold Book standards. Initial gravel application shall be a minimum of 6 inches. The access roads would have a 20-foot running surface with additional width for drainage ditches and occasional vehicle turnouts. Typical new road and pipeline construction would adhere to the road design package submitted with the APD/SUPO. Road and pipeline work shall occur within an average 50-foot-wide disturbance corridor. Generally, culvert locations outlined in the road design plats shall be reviewed during the road pioneering by BLM and Terra field personnel and installed after buried pipelines are installed.

   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.)*

   a. Road Construction Staking. The road centerline would be flagged and staked prior to the start of tree/brush clearing and/or earthwork within the planned disturbance corridor. The edges of disturbance for the road and pipeline would be established with flagging before the tree clearing work is completed. Consideration shall be given to the extra pipeline construction space needed during the road corridor staking.

   b. Construction Best Management Practices. The following BMPs proposed by the operator would be incorporated into the construction techniques to address any saturated or fragile soil conditions, seeps, springs, or slumps encountered during the actual road pioneering:

   – During the initial road pioneering, a surface disturbance corridor shall be established with sufficient area to allow trenching, spoil storage, and pipeline burial within the roadway disturbance corridor.

   – Road structures and cut/fill instability issues, if present, shall be mitigated with soil and slope reinforcement including, but not limited to; soil importation, mechanical compaction, design, and

installation of synthetic geogrids, aggregated subgrade and road base, mechanically stabilized earth walls, and gabion buttress walls and mattresses.

- Surface runoff shall be mitigated with, but not limited to, the installation of CMP culverts, borrow ditches, diversion berms, riprap and other diversionary structures as required by site conditions.
- Subsurface ground water shall be mitigated with the installation of several alternatives including, but not limited to; gravel pack drains, French drains, and collection sumps as required by site conditions.
- During road and/or pipeline construction, topsoil would be segregated along both sides of the road or along one edge of the pipeline corridor for later placement back onto the reclaimed right-of-way.

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 deemed 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 plats, 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 site 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 reseedings 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 be employed as necessary to reduce transport of sediments into the drainages. In areas with high erosion potential, the BLM may, 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. 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**.

10. 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.

11. 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).

12. 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 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 audial 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 that are initiated prior to May 1 and continue into the 60-day period at the same location.

13. 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.

14. Fossil Resources. The operator shall retain the services of use a qualified paleontological monitor during construction that would adversely affect bedrock or outcrop exposures.

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, where feasible, the operator shall suspend ground-disturbing activities at the discovery site and immediately notify the BLM. 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.

15. 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 in the vicinity of 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 the vicinity of 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).

16. 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.

To help achieve VRM Class II objectives and reduce the degree of contrast associated with implementation of the Proposed Action, the following visual resource measures shall be implemented:

- Aboveground facilities shall be painted **Shadow Gray** to blend with adjacent and background pinyon-juniper woodlands. Unless otherwise approved by the BLM Authorized Officer, fluids shall be stored in **low–profile steel blowdown tanks** at each of the BLM pads to reduce visual impacts.
- All proposed operating equipment should be located away from the outer pad surface perimeters above fill faces to avoid the potential for creating a ridgeline effect whereby the operating equipment are silhouetted against the sky at certain viewing angles, increasing the chance of visibility. When feasible, all operating equipment should be located within the interior portion of the pad or along the toe of cut slopes at the pad surface perimeter.
- Retain cut pinyon-juniper slash onsite and distribute on the proposed pad cut and fill faces to break-up any unnatural or geometric forms resulting from grading activities and to help blend each site more seamlessly with surround and background vegetation.

17. 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.

18. Windrowing of Topsoil. Where feasible given the challenging topography and presence of adjacent slope restrictions in BG2MDP area, topsoil shall be windrowed around the pad perimeter to create a berm that limits and redirects stormwater runoff and extends the viability of the topsoil per BLM Topsoil Best Management Practices (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.

19. 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.

PROJECT-SPECIFIC SURFACE-USE COAS APPLICABLE TO PROJECT COMPONENTS

Vegetation Clearing on Pads/Roads/Pipeline. Hydro-axe equipment shall be used to clear woody vegetation and trees within from the staked and/or flagged pad, pipeline, and road construction limits prior to topsoil stripping, windrowing, or storage. Dead and live juniper trees shall be set aside during clearing operations to be placed on pad or road fill slopes as directed in the visual mitigation COAs.

Terra shall purchase a firewood cutting permit to compensate the BLM for the removal of pinyon and juniper trees within the PA 32-13, PA 32-13 Operations Support Pad, and PA 44-13 pad footprints and along the entire PA 32-13 access road (northwest of Garfield County Communication Tower Facility).

Topsoil Storage. Given the lack of flat topography in and around the Balzac 2 well sites, topsoil shall generally be stored in stockpile at areas noted in the APD package including the individual road design plats. Topsoil shall be stripped from the proposed storage areas prior to any topsoil stockpiling.

Hydraulic Fracturing Limitations: To satisfy the air emission thresholds forecasted by the operator during the APD permitting process, the average duration of hydraulic fracturing shall not exceed 25 hours per well, utilizing no more than eighteen 2,000-hp Tier 2 engines.

Stormwater Design: A detailed stormwater plat and plan shall be submitted with the APD, providing details of stormwater control BMPs used to stabilize slopes prior to excavation work, addressing the location and size of ditches and planned structures to control run-on and runoff from the development, and demonstrating suitable drainage diversion and containment around the pad perimeter including any excess material storage piles.

Required Stormwater Structures. Staked straw mat blankets, hydroseed/hydromulch applications, and/or properly spaced and staked straw wattles or straw bales shall be used on any slopes that exceed 50% within the proposed disturbance areas to help stabilize soils while promoting the establishment of desirable vegetation.

Culvert and Low-Water Crossing Designs: Detailed drawings and specifications for low-water crossing or major culvert installations shall be submitted with the appropriate APD package, indicating the structure size of the crossing, providing detailed construction design and/or drawings for the proposed structure, and including, if appropriate, the pipeline alignment and installation methods related to the crossing. For the purpose of this COA, a major culvert is larger than 36 inches in diameter. Culverts and low-water crossings proposed in the project shall include an existing crossing on the PA 31-26 access road, a major culvert (12-foot-diameter) at the drainage crossing south of the PA 34-24 pad, major and minor culverts along the PA 32-13 access road, and low-water crossing/road shift proposed at the unnamed drainage crossing near the end of county road. Proposed culvert locations and dimensions (for all culverts) shall be listed on road design packages submitted with APDs.

Stormwater Controls for Drainages with Steep Sideslopes. The areas with slopes >50% ("affected" steep areas) shall be stabilized with appropriate stormwater controls prior to excavation work startup (using BMPs identified in stormwater plan) and such areas shall be promptly reclaimed within 7 days after the excavation work is completed.

Sediment traps shall be installed at the inlet and outlet side of the road culverts and with rock armoring to help retard and direct flows through the culverts. The road culvert design would act as an overall sediment control for the drainages since the natural flow would be slowed and controlled with the traps and erosion control structures (ditch checks) planned for the road. Some minor cutslope work would occur on the inside of the road prism at most of the culvert crossings planned with the use of compacted embankments on the outside edge of the roadway. Large boulders generated from the construction work would be used in the embankment/fillslope to help control erosion and reduce the overall disturbance footprint.

Use of Boulders / Rocks Encountered during Pad/Road Construction. Large rocks and sandstone boulders shall be used to armor culvert inlets/outlets and to construct machine-placed walls on cut/fill slopes to help reduce the disturbance footprint of access roads and/or pads.

Annual Monitoring of Steep Slope Mitigation. The various project areas (noted above) that exceed the Steep Slope NSO shall be monitored on an annual basis to ensure slope stability is maintained, vegetation cover is becoming or has established, and erosion from areas is not occurring or measurable (comply with Steep Slope objective from Roan Plateau RMPA, which states "maintain watershed soil stability and productivity"). The operator shall ensure cut-and-fill slopes at culvert installations along the roadways are stable, maintained, and acceptably vegetated or establishing desirable vegetation. Periodic inspection of the subject areas shall occur across the life of the project with timing and reporting deadlines to be determined by the BLM.

Annual Monitoring of Viewshed Mitigation. Perform annual monitoring of the proposed project sites to ensure compliance with the objectives of the I-70 Viewshed NSO stipulation. The operator shall ensure cut-and-fill slopes are stabilized and that adequate slash is distributed across cut and fill faces to facilitate blending with the surrounding, and background, vegetation. In addition, project sites should be viewed from each KOP location to ensure the level of contrast regarding form, line, color, or texture are rated no greater than *weak* to prevent the viewshed from being degraded below VRM Class II standards. After interim reclamation is completed on project components, the need for continued annual monitoring shall be reviewed by the BLM.

PROJECT-SPECIFIC MITIGATION MEASURES APPLICABLE TO SPECIFIC COMPONENTS

PA 34-24 Well Pad, Road, and Pipelines

Geotechnical Field Examination. Once the PA 34-24 APDs are approved and the road is pioneered for core-drilling equipment access, a geotechnical examination including soil analysis assessing soil stability and structure shall be undertaken prior to establishing the finish slopes of the PA 3424 pad. Recommendations from the examination shall be incorporated into the final pad construction including the grades on finished cut-and-fill slopes. Operator shall adhere to any special recommendations developed from the geotechnical exam.

The northeast corner of the well pad shall be pulled away from the existing drainage, providing a distance that allows suitable space for establishment and maintenance of stormwater structures and avoids any direct impacts from the pad reconstruction to the nearby drainage course.

The access road serving the PA 34-24 pad shall be regularly treated with magnesium chloride or other dark-colored dust abatement treatment to darken the road surfacing used on the road and soften the contrast of the new access route as seen in the viewshed, particularly from KOP #7 as shown in MountainWest VRM report and addendum.

Cuttings shall be shall be stored in the cuttings management areas at the north side of the pad, tested for adherence to COGCC's Table 910-1 standards, capped with 3 feet of clean soil and incorporated into the interim reclamation work. Excess cuttings could be hauled to the nearby PA 22-25 fee pad provided prior approval is obtained from private landowner.

The topsoil pile at the northern extent of the PA 34-24 pad (as shown on Plat 2, Construction Layout Sheet in the APD) shall be partially designated for excess material storage. Topsoil shall be stripped from the excess storage area and piled separately from the excess material.

PA 31-26 Well Pad, Road, and Pipelines

During the hydro-axe clearing operations, some of the smaller juniper trees shall be uprooted and collected for placement against the toe of the pad and road fill slopes to mitigate the visual contrast. The remainder of the access road and pad shall be hydro-axed to achieve a clean appearance and eliminate excess woody materials.

With the exception of the low-water crossing, the access road serving the PA 31-26 pad shall be regularly treated with magnesium chloride or other dark-colored dust abatement treatment to darken the road surfacing used on the road and soften the contrast of the new access route as seen in the viewshed, particularly from KOP #7 as shown in MountainWest VRM report and addendum.

Cuttings shall be shall be stored in the constructed trench at the north and west edges of the pad, tested for adherence to COGCC's Table 910-1 standards, capped with 3 feet of clean soil and incorporated into the interim reclamation work. Excess cuttings could be hauled to the nearby PA 22-25 fee pad provided prior approval is obtained from private landowner.

The existing double steel-frame gate in the boundary fence between private and BLM land west of the PA 23-25 frac pad shall be moved to the new road route that bisects the fence, and any unneeded portions of the two-track west of the old gate location on BLM shall be reclaimed/seeded.

The series of small side drainages coming off the slope west of the proposed PA 31-26 pad shall be directed around the southwest pad perimeter using a stormwater deflection berm built with excess material. The man-made ditch shall be aligned around the south edge of the pad and through a culvert installed at the pad entrance and into a sediment trap that outlets into a side draw near SE pad corner.

The relatively flat area south of the pad between the road and drainage shall be used specifically for topsoil stockpile as shown on POD. Topsoil cannot be readily windrowed around pad perimeter due to topographical constraints, although the north side of pad shall be used for topsoil windrow to direct stormwater around and through that north-side edge between the pad and the excess pile staged north of the pad.

PA 44-13 Well Pad, Road, and Pipelines

Geotechnical Field Examination. Once the PA 44-13 APDs are approved and the road is pioneered for core-drilling equipment access, a geotechnical examination including soil analysis assessing soil stability and structure shall be undertaken prior to establishing the finish slopes of the PA 44-13 pad. Recommendations from the examination shall be incorporated into the final pad construction including the grades on finished cut-and-fill slopes. Operator shall adhere to any special recommendations developed from the geotechnical exam.

Terra shall coordinate with Garfield County Road and Bridge department on the low water crossing improvements needed at the unnamed drainage north of the locked gate at end of county road including special considerations for heavy truck traffic crossing the low water crossing.

PA 32-13 Well Pad, Road, and Pipelines

Geotechnical Field Examination. Once the PA 32-13 APDs are approved and the road is pioneered for core-drilling equipment access, a geotechnical examination including soil analysis assessing soil stability and structure shall be undertaken prior to establishing the finish slopes of the PA 32-13 pad. Recommendations from the examination shall be incorporated into the final pad construction including the grades on finished cut-and-fill slopes. Operator shall adhere to any special recommendations developed from the geotechnical exam.

Terra shall coordinate with Garfield County Road and Bridge department on the low water crossing improvements needed at the unnamed drainage north of the locked gate at end of county road including special considerations for heavy truck traffic crossing the low water crossing.

PA 32-13 Operations Support Pad

After the drilling and completion work is completed and the support pad is no longer necessary, the pad will undergo final reclamation work with the exception of the pass-through PA 32-13 access road and the width and length necessary for truck safety turnout.

Dead and live juniper trees shall be set aside during clearing operations to be placed on pad or road fill slopes as directed in the visual mitigation COAs

Cuttings Storage

Excess cuttings generated from the PA 44-13 and PA 32-13 wells shall be hauled and stored within the constructed cuttings trench at the RWF 21-18 and RWF 334-18 pads per the respective Construction Layout for each pad.

RWF 12-20 Tank Pad

Operator shall coordinate with Xcel to ensure the overhead powerline along county road and near the pad entrance has safe clearance for drilling, completion, and production traffic.

Surface Frac Lines

The installation of welded steel 4.5-inch surface lines shall use the edges of existing roads and/or pipeline corridors wherever feasible. Where possible, such lines shall be welded together on existing pads and pulled/placed alongside roads while keeping ditches clear for maintenance. Pre-work meeting shall be held with BLM and Terra representatives (including the contractor hired for the surface line installations) to outline in detail the location and method of installation for the cross-country segments. The lines shall be tested initially after installation and periodically during their operation to ensure they have suitable integrity to deliver fluids without failure or spill.

Prior to installation of steel frac lines proposed between the PA 44-13 and RWF 12-19 pads, the surface lines shall be painted with color (Carlsbad Canyon) that matches the dominant soil color evident on the south-facing slope directly north of the RWF 12-19 pad to avoid drawing attention to the surface lines from I-70. These particular surface lines shall be pushed and directed along the south-facing ridgeline and down the steep slope in a manner that minimizes damage to any standing trees. A landing area for the steel lines bearing down the steep slope shall be established with flagging prior to installation. The steel lines shall be anchored along the alignment as needed to maintain the lines in place during their installation and operation. To remove the frac lines, they shall be cut on the RWF 12-19 pad, pulled uphill to the PA 44-13 pad/access road or down the existing road to the RWF 23-19 pad, cut into 40-foot sections, loaded on trailers, and hauled to a wareyard for inspection and reuse.

The surface frac lines installed for the PA 31-26 completion operations shall span the main drainage upgradient from the low water road crossing in a manner that reduces the span length and avoids trees and weak-appearing slopes or drainage walls. The portion of each steel line spanning the high-walled drainage shall be cased inside a segment of steel pipe or 10-inch poly water line featuring 2-inch-thick walls to act as a protective sleeve.

APPENDIX B

BUREAU OF LAND MANAGEMENT

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

Drilling Conditions of Approval
Applications for Permit to Drill

Operator:	TEP Rocky Mountain LLC
Lease Number:	COC73094
Pad:	PA 34-24 // 11 wells
Surface Location:	Garfield County, Lot 4, Section 24, T6S, R95W

1. Twenty-four hours *prior* to (a) spudding, (b) conducting BOPE tests, (c) cementing/running casing strings, and (d) within 24 hours *after* spudding, the CRVFO shall be notified. One of the following CRVFO inspectors shall be notified by phone. The contact number for all notifications is 970-876-9064. The BLM CRVFO inspectors are Marlan Deaton, Ed Fancher, Brandon Jamison, Alex Provstgaard, Greg Rios, Jennifer Robinson

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 below).

3. If a well control issue or failed test (e.g. kick, blowout, water flow, formation integrity test, 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. 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/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.

6. 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.

7. All flare lines must be 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.

8. 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.

9. 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 CRF 3160-9 (a).

10. 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

11. Should the well be completed for production, the AO will be notified when the well is placed in a producing status. Such notification shall be a written notification sent no later than five (5) days following the date on which the well is placed on production.

12. All off-lease storage, off-lease measurement, or commingling on-lease or off-lease will have prior written approval from the AO.

13. For reporting the water used during construction, submit the total water used for construction with the first completion report.

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					

14. "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.

Contact Information

Bob Hartman
Petroleum Engineer
Office: (970) 244-3041
Cell: (970) 589-6735
bhartman@blm.gov

Stephen Garcia
Petroleum Engineer
Office: (970) 876-9031
Cell: (970) 456-2138
sbgarcia@blm.gov

Pad Name	*Lease*	*Well Name*	*Surface Location*	*Bottomhole Location*
PA 34-24 Pad 11 wells (Federal surface / new pad)	COC73094	PA 412-24	Lot 4, Section 24, T6S R95W	SWNW Sec. 24 T6S R95W
		PA 22-24		SENW Sec. 24 T6S R95W
		PA 322-24		SENW Sec. 24 T6S R95W
		PA 422-24		SENW Sec. 24 T6S R95W
		PA 522-24		SENW Sec. 24 T6S R95W
		PA 323-24		NESW Sec. 24 T6S R95W
		PA 13-24		NWSW Sec. 24T6S R95W
		PA 313-24		NWSW Sec. 24 T6S R95W
		PA 513-24		NWSW Sec. 24 T6S R95W
		PA 413-24		NWSW Sec. 24 T6S R95W
		PA 14-24		SWSW Sec. 24 T6S R95W

BUREAU OF LAND MANAGEMENT

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

Drilling Conditions of Approval
Applications for Permit to Drill

Operator:	TEP Rocky Mountain LLC
Lease Number:	COC73094
Well:	PA 44-13 Pad // 20 wells
Surface Location:	Garfield County, SE SE Sec 13 T6S R95W

1. Twenty-four hours *prior* to (a) spudding, (b) conducting BOPE tests, (c) cementing/running casing strings, and (d) within 24 hours *after* spudding, the CRVFO shall be notified. One of the following CRVFO inspectors shall be notified by phone. The contact number for all notifications is 970-876-9064. The BLM CRVFO inspectors are Marlan Deaton, Ed Fancher, Brandon Jamison, Alex Provstgaard, Greg Rios, and Jennifer Robinson

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 below).

3. If a well control issue or failed test (e.g., kick, blowout, water flow, formation integrity test, 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. 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/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.

6. 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.

7. All flare lines must be 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.

8. 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.

9. 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 CRF 3160-9 (a).

10. 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.

11. Should the well be completed for production, the AO will be notified when the well is placed in a producing status. Such notification shall be a written notification sent no later than five (5) days following the date on which the well is placed on production.

12. All off-lease storage, off-lease measurement, or commingling on-lease or off-lease will have prior written approval from the AO.

13. For reporting the water used during construction, submit the total water used for construction with the first completion report.

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					

14. "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.

Contact Information

Bob Hartman
Petroleum Engineer
Office: (970) 244-3041
Cell: (970) 589-6735
bhartman@blm.gov

Stephen Garcia
Petroleum Engineer
Office: (970) 876-9031
Cell: (970) 456-2138
sbgarcia@blm.gov

APPENDIX C

RATIONALE FOR GRANTING EXCEPTIONS TO NSO STIPULATIONS FOR THE I-70 VIEWSHED AND STEEP SLOPES GREATER THAN 50% FOR THE BALZAC GULCH PHASE 2 MDP

Interstate 70 Viewshed (VRM Class II)

As stated in Lease COC73094:

> To protect areas with high visual sensitivity within 5 miles of 1-70, no ground-disturbing activities on slopes steeper than 30% with high visual sensitivity in the 1-70 viewshed will be permitted. These are lands within 5 miles of the highway, of moderate to high visual exposure, where details of vegetation and landform are readily discernible, and changes in contrast can be easily noticed by the casual observer on 1-70.
>
> A ground-disturbing activity may be permitted if BLM determines that the requested activity would not impair values associated with VRM Class II objectives or degrade the visual characteristics of the viewshed below Class II standards. In making this determination, BLM will consider the following resource factors: retention of the overall landscape character on both a site-specific and cumulative basis including line, form, color, and texture; the extent to which the activity blends with characteristics of the natural landscape; the type, amount, and duration of the surface disturbance; the relative extent of viewshed characteristics and current conditions; the relationship to topography and vegetation screening; the type, location, duration, and intensity of potential adverse effects including line, form, color, and texture; mitigation measures to avoid, minimize, or offset the adverse effects; and other factors that may affect the visual and aesthetic quality. Approval of ground-disturbing activities in any given year does not constitute approval for subsequent years; approval for such activities must be granted (or extended) annually by BLM. The proponent of any ground-disturbing activity must provide an assessment with the proposal that (a) documents anticipated compliance or non-impairment of resource values protected by this stipulation and (b) considers the resource factors mentioned above.
>
> During and following the project activities covered by this provision, ongoing monitoring data shall be collected by the proponent using widely accepted scientific methods and reported to BLM not less often than annually. If unanticipated types or levels of adverse effects are noted during monitoring, BLM shall be promptly notified, and corrective measures as approved by BLM shall be identified and implemented by the proponent. This information will be used through an adaptive management process to refine the project components and associated mitigation measures to be applied to future proposed activities.

The areas affected by this NSO stipulation, results of the Visual Assessment Report (Proposed Action) and Addendum (Preferred Alternative) prepared by MountainWest (Perdue 2018a, 2018b), and required mitigation measures are presented in **Section 4.15** of the EA and are not repeated here.

Steep Slopes Greater than 50 Percent

As stated in Lease COC73094:

> Steep Slopes Greater Than 50 Percent: To protect soil stability and reduce impacts of erosion, no ground-disturbing activities will be authorized on slopes steeper than 50%. No ground-disturbing activities will be approved in areas of steep slopes that also are designated as wildlife movement corridors. No ground-disturbing activities will be approved in areas with slopes steeper than 50% to allow access to areas with slopes less than 50%.

Description of Areas that Exceed 50% Slopes

TEP commissioned the collection of Light Detection and Ranging (LIDAR) data for the BG2MDP via survey aircraft. This remote sensing method captures accurate data (0.2-meter resolution) to examine the surface of the Earth. The plats on the following pages show a boundary (pink salmon color) that represents the 50% steep slope NSO. Note that occasional "dots" of a steep slope boundary shown on the attached maps typically represent large boulders or random depressions common in the landscape.

Nine areas along the PA 31-26, PA 34-24, and PA 32-13 access roads as well as a portion of the PA 32-13 pad intersect sideslopes that exceed the 50% slope benchmark described in the NSO stipulation.

In general, the proposed areas of disturbance within the steep slope NSO are relatively minor and directly involve side drainages that would be crossed by access roads with culverts that allow passage of drainage flow. In nearly every instance of steep slope NSO conflict, the sideslopes of a drainage are the slopes that exceed 50% and not the continuous slopes that parallel the proposed access roads. With the installation of culverts at these drainage crossings, there is an opportunity to control upgradient erosion. The use of sediment basins at the inlet and outlet of culverts, rock armoring at both ends of the pipes and at the basin outlets, and anchored straw matting or staked wattle placements are examples of sediment controls that could be used to protect and maintain site stability and productivity.

The intent of protecting the continuous steep slopes within the project area would remain intact as every effort was made to avoid the laterally lengthy, potentially unstable slopes common in the Balzac Gulch area.

The following narrative describes these nine areas and lists the mitigation developed to maintain or improve soil stability and justify an exception to the steep slope NSO. Seeding per CRVFO's standard reclamation COAs would occur on the entire road disturbance corridors and PA 32-13 pad. A COA would involve the installation of straw matting and/or staked straw wattles on all areas that exceed the steep slope NSO. Plats showing details and locations of these nine areas (marked with corresponding letters A to I) are included on the following pages.

- Two areas on BLM land along the proposed PA 31-26 access road (totaling 0.14 acre): Area A is the western embankment of the proposed low-water crossing; the proposed western embankment of the low-water crossing was shifted downgradient of the existing one in order to minimize the length of the crossing, as well as eliminate unnecessary curves in the road alignment for safety. Area B follows the fairly level existing two-track road that would purposefully be shifted upgradient and away from the near vertical edge of the ephemeral drainage. This upgradient shift would locate the proposed access road across a 100-foot-long toe of a side ridge with sideslopes that exceed 50%. Fill material would be placed at either approach of the side ridge to maintain a suitable road grade, thereby eliminating the steep sideslopes and creating gradual road fill slopes that can be readily reclaimed without threat of erosion.

- Two areas along the proposed PA 34-24 access road (totaling 0.27 acre): Area C (0.24 acre) is located on private land (not subject to the steep slope NSO) where the road traverses 250 feet of a short sideslope that exceeds 50%. Area D (0.03 acre) is on BLM land where the nearly vertical sides of an ephemeral channel would be crossed with the installation of a 12-foot-diameter corrugated metal pipe.

- Four areas on BLM land along the proposed PA 32-13 access road (totaling 0.33 acre): Areas E to H are successive drainage crossings, where culverts (24-inch minimum diameter) would be installed to ensure continued drainage function. In addition, stormwater structures would be

constructed at the culvert inlets and outlets for stability and to control erosion that might occur off the sideslopes of the drainages that exceed 50%.

- One area of the Preferred Alternative's PA 32-13 BLM drill pad (0.01 acre): Note that Area I would be temporarily occupied until interim reclamation (within 6 months after completion operations are finished). The Preferred Alternative pad footprint would eliminate the southeast corner of the Proposed Action's pad footprint, thereby avoiding any pad construction and lengthy culvert placement in the drainage with sideslopes that exceed 50%. The reduced pad footprint would nearly avoid all 50% slopes, except in a small area at the central southern pad perimeter. The entire length of the pad fillslope would be designed with a 0.5:1 slope using geogrid materials and compacted lifts (details formulated from planned geotechnical soil testing and core drilling) to create a stable, yet steeper fillslope, reduce fillslope disturbance area, and essentially avoid the surrounding steep slope constraints.

Overall, the various small areas on BLM land needing exception to the steep slope NSO would total 0.51 acre of steep sideslopes. As shown in the various exhibits, eight of the nine locations exceeding a 50% slope would occur on BLM land, with one location (shown as "C" and representing 0.24 acre) along the PA 34-24 access road occurring on private land. These isolated small areas are typically drainage-related (areas of steep channel sideslopes) and would be readily mitigated with stormwater controls and best management reclamation practices associated with culvert installations representing 0.36 acre on BLM road segments. In other instances, small steep areas would be compacted, controlled, and stabilized during placement of fill material around and over the steep areas to become part of the new roadway on the PA 31-26 access road (shown as "B" and representing 0.14 acre) or the southern fillslope of the PA 32-13 pad (shown as "I" and representing 0.01 acre).

Geotechnical Review

In considering the Preferred Alternative, Areas A through H would be the same as under the Proposed Action, and Area I would be greatly reduced in size to nearly avoid 50% slopes. Consequently, the geotechnical review below is applicable, as well as the required mitigation.

In August 2017, David Fox (Professional Engineer, Fox Engineering Solutions, Inc.) and John Withers (Professional Engineer, Geotechnical Engineering Group) conducted site visits at the PA 32-13, PA 34-24, and PA 41-24 proposed pads and made general recommendations for cuts and fills, compaction lifts, site drainage, and on-site inspection during the construction work. The engineers requested approval from the BLM to conduct follow-up site investigations at the three sites to "determine the appropriate sideslopes (H:V) of the cut-and-fill slopes to maintain slope stability and provide information on the adequacy of the onsite fill material and its compaction requirements." The BLM denied the request to continue with site investigation work since such work would require surface disturbance to provide, at a minimum, a pioneered roadway to the proposed sites. The BLM informed Terra and the engineers that such investigative work could proceed once the EA is finalized, APDs are approved, and suitable pioneered routes are built to the sites.

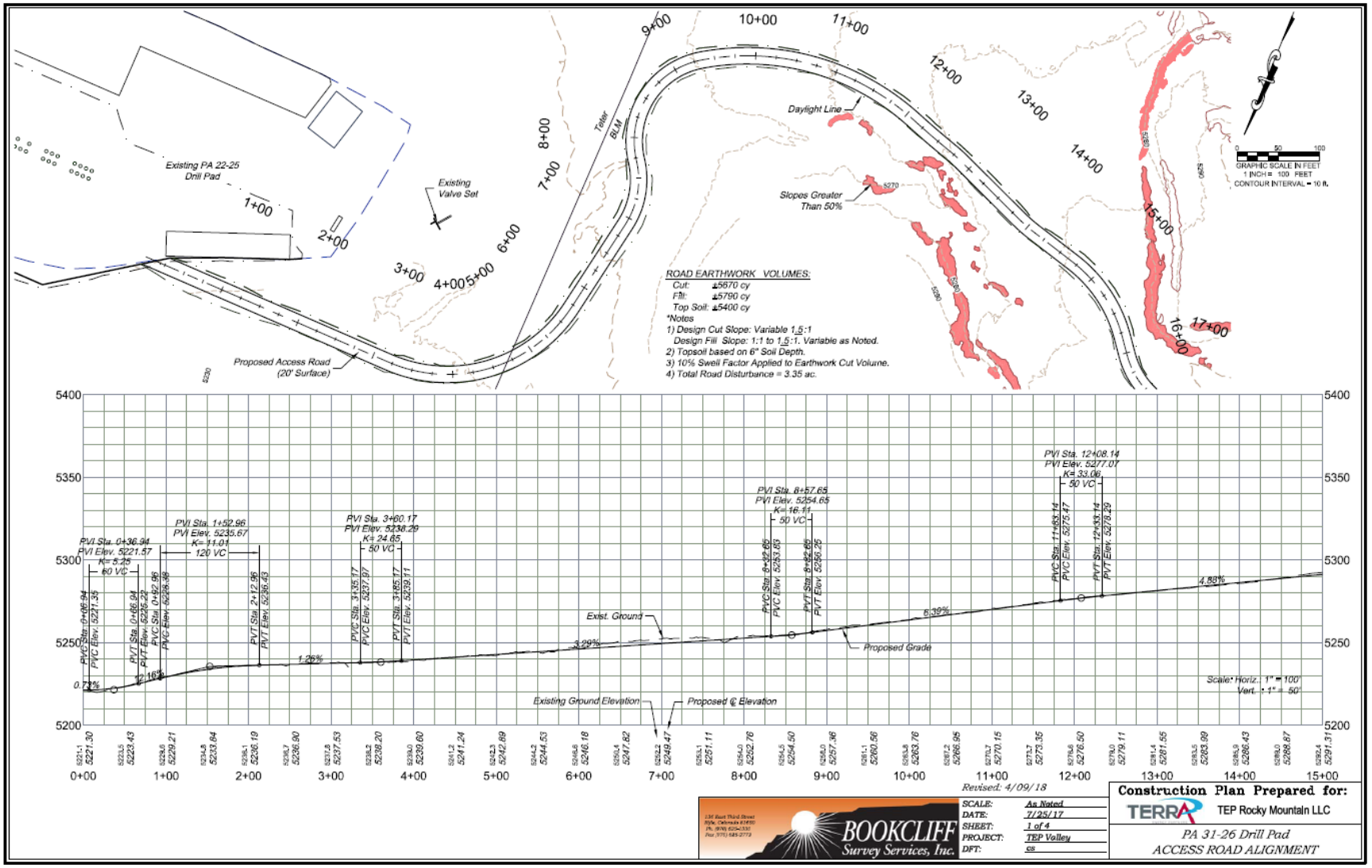
In spring 2018, John Withers conducted site visits at the request of Terra and the BLM to assess slope stability, in particular at Areas A to D along the PA 31-26 and PA 34-24 access roads. The four areas could be expected to remain stable with the planned road designs and adequate compaction overseen by geotechnical engineers. Although the proposed roadway at Area C is located on private land and not subject to the Federal lease NSO for steep slopes, the BLM requested a review to ensure that the probability of slope instability was low and would not adversely impact the private land, the adjoining BLM land, or access to the planned Federal well development on the PA 34-24 pad.

Required Mitigation

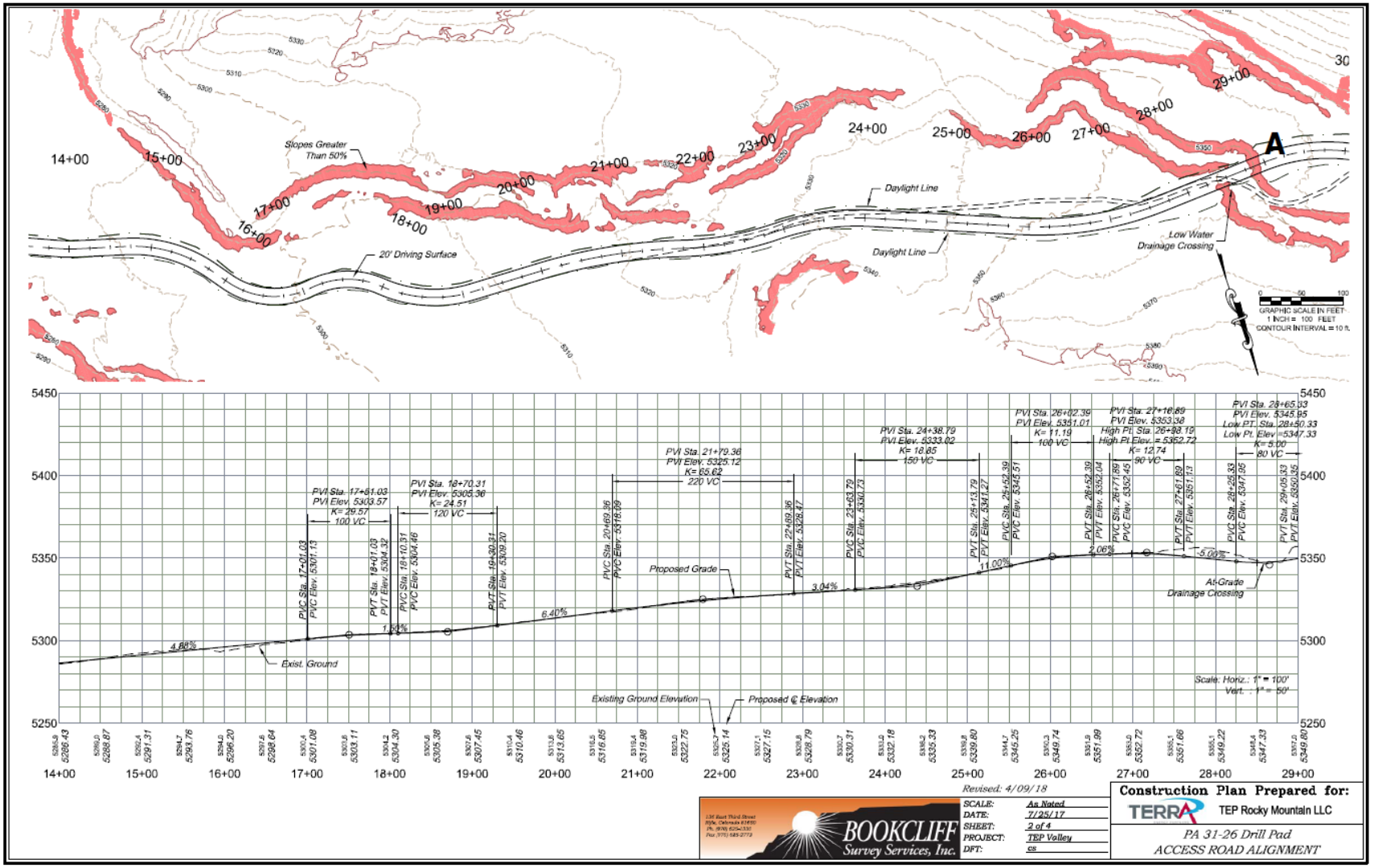
Follow-up Geotechnical Site Investigation. Once the APDs are approved and the road is pioneered for core-drilling equipment access, a geotechnical examination of soil stability and soil compaction/ structure shall be undertaken prior to implementation of full-scale pad construction work. Recommendations from the examination shall be incorporated into the final pad construction, including soil compaction requirements and final slope gradients for cuts and fills. Terra shall adhere to any special engineering recommendations developed from the geotechnical examination.

Required Stormwater Structures. Staked straw mat blankets, hydroseed/hydromulch applications, and/or properly spaced and staked straw wattles shall be used on any slopes that exceed 50% within the proposed disturbance areas to help stabilize soils while promoting the establishment of desirable vegetation. The affected steep areas shall be stabilized with appropriate stormwater controls and promptly reclaimed within 7 days after excavation work is completed.

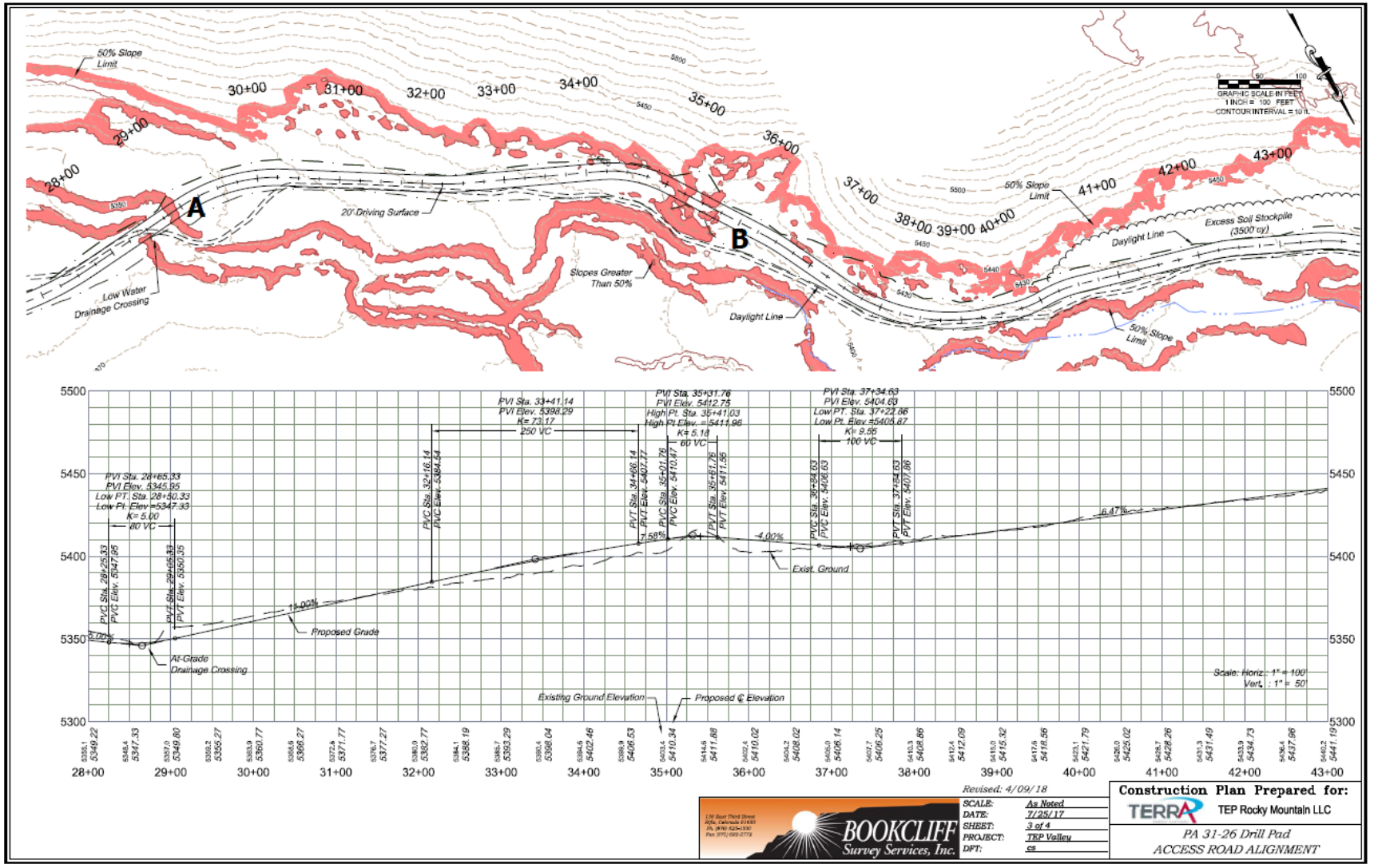
Annual Monitoring of Steep Slope Mitigation. The various project areas (noted above) that exceed the Steep Slope NSO shall be monitored on an annual basis to ensure slope stability is maintained, vegetation cover is becoming or has established, and erosion from areas is not occurring or measurable (comply with Steep Slope objective from Roan Plateau RMPA, which states "maintain watershed soil stability and productivity"). The operator shall ensure cut-and-fill slopes at culvert installations along the roadways are stable, maintained, and acceptably vegetated or establishing desirable vegetation. Periodic inspection of the subject areas shall occur across the life of the project with timing and reporting deadlines to be determined by the BLM.



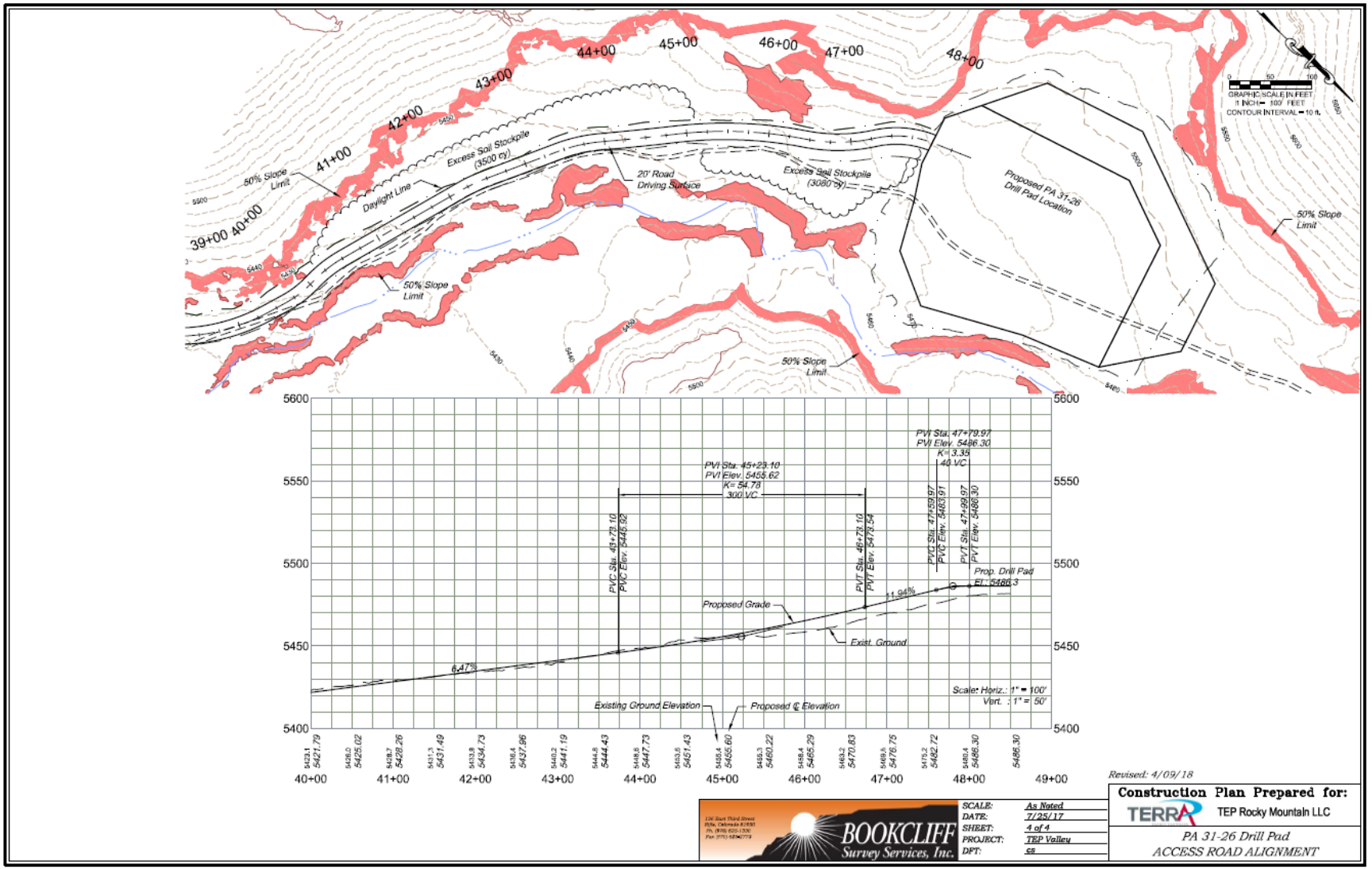
PA 31-26 Access Road Alignment, Page 1 of 4



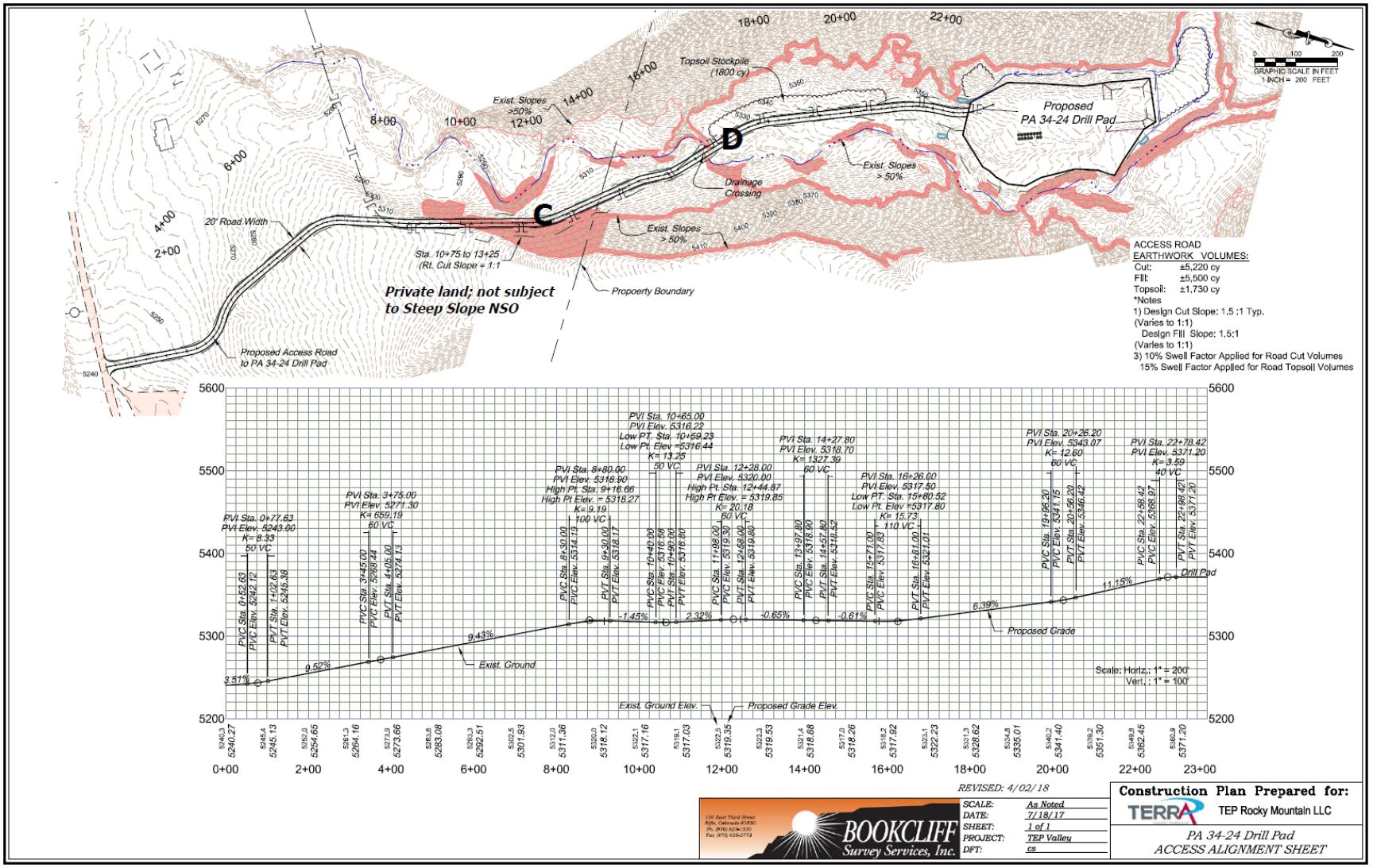
PA 31-26 Access Road Alignment, Page 2 of 4 (depicts Area A)



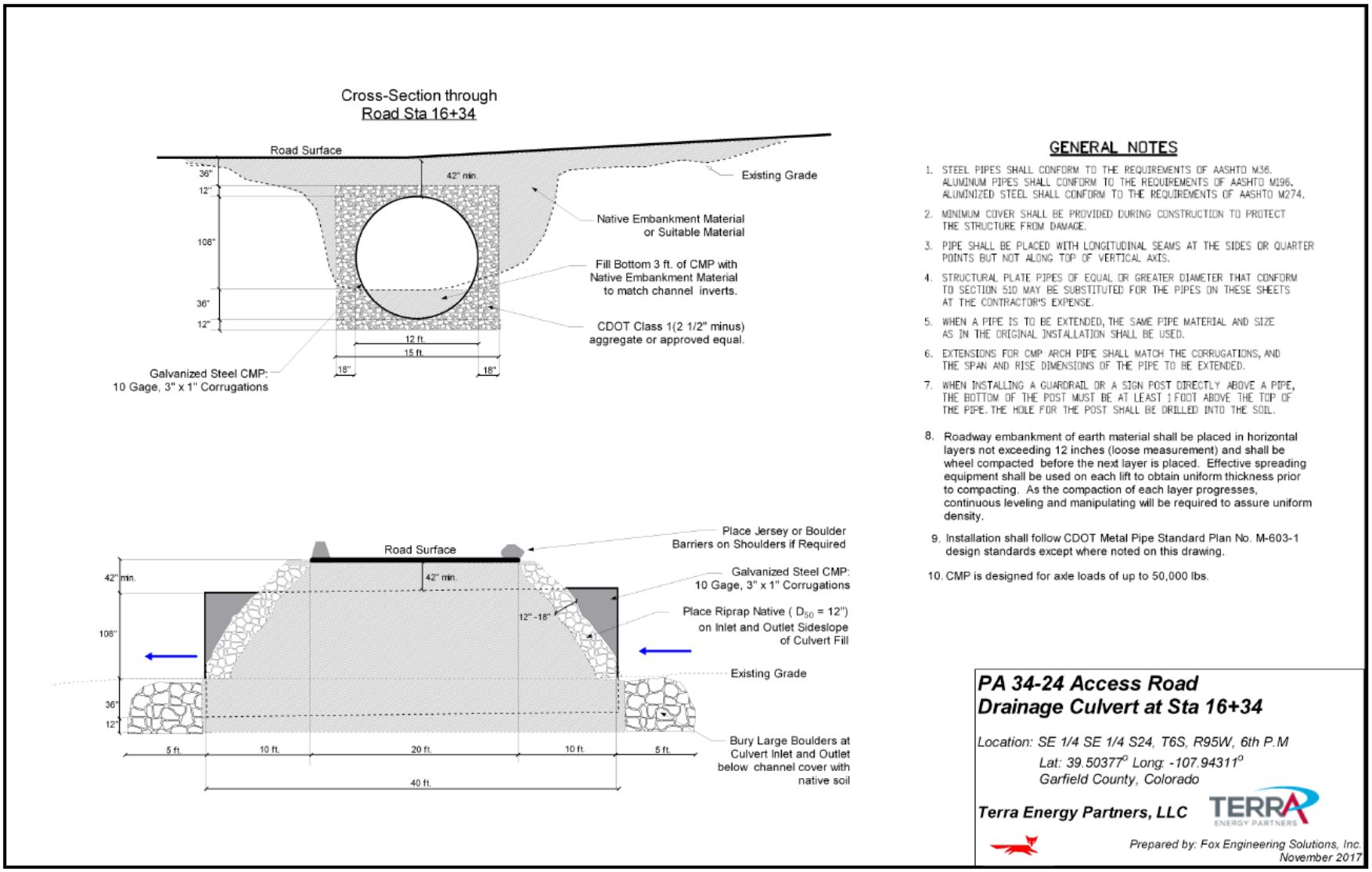
PA 31-26 Access Road Alignment, Page 3 of 4 (depicts Areas A and B)



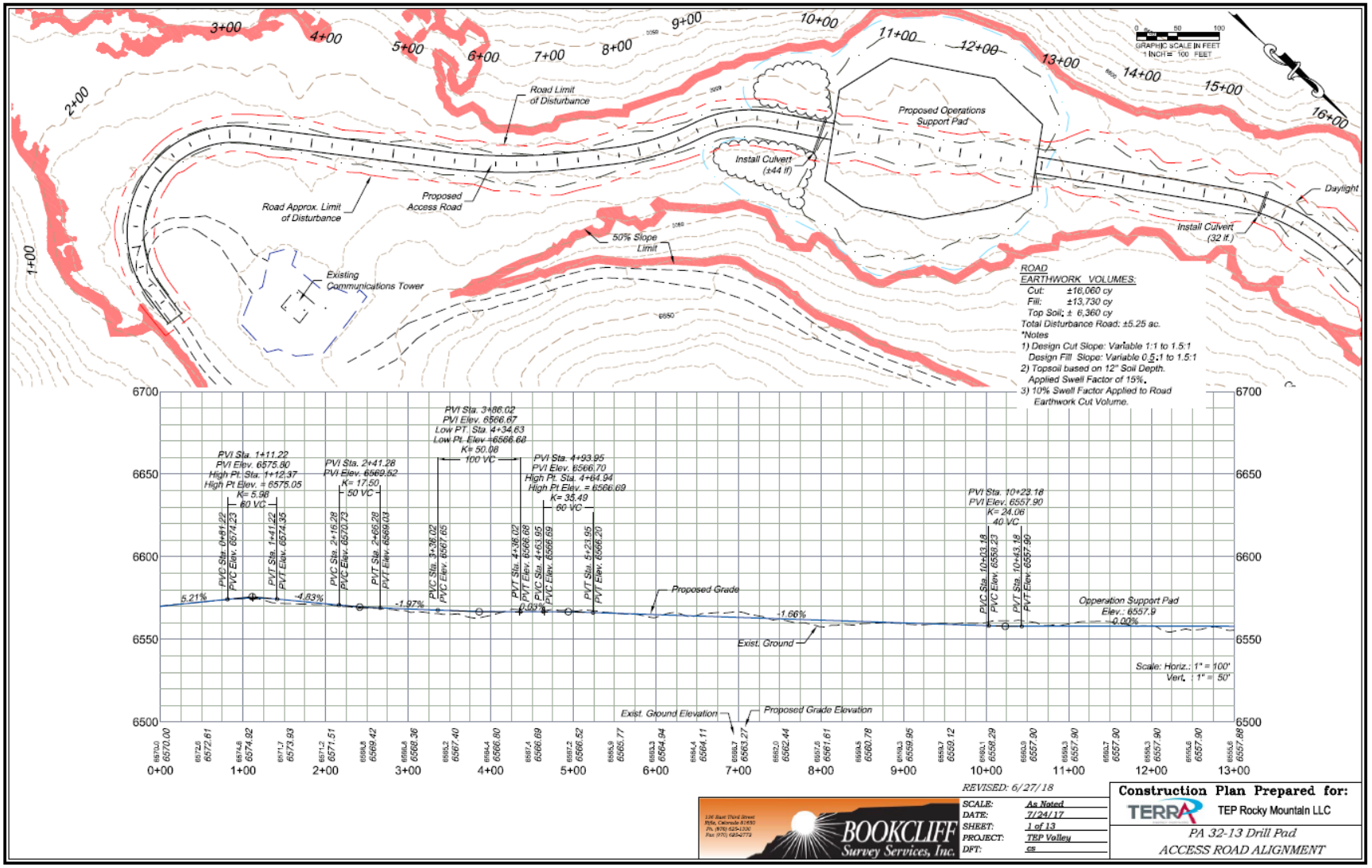
PA 31-26 Access Road Alignment, Page 4 of 4



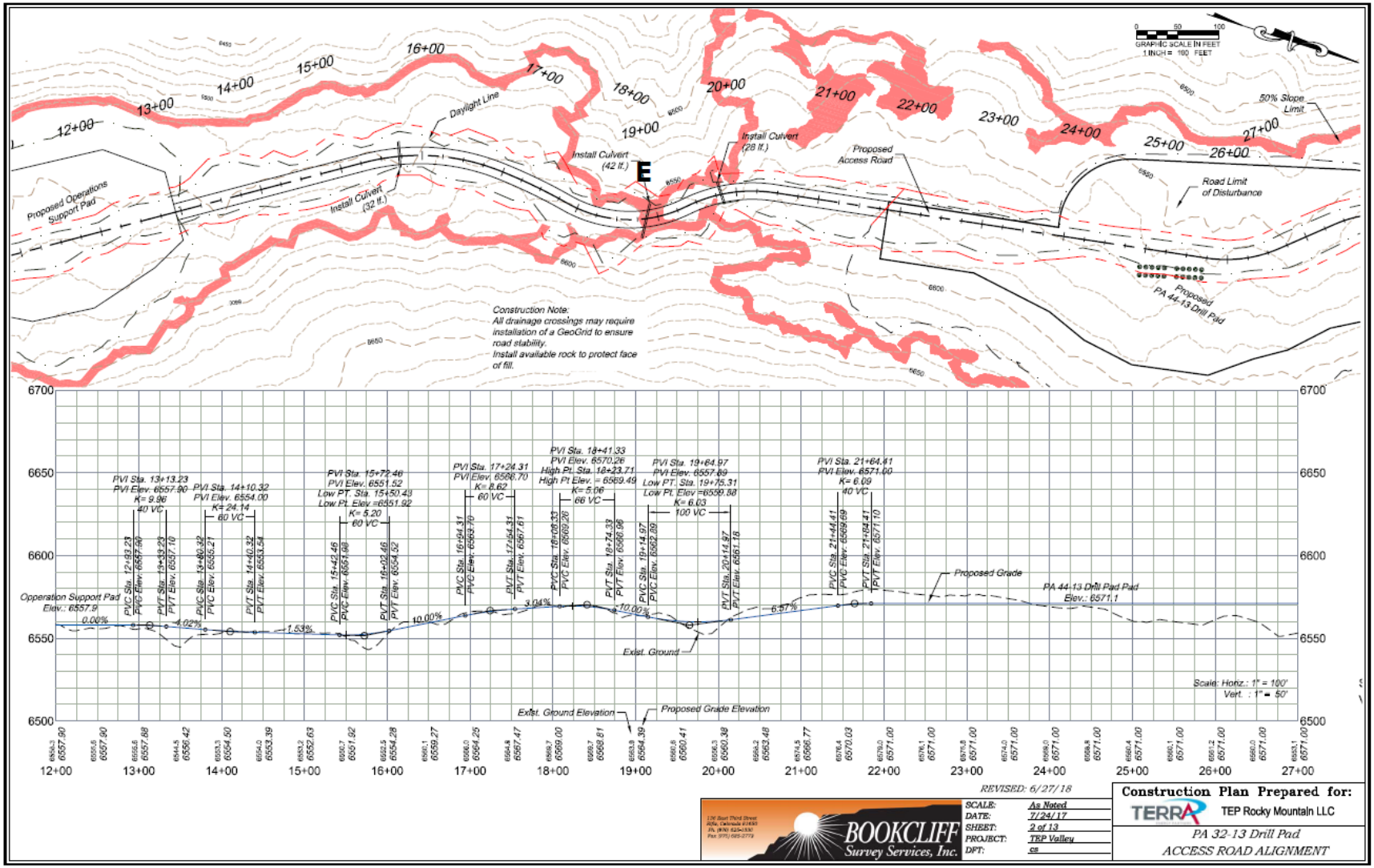
PA 34-24 Access Road Alignment, Page 1 of 1 (depicts Areas C and D)



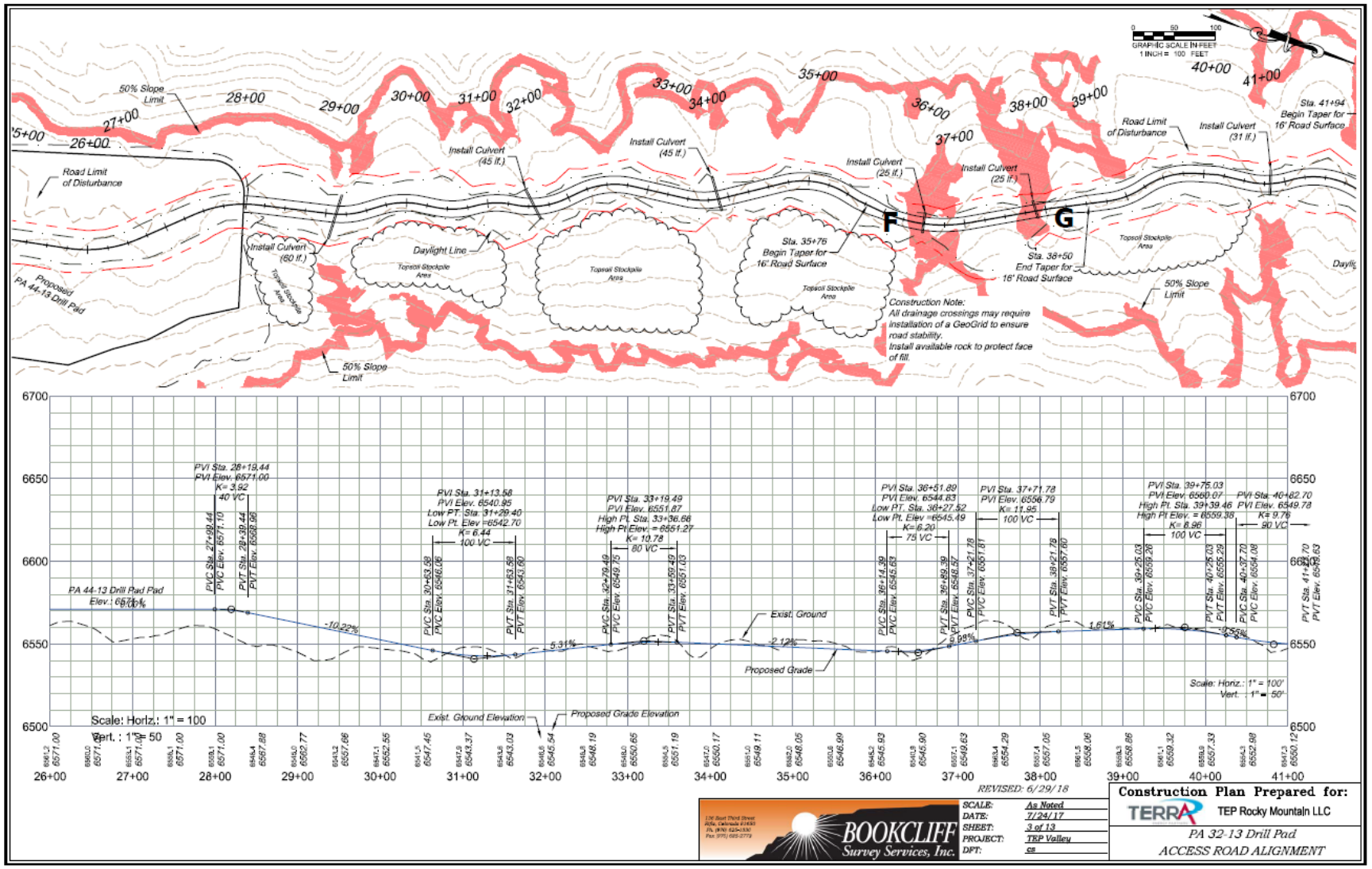
Major Culvert Detail for Station 16+34, PA 34-24 Access Road across Balzac Gulch (Area D)



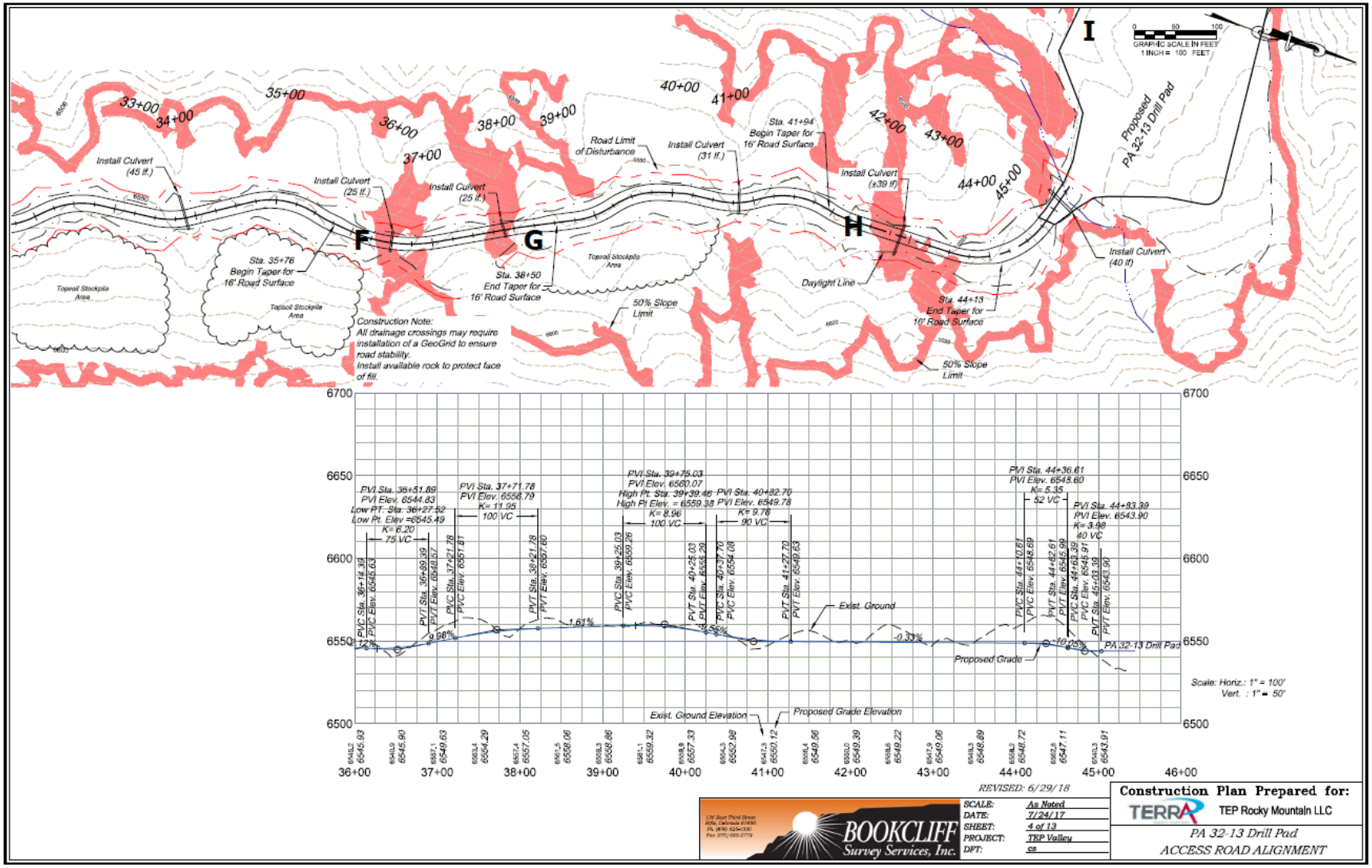
PA 32-13 Access Road Alignment, Page 1 of 4, Preferred Alternative



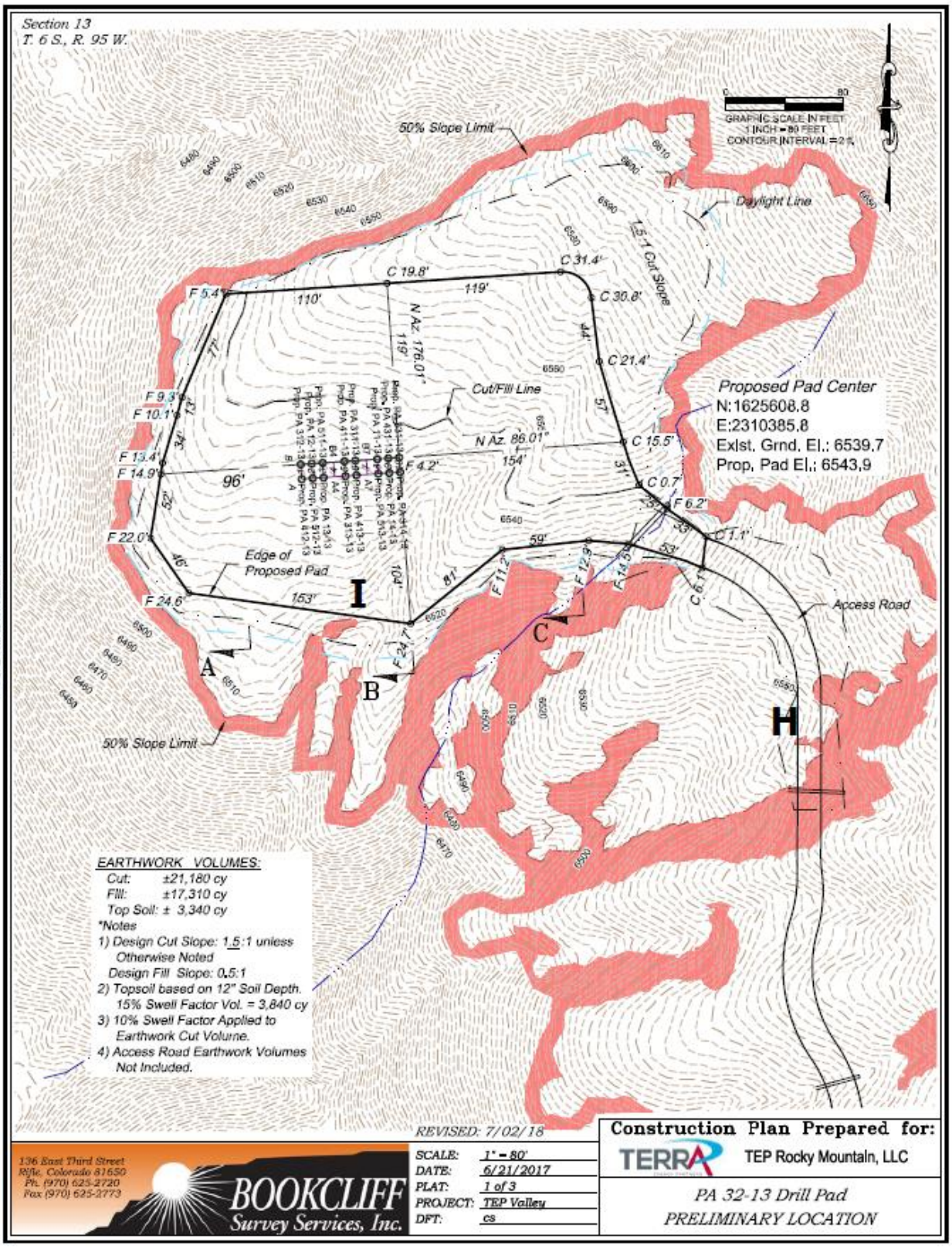
PA 32-13 Access Road Alignment, Page 2 of 4 (depicts Area E), Preferred Alternative



PA 32-13 Access Road Alignment, Page 3 of 4 (depicts Areas F and G), Preferred Alternative



PA 32-13 Access Road Alignment, Page 4 of 4 (depicts Areas F, G, H, and I), Preferred Alternative



PA 32-13 Construction Layout, Preferred Alternative

Appendix D

Public Scoping Comments and BLM Responses

The BLM placed information regarding the BG2MDP project on its public website in mid-December 2017 with a subsequent 30-day public scoping review and comment deadline established for February 8, 2018. A news release was issued to local media outlets on January 9, 2018. Copies of the public scoping letter and project map were mailed to nearby landowners and other interested parties on January 9, 2018.

A public notice for the project scoping was filed in the Rifle Citizen Telegram and Glenwood Post Independent for three consecutive weeks beginning on January 18, 2018.

Following are 14 written comments (letter or email, listed in the order receive) and BLM's responses.

Gary Oliver, email submission to BLM website on January 9, 2018

> ***Comment:*** We need the work in this area. The objection you will get is the same old save the planet over the top naysayer. This will be great for the area, home sales, business owners, construction companies, and tax revenues.
>
> **Response**: *Thank you for your comment.*

Chelsea Brundige, email submission to BLM website on January 10, 2018

> ***Comment:*** (*Regarding the assumption that the Balzac Gulch 2 project is in close proximity to the Project Rulison nuclear explosion from the 1960s*) Any proposal to allow exploration for oil and gas in the Rulison area would have to entail extensive involvement from Federal and state and county officials from offices of environmental quality and human health. The opposition to drilling in this area will be extreme.
>
> And the idea is stupid…. The I-70 corridor in Garfield County is already a sacrifice zone; enough is enough. The gravel dredging from the Colorado River to create pads for rigs is disastrous for the river. The air quality problems that now plague the corridor are atrocious. And on top of that, you want to permit drilling in a known radioactive area?
>
> Please don't. If you must continue to tear up western Colorado for oil and gas leasing, then at least have the wisdom to find a way to remove the BLM lands from any leasing program and exchange them for other more suitable lands.
>
> **Response**: *The Balzac Gulch Phase 2 project is relatively far removed (at least 5 miles to the north) from the exterior (Tier 2) boundary as mapped by the Colorado Oil and Gas Conservation Commission. The Environmental Assessment (EA) has analyzed air quality impacts associated with the BG2MDP. The BLM lease was analyzed in the Roan Plateau Proposed Resource Management Plan Amendment and Final Supplemental Environmental Impact Statement (Proposed RMPA/Final SEIS), allowing future oil and gas development in the Balzac Gulch area with a series of specific stipulations, and was issued in 2016. Terra is pursuing that lease right by proposing this second phase of development in the BG2MDP.*

Daniel Gates, email submission to BLM website on January 10, 2018

> ***Comment:*** I've been waiting to hear about production picking up in the area I work in. This is great news for my livelihood and me. I also support American energy and not Foreign. I work in the Gas & Oil Field in Rifle area and I see how strict they are with Environmental and safety. I have been working in The Oil Fields in Garfield and Mesa County for 12 years. Environmental practices are top notch and our economy needs the boost.

Response: *Thank you for your comment.*

Holly McLain, email submission to BLM website on January 11, 2018

Comment: Do not grant any new oil and gas leases on public lands in Colorado, I am extremely upset that the BLM would grant 63 new gas and oil well on our public lands just North of Interstate 70 at Rulison. The damage being done by oil and gas extraction to our lands, to our ground water, and ultimately to our human health and that of our livestock is appalling.

Response: *The BG2MDP project involves the development of Federal leases that have been issued previously. This is not an environmental document that analyzes leasing. Thank you for your comment.*

Dana Wood, email submission to BLM website on January 11, 2018

Comment: I am writing to you to express my strong opposition to the continued exploration and exploitation of the Roan Plateau by the potential of drilling 66 new gas wells. Enough is enough. This land and habitat has been abused and neglected for way too long and our community does not benefit from the false hopes that natural gas will be an economic driver.

Response: *Thank you for your comment.*

Kay Esterbrook, letter submission via USPS mail on January 11, 2018

Comment: Pursue the oil and gas fields - there will always be some consequences and inconveniences, no matter what path we take. We must accept that and deal with it. Not sit around at meetings and whine! The people who oppose this would have probably opposed trains, running hot water and Oreos – back in the day!! Thanks for your work, you guys and gals!

Response: *Thank you for your comment.*

Emily Oyler, email submission to BLM website on January 20, 2018

Comment: I do not think we should allow more drilling and wells in this area. We need to be protecting what is left of our wild, open land for ourselves and future generations. This area is very biologically rich, and all that the Colorado outdoors have to offer. Please do not open it up to further destruction.

Response: *Thank you for your comment.*

Daniel Alvis, email submission to BLM website on January 27, 2018

Comment: I have no objections to these wells, as this area is already developed.

Response: *Thank you for your comment.*

Garfield County Commissioners, letter submission to BLM on February 5, 2018

Comment: Garfield County requests BLM fully analyze potential visual resource impacts of the BG2MDP and ensure effective long-term visual screening and other best management practices that optimally protect the view shed in the area of the BG2MDP. Of particular concern is effective visual screening of new roads, pipelines and well pads on the slopes below the rim.

Response: *The EA analyzes visual resources outlining BLM's Visual Resource Management objectives, identifying resource constraints in the Federal lease stipulations and BLM's land use plan (Roan Plateau RMPA/ROD), providing conclusions of the project-specific inventory including specific visual simulations of the Proposed Action and Preferred Alternative, and summarizing required mitigation measures needed to successfully implement the project. The analysis provides*

rationale for meeting the objectives and lease stipulations, supports the granting of an exception to the No Surface Occupancy (NSO) of the Interstate 70 viewshed, and identifies follow-up monitoring to ensure the spirit of the lease restrictions is satisfied. The Preferred Alternative specifically deleted the proposed PA 41-24 Pad to avoid potential impacts to the viewshed and Garfield County's Communication Facility.

Comment: Garfield County road & bridge staff, project proponent Terra and BLM have already embarked on discussions regarding Federal/County roadway jurisdictions and responsibilities relative to roadway management and maintenance needs for the BG2MDP. The county has no specific concerns to express regarding analysis of roadways in the EA at this time.

Response: *Thank you for your comment.*

Comment: Garfield County asks BLM to utilize this (IMPLAN) data and analysis and relevant components of the IMPLAN model used for the Roan Plateau RMPA/FEIS to inform the socioeconomic analysis portion of the EA for the BG2MDP.

The EA for the BG2MDP should specifically address the socioeconomic benefits to be derived from development of the leases including employment, tax revenues (property and severance) and Federal Mineral Lease dollars.

Response: S*ection 4.11 (Socioeconomics) of the EA specifically addresses oil and gas industry's impacts to employment, tax revenues, payment in lieu of taxes (PILT) and Federal mineral royalties.*

Leslie Robinson, Grand Valley Citizens Alliance, letter submission to BLM on February 6, 2018

Comment: Increased O&G development from Rifle to Parachute could affect the amount of particulates in the air, and as recent Colorado State University studies have shown, adding more Benzene released from the drilling and fracking process. There should be air monitors in place at this central valley location to determine the cumulative effects from drilling on public lands at the base of the Roan Plateau.

Response: *Section 4.2 of the EA addresses modeled emissions from the BG2MDP, including particulate matter and hazardous air pollutants (HAPs, such as benzene). Garfield County manages four Colorado air-quality monitoring sites near the project – Parachute Creek, Battlement Mesa, Rifle, and Bell Ranch (south of Silt). As noted in Garfield County's 2016 Air Quality Monitoring Report, a number of HAPs, including benzene, have measured statistically significant decreasing annual average trends at all monitoring sites (https://www.garfield-county.com/air-quality/documents/airquality/GARCO_2016%20Annual%20Report_FINAL.pdf).*

Comment: Although there are plans to diminish drilling during the winter, we believe that drilling during deer and elk calving season is imperative as well -- especially when deer numbers are dropping dramatically.

Response: *The Preferred Alternative described in the EA outlines the Operator's modified dual rig drilling schedule, which avoids BLM's big game winter timing limitation period.*

Comment: The land is not being timely reclaimed nor protected from erosion and wind. Having the Balzac MDP Phase 2 in a very prominent location would highlight the lack of BLM oversight on reclamation on Federal leases. Reclamation plans are inadequate for this site.

Response: *The EA addresses the need for timely reclamation, particularly on BLM lands with its supporting regulatory requirement to initiate reclamation within 6 months after well completions. As noted in Section 4.12 of the EA, impacts would be minimized by implementing stormwater*

management BMPs, stockpiling and windrowing topsoil, controlling erosion, and rehabilitating disturbed surfaces as quickly as feasible. Continued road and pad maintenance would also reduce erosion (e.g., graveled roads, crowned road surfaces). In Appendix A of the EA, an erosion control Condition of Approval (COA) would require that cut-and-fill slopes 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 would be employed as necessary to reduce transport of sediments into the drainages. The BLM may, in areas with high erosion potential, require the use of hydromulch or biodegradable blankets/matting to ensure adequate protection from slope erosion and offsite transport of sediments and to improve reclamation success.

***Comment**:* GVCA members believe there are too many impacts from the fracking, drilling, and production on air quality and the environment – plus, the disturbance from road building, and pipeline digging will affect wildlife and cause more particulates to enter the air.

Response: *Section 4.2 of the EA evaluates potential air quality impacts, including criteria pollutants, HAPs, and greenhouse gases (GHGs). In general, the Proposed Action would have a temporary impact on air quality, which would mostly occur during the development phase and the initial production years before well yields decline (production declines in excess of 50% during the first three years are typical). Use of the access roads, surface disturbances for well pad and pipeline construction, and development activities, such as drilling, hydraulic fracturing, well completion, and equipment installation would impact air quality through the generation of dust related to worker travel, materials transport, and general construction. This phase would also produce short-term emissions of criteria, hazardous, and GHG pollutants from vehicle and construction equipment exhausts. Once development is complete, the daily activities at the site would reduce to operational and maintenance checks and product load-out and hauling, which initially may occur as frequently as multiple daily visits (prior to declining production). In Appendix A of the EA, a dust abatement COA would require the operator to 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.*

Associated Governments of Northwest Colorado (AGNC), letter submission to BLM on February 7, 2018

***Comment**:* AGNC members urge the Colorado River Valley Field to develop the environmental assessment (EA) for and approve the Balzac Gulch Phase 2 Master Development Plan as supported by the Settlement Agreement. This development will aid AGNC communities and counties by creating jobs and supporting communities within the region.

Response: *Thank you for your comment.*

Randy Fricke, email submission to BLM website on February 8, 2018

***Comment**:* Please deny the approval of Terra Rocky Mountain LLC to drill on any area of the Roan Plateau including the Balzac Gulch Phase. The Bureau of Land Management needs to get out of the fossil fuel business. Please the Roan Plateau area wild and free of any fossil fuel development. Remember, the BLM does not dictate to the American people what to do with these lands. It is the American people who are your boss. The Garfield County Commissioner's letter of support does not speak for the people of Garfield County. This is an official comment protesting drilling on any part of the Roan Plateau or any public lands.

Response: *Thank you for your comment.*

David Ludlam, West Slope Colorado Oil & Gas Association (WSCOGA), letter submission to BLM on February 8, 2018

Comment: A timely and expedited approval of drilling permits for leases already a decade in wait will demonstrate BLM is taking the current executive orders (and Congressional and Administrative guidance) seriously. Approval of the Master Development Plan will add hundreds of millions of dollars of economic contribution to the Federal Treasury, State of Colorado, local governments, royalty owners and businesses over the decades' long production life of proposed wells.

Response: *Thank you for your comment.*

Comment: WSCOGA also formally requests that in the final socioeconomic section of the ROD BLM not simply state the economic contribution of oil and natural gas to Northwest Colorado, but spell out in detail the following:

1. How much does the Federal treasury derive from oil and natural gas production by BLM each year and what programs, agencies, and entitlements do these monies contribute to funding?
2. What amount of Federal Mineral Royalty Payments have been returned to Colorado in recent years and how have these monies returned to communities in Northwest Colorado?
3. How will the Garfield County and Mesa County Federal Mineral Lease District benefit from these wells and what have the Districts Funded in Mesa and Garfield Counties in recent years?

Response: *Section 4.11 (Socioeconomics) of the EA specifically addresses oil and gas industry's impacts to employment, tax revenues, payment in lieu of taxes (PILT) and Federal mineral royalties. The series of broader questions regarding oil and gas production and receipts generated to the State and local communities from such production on public lands are generally answered in the Roan Plateau Proposed RMPA/Final SEIS.*

Peter Hart, Wilderness Workshop et al., letter submission to BLM on February 8, 2018

Comment: We note that BLM's analysis also must consider other past, present, and reasonably foreseeable developments in the area. That includes the 66 wells proposed in the Balzac Gulch Phase 1 MDP, the 79 wells that Terra currently operates in the area, and any and all other existing, proposed, or foreseeable development.

Response: *Section 2 of the EA identifies existing development and infrastructure to provide a baseline for analysis of cumulative impacts. This includes the 79 wells that Terra currently operates in the area, the 66 wells being developed as part of Balzac Gulch Phase 1, the proposed development of Phase 2 (either with the Proposed Action or Preferred Alternative), and another existing development, Garfield County's Anvil Points Communication Site. Section 5 (Cumulative Impacts) of the EA references Section 2 and focuses on air resources, existing oil and gas developments, and overall cumulative impacts.*

Comment: We ask that BLM, in its analysis of this project, include tallies of wells approved and analyzed within the boundaries of the MDP, within the Roan Plateau planning area, and on other lands nearby. We further ask BLM to specifically identify and disclose where existing and foreseeable wells were previously analyzed.

Response: *Table 1 in the EA titled "Existing Development within the Balzac Gulch Phase 2 MDP Project Area" has been revised from the table presented in the Proposed Action and lists previously approved projects with Federal wells and the associated NEPA document. Foreseeable well development was identified in Sections 2 and 5.*

Comment: Further, the agency must confirm that the number of wells being considered in this project, and any other new project in the area, is within the number that was actually projected and analyzed in the relevant programmatic EIS. Here that would be the Supplemental EIS for the RMPA.

Response: *Alternative IV of the Final SEIS evaluated 2,475 wells – 149 wells atop the Roan Plateau and 2,326 wells below the Cliffs. The combined well development from both phases (66 Federal wells being developed as part of Balzac Gulch Phase 1 and the proposed development of (63 Federal wells in the Proposed Action or 58 Federal wells in the Preferred Alternative for Phase 2) would represent 5.5 percent or 5.3 percent of the potential well development below the Roan Cliffs that was evaluated in the Final SEIS. The Final SEIS was a programmatic rather than a project-level evaluation, as noted in the following excerpt from the Final SEIS.*

> *"Certain actions under the four alternatives would not be implemented or permitted immediately upon adoption of the RMPA. For example, oil and gas development would occur only after an area has been leased and proposed well locations, road and pipeline alignments, and other facilities have gone through a site, or project-specific, NEPA and permitting process. Furthermore, while the assumptions associated with the alternatives represent reasonable projections of what could occur, it is impossible to predict, with certainty, the precise outcome of any of the actions due to the large number of variables involved.*
>
> *Using oil and gas development as an example, the number of wells could be larger or smaller, drilling of wells could occur at a faster or slower rate, and the pace and success of reclamation and other mitigation measures may prove greater or less than anticipated. Additionally, it should be noted that the number of wells assumed to be developed under each alternative was derived from the Oil and Gas Reasonable Foreseeable Development (RFD) scenario (BLM 2014b) (Appendix G). The number was further broken down based on assumed annual drilling rates, surface-use restrictions, and the total wells needed for full field development in each alternative."*

Comment: Similarly, BLM should be maintaining and disclosing inventories of surface disturbance related to pads and new roads. For example, how do disturbance estimates for this project square with the assumptions in the RMPA? How much total land disturbance exists (both in the Roan Plateau Planning Area and in the Balzac Gulch area)? Those figures should also be included in any new analysis of proposed oil and gas development in the area.

Response: *The Final SEIS assumed 2.5 acres of long-term surface impacts for multi-well pads, 1.5 acres of temporary impacts for pads (comprising areas revegetated within 2 years), and 0.4 miles of access roads per well pad. The development of 16 wells per pad was also assumed.*

For Balzac Gulch Phase 1, 41.47 acres (25.00 Federal and 16.47 private) of short-term disturbance was evaluated for three well pads, four support pads, 0.34 mile of access roads, and pipelines. The majority (63%) of disturbance was existing or previously disturbed. The disturbance reduced by 80% to 8.30 acres (4.66 Federal and 3.64 private) in the long-term. These overall disturbances equate to 2.77 acres of long-term disturbance per multi-well pad (including access roads), 13.82 acres of temporary impacts per well pad (including four support pads, access roads, and pipelines), and 0.11 mile of access road per well pad. Phase 1 evaluated the development of 22 wells per pad.

The Balzac Gulch Phase 2 Proposed Action would disturb 55.49 acres (43.32 Federal and 12.17 private) in the short-term for four well pads, seven support pads, 2.07 miles of access roads, and pipelines. The majority (61%) of disturbance would be new. The disturbance would reduce by 80% to 10.90 acres (9.14 Federal and 1.76 private) in the long-term. These overall disturbances equate to 2.73 acres of long-term disturbance per multi-well pad (including access roads and pipelines), 13.87

acres of temporary impacts per well pad (including seven support pads, access roads, and pipelines), and 0.52 mile of access road per well pad. In the Phase 2 Proposed Action, approximately 16 wells would be developed per pad.

The Balzac Gulch Phase 2 Preferred Alternative would disturb 56.61 acres (44.48 Federal and 12.13 private) in the short-term for four well pads, six support pads, 2.10 miles of access roads, and pipelines. The majority (59%) of disturbance would be new. The disturbance would reduce by 82% to 10.30 acres (8.44 Federal and 1.86 private) in the long-term. These overall disturbances equate to 2.58 acres of long-term disturbance per multi-well pad (including access roads and pipelines), 14.15 acres of temporary impacts per well pad (including six support pads, access roads, and pipelines), and 0.52 mile of access road per well pad. In the Phase 2 Preferred Alternative, 14.5 wells would be developed per pad.

***Comment**:* In addition, BLM should ensure that baseline monitoring is conducted prior to authorizing any activity on this project, to assess winter range conditions, mule deer and elk populations, and other conditions in this area of the Roan Plateau Planning Area. The NEPA analysis should expressly address what information gaps exist and how they can be addressed, because this information is necessary for BLM to make a reasoned choice on whether to approve the project and under what conditions. Documenting baseline conditions is necessary to fulfill this commitment.

The parties to the Roan Settlement have created a fund specifically for such monitoring, and those funds may be available for this purpose.

Response: *In Section 4 of the EA, the existing condition of each relevant resource is described. Additional data were collected as necessary in order to adequately identify the affected environment and analyze potential environmental consequences. For instance, a visual resource assessment was conducted by a landscape architect consultant using BLM's Visual Contrast Rating Worksheets and deriving assumptions of the potential impacts of the Proposed Action and Preferred Alternative.*

***Comment**:* Under the Roan Settlement, BLM and Terra are required to consult with the Colorado Division of Parks and Wildlife to develop terms that minimize impacts to wildlife and other resources, which will be included in the MDP, Roan Settlement - Exhibit 3.

Response: *Aligned with the requirements for base leases (Exhibit 3 of the Settlement Agreement, Appendix I of the RMP Amendment), Terra submitted its plan of development for the BG2MDP as part of the NEPA process and preparation of this EA. Incorporating comments from the public scoping on the Proposed Action, Terra, in consultation with BLM and CPW, developed the Preferred Alternative, which involves using two rigs to drill the proposed wells in a single year and while the big game winter timing limitation period (see Section 3.7 of the EA). In many instances, the BLM and CPW have agreed that allowing winter drilling as a way to shorten the duration of development activities would benefit wildlife. Consequently, while using two drilling rigs to complete the work during the 2019 spring, summer, and fall seasons would intensify traffic, noise, and other disruptive activities, this would be outweighed by the combination of a shorter duration and avoidance of the winter season.*

***Comment**:* Page 6 of the Proposed Action suggests that Terra would need an exception to the timing limitations on subject leases to proceed with the plan. *See* TEP Rocky Mountain LLC, Proposed Action, Balzac Gulch Phase 2 Master Development Plan for Oil and Gas Exploration and Development (Proposed Action), at 6; Table 3. We urge BLM to avoid such an exception and to require Terra to comply with all timing limitations. Further, the full impacts of any exception being considered should be analyzed and disclosed, and BLM should consider alternatives that do not involve waiver, modification, or exception of timing limitations and that fully comply with the terms

of the settlement agreement. Also, in an effort to adequately consider cumulative impacts to wildlife, BLM should consider and disclose the number of other waivers, exceptions, and modifications to these stipulations that have been granted in the broader area.

Response: *Terra's proposed changes reflected in the Preferred Alternative were a direct response to comments received during the scoping of the Proposed Action in January 2018. A component of the Preferred Alternative is the dual rig drilling schedule (Table 8 of the EA), which avoids construction, drilling, and completion work during the December 1 through April 30 big game winter timing limitation stipulated on the Federal leases.*

In consideration of the Proposed Action's drilling schedule (Table 4 of the EA), Section 4.18 addresses the potential for year-round drilling, which would require an annual exception to the Big Game Winter Range Timing Limitation (TL). Consistent with other TL exception requests for the broader area, the following would be considered prior to granting a TL exception:

1. *With the interspersion of Federal and private lands, impacts to wildlife may indirectly increase by implementing a TL on BLM lands. For instance, an operator may cease drilling activities at a site on BLM lands in compliance with a TL but then shift the activities to nearby site on private land that lacks a winter range TL but has equal or greater habitat values. While activities are continuous in the general area, moving the drilling equipment from one site to another can cause more disturbance than leaving it at a single location.*
2. *Impacts from multiple seasonal pad visits to develop all wells at a site are often greater than those from one continuous visit. Given industry's technological advancements (directional and horizontal drilling), and BLM's goal of reducing well pad density, the number of wells per pad has increased in recent years. As a result, the duration of well development activities at a single location increases due to a larger number of wells at that location. However, drilling that number of wells in one continuous pad visit – even into or across winter – is often less impactful to wildlife than multiple visits extending over a longer duration.*
3. *A TL exception granted in accordance with the stipulation standards (Appendix B of the RMP Amendment), and after conferring with CPW, does not impair values associated with the quantity and quality of winter range for the species of interest. Common types of TL exception requests including allowing continuation of development activities that are underway before the TL period begins (normally December 1); commencing preparatory work late in spring to allow the completion of development activities before the next TL period; or performing reclamation activities into December or commencing in spring for better seeding results. TL exception requests are rarely granted for commencing activities during the TL period, except near the end (e.g., in April) following a mild winter, when animals are already moving out of the area. The reason for generally avoiding initiation of activities during the TL period is due to the greater disruption to big game that have already established their patterns of movement and habitat use, compared to situations in which development is already occurring at location when the animals begin to arrive from their summer range and can adjust their distributions in response. Such a situation, if approved after conferring with CPW, likely requires additional mitigation beyond the usual amount.*
4. *The BLM requires mitigation for granting a TL exception as the basis for the Authorized Officer to determine that big game would not be significantly affected. In the general area where the project is located, mitigation typically consist of habitat treatments at a nearby location, and consisting of a type and scale of treatment developed in consultation between the BLM and CPW. Operators may conduct treatments in advance of their need to "bank" mitigation credits from which they can "withdraw" mitigation debits for specific projects. Not all requests are granted,*

based on either BLM's decision to deny a request or after receiving feedback from CPW recommending denial.

Comment: Any proposal to construct a road, pipeline, pad, or other infrastructure through an area subject to NSO stipulations should be rejected. We note that the parties' agreement not to sue under the Roan Settlement does not apply to any BLM decision that approves "surface disturbing activities at a location…subject to an NSO stipulation and the grant of any exceptions, modifications, or waivers of lease stipulations." Roan Settlement 13.

Response: *Thank you for your comment.*

Comment: Again, any waiver, exception, or modification of stipulations should be disclosed in BLM's analysis. The potential impacts of any such decision should also be analyzed, and alternatives to such a course of action should be considered.

Response: *As discussed in Sections 4.12, 4.15, and 4.18 of the EA, the Proposed Action and Preferred Alternative may necessitate exceptions to lease stipulations. Appendix B of the 2016 Roan Plateau Approved RMPA defines and outlines the standard exception framework.*

"An exception is a one-time exemption for a particular site within the leasehold or within a land use authorization. Exceptions are determined on a case-by-case basis, and if granted, suspend the restrictions of a stipulation for a specified period, location, or activity. The stipulation continues to apply to all other sites within the leasehold or authorized use area. In situations where a land use activity is excepted, the activity could be subject to additional conditions of approval, reclamation measures, or BMPs. Measures applied would be based on the nature, extent, and values potentially affected by the surface-disturbing activity. Excepted surface disturbing activities/lease stipulations are given on a one-time, case-by-case basis and will not necessarily constitute subsequent approvals. Exceptions that conform to an RMP do not require public notice."

The Proposed Action would require an exception to the Big Game Winter Range TL lease stipulation, and exceptions to the No Surface Occupancy lease stipulations for Steep Slopes (>50%) and the Interstate 70 viewshed. Per Section 4.18, "Terra has expressed a desire for year-round drilling to complete the drilling schedule outlined in Table 4 of the EA, which would require an annual exception to the TL. Terra has been working in consultation with the BLM and CPW to develop a plan that would mitigate impacts that would potentially impair habitat value should a TL exception request be pursued." With regard to the NSO exceptions, analyses and specific mitigation measures (COAs) are outlined in Section 4.12 (Soils) and Section 4.15 (Visual Resources). The COAs are included in Appendix A.

The Preferred Alternative would require exceptions to the NSO lease stipulations for Steep Slopes (>50%) and the Interstate 70 viewshed. With regard to these exceptions, analyses and specific mitigation measures (COAs) are outlined in Section 4.12 (Soils) and Section 4.15 (Visual Resources). The COAs are included in Appendix A. Appendix C provides the rationale for consideration of exceptions to the NSO for steep slopes in the Preferred Alternative.

Comment: We ask that BLM pay close attention to impacts that this project may have on important resources in the area, including wildlife (e.g., deer and elk, and raptors); important security, nesting, and winter habitat; sensitive plant species; municipal water sources; steep and erosive soils; and nearby LWC units. We ask that these resources be protected by the terms of any approved MDP. This is especially important in light of the extensive development in and around the project area that is already impacting these important resources. If this project will result in degradation of any of

these resources, we ask that the impacts be disclosed and that BLM consider alternatives that avoid the impacts.

Response: *Each resource section in the EA analyzes potential impacts to the resource from the Proposed Action, Preferred Alternative, and No Action Alternative. Standard and site-specific COAs are established with the intent of mitigating those potential impacts.*

Comment: While development of those formations [Mesa Verde and Williams Fork] appears to have been considered in the applicable RMPA, the fact that the project proponent has requested an increase in bottomhole density may result in impacts that BLM has not examined or disclosed in prior NEPA. *See e.g.*, Terra Energy Partners' Amended Request for Increased Bottomhole Density (March 2, 2017). To the extent that potential impacts of drilling wells with 10-acre spacing does not square with assumptions in existing analyses, BLM must take a hard look at those impacts and disclose them to the public.

Response: *Quoted from the Roan Plateau Final SEIS, the process for finalizing downhole spacing is described below, as well as typical approved downhole spacing for the area.*

> *"Initially, the operator selects the location of a proposed drill site. This selection is based on COGCC spacing requirements, the subsurface geology, the topography, and the avoidance of known protected surface resource values. Spacing requirements are established by the COGCC to protect the correlative rights of offsetting mineral owners and efficiently recovering the resource. This applies to all mineral ownership (i.e., fee, State, and Federal minerals). The Roan Plateau Planning Area is subject to State spacing COGCC Rule 318, which, for wells deeper than 2,500 feet, would be about 40 acres. This does not mean that all wells can be approved at 40-acre spacing. For wells shallower than 2,500 feet, the wells must be spaced at least 300 feet from the nearest well and a distance of at least 200 feet from the lease boundary. However, the majority of wells drilled target the Mesaverde Formation, in which 10-acre equivalency spacing is typically approved by the COGCC. This allows wells to target the equivalency of 10 acres per drilling and spacing unit so that efficient drainage of isolated tight sand lenses may take place."*
>
> *"The current State of Colorado spacing requirement is 40 acres (600-foot setbacks from the lease line) for wells greater than 2,500 feet in depth, but this spacing can be increased or decreased depending on geology and reservoir characteristics and has been greatly modified in the Piceance Basin. The COGCC uses the term "default spacing," with modification 11 occurring through Cause Orders. These adjustments are meant to maximize production of the resource while minimizing surface disturbance and expense. In the case involving production from the Williams Fork Formation, 10-acre spacing has been justified and approved."*
>
> *"The largest producer in the region is Terra Energy Partners LLC, which is currently developing reserves on Federal and private lands in the southern portion of the Planning Area at an approved downhole spacing of 10 acres. Most of the leases currently being developed for oil and gas in the region are approved for 10-acre spacing."*

The Proposed Action would target Federal fluid minerals within the Mesaverde and Williams Fork formations. The Roan Plateau Final SEIS assumes a downhole spacing of 10 acres for the Mesaverde Formation and 20 acres for the Williams Fork Formation. Terra's amended application to the COGCC requests a downhole spacing of 10 acres for the Williams Fork Formation, which will undergo COGCC's aforementioned process.

Comment: The Proposed Action discusses water usage and sources, but fails to discuss the actual amount of water that is anticipated to be necessary for the plan, or how water needs square with assumptions in the overarching resource management plan. *See* Proposed Action at 7. BLM should take a hard look at those details in its analysis of this proposal.

Response: *Sections 4.13 (Special Status Species) and 4.17 (Water Resources) discuss water usage and sources. Terra estimates using approximately 500 barrels of fresh water per well for dust control and approximately 4,000 barrels of fresh water per well for well development. The estimated amount of recycled water used for well development is 75,000 barrels per well. This equates to 79,500 barrels of water used per well, of which 6 percent is fresh and 94 percent is recycled. Alternative IV of the Final SEIS assumes an estimated fresh-water use of 1,892 acre-feet for 2,475 wells (i.e., 0.76 acre-feet per well). For comparison, the Proposed Action and Preferred Alternative (PA/PA) estimates using 4,500 barrels (0.58 acre-feet) of fresh water per well. As discussed in Section 4.13 of the EA, while the PA/PA provides an estimate of fresh water use per well, the BLM will obtain, analyze, and compile actual fresh water use data, as well as reused/recycled water use data (see COA in Appendix B). The compiled water use data will be reported annually to the U.S. Fish and Wildlife Service consistent with the current Programmatic Biological Opinion with regard to endangered fish species in the Upper Colorado River basin.*

Comment: BLM must analyze the depth and quality of aquifers underlying the project area and require that Terra construct its wells with casing and cementing adequate to protect all usable waters. Since 1988, BLM's Onshore Order No. 2 has required operators to construct wells to isolate and protect aquifers containing "usable water," defined as having up to 10,000 ppm total dissolved solids (TDS). 53 Fed. Reg. 46,798, 46,801, 46,805 (Nov. 18, 1988). BLM adopted the 10,000 ppm standard because it matched the definition of "underground source of drinking water" used by EPA in administering the Safe Drinking Water Act (SDWA). *See* id. at 46,798 (citing 40 C.F.R. § 144.3).

Response: *The Groundwater Subsection of Section 4.17 identifies and discusses aquifers of the project area. Geologic and engineering reviews are conducted to ensure that the cementing and casing programs are adequate to protect downhole resources. As discussed in Section 4.17 of the EA, "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 space between the casing and borehole wall is sealed." While this area requires that surface casing generally be set from 800 to 1,500 feet deep to protect downhole resources including usable water, the depth of surface casing is determined as appropriate for each APD, depending on geology, groundwater resources, and existing groundwater uses in the project vicinity. For example, the BLM may require a longer surface casing across a specific interval when a water well is nearby. In addition, downhole COAs were developed and are provided in Appendix B.*

Comment: Industry's admissions raise a significant environmental concern that BLM must address before approving Terra's proposal. In its 2016 hydraulic fracturing study, the Environmental Protection Agency (EPA) noted that "the depth of the surface casing relative to the base of the

drinking water resource to be protected is an important factor in protecting the drinking water resource.

Response: *See previous response.*

Comment: WEA's description of widespread non-compliance with Onshore Order No. 2 raise a significant environmental issue that must be addressed as a reasonably foreseeable effect of the BG2MDP. *See Baltimore Gas & Elec. Co. v. NRDC*, 462 U.S. 87, 97 (1983) (an agency must "consider every significant aspect of the environmental impact of a proposed action"); *see also Davis v. Mineta*, 302 F.3d 1104, 1123 (10th Cir. 2002). Moreover, BLM's analysis must "state how alternatives considered in it and decisions based on it will or will not achieve the requirements of [NEPA] and other environmental laws and policies." 40 C.F.R. § 1502.2(d); *League of Wilderness Defenders v. USFS*, 585 Fed. Appx. 613, 614 (9th Cir. 2014); *Montana Wilderness Association v. McAllister*, 658 F. Supp. 2d 1249, 1255-56 (D. Mont. 2009). The Council on Environmental Quality regulations also require a discussion of possible conflicts with the objectives of state, local and Federal land use plans, policies and controls for the area concerned. 40 C.F.R. § 1502.16(c).

Response: *The EA analyzes potential environmental impacts of the proposed BG2MDP, including the isolation and protection of aquifers containing "usable water." Threats of violation of Federal, State, or local law or requirements imposed for the protection of the environment were considered but not known to potentially occur pursuant to the Proposed Action. Environmental laws and policies that were considered in the EA include, but are not limited to: the Bald and Golden Eagle Protection Act, Clean Air Act; Clean Water Act; Colorado Noxious Weed Act; requirements of the Colorado Department of Public Health and Environment; Colorado Oil and Gas Conservation Commission's Rules and Regulations; Comprehensive Environmental Response, Compensation, and Liability Act; Endangered Species Act; Federal Land Policy and Management Act; Migratory Bird Treaty Act; Mineral Leasing Act; Native American Graves Protection and Repatriation Act; National Environmental Policy Act; National Historic Preservation Act; Oil Pollution Act; Resource Conservation and Recovery Act; Superfund Amendments and Reauthorization Act; and Water Quality Control Commission regulations.*

Comment: To make an informed decision on whether to approve Terra's proposal, BLM needs to know whether doing so will put underground sources of drinking water at risk, and what additional conditions are needed to prevent such contamination. The information necessary to make such an assessment is readily available in BLM's own permitting files for existing oil and gas wells, from produced water records on existing wells, and from other sources such as US Geological Survey reports. 80 Fed. Reg. at 16,151–52. Moreover, to the extent any information gaps exist, it is incumbent on BLM to obtain that additional information before approving Terra's project. Additional data on, for example, aquifer quality or well construction practices is "essential to a reasoned choice among alternatives" and can be collected at a cost that is not "exorbitant." See 40 C.F.R. § 1502.22.

Response: *The Groundwater Subsection of Section 4.17 (Water Resources) identifies wells near the project that are beneficially used for domestic, commercial, and/or industrial purposes. In addition, potential impacts to groundwater resources are discussed. After reviewing the geology, groundwater resources, and existing groundwater uses in the project vicinity, downhole COAs were developed and are provided in Appendix B. Significant impacts to groundwater resources and uses are not anticipated to result from the project with the implementation of proper construction practices, drilling practices, and best management practices, including the downhole COAs.*

Comment: BLM should disclose to the public how the necessary ROW authorizations will be considered and approved, and what kind of process is involved with those decisions. For example, we would like to know if new road and pipeline ROW authorizations require additional analysis? If new roads and/or pipelines necessitate waiver, exception or modification of any lease stipulations, what kind of public process will be involved with those decisions? Or will those decisions be approved with the MDP?

Response: *Section 3.2 (BLM Rights-of-Way Considerations) and Table 5 provide details on ROWs to be authorized. The BG2MDP EA analyzes these ROWs along with the APDs related to the Proposed Action.*

Section 3.8 (BLM Right-of-Way Considerations for Preferred Alternative) and Table 9 provide details on ROWs to be authorized. The BG2MDP EA analyzes these ROWs along with the APDs related to the Preferred Alternative.

Comment: Any analysis BLM prepares in consideration of this proposal should include maps of impacted values and relevant stipulations from the RMPA. The maps should depict proposed facilities in relation to existing stipulations and values. Maps should also show existing wells and pads and roads, and pipelines. Maps should be granular enough so that the public can assess whether proposed pad expansions would overlap NSO areas.

Response: *A detailed map is provided in Section 4.15 (Visual Resources) regarding the relationship of the visual resources relative to VRM Class II and the Interstate 70 viewshed. A series of maps depicting the relationship of the steep slope NSO with the proposed pads and roads are provided in Appendix C.*

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Colorado River Valley Field Office
2300 River Frontage Road
Silt, CO 81652

IN REPLY REFER TO:
LLCON040
3160
COC62160, COC73094

January 9, 2018

Dear Interested Public,

The Bureau of Land Management (BLM) Colorado River Valley Field Office is initiating an Environmental Assessment (EA) #DOI-BLM-CO-N040-2018-0033-EA for the Balzac Gulch Phase 2 Master Development Plan (BG2MDP) for oil and gas exploration and development. The Proposed Action describes development of 63 additional Federal directional wells on four new well pads. The project area includes 2,648 acres of BLM-administered public land and 269 acres of Fee (private) lands (2,917 acres total) approximately 9 miles west of Rifle, Garfield County, Colorado, and north of the Rulison Exit on Interstate 70 (see **Project Map**). The project proponent is TEP Rocky Mountain LLC (Terra). Development of the currently proposed 63 Federal wells in the BG2MDP could produce nearly 120 billion cubic feet (bcf) of natural gas over the estimated 40-year project life.

The BG2MDP project area is contained within the same boundaries as a Phase 1 BGMDP, which included 66 Federal wells to be drilled from three existing, expanded well pads and was approved by the BLM in EA #DOI-BLM-CO-N040-2017-0093 in September 2017. The Phase 1 EA disclosed a possible future phase of development. Because Phase 2 had not yet been planned in sufficient detail to provide a firm number of additional wells for analysis, the EA for Phase 1 used a potential total of 165 wells. This potential total was addressed in the cumulative impacts analysis for Phase 1. In comparison, the actual combined total for the two phases is 129 wells, consisting of 66 in Phase 1 and 63 in Phase 2.

In addition to the new wells and well pads, the Proposed Action includes two new ancillary pads to support project staging and well completions, continued use of two existing pads for well completions support, a new tank farm on private land near the valley floor, storage of drill cuttings on an existing pad, new road construction totaling 2.3 miles, use of temporary surface water lines, and installation of 5.3 miles of buried natural gas, liquid condensate (oil), and/or water pipelines. In addition to wells included in Phases 1 and 2 of the BGMDP, Terra currently operates 79 directional wells on 11 well pads in the area (see **Project Map**).

The Balzac Gulch area is located along the south-facing base of the Roan Plateau and includes all or portions of Sections 19, Township 6 South, Range 94 West, and Sections 13 and 23-26, Township 6 South, Range R95 West, Sixth Principal Meridian (see Project Map). Access routes to the project area exit from I-70 and continue generally northward across County Roads and private oil and gas roads.

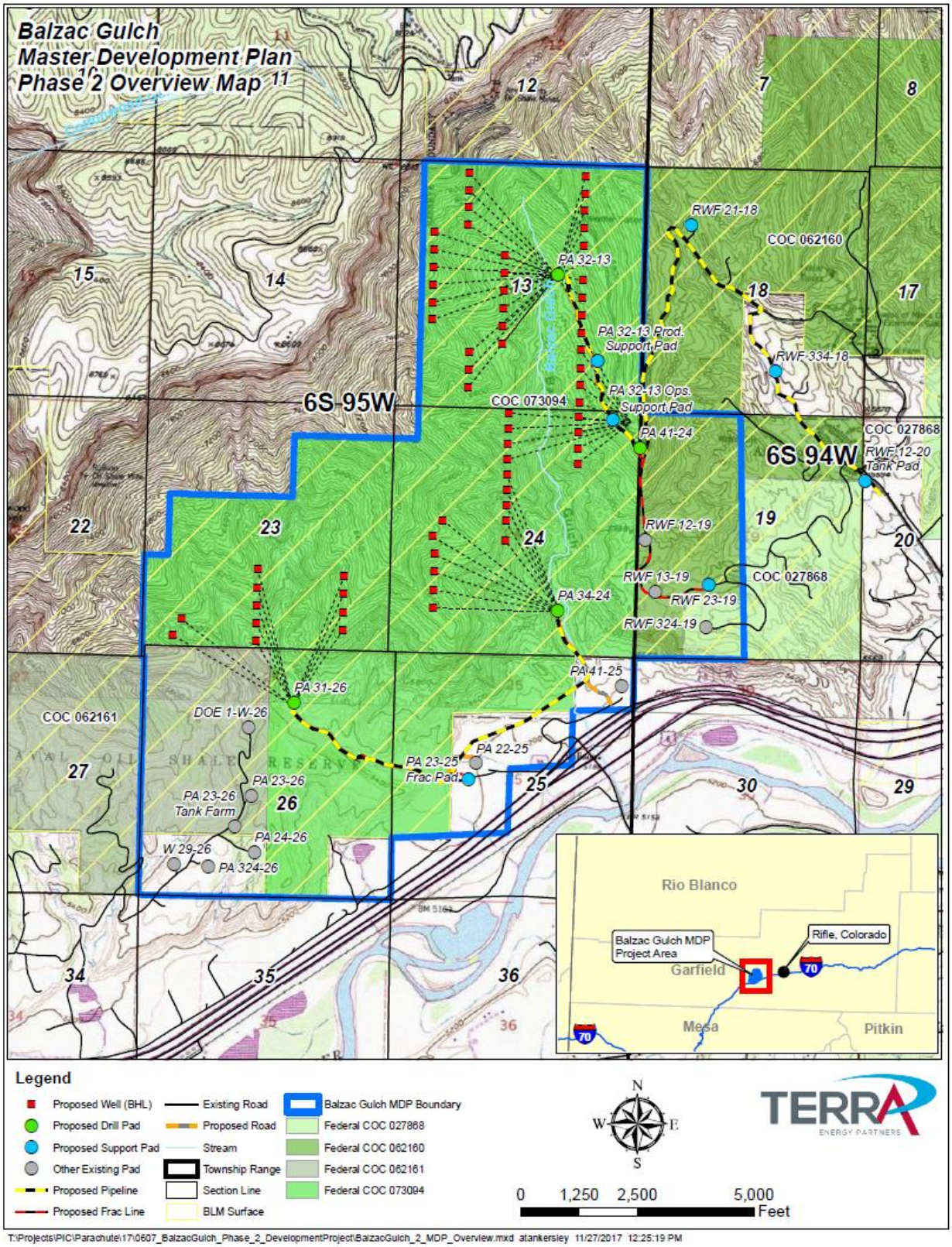
The BLM is preparing the EA for the BG2MDP to disclose and analyze the direct, indirect, and cumulative environmental impacts of the Proposed Action and a No Action Alternative. In connection with the EA, the BLM is soliciting public input on issues to be considered.

You are invited to provide any comments, concerns, or issues regarding the proposed development plan. Comments will be most helpful if received by February 8, 2018. Written comments and questions should be directed to the Colorado River Valley Field Office at 2300 River Frontage Road, Silt, CO 81652, or submitted electronically to blm_co_si_mail@blm.gov. Copies of the Proposed Action are available for review at the BLM Colorado River Valley Field Office and online at: https://go.usa.gov/xnp44.

Sincerely,

Allen B. Crockett, Ph.D.,
Supervisory Natural Resource Specialist

Enclosure – Project Map


Balzac Gulch
Master Development Plan
Phase 2 Overview Map
6S 95W
6S 94W
RWF 21-18
COC 062160
PA 32-13
PA 32-13 Prod. Support Pad
RWF 334-18
PA 32-13 Ops. Support Pad
COC 073094
PA 41-24
COC 027868
RWF 12-20 Tank Pad
RWF 12-19
RWF 13-19
RWF 23-19
RWF 324-19
COC 027868
PA 34-24
PA 41-25
PA 31-26
COC 062161
DOE 1-W-26
PA 22-25
PA 23-25 Frac Pad
PA 23-26
PA 23-26 Tank Farm
PA 24-26
W 29-26
PA 324-26
Rio Blanco
Balzac Gulch MDP Project Area
Rifle, Colorado
Garfield
Mesa
Pitkin
Legend
Proposed Well (BHL)
Proposed Drill Pad
Proposed Support Pad
Other Existing Pad
Proposed Pipeline
Proposed Frac Line
Existing Road
Proposed Road
Stream
Township Range
Section Line
BLM Surface
Balzac Gulch MDP Boundary
Federal COC 027868
Federal COC 062160
Federal COC 062161
Federal COC 073094
N
W
E
S
0 1,250 2,500 5,000
Feet
T:\Projects\PIC\Parachute\17\0607_BalzacGulch_Phase_2_DevelopmentProject\BalzacGulch_2_MDP_Overview.mxd atankersley 11/27/2017 12:25:19 PM

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

FINDING OF NO SIGNIFICANT IMPACT (FONSI)

Balzac Gulch Master Development Plan – Phase 2

Terra Energy Partners Rocky Mountain LLC
Federal Leases COC62160 and COC73094

DOI-BLM-CO-N040-2018-0033-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 Preferred Alternative 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 58 Federal wells by constructing four new well pads (PA 31-26, PA 32-13, PA 34-24, and PA 44-13) and one ancillary support pad (PA 32-13 Operations Support Pad) located on BLM land; building, using, and maintaining 2.09 miles of new access roads on BLM and adjacent private land; installing 5.27 miles of buried pipelines to transport gas, condensate, and water; and using 3.50 miles of temporary surface water lines to deliver and collect water for well completion operations. Construction of the five new pads on BLM land would initially disturb 15.57 acres with a long-term impact on 3.61 acres. The total initial project disturbance on BLM land would be 44.48 acres with 8.44 acres occurring over the 40-year life of the wells.

The EA also analyzes the use of the Federal-surface RWF 23-19 frac pad and private-surface PA 23-25 frac pad to serve as remote frac sites supporting the 58 Federal wells. Two reclaimed locations (RWF 21-18 pad on BLM and RWF 334-18 pad on private land) would be redisturbed to accommodate cuttings storage. The RWF 12-20 Tank pad would be built next to CR 246 to house steel tanks storing produced water and condensate generated from the well developments. No private wells would be developed with this project.

The buried natural gas pipelines, installed along the new pad access roads, would transport gas to Terra's existing gas gathering infrastructure along the I-70 corridor. Delivering produced water and condensate through buried water lines collocated with the gas pipelines to tank farms on the valley floor (RWF 12-20 and PA 22-25 pads on private land) will greatly reduce truck traffic within the field. Using the existing remote frac pads, Terra's existing water line distribution system, and surface frac lines will considerably decrease truck traffic on state, county, BLM, and private roads.

The project would develop directional oil and gas wells drilled into Federal fluid mineral lease COC73094 analyzed in the Roan Plateau Resource Management Plan Amendment/ EIS. These operations would occur along the north side of the Colorado River within Balzac Gulch and would be generally located north and west of the Rulison, I-70 interchange.

Implementation of the second phase of the Balzac Gulch Master Development Plan could produce nearly 115-120 billion cubic feet (bcf) of natural gas over the life of the project, estimated to be 40 years. The initial phase of the BGMDP was approved for 66 Federal wells in 2017 (also generating 120 bcf of

natural gas), and is currently being developed. The two-phased project has a total of 124 Federal wells developed within Federal lease COC73094.

A series of BLM linear rights-of-way across Sections 18 and 19 would authorize an existing access road and buried, collocated gas, water and condensate lines serving the eastern portion of the BG2MDP development.

The site is located approximately 9 miles west of the City of Rifle in Garfield County, Colorado. The project was posted on the CRVFO NEPA website in January 2018 to invite public involvement.

INTENSITY/SEVERITY

I have considered the potential intensity/severity of the impacts anticipated to accompany implementation of the Preferred Alternative in relation to each of the ten areas suggested for consideration by the 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 Preferred Alternative affects public health and safety. The Preferred Alternative 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 Preferred Alternative 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 visual resources and recreation. 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. Features of the Preferred Alternative would involve avoidance of the No Surface Occupancy (NSO) stipulation for Steep Slopes greater than 50% with the exception of minor drainage crossings along the PA 32-13 access road, and the NSO for the I-70 Viewshed has been suitably mitigated with the project design, best management practices, and specific condition of approval addressing viewshed impacts. Because granting of exceptions to these NSO stipulations has been thoroughly considered and addressed, including based on analyses by outside consultants, 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 pads, roads, and buried pipelines and the drilling, completion, and production of oil and gas wells are common activities in the project vicinity, and currently unknown risks are not anticipated.

6. The degree to which the Preferred Alternative 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 Preferred Alternative is related to other actions with individually insignificant but cumulatively significant impacts. The Preferred Alternative 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 Preferred Alternative 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 Preferred Alternative would have no adverse impacts to the above resources.

9. The degree to which the Preferred Alternative 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 Preferred Alternative 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 Preferred Alternative 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 Preferred Alternative or alternatives will not have significant environmental impacts beyond those already addressed in the "Record of Decision and Resource Management Plan," (2015); (2) the Preferred Alternative is in conformance with the Resource Management Plan; and (3) the Preferred Alternative 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

Date 9/4/2018

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

DECISION RECORD

Balzac Gulch Master Development Plan – Phase 2

Terra Energy Partners Rocky Mountain LLC
Federal Leases COC62160 and COC73094

DOI-BLM-CO-N040-2018-0033-EA

DECISION: It is my decision to approve the Preferred Alternative as described in Section 2 of the attached EA, including constructing four well pads and one ancillary support pad; drilling, completing, and producing 58 Federal oil and gas wells from the four pads; constructing 2.09 miles of new access roads on BLM and adjacent private land; installing 5.27 miles of buried pipelines to transport gas, condensate and water; and using 3.50 miles of temporary surface water lines to deliver and collect water for well completion operations; and operating ancillary surface facilities for tank farm storage and cuttings management) located in the 6th Principal Meridian, Township 6 South, Range 94 West, Sections 18, 19 and 20 and Township 6 South, Range 95 West, Sections 24, 25 and 26. This decision is based on the design, mitigation, and monitoring requirements in **Appendices A and B** (Surface-Use Conditions of Approval and Downhole Conditions of Approval) of the EA.

In approving the Preferred Alternative, I am specifically approving exceptions to the No Surface Occupancy (NSO) stipulations for Steep Slopes greater than 50% and for the I-70 Viewshed, based on the design, mitigation, and monitoring requirements in **Appendix C**. The project was noticed to the public by posting on the CRVFO NEPA website in January 2018. Fourteen written comments were received during the public scoping process for the EA. **Appendix D** lists the comments and BLM responses.

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

RATIONALE: The bases for this decision are as follows:

1. Approval of the Preferred Alternative is validating the rights granted with Federal oil and gas leases (COC62160 and COC73094) to develop the leasehold to provide commercial commodities of oil and gas.

2. The project would allow natural gas and associated liquid hydrocarbons ("condensate") 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 Preferred Alternative 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 new Federal oil and gas wells may commence only upon approval by BLM of an Application for Permit to Drill (APD) for each well. Similarly, this Decision does not authorize the initiation of construction activities or surface use associated with any access road or natural gas, condensate, or water gathering pipelines. Initiation of construction or surface use related to the existing access roads or the proposed pipelines may commence only upon approval by BLM of a ROW for the access road(s) or linear gas and water gathering pipelines. However, this decision provides the BLM's Authorized Officer with an analysis upon which to base approval of the APD and 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 **Appendices A and B** 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 linear access road or pipeline ROW is approved as an outcome of this decision, the Surface-Use COAs provided in **Appendix A** of the attached EA would be developed as Special Stipulations to 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: September 1, 2018

SIGNATURE OF AUTHORIZED OFFICIAL:

Gloria Tibbetts, Acting Field Manager
Colorado River Valley Field Office

DATE SIGNED: 9/4/2018